Montara Production Drilling Environment Plan Summary

TECHNICAL DOCUMENT

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0	24-10-2013	Environment Plan Summary	GLEN NICHOLSON

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1 INTRODUCTION

PTTEP Australasia (Ashmore Cartier) Pty Ltd (PTTEP AA), as Titleholder under the Offshore Petroleum and Greenhouse Gas Storage (OPGGS) Environment Regulations (OPGGS(E)R 2009), proposes to undertake production drilling activity within the Montara, Swift, Swallow and Skua fields (collectively referred to in this document as the Montara Development Project (MDP)) located in production licences AC/L7 and AC/L8.

This Environment Plan (EP) Summary has been prepared to meet the requirements of Regulations 11(3) and 11(4) of the OPGGS(E)R, as administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). This document summarises the updated Montara Production Drilling Environment Plan (the EP), accepted by NOPSEMA under Regulation 10A of the OPGGS(E)R. The EP was originally accepted by NOPSEMA on 16 October 2013 and was updated to include the drilling of a new well, which represents a new activity in accordance with Regulation 17 of the (OPGGS(E)R.

The Montara Production Drilling EP applies to re-entering and drilling the Montara H5 well utilising a jack up rig. The MDP comprises the production of hydrocarbons in Australian waters in the Timor Sea, using the Montara Venture Floating Production Storage and Offloading facility (FPSO), a Wellhead Platform (WHP) and associated flowlines and subsea equipment.

1.1 THE TITLEHOLDER

The operator for this activity and titleholder of the AC/L7 and AC/L8 production licences is PTTEP AA. Contact details for PTTEP AA are as follows:

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2 LOCATION OF THE ACTIVITY

2.1 OVERVIEW AND LOCATION

The MDP is located in Commonwealth waters within Production Licences AC/L7 and AC/L8 in the Timor Sea, between Australia and the island of Timor approximately 690 km (373 nm) east of Darwin in a water depth of approximately 77m lowest astronomical tide (LAT) (refer to Figure 2.1).

The MDP includes developing the Montara, Swift, Skua and Swallow fields and operating the developed facilities for commercial production of the oil reserves. Oil is extracted from production wells in each of the fields and transported in flow lines to the Montara Venture FPSO, via the Montara Well Head Platform. The location coordinates for key infrastructure associated with the MDP is listed in Table 3.2.

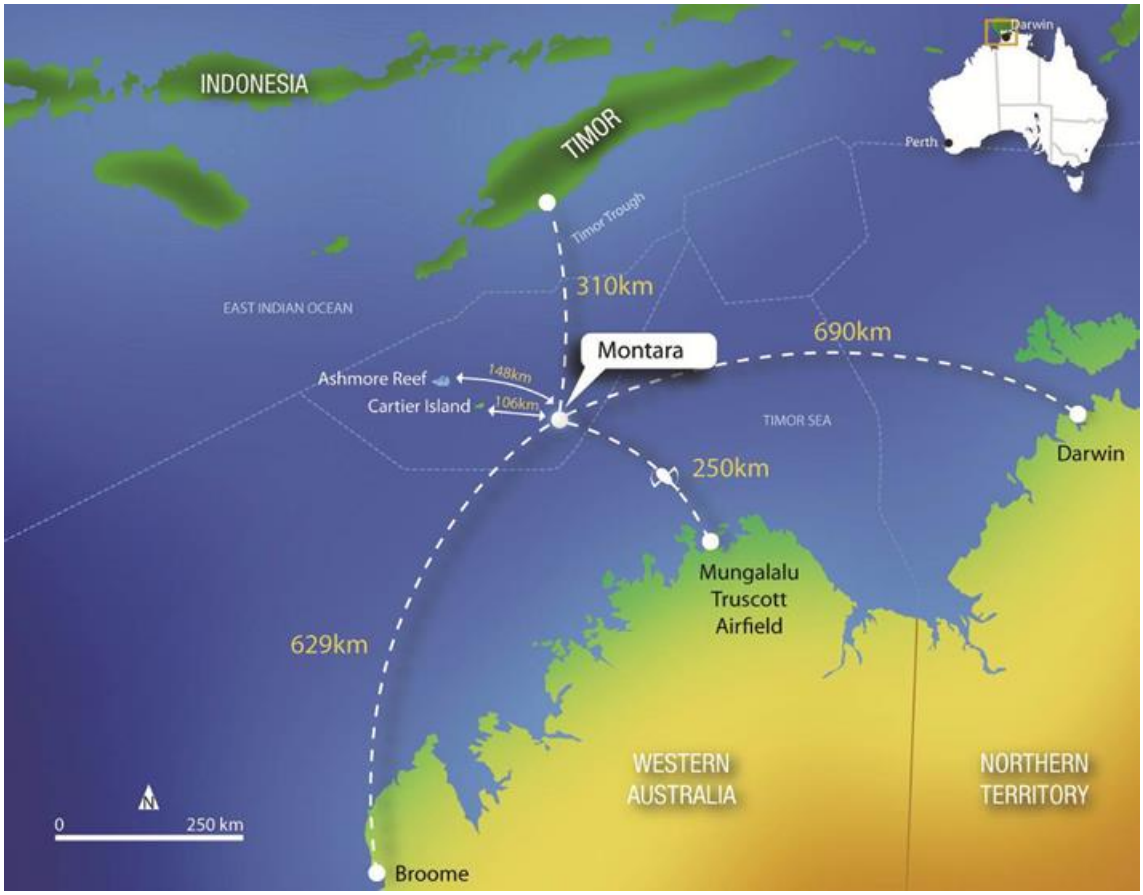

Figure 2.1 Site Location of Montara Field

3 DESCRIPTION OF THE ACTIVITY

3.1 TIMING OF THE ACTIVITY

Production Drilling activities within the MDP area are scheduled to commence in September 2017 and are likely to last for a period of approximately 60 days, however timings are subject to weather and operational factors. The proposed schedule for production drilling therefore extends from September 2017 to February 2018, with a timetable of specific activities outlined in Table 3.1.

Table 3.1 Estimated Timetable of Drilling Activities

Operation	Duration (Days)
Tow Rig to Montara WHP	0.7
Pre-load & Jack up	2.07
Establish Platform Interfaces	3.18
Nipple Up Blowout Preventor (BOP)	1.40
Drill 12 1/4" Hole	4.78
Run and cement 9 5/8" Casing, Run W/L Logs	3.30
Drill 8 1/2" Hole	6.46
Run and cement 7" Liner, Run W/L Logs	4.30
Drill 6" Hole to 5238 m MDRT	6.42
Run Lower Completion	4.77
Run Upper Completion	3.43
Production Tie-In	13.18
Demobilise the Rig	3.47

3.2 MONTARA DEVELOPMENT INFRASTRUCTURE

The MDP consists of the following infrastructure at the coordinates listed in Table 3.2 below:

- An unmanned wellhead platform (WHP) at the Montara field;
- Five (5) subsea wells for development of the Skua, Swift and Swallow fields;
- Production flowline system consisting of two (2) 6- inch, one (1) 10 inch and three (3) 14 inch flowlines and associated tie-in spools;
- Gas lift flowline system consisting of one (1) 6 inch and three (3) 4 inch flowlines and associated tie-in spools;
- Three (3) infield control umbilicals and associated flying leads;
- A subsea manifold in the Swift field for comingling the production fluids and distributing the compressed gas and electro-hydraulic services to the subsea wells; and
- A FPSO facility and its associated mooring system located approximately 1.5 km northeast of the WHP. Two (2) 10 inch Flexible Production Risers and associated riser bases. One (1) 6 inch Flexible Gas Lift Riser and associated riser base. Two (2) control umbilicals and associated riser bases. One (1) gas compressor for the gas lift system.

Table 3.2 Montara Development Infrastructure Coordinates (Surface) (GDA 94, Zone 51)

Well and Infrastructure Locations	Latitude (South)	Longitude (East)
Montara Venture FPSO (Turret centre)	12° 39' 35.3"	124° 32' 41.1"
Wellhead Platform	12° 40' 20.5"	124° 32' 22.2"
Swallow 1 Subsea well	12° 32' 29.5"	124° 26' 36.8"
Swift North 1 Subsea well	12° 31' 29.9"	124° 27' 33.7"
Swift-2 Subsea well	12° 32' 3.6"	124° 27' 6.0"
Skua 10 Subsea well	12° 30' 4.6"	124° 25' 5.4"
Skua 11 Subsea well	12° 30' 4.6"	124° 25' 5.6"
Montara H5 ST-1 well (plugged and suspended)	12° 40' 20.466"	124° 32' 22.320"
Montara H4 well	12° 40' 20.547"	124° 32' 22.321"
Montara H3 ST-1 well	12° 40' 20.548"	124° 32' 22.162"
Montara H2 well	12° 40' 20.548"	124° 32' 22.241"
Montara G2 well	12° 40' 20.466"	124° 32' 22.320"

The Montara field development consists of both subsea and platform wells. Apart from the differences in wellhead and Xmas Tree designs, the basic well construction is the same. All equipment items installed within the wellbore are designed to allow well fluids to be produced in a safe and controlled manner. These items include the steel casing liner cemented into the wellbore.

The casing of the wellbore serves a number of functions:

- To prevent deterioration of the hole, e.g. caving-in, swelling, wash-outs;
- To effectively isolate formations penetrated while drilling and hence prevent cross-flow of fluids from higher to lower pressure zones;
- To provide a sealed passage for flow of well fluids to the production tubing. The production casing and/or liner are the only sections that are exposed to the well fluid. This is important in avoiding leakage of well fluids to the surface from outside of the wellbore; and
- To provide pressure integrity for gas-lift and well killing.

The production string consists of production tubing, flow control valves, isolation packers, landing nipples, sand excluder/control screens and other specialised equipment to provide a flow path for the reservoir fluids to the wellhead.

3.3 DRILLING ACTIVITY

3.3.1 The MODU and Mobilisation

The MODU contracted for the drilling activity is owned by Noble Drilling Holding LLC and operated by Noble Contracting II GmbH (hereafter referred to as Noble). The jack-up MODU, Noble Tom Prosser will be used for the proposed operations, which was built in Jurong Ship Yard Pte Ltd Singapore in 2012/2014 and can operate in water depths of up to 400ft and drill to depths of 35,000ft. Refer to Table 3.3 for the Noble Tom Prosser MODU specifications.

Table 3.3 MODU Specifications

Noble Tom Prosser	
Design	Friede and Goldman JU- 3000N design
Operator	NOBLE Contracting II GmbH
Built	2012/2014 Jurong Ship Yard Pte Ltd, Singapore
Class	ABS A-1 Self Elevating Mobile Offshore Drilling Unit CDS
Registry	Republic of Liberia
Principal dimensions	Length Overall (including Helideck): 102.59m / 336.58 ft
	Breadth of Hull: 84.45 m / 277.066 ft
	Depth of Hull: 9.45 m / 31.00 ft
	Length of Legs (including Spud Can Tip) 169.11 m /554.83 ft
	Footing Area of Each Spud Can 254.05 m^2 / 2734.51 ft2
	Height of Spud Can (Below Base of Spud Can) 2105 m / 6.906 ft
Transit Draft(Maximum):	6.30 m / 20.67 ft
Rated Drilling Depth	35.000 ft
Operating Water Depth	76.05m
Leg Penetration	2 –2.5 m
Max total draft	20.8 ft
Transit Displacement	25522.49 MT
Accommodation	150 berths
Mud	7747 bbl (active and reserve mud pits)
Base Oil Storage	2176 bbl (if used)

3.3.2 Drilling

The approved Field Development Plan (2011) included drilling and completing four development wells and one gas injector well from the Montara WHP. Due to operational difficulties and scheduling constraints, only three development wells and the gas injector well have been completed to date. To achieve the Field Development Plan objectives, the currently suspended H5 ST-1 well will be re-entered and the Montara H5 ST-2 development well will be side-tracked and completed.

A summary of the proposed 2017 drilling activities is detailed below, with an estimated timetable of activities is provided in Table 3.1. Scheduling of activities may be subject to delays e.g. weather and MODU availability. The drilling activities, detailed below, provide the basis for identifying environmental impacts associated with the drilling activities and implementation of mitigation measures.

In 2013/14, drilling & completion operations intended on the Montara H5 ST-1 were not fully achieved. The proposed 2017 drilling operations involve well re-entry, sidetracking from the 13-3/8" casing shoe and drilling then completing the well as a horizontal production well, hereafter known as Montara H5 ST-2.

The proposed work-scope includes:

Sidetrack, drill and complete Montara H5 ST-2 (estimated duration 57 days)

- Move rig onto platform, establish services and safety systems;
- Change out of the unitised Wellhead on H5 ST-1;
- Installation of the drilling BOPs;
- Drill out suspension plugs to 13-3/8" shoe;
- Sidetrack out of cement plug in 12 ¼" hole as Montara H5 ST-2;
- Drill directional 12 ¼" hole, then run and cement the 9 ⅝" production casing;
- Drill directional 8 ½" hole, then run and cement the 7" production liner;
- Drill 6" horizontal hole section;
- Run the lower 4" sand-screen completion and hang off on packer;
- Run the upper 3-1/2" x 5-1/2" completion;
- Suspend the well and install the Xmas Tree;
- Tie in Production Flow line and clean up well to FPSO; and
- Move rig off location.

3.3.3 Drilling Fluids and Cuttings

A drilling fluid programme will be developed for the Montara H5 ST-2 well in accordance with the PTTEP AA Drilling Management System. The primary function of the drilling fluid is to control sub-surface formation pressures, cool and lubricate the drill bit, transport the cuttings to the surface, maintain well bore stability and minimize reservoir damage. Drilling fluid is continually circulated down the drill string to the drill bit and returns to the surface via the annulus space between the drill string and the well bore.

Water Based Mud (WBM) has been selected for the drilling. Non Aqueous Drilling Fluid (NADF) is a contingency option, but will only be considered in the event of severe hole stability problems which cannot be remedied with WBM. Based on offset well data, wellbore stability is only foreseen to be a potential problem in the 8½" interval, therefore, NADF is only a contingency system for this interval.

NADF shall consist of a base oil approved for use in Australia to which other ingredients such as emulsifiers, wetting agents, rheology modifiers, organophilic clay, lime, and barite are added. As described above, NADF will be circulated down-hole where it picks up cuttings produced by the grinding action of the drill bit on the formation solids.

Drilling fluid containing suspended drilled cuttings is processed with solid:liquid separation equipment to remove the drilled cuttings from the NADF. NADF is then returned to the MODU mud pits for recirculation down-hole. Cuttings will naturally have adhered NADF, so in order to minimise the NADF associated with cutting discharges, they will be treated with cutting dryers prior to being discharged over board. Frequent daily measurements on both the primary and secondary solids processing equipment will ensure NADF adhered on cuttings is less than 10% (dry average weight).

Whole NADF, both used and unused, will be transferred from the MODU to a support vessel and transported back to the suppliers shore based facility to be reconditioned for future use, or disposal. The control, containment and appropriate use of NADF during drilling operations will be monitored on-board by a specialist third party NADF compliance engineer.

If NADF was required as contingency for drilling the 8½" interval, a maximum of 68m^3 of drilled cuttings would be generated with a maximum of 22 m^3 of synthetic base oil adhered on cuttings prior to discharge to the ocean. This calculation is based on achieving a maximum 10% wt/wt synthetic base oil retention on drilled cuttings. The drilled cuttings discharged, being denser than seawater, are anticipated to settle rapidly and accumulate on the sea floor near the discharge point.

WBM typically consist of between 80-90% by volume fresh, or saline water, with the balance made up of water soluble and insoluble drilling fluid additives to give the mud the exact properties it requires to meet the desired functions for a particular hole interval. In the marine environment these additives are either completely inert, (naturally occurring benign materials) or readily biodegradable organic polymers, with a very fast rate of biodegradation in the marine environment. Drilling fluid additives that are typically used include; sodium chloride, potassium chloride, bentonite (clay)/pre-hydrated gel, naturally occurring water soluble polymers, barium sulphate and calcium carbonate.

All cuttings will be discharged overboard post processing to separate and recycle drilling fluids, with the total volume of cuttings to be discharged equating to approximately 166 m^3 for the drilling campaign. See Table 3.4 below for a summary.

Table 3.4 Montara H5 ST-2 Well Profile Information

Well	Well Section	Mud Type	Hole Diameter	Length	Cuttings Discharged	WBM Discharged
			inches	m	m^3	m^3
Montara H5 ST-2	Surface hole (Already drilled)	n/a	n/a	n/a	n/a	n/a
	Production hole	WBM (TBA)	12¼"	731	69	232
	Production Hole	WBM (NADF as contingency)	8½"	1810	73	720
	Reservoir hole	WBM (Peflow)	6⅛"	1010	24	426
				Total	166	1379

3.3.4 Cementing

Once a hole section has been drilled, steel casing of a smaller diameter than the hole section is run into the well. For example 9-5/8" casing is run into the 12-1/4" hole.

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, there may be small excess volumes of cement (approx. $2m^3$) that will be discharged to sea. Minor quantities of cement may also be discharged into the sea during clean-up of the cementing unit after each job is finished.

In the 6" hole, 4" sand screens will be run, rather than traditional casing. The sand screens are not cemented in place, but secured via a liner hanger.

3.3.5 Well Evaluation

Mud Logging

Mud-logging will be undertaken during drilling operations to evaluate the formation. This will involve the collection and processing of cuttings samples, analysis of mud gas, monitoring and recording of all drilling parameters, pressure detection and full evaluation of the formation.

Formation Evaluation

Formation evaluation is the interpretation of a combination of measurements taken inside a wellbore to detect and quantify oil and gas reserves in the rock adjacent to the well. Mud-logging will be undertaken during drilling to evaluate the drilled formations. This will involve collection and processing of cuttings samples, analysis of mud gas, monitoring and recording of all drilling parameters, pit levels and pressure detection. A wireline log is a continuous measurement of formation properties with electrically powered instruments to enable decisions to be made about drilling operations. Wireline logging will be required to confirm cement isolation in the 7" x 8-1/2" casing annulus, and the 9-5/8" x 12-1/4" casing annulus.

Vertical Seismic Profiling (VSP) and Flaring

There is no plan to undertake a VSP or for flaring to be carried out as part of the activity.

3.3.6 Drilling Support Operations

Support will be provided by anchor handling tug/supply vessels, which will operate out of Darwin (Table 3.5). Supply vessels will supply bulk chemicals, liquid drilling fluids and diesel fuels to the drilling rig. The key risk associated with the operation of support vessels is a diesel spill while offloading fuel. This risk will be mitigated by proper fuel transfer practices and procedures including appropriate maintenance of hoses and couplings.

Helicopter support will be provided by Babcock Offshore Services Australia Pty Ltd. A shared Sikorsky S-92 helicopter and flight crew, along with shared technical back-up helicopter, will be based at Mungalalu – Truscott Air base to support the rig as follows:

- Personnel transfers between Mungalalu-Truscott and the rig for crew changes;
- Down-manning of the rig for tropical cyclone response (note: an additional Helicopter and crew will be available during cyclone season); and
- Emergency response, including medivac, evacuation of the rig, and search and rescue.

Routine helicopter operations are expected to be during daylight hours. Helicopter flight time between Mungalalu-Truscott and the rig is 70 minutes with approximately 5 – 7 flights per week anticipated. Helicopter refuelling is planned and will use the permanent helicopter refuelling facilities on the Drilling Rig.

Table 3.5 Indicative Support Vessels

	Primary Tow Vessel Pacific Centurion	***Secondary Anchor Handler 120T BD Pacific Vulcan***	***3rd Anchor Handler 120T BD Pacific Viper***
Type/Service	Anchor handling tug supply vessels		
Length (m)	86.0	66	66
Gross Registered Tonnage (tonnes)	4,566	2147	2,147
Maximum Speed (knots)	15.7	16	16
Accommodation (berths)	35	32	32
Total Fuel Tank Capacity (m^3)	1594	827	827
Rescue Capabilities per vessel	2 fast rescue craft 280 persons rescue capacity	1 fast rescue craft >100 persons rescue capacity	1 fast rescue craft >100 persons rescue capacity

4 DESCRIPTION OF THE ENVIRONMENT

4.1 INTRODUCTION

The physical, biological and socio-economic environment in and around the project area and the wider region are described in this section, together with the values and sensitivities of the region. These often interchangeable terms are used throughout this section with regard to the description of the area and are defined as:

- 'MDP Area': refers to the area of the Montara Development Project, and comprises the Montara, Swift, Skua and Swallow fields. Drilling of the Montara H5 ST-2 well will be located in the Montara field within the MDP area;
- 'Environment that may be affected (EMBA)': defined by the area that could potentially be impacted in the event of a hydrocarbon spill. The EMBA is conservatively estimated based upon worst case oil spill modelling. A threshold of 10 g/m^2 has been used to estimate the potential spatial extent of biological impacts from hydrocarbon spills for on water and in water exposure, and 110g/m^2 for shoreline impacts. A surface hydrocarbon threshold of 0.5 g/m^2, which represents a visible oil (rainbow) sheen, has been used to provide an indication of the extent to which stakeholders may visually observe oil on the sea surface. This is considered to provide a more relevant and conservative extent of potential impacts to socio-economic receptors associated with visual amenity. The description of the socio-economic environment in Section 4.5 covers this wider EMBA.

4.2 REGIONAL SETTING

Australia's offshore waters have been divided into six marine regions in order to facilitate their management by the Australian Government under the EPBC Act. The MDP area is located within the North West Marine Region (NWMR), however, the EMBA includes areas within both the NWMR and the North Marine Region (NMR). A summary of each region is provided below.

The NWMR encompasses Commonwealth waters from the Western Australia/Northern Territory border in the north, to Kalbarri in the south. A number of regionally important marine communities and habitats have been identified as part of the NWMR bioregional plan and WA State planning processes. These include Ashmore Reef, Cartier Island, Seringapatam Reef and Scott Reef, which have been identified as regionally important areas supporting a high biodiversity of marine life and supporting foraging and breeding aggregations. Ashmore Reef and Cartier Island are located approximately 160 km and 100 km north-west respectively from the MDP area.

The NMR comprises Commonwealth waters from the west Cape York Peninsula to the Northern Territory–Western Australia border, covering approximately 625,689 km^2 of tropical waters in the Gulf of Carpentaria and Arafura and Timor seas. The marine environment of the NMR is known for its high diversity of tropical species but relatively low endemism, in contrast to other bioregions. A number of regionally important marine communities and habitats have been identified as part of the NMR bioregional plan. These include the Gulf of Carpentaria coastal zone, plateaux and saddle north-west of the Wellesley Islands, and the submerged coral reefs of the Gulf of Carpentaria.

4.2.1 Protected Areas

Commonwealth Marine Reserves

Commonwealth marine reserves (CMRs) have been established around Australia as part of the National Representative System of Marine Protected Areas, the primary goal of which is to establish and effectively manage a comprehensive, adequate and representative system of marine reserves to contribute to the long-term conservation of marine ecosystems and protect marine biodiversity. The CMRs located within the EMBA include the following:

- Ashmore Reef Commonwealth Marine Reserve;

- Cartier Island Commonwealth Marine Reserve;
- Mermaid Reef Commonwealth Marine Reserve;
- Kimberley Commonwealth Marine Reserve;
- Argo-Rowley Commonwealth Marine Reserve;
- Oceanic Shoals Commonwealth Marine Reserve;
- Joseph Bonaparte Gulf Commonwealth Marine Reserve;
- Arafura Commonwealth Marine Reserve;
- Arnhem Commonwealth Marine Reserve; and
- Wessel Commonwealth Marine Reserve.

State and Territory Reserves

Eighteen State and Territory reserves are located within the EMBA, including 14 reserves identified in a search of the EPBC Act Protected Matters database:

- Adele Island Nature Reserve (WA)
- Browse Island Nature Reserve (WA)
- Lalang-garram / Camden Sound Marine Park (WA)
- Lalang-garram / Horizontal Falls Marine Park (WA)
- North Kimberley Marine Park (WA).
- Rowley Shoals Marine Park (WA)
- Scott Reef (WA)
- Dambimangari (WA)
- Low Rocks (WA)
- Prince Regent (WA)
- Uunguu - Stage 1 (WA)
- Prince Regent National Park (WA)
- Low Rocks Nature Reserve (WA)
- Unnamed WA41775 WA (Browse island)
- Unnamed WA44673 WA (Adele Island)
- Unnamed WA44674 WA (Adele Island)
- Vernon Islands (NT)
- Garig Gunak Barlu National Park/Cobourg Marine Park (NT)
- Djelk (NT)
- Djukbinj (NT)
- Djukbinj National Park (NT)

Of these reserves, three are Indigenous Protected Areas (IPAs); the Dambimangari IPA, Djelk IPA and Uunguu IPA. The most relevant value and sensitivity within the IPA is traditional fishing, which is practised within these reserves.

Key Ecological Features

Key Ecological Features (KEFs) are components of the Commonwealth marine environment recognised for their regional importance for either the region's biodiversity or ecosystem function and integrity (Commonwealth of Australia 2012). KEFs that are relevant to the MDP area and wider EMBA are summarised in Table 4.1.

Table 4.1 Key Ecological Features located within the EMBA (Commonwealth of Australia 2012)

Key Ecological Feature	Values
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	High productivity and aggregations of marine life.
Continental slope demersal fish communities	High levels of endemism
Ancient coastline at 125 m depth contour	Unique seafloor feature with ecological properties of regional significance
Seringapatam Reef and Commonwealth waters in the Scott Reef complex	High productivity and aggregations of marine life
Carbonate bank and terrace system of the Sahul Shelf	Unique seafloor feature with ecological properties of regional significance
Carbonate bank and terrace system of the Van Diemen Rise	Unique seafloor feature with ecological properties of regional significance
Pinnacles of the Bonaparte Basin	Unique seafloor feature with ecological properties of regional significance
Shelf break and slope of the Arafura Shelf	Ecological significance associated with productivity emanating from the slope

Wetlands of conservation significance (declared Ramsar wetlands)

There are no “wetlands of international importance” under the Convention on Wetlands of International Importance (Ramsar Convention), referred to henceforth as Ramsar wetlands, within the MDP area. Within the wider EMBA, Ashmore Reef CMR and the Cobourg Peninsula are designated Ramsar Wetlands.

4.3 PHYSICAL ENVIRONMENT

The MDP area experiences a monsoonal climate with two predominant seasons including a hot wet summer season from October to March and a cool dry winter season from April to September, referred to as the northwest and southeast monsoons respectively. The climate is influenced by two major atmospheric pressure systems: the subtropical ridge of high pressure cells referred to as highs or anticyclones, and a broad tropical low pressure region called the monsoon trough (RPS Metocean 2008). These two major systems create three discrete weather phenomena that influence conditions within the MDP area and wider EMBA:

- The north-west monsoon season, or wet season, occurs from October to March and is characterised by north-west to south-west winds. The monsoon season is generally associated with broad areas of cloud and rain including periods of widespread heavy rainfall;
- Steady north-east to south-east winds (south-east trade winds) from April to September (dry season) caused by development and intensification of anticyclones over south-western Australia, brings predominantly fine conditions with low rainfall in most areas;
- Cyclonic activity occurs between November to April and the drilling area will experience on average three cyclones a year. Cyclones can bring very large amounts of rain, with strong swell and rough seas common during these events.

The oceanographic regime of the north-west Australian offshore area is strongly influenced by the Indonesian Through Flow which transports warm, low salinity, oligotrophic waters through a complex system of currents, linking the Pacific and Indian Ocean via the Indonesian Archipelago (Department of State Development (DSD) 2010). The strength of the Indonesian Through Flow fluctuates seasonally and reaches maximum strength during the south-east monsoon (May to September) and weakens during the north-west monsoon.

The currents in the MDP area and wider EMBA are influenced by the semi-diurnal tides that have four direction reversals per day. Both the semidiurnal and diurnal tides appear to travel north-eastwards in the deep water leading to the Timor Trough prior to propagation eastwards and southwards across the wide continental shelf. The NWMR experiences some of the largest tides along a coastline adjoining an open ocean in the world.

4.4 BIOLOGICAL ENVIRONMENT

4.4.1 Benthic Habitat and Communities

The benthic habitats in the MDP area and wider EMBA are generally dominated by soft sediments, sand and mud, with occasional patches of coarser sediments. A benthic habitat assessment was undertaken in the area of Petroleum Production Licence AC/L7 during the 2010 wet season, which included the Montara field and surrounding areas (ERM 2011). Benthic habitats surveyed were characterised by homogenous, flat, featureless soft sediment; predominately comprised of sand with small rubble/shell fragments and marked by low relief ripples with evidence of bioturbation. Sparse patches of epifauna were recorded and included hydroids, octocorals (soft corals, gorgonians and seapens), black corals and ascidians.

Macrobenthic faunal assemblages surveyed had a generally low and highly patchy abundance of individuals. Polychaete bristleworms from the Phylum Annelida contributed the highest relative abundance of macrobenthic assemblages across the surveyed area (abundance ranging from approximately 40 to 60%); followed by Malacostracan crustaceans (shrimps, crabs etc.) (approximately 13 to 19%). Gastropoda was represented by 33 taxa across the surveyed area with abundance ranging from approximately 0.5 to 5%.

Soft sediment habitats are expected to be broadly similar in the wider EMBA to the surveyed locations in the Montara field and surrounding areas. In a study of benthic habitats on the continental shelf near the Big Bank Shoals (approximately 200 km to the northeast of the MDP area) by Heyward *et al*. (1997), the predominant benthic infaunal species were polychaetes (burrowing worms) and crustaceans (prawns, shrimp, crabs, etc.).

Given the large regional area associated with EMBA, a large number of different benthic communities occur within this area. These habitats include banks, shoals, coral reefs and seagrasses.

Banks and Shoals

A study by Heyward *et al.* (2010) identified more than 20 possible shoal features (defined as abrupt submerged features rising from deeper than 50 m) within a 100 km radius of the MDP area and greater than 100 similar bathymetric features within 200 km. The nearest shoals to the MDP area are Goeree and Vulcan Shoals, located approximately 30 km to the southwest. Other shoals in close proximity to the MDP area include Eugene McDermott Shoal (approximately 45 km south) and Barracouta Shoal (approximately 60 km northwest).

Due to their remote location, most of the shoals in the region are either understudied or poorly characterised. The benthic environments of the few shoals that have been surveyed in some detail, including Vulcan and Barracouta Shoals, provide an indication of shoal habitats present in the region and are discussed in this section. In general, the bank and shoal systems in the region support diverse biological communities including corals, sponges, seagrasses and a variety of reef fish, with dominant organisms ranging from the macroscopic alga *Halimeda* to soft and hard coral communities (Heyward et al. 1997).

Coral Reef Communities

No coral reefs were identified within the MDP. Coral reefs in the EMBA can be categorised into two general groups: fringing reefs around coastal islands and the mainland shore and large platform reefs, banks and shelf edge atolls offshore.

Coral reefs within the MDP include Ashmore Reef, Cartier Island, Seringapatam Reef, and Scott Reef. These reefs, in particular Ashmore Reef, are recognised as having the highest richness and diversity of coral species in Western Australia (Mustoe and Edmunds 2008, cited in DSD 2010).

Seagrass

There is no seagrass within the MDP area due to water depth and lack of suitable habitat. Within the broader EMBA, seagrasses occur along the mainland coastline of the Northern Territory and Western Australia and within the protected coastal areas of islands, including the Tiwi Islands, outer Darwin Harbour and in the waters surrounding of the Van Diemen Gulf adjacent to Arnhem Land (Roelofs et al. 2005). The largest known seagrass locations for the NWMR have been reported from around the Buccaneer Archipelago located north of the Dampier Peninsula (Wells et al. 1995). The regionally dominant genera are *Halophila* and *Halodule* (Duke et al. 2010).

4.4.2 Shoreline Habitats

There are many islands that occur within the NWMR and NMR. There is no emergent land within the MDP area; however, extensive coastline and numerous small islands are present within the EMBA. Shoreline habitat types in the region include mangrove systems, sandy beaches, tidal mud flats and rocky reef/limestone platforms, which are described below and are widely distributed.

Mangrove systems provide complex structural habitats that act as nurseries for many marine species as well as nesting and feeding sites for many birds and reptiles. Mangroves also maintain sediment, nutrient and water quality within habitats and minimise coastal erosion. Mangrove communities make up a common shoreline habitat along the Northern Territory and Western Australian coastlines with extensive mangrove communities along the Kimberley, Joseph Bonaparte, Tiwi Islands and Arnhem Land coastlines.

Sandy beaches are located throughout the region and some are considered significant habitat for turtles and seabirds, with turtle and seabird nesting occurring above the high tide line. Generally, sands are highly mobile and therefore do not support a high level of biodiversity. Fauna within sandy beach habitats usually consists of polychaete worms, crustaceans and bivalves. These fauna provide a valuable food source for resident and migratory sea and shorebirds (DEC/MPRA 2005). Natural processes tend to supply fresh sediments and larval stock with each tidal influx.

Tidal mud flats are located throughout the region. They support a high density of benthic invertebrates and are considered to provide important nursery habitats for fish and crustaceans. The invertebrates that are found in tidal mud flat habitats are key sources of food for shorebirds. The tidal mudflats along the Kimberley coastline are also known to provide important habitats for migratory shorebirds.

Rocky reefs and limestone platforms are located along the Kimberley and Northern Territory coastlines. The majority of the limestone platforms are surrounded by an extensive reef system. Rocky reefs and limestone platforms support a high diversity of benthic filter feeders and primary producers.

Green, hawksbill and loggerhead turtles are known to forage for seagrass and algae within rocky reefs (DEWHA 2008). Rocky reefs also provide foraging habitats for dugong within the Darwin area of the Northern Territory.

Indonesia and Timor Leste

The Indonesian coastline is rich in tropical marine ecosystems such as sandy beaches, mangroves, coral reefs and seagrasses ecosystems (Hutomo and Moosa, 2005). These are home to a wide variety of living communities and a high species diversity and richness.

Mangrove forests in Indonesia account for 76% of the total mangroves found in the Southeast Asian Region.

The best environment for growth of sea grass is considered to be the sandy reef flats that occur in sheltered areas in the low tidal ranges. Wide areas of the Indonesian coastal waters are covered by dense beds of seagrass. Pioneering vegetation in the intertidal zone is dominated by *Halophila ovalis* and *Halodule pinifolia* while *Thalassodendron ciliatum* dominate the lower subtidal zones.

Indonesia has an estimated 75,000 km^2 coral reef ecosystem distributed throughout the archipelago (Tomascik *et al*. 1997 cited in Hutumo and Moosa, 2005). Fringing reefs are the most common reef types with scleractinian corals as being the most dominant and important group. It is estimated that Indonesian waters are home to 452 species of hermatypic scleractinian coral and 590 species of scleractinian corals (Tomascik *et al 1997,* cited in Hutumo and Moosa, 2005*;* Suharsono 2004, cited in Hutumo and Moosa, 2005).

As part of the Montara oil spill in 2009, PTTEP AA and APASA developed a set of detailed aerial imagery and habitat mapping for the Indonesian and Timor coastlines. Below provides a snapshot of the shoreline habitats along the Indonesian coastline.

The Java and Bali Province is rich in tropical marine ecosystems such as mangroves, coral reefs, seagrasses and seaweeds, sand beaches on the east coast of Java and rocky coasts on the south-eastern coast of Bali. The mangrove forests provide a valuable physical habitat for a variety of important coastal species such as crabs, shrimps, fishes, and commercial fishes. Turtles are commonly seen at Crystal bay.

Maluku Province's inshore waters are rich in mangroves, seagrass beds and coral reefs habitats for dugongs, green turtle, reef fish, shark, giant clam, trochus (Moss and Van Der Wal 1998).

West Nusa Tengarra Province consists of two islands: Lombok Island and Sumbawa Island. Mangroves, seagrass beds and coral reefs exist in the surrounding waters of Lombok (Atmadja 1992 cited in Tomascik *et al*. 1997). It has been noted that fishermen in the west coast of Lombok collect seagrass from mixed seagrass meadows (Atmadja 1992 cited in Tomascik *et al.* 1997). Green turtles and dugong likely feed on the seagrass beds located on the west coast of Lombok and north coast of Sumbawa.

The Timor Leste coastline features mangrove communities surrounding entrance to rivers primarily on the south coast, whilst the north and eastern coast feature a higher degree of coral reef communities.

Below lists out the shoreline habitats that are present in the East Nusa Tengarra Province and Timor Leste:

- Rote Island features mangrove communities with sparse patches of seagrass habitats and high abundance of coral reef communities.
- The Savu sea region has an abundance of coral reef habitats that act as nurseries and feeding grounds for whales and dolphins. In particular Savu and Raidjua Islands are surrounded by a fringing coral reef community. Savu Island features a small area of seagrass located in the north east corner of the Island.
- Sumba Island is surrounded by a fringing coral reef community, with sparse patches of seagrass and mangrove communities around the island.
- The majority of the West Timor coastline features a narrow fringing coral reef community with four dense areas of mangrove communities occurring primarily along the south coast.
- Pulau Dana the southernmost island of Indonesia is surrounded by exposed reefs and is known to be inhabited by a large number of bird species and nesting turtles.
- Alor is an island that located at the border between Indonesia and Timor Leste with mangroves, coral reefs and seagrasses.
- The majority of the Pulau Semau coastline features a narrow fringing coral reef community with areas of mangrove and seagrass communities occurring primarily along the east coast.

4.4.3 Marine Fauna

Species of conservation significance

Species of conservation significance under the EPBC Act with the potential to occur within the MDP area and the broader EMBA have been identified for the Montara Production Drilling EP. Species were identified through a search of the EPBC Act Protected Matters Search Tool (PMST), on 27 March 2017. Searches identified 18 threatened and 29 migratory species as potentially occurring within the MDP area, while 60 threated and 69 migratory species may potentially occur within the EMBA described above. Biologically Important Areas (BIAs) associated with species of conservation significance within the EMBA have been identified and a summary of this information is provided below.

Table 4.2 and Table 4.3 below present species listed as threatened and/or migratory under the EPBC Act. Table 4.2 lists species that have the potential to occur within the MDP area (based on a search of a 20 km radius from the Montara H5 ST-2 well location), while Table 4.3 presents additional species that have the potential to occur within the EMBA.

Table 4.2 EPBC Listed Threatened and/or Migratory Species potentially occurring within MDP area

Species Name	Common Name	EPBC Threatened Status	Migratory
Marine Mammals			
Balaenoptera borealis	Sei Whale	Vulnerable	Migratory
Balaenoptera musculus	Blue Whale	Endangered	Migratory
Balaenoptera physalus	Fin Whale	Vulnerable	Migratory
Balaenoptera bonaerensis	Antarctic Minke Whale	N/A	Migratory
Balaenoptera edeni	Bryde's Whale	N/A	Migratory
Megaptera novaeangliae	Humpback Whale	Vulnerable	Migratory
Orcinus orca	Killer Whale	N/A	Migratory
Physeter macrocephalus	Sperm Whale	N/A	Migratory
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted Bottlenose Dolphin	N/A	Migratory
Marine Reptiles			
Caretta caretta	Loggerhead Turtle	Endangered	Migratory
Chelonia mydas	Green Turtle	Vulnerable	Migratory
Dermochelys coriacea	Leatherback Turtle	Endangered	Migratory
Eretmochelys imbricata	Hawksbill Turtle	Vulnerable	Migratory
Lepidochelys olivacea	Olive Ridley Turtle	Endangered	Migratory
Natator depressus	Flatback Turtle	Vulnerable	Migratory

Species Name	Common Name	EPBC Threatened Status	Migratory
Sharks, Sawfish and Rays			
Carcharodon carcharias	Great White Shark	Vulnerable	Migratory
Glyphis garricki	Northern River Shark	Endangered	N/A
Isurus oxyrinchus	Shortfin Mako	N/A	Migratory
Isurus paucus	Longfin Mako	N/A	Migratory
Manta alfredi	Reef Manta Ray	N/A	Migratory
Manta birostris	Giant Manta Ray	N/A	Migratory
Pristis Pristis	Freshwater Sawfish	Vulnerable	Migratory
Pristis zijsron	Green Sawfish	Vulnerable	Migratory
Rhincodon typus	Whale Shark	Vulnerable	Migratory
Avifauna			
Anous tenuirostris melanops	Australian Lesser Noddy	Vulnerable	N/A
Anous stolidus	Common Noddy	N/A	Migratory
*Calidris ferruginea**	Curlew Sandpiper	Critically Endangered	Migratory
Calonectris leucomelas	Streaked Shearwater	N/A	Migratory
Fregata ariel	Lesser Frigatebird	N/A	Migratory
Fregata minor	Great Frigatebird	N/A	Migratory
*Numenius madagascariensis**	Eastern Curlew	Critically Endangered	Migratory

* It is noted that these are migratory shorebird species and activity within the MDP area will be limited to migration.

Table 4.3 Additional Threatened and Migratory Species potentially occurring within the EMBA

Species Name	Common Name	EPBC Threatened Status	Migratory
Mammals			
Dugong dugon	Dugong	N/A	Migratory
Orcaella heinsohni	Irrawaddy Dolphin	N/A	Migratory
Sousa sahulensis/ Sousa chinensis	Indo-Pacific Humpback Dolphin	N/A	Migratory
Reptiles			
Aipysurus apraefrontalis	Short-nosed Seasnake	Critically Endangered	N/A
Aipysurus foliosquama	Leaf-scaled Seasnake	Critically Endangered	N/A

Species Name	Common Name	EPBC Threatened Status	Migratory
Crocodylus porosus	Salt-water Crocodile	N/A	Migratory
Sharks Sawfishes, and Rays			
Anoxypristis cuspidata	Narrow Sawfish	N/A	Migratory
Glyphis glyphis	Speartooth Shark	Critically Endangered	N/A
Pristis clavata	Dwarf Sawfish	Vulnerable	Migratory
Avifauna*			
Calidris tenuirostris	Great Knot	Critically Endangered	N/A
Charadrius leschenaultii	Greater Sand Plover	Vulnerable	N/A
Charadrius mongolus	Lesser Sand Plover	Endangered	N/A
Limosa lapponica baueri	Bar-tailed Godwit	Vulnerable	N/A
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	Critically Endangered	N/A
Rostratula australis	Australian Painted Snipe	Endangered	N/A
Phaethon lepturus	White-tailed Tropicbird	N/A	Migratory
Phaethon rubricauda	Red-tailed Tropicbird	N/A	Migratory
Puffinus pacificus	Wedge-tailed Shearwater	N/A	Migratory
Sterna albifrons	Little Tern	N/A	Migratory
Sterna anaethetus	Bridled Tern	N/A	Migratory
Sterna caspia	Caspian Tern	N/A	Migratory
Sterna dougallii	Roseate Tern	N/A	Migratory
Sula tylatra	Masked Booby	N/A	Migratory
Sula leucogaster	Brown Booby	N/A	Migratory
Sula sula	Red-footed Booby	N/A	Migratory

Biologically Important Areas

Biologically Important Areas (BIAs) have been identified, described and mapped for protected species under the EPBC Act through the marine bioregional planning program. BIAs are spatially and temporally defined areas or regions where species protected under the EPBC Act display biologically important behaviours, such as breeding, foraging, resting or migration, based on the most current and robust scientific information. They are therefore areas of particular importance for the conservation of protected species.

BIAs associated with species that may occur within the EMBA and are listed under the EPBC Act are presented in Figure 4.1, Figure 4.2 and Figure 4.3. Further information on BIAs is discussed in the relevant species descriptions below.

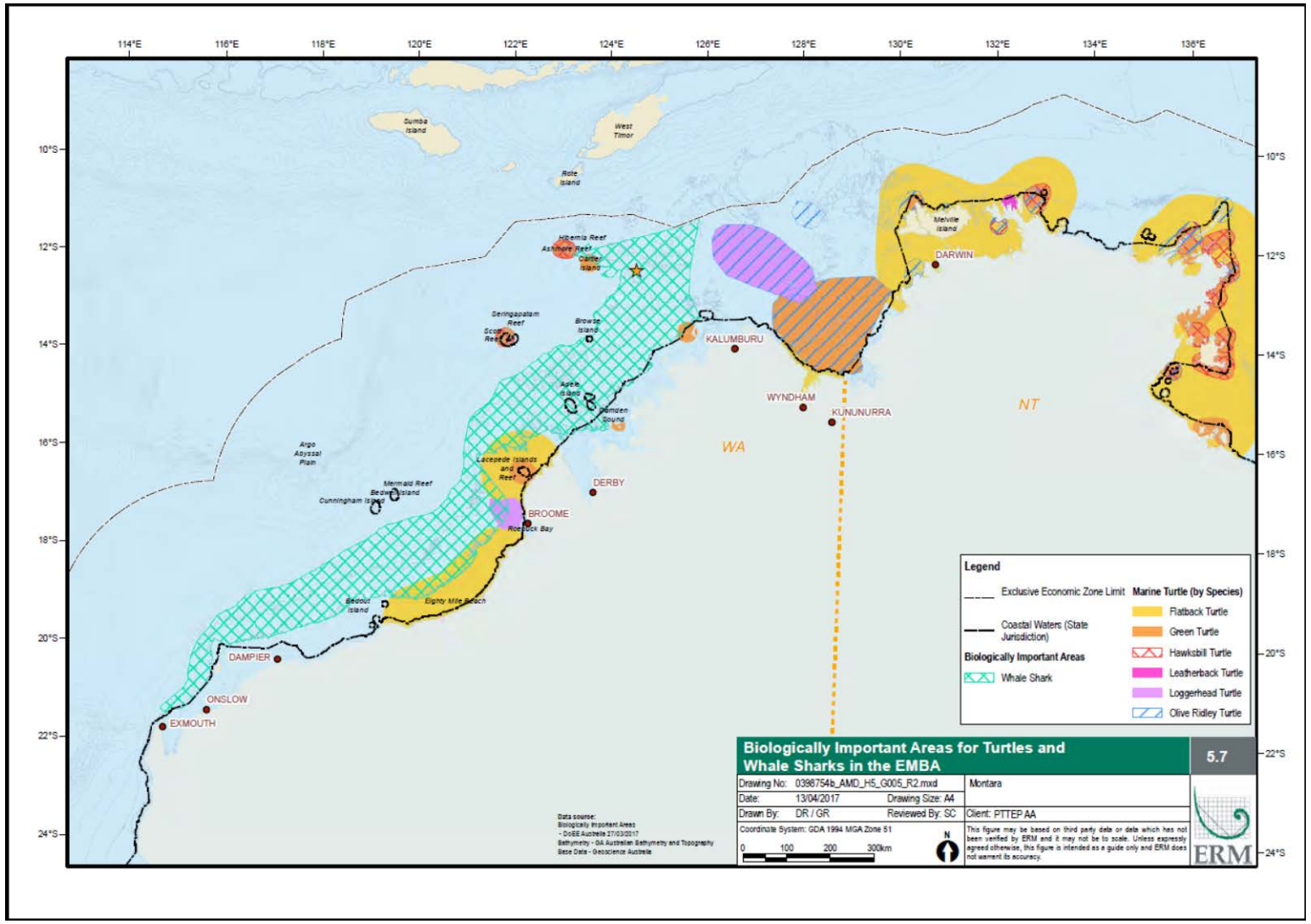

Figure 4.1 Biologically Important Areas for Turtles and Whale Sharks in the EMBA

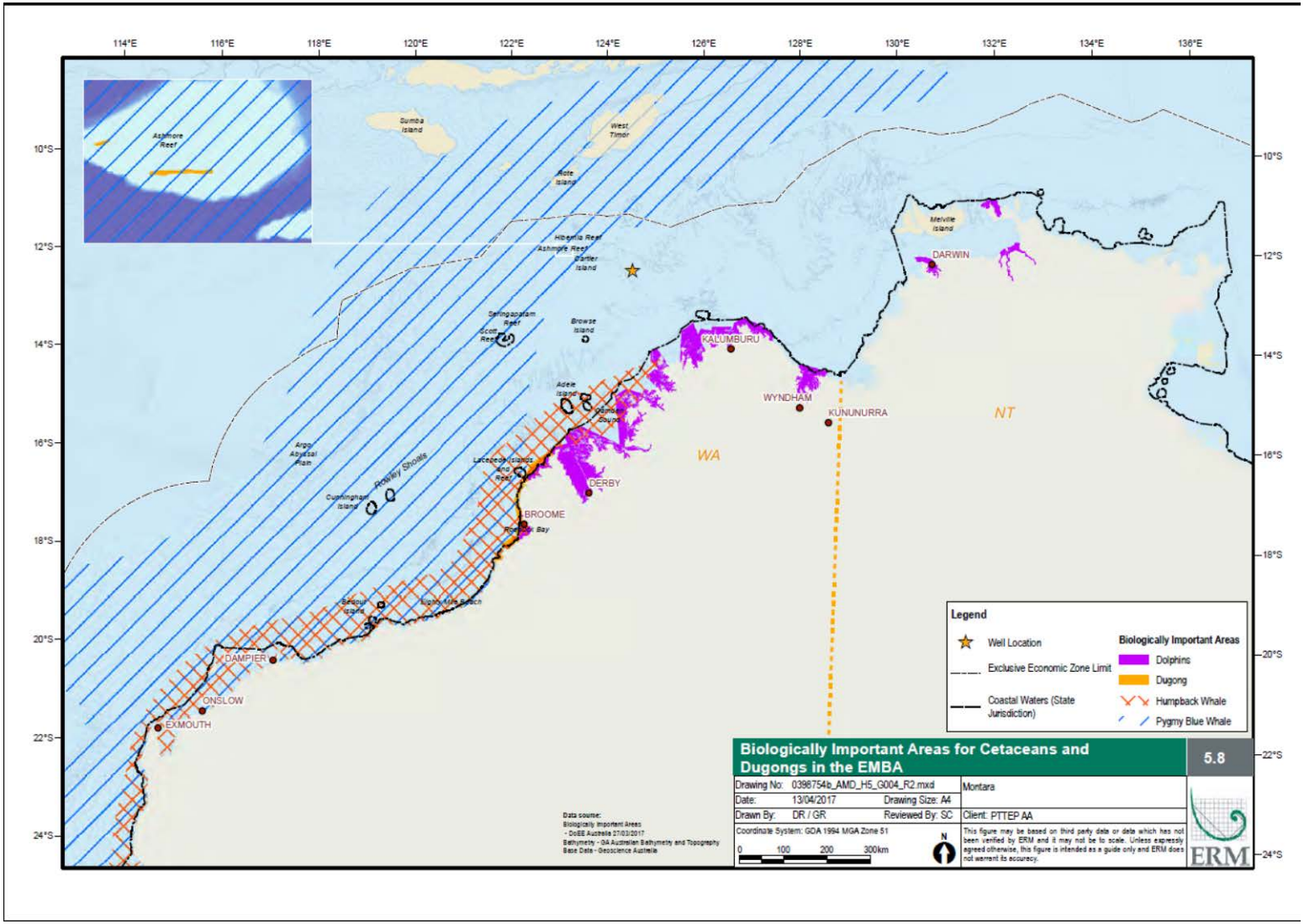

Figure 4.2 Biologically Important Areas for Cetaceans and Dugong in the EMBA

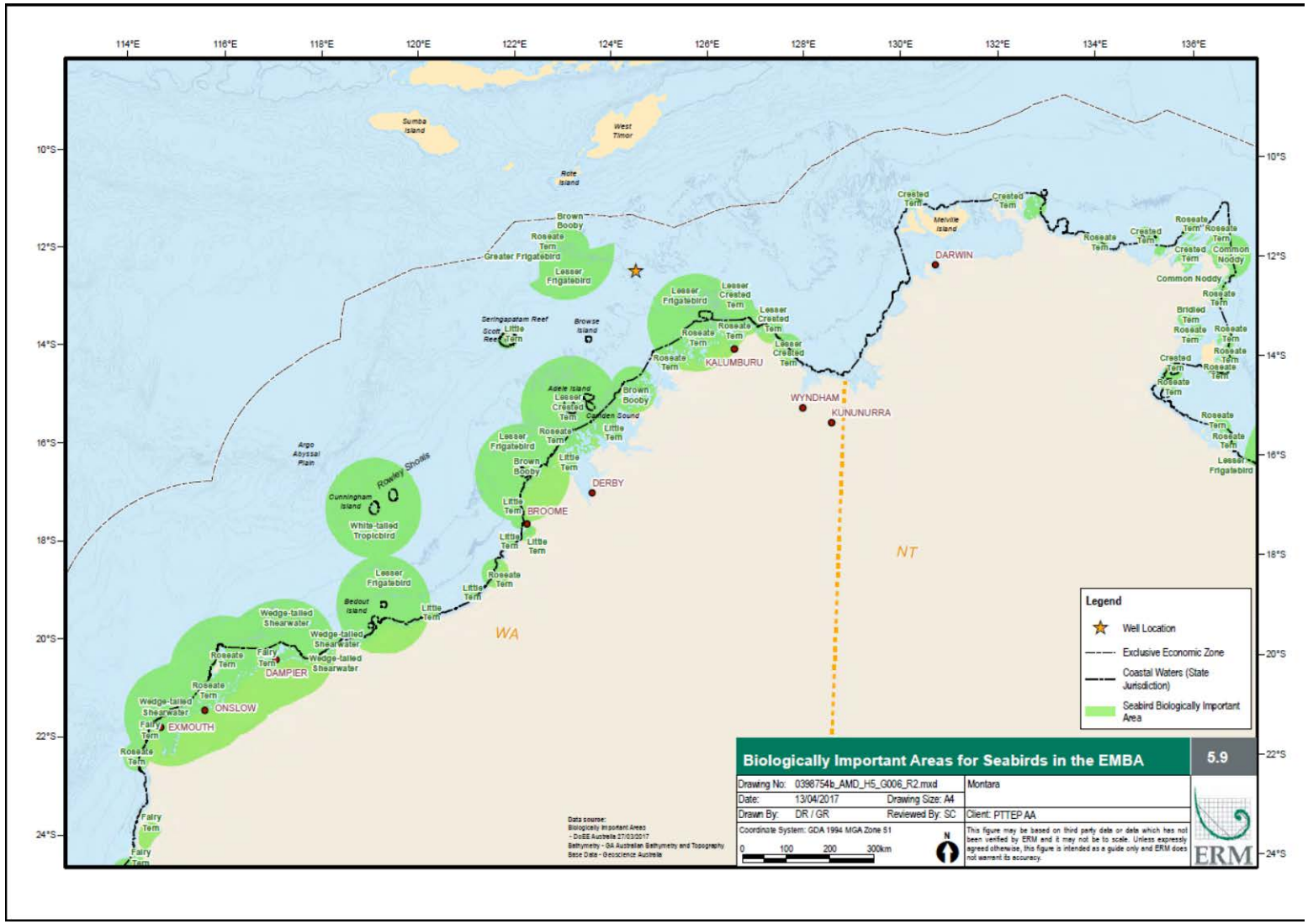

Figure 4.3 Biologically Important Areas for Seabirds in the EMBA

Fish and Elasmobranchs

A search of the EPBC Act Protected Matters search tool identified 38 species of seahorses and pipefish, six shark species, two rays, and four sawfish species that may occur in, or have habitat within the MDP area or wider EMBA.

Seahorses and Pipefish (Marine)

Of the fish species identified as potentially occurring within the MDP area and wider EMBA, 38 are species of pipefish and seahorse. Most of these are found in shallow waters, although two have also been recorded in deeper shelf waters of up to 200 m (DoEE, 2012); overall, pipefish and seahorses are unlikely to occur within the MDP area.

Whale Shark (Vulnerable/Migratory)

Whale sharks (*Rhincodon typus*) are listed as Vulnerable and Migratory under the EPBC Act. They are not known to feed or breed in the MDP area, however, whale sharks may occur in the MDP area due to their widespread distribution and highly migratory nature, albeit in very low numbers. The MDP area is located within the northernmost section of the migratory BIA for the whale shark (Figure 4.1). Given the species migrates south to Ningaloo reef to feed during coral spawning, occurring in March/April, it is unlikely that whale sharks will be encountered in significant numbers in the MDP area or wider EMBA during drilling operations given the timing of proposed drilling activities.

Great White Shark (Vulnerable/Migratory)

The Great White Shark (*Carcharodon carcharias*) is widely, but sparsely, distributed in all seas, having been recorded from central Queensland around the south coast to north-west WA (DoEE 2017). Given a preference for cooler southern waters, great white sharks are considered unlikely to be encountered in either the MDP area or EMBA.

Northern River Shark (Endangered)

Northern River Sharks (*Glyphis garricki*) are known to inhabit rivers, tidal sections of large tropical estuarine systems, macrotidal embayments, as well as inshore and offshore marine habitats (DoEE 2017). Given the offshore location of the MDP area, it is unlikely that the species will be encountered, although habitat occurs within the wider EMBA.

Shortfin and Longfin Mako Sharks (Migratory)

The shortfin mako (*Isurus oxyrinchus*) and the longfin mako (*Isurus paucus*) are both offshore epipelagic species found in tropical and warm-temperate waters (DoEE 2017). Both species occur in Australia in coastal waters off WA, NT, QLD and NSW at depths ranging from shallow coastal waters to at least 500m (DoEE 2017). These species may migrate through the MDP area, and may be found within the wider EMBA.

Reef Manta Ray (Migratory)

The reef manta ray (*Manta alfredi*) is commonly sighted inshore, but also found around offshore coral reefs, rocky reefs and seamounts, tending to inhabit warm tropical or sub-tropical waters (Marshall *et. al.* 2011). Based on the species' habitat preferences it is unlikely that the giant manta ray will be encountered in the MDP area. Given the EMBA overlaps with a number of coral and rocky reefs in the region, it is possible that the species may be encountered within the EMBA.

Giant Manta Ray (Migratory)

The giant manta ray (Manta birostris) inhabits tropical, marine waters worldwide, between latitudes 30°N and 35°S. The species is commonly sighted along productive coastlines with regular upwelling, oceanic island groups, particularly offshore pinnacles and seamounts. Nearer to shore the giant manta ray is commonly encountered on shallow reefs while being cleaned or is sighted feeding at the surface inshore and offshore.

Based on the species' habitat preferences it is unlikely that the giant manta ray will be encountered in the MDP area. Given the EMBA overlaps with a number of coral and rocky reefs in the region, it is possible that the species may be encountered within the EMBA.

Freshwater Sawfish (Vulnerable/Migratory)

The freshwater sawfish (*Pristis pristis*) may occur in all large rivers of northern Australia from the Fitzroy River in Western Australia, to the western side of Cape York Peninsula, Queensland, although is mainly confined to the primary channels of large rivers (DoEE 2017). Based on the distribution, and preferred habitat of the species, it is considered unlikely that freshwater sawfishes will be found at the MDP area. Given the species' known distribution individuals are likely to be found within the EMBA.

Green Sawfish (Vulnerable/Migratory)

In Australian waters, green sawfishes (*Pristis zijsron*) have been recorded in the coastal waters off Broome, Western Australia, around northern Australia to Jervis Bay, New South Wales (NSW) (DoEE 2017). Based on the offshore, deeper-water project location, and the species' preference for turbid, inshore water, it is unlikely green sawfishes will be encountered in the MDP area. Based on the known distribution of the species, individuals are likely to exist within the EMBA.

Speartooth Shark (Critically Endangered)

Speartooth sharks (*Glyphis glyphis*) were not recorded in a PMST search of the MDP area, although identified as potentially occurring in the EMBA. The shark is reported to occur in northern Australian waters and in waters off New Guinea. In Australia, the speartooth shark has so far only been recorded in tidal rivers and estuaries within the Northern Territory and Queensland. Based on the species' habitat preference it is highly unlikely to be found within the MDP area, although individuals may be encountered within certain areas of the EMBA.

Narrow Sawfish (Migratory)

Narrow sawfishes (*Anoxypristis cuspidate)* were not recorded in a PMST search of the MDP area, although identified as potentially occurring in the EMBA. The species is bentho-pelagic inhabiting estuarine, inshore and offshore waters to at least 40 m depth (IUCN 2017). Inshore and estuarine waters are critical habitats for juveniles and pupping females, while adults occur predominantly offshore (IUCN 2017).

Based on the species' habitat preference it is highly unlikely to be found within the MDP area, although it may be encountered within certain areas of the EMBA.

Dwarf Sawfish (Vulnerable/Migratory)

Dwarf sawfishes (*Pristis clavata)* are thought to be distributed along the northern coast of Australia from Cairns, in Queensland to the Pilbara coast in Western Australia. The species usually inhabits shallow (2–3 m) coastal waters and estuarine habitats (DoEE 2017). Based on the species' habitat preference it is highly unlikely to be found within the MDP area, although may be encountered within certain areas of the EMBA.

Marine Reptiles

A search of the EPBC Act Protected Matters database identified six species of marine reptiles (turtles) that may occur in, or have habitat within the MDP area and wider EMBA. Three additional reptile species (two sea snakes and the saltwater crocodile) were identified as potentially occurring within the EMBA.

Sea Snakes

Two species of listed sea snake may occur in, or have habitat in, the EMBA, while none were identified within the MDP area.

Short-nosed Sea Snake

Short-nosed sea snakes (*Aipysurus apraefrontalis*) are endemic to Western Australia. Given the preference of the species for shallow reef areas, short-nosed seasnakes are considered unlikely to be encountered within the MDP area. As the species is known from Ashmore reef the species is likely to be found within the EMBA.

Leaf-scaled Sea Snake

Leaf-scaled sea snakes (*Aipysurus foliosquama*) are found only on the reefs of the Sahul Shelf in WA, especially on Ashmore and Hibernia Reefs (DoEE 2017). Based on the lack of preferred habitat for the species within the MDP area, it is considered unlikely that the species will be encountered. Given the species is known from Ashmore and Cartier Reefs the species is likely to be found within the EMBA.

Marine Turtles

Six species of marine turtle may occur within the MDP area and wider EMBA (Table 4.2). The MDP area does not intersect with any marine turtle BIAs; however, the EMBA intersects with a number of BIAs in the region (Figure 4.1).

Green Turtle (Vulnerable/Migratory)

Green turtles (*Chelonia mydas*) are found in tropical and subtropical waters. Green turtles may occasionally pass through the MDP area. However, due to the water depths the area does not provide foraging habitat. The closest known significant breeding/nesting grounds to the MDP area are the Ashmore Reef and Cartier Island CMRs, approximately 160 and 110 km to the northwest of MDP area, respectively. The EMBA intersects green turtle BIAs at Scott, Ashmore and Cartier Reefs, in the Joseph Bonaparte Gulf, and around Melville Island, with the areas used for foraging, internesting, and nesting. Green turtle BIAs in the region are illustrated in Figure 4.1.

Flatback Turtle (Vulnerable/Migratory)

The flatback turtle (*Natator depressus*) is found in the tropical waters of northern Australia, Papua New Guinea and Irian Jaya. Due to their migrations between the Pilbara and the Kimberley regions of WA, individual flatback turtles may transit the MDP area during migration. However, given the distance from known aggregation areas, it is unlikely that significant numbers of flatback turtles will be encountered within the MDP area. Due to the water depths the area does not provide foraging habitat. The species will also be present within the wider EMBA and the timing of proposed drilling activities overlaps with the breeding season at nesting beaches in the EMBA.

Hawksbill Turtle (Vulnerable/Migratory)

Hawksbill turtles (*Eretmochelys imbricata*) are found in tropical, subtropical and temperate waters in all oceans of the world. There are no known nesting or breeding areas in or near the MDP area. Due to the distance from nesting sites and the lack of foraging habitats in the MDP area, only low numbers of hawksbill turtles are expected to be observed, in transit from WA to the NT. The species is likely to be present within the wider EMBA.

Leatherback Turtle (Endangered/Migratory)

The Leatherback turtle (*Dermochelys coriacea*) 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 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 Northern Territory (Limpus and McLachlin 1994). As such, it is expected that very few leatherback turtles will be encountered in the MDP area. The species is likely to be present within the wider EMBA.

Loggerhead Turtle (Endangered/Migratory)

The closest known Loggerhead turtle breeding/nesting grounds to the MDP area are found at Muiron Island and the beaches of the Northwest Cape (Baldwin et al. 2003), approximately 1,500 km south-west of the MDP area and outside the EMBA. Loggerhead turtles have been recorded in the reserves of Ashmore Reef and Cartier Island, approximately 100 km northwest of the MDP area (Guinea 1995). Loggerhead turtles are unlikely to be encountered within the MDP area in significant numbers. This species is likely to be present, in limited numbers, within the wider EMBA.

The EMBA intersects with one loggerhead turtle BIA, a foraging area, on the Sahul Bank, off Northern Territory waters (Figure 4.1). No loggerhead turtle BIAs are intersected by the MDP area.

Olive Ridley Turtle (Endangered/Migratory)

The olive ridley turtle (*Lepidochelys olivacea*) has a circum-tropical distribution, with nesting occurring throughout tropical waters. This species may be encountered, in limited numbers within the wider EMBA.

The EMBA intersects with a number of olive-ridley turtle BIAs (foraging and internesting areas), the Sahul Bank in the Joseph Bonaparte Gulf, and in Northern Territory waters off the Arnhem Land coast (Figure 4.1). No loggerhead turtle BIAs are intersected by the MDP area.

Cetaceans

Four threatened/migratory, seven migratory and 19 listed marine cetaceans were identified by a search of the EPBC Act Protected Matters Database as potentially occurring within the MDP area or wider EMBA (Table 4.2 and Table 4.3).

Blue Whale (Endangered/Migratory)

Blue whales (*Balaenoptera musculus*) are widely distributed throughout the worlds' oceans. There are two subspecies in the Southern Hemisphere: the southern blue whale (*Balaenoptera musculus intermedia*) and the pygmy blue whale (*Balaenoptera musculus brevicauda)* (DEWHA 2008). In general, the southern blue whale is found south of 60° S and pygmy blue whales are found north of 55° S (DEWHA 2008), making it highly likely that any blue whales frequenting the waters of the MDP area and EMBA would be pygmy blue whales.

The MDP area does not include any recognised blue whale migratory routes or known feeding, breeding or resting areas. However, low numbers of blue whales migrating to and from Indonesian waters may occasionally pass through the MDP area, most likely during the southern migration (October to November) (DoEE 2017).

The EMBA overlaps with the pygmy blue whale migratory route BIA off the Kimberley Coast (Figure 4.2). Blue whale activities occurring within the area of the BIA overlapping with the EMBA include migration, foraging, and 'distribution'.

Humpback Whale (Vulnerable/Migratory)

Humpback whales (*Megaptera novaeangliae*) have a wide distribution, having been recorded from the coastal areas off all Australian states other than the Northern Territory (Bannister et al. 1996). Given the MDP area is situated north of the northern-most point of the humpback whale migration, and that activities will be undertaken outside of migration and breeding periods it is considered unlikely that the species will be encountered. Individuals may be encountered within the wider EMBA.

Sei Whale (Vulnerable/Migratory)

Sei whales *(Balaenoptera borealis)* are a cosmopolitan species, found in the waters off all Australian states (DoEE 2017). Based on the cosmopolitan distribution of the species, sei whales may be encountered in low numbers within the MDP area. However, as project activities will occur outside of migration periods, the potential for the species to be encountered is further reduced. Individuals of the species may be encountered within the EMBA, although large numbers are unlikely.

Fin Whale (Vulnerable/Migratory)

Fin Whales (*Balaenoptera physalus)* are found in the waters all around Australia, including Tasmania, and the waters of the Australia Antarctic Territory (DoEE 2017). The Australian Antarctic waters are also thought to be important feeding grounds for fin whales, while feeding has been observed in the Bonney Upwelling area indicating the area to be of importance as a feeding ground for the species.

Based on the cosmopolitan distribution of the species, fin whales may be encountered in low numbers within the MDP area. Individuals of the species may be encountered within the EMBA, although large numbers are unlikely.

Antarctic Minke Whale (Migratory)

Antarctic Minke Whales (*Balaenoptera bonaerensis*) are known from the waters of all states with the exception of the Northern Territory, however the distribution along the west Australian coast is poorly delineated (DoEE 2017). The species' distribution is primarily in cold, southern Antarctic waters, and given no specific breeding or feeding grounds are known from the MDP area, as well as activities occurring outside of migration periods, the species is not expected to be encountered in significant numbers within the MDP area. Isolated individuals may be encountered within the EMBA.

Bryde's Whale (Migratory)

Bryde's Whales (*Balaenoptera edeni*) are a cosmopolitan species, found in the waters of all Australian states, including both Christmas and the Cocos Islands (DoEE, 2017). Ambient noise monitoring conducted in the Southern, Cash-Maple and Oliver permits by JASCO (2012) over a 12 month period between December 2010 and December 2011 recorded whale calls that were attributed to Bryde's whales year round at all three permits, with no seasonal cycle observed. This data demonstrates that individuals may be encountered within the MDP area and are also likely to occur within the EMBA.

Killer Whale (Migratory)

Killer Whales (*Orcinus orca*) are a cosmopolitan species, found in the waters off all Australian states in oceanic, pelagic and neritic regions, in both warm and cold waters (DoEE 2017). Given the lack of known migration routes or areas of significance in the region, the species is not expected to be encountered in either the MDP area or EMBA in significant numbers.

Sperm Whale (Migratory)

Sperm Whales (*Physeter macrocephalus*) have been recorded from the waters of all Australian states (DoEE 2017). Given the shallow water depths at the MDP area (<100 m), and the lack of upwellings or sharp bathymetric contours, it is unlikely that the species will be encountered in significant numbers. Isolated individuals may be encountered within the EMBA.

Spotted Bottlenose Dolphin (Migratory)

The spotted bottlenose dolphin (*Tursiops aduncus*) is generally considered to be a warm water subspecies of the common bottlenose dolphin (*Tursiops truncates*) and known to exist in waters off all Australian states.

Due to the distance from the coast and deeper waters of the MDP area, spotted bottlenose dolphins are not expected to occur, particularly given the preference for shallower, coastal waters. Given their cosmopolitan distribution, the species may be encountered within the EMBA.

Irrawaddy Dolphin (Migratory)

The Irrawaddy dolphin (*Orcaella heinsohni*) (listed under the EPBC Act as *Orcaella brevirostris)* occurs around the northern coast of Australia between approximately Broome and the NSW/Qld border (DoEE 2017). Within WA, the species has been found in the shallow coastal waters and estuaries along the Kimberley coast (DoEE 2017). Given their cosmopolitan distribution, the species may be encountered within the EMBA; although a search of the PMST did not list this species as occurring within the MDP area.

Indo-Pacific Humpback Dolphin (Migratory)

The Indo-Pacific humpback dolphin (*Sousa sahulensis*) (listed under the EPBC Act as *Sousa chinensis*) occurs along the northern coastline of Australia from NSW on the east coast to approximately Shark Bay on the WA coastline (DoEE 2017). Given their cosmopolitan distribution, the species may be encountered within the EMBA; a search of the EPBC PMST did not list this species as occurring within the MDP area.

Dugongs

Dugongs (*Dugong dugon*) are protected under the Wildlife Conservation Act 1950 (WA) and are listed as migratory under the EPBC Act. Ashmore Reef is considered a BIA for dugongs due to the foraging opportunities afforded by the seagrass beds present. Although there is limited information on the presence of dugongs in deeper offshore waters, such as the MDP area, the absence of seagrass beds upon which the species grazes suggests that their presence is unlikely. Given the known distribution of the species, dugongs are likely to be found within the EMBA.

Avifauna

Seven threatened and/or migratory seabirds were identified as potentially occurring within, or having habitat potentially occurring within, the MDP area as discussed below.

Australian Lesser Noddy (Vulnerable)

The Australian lesser noddy (*Anous tenuirostris melanops*) is usually only found around its breeding islands including the Houtman Abrolhos Islands and on Ashmore Reef and Barrow Island in WA (DoEE 2017). Given the distribution of the species and the breeding population at nearby Ashmore Reef and Cartier Island, this species may be present in the MDP area, although only in low numbers. Based on known distribution and the location of rookeries the species is known to occur within the EMBA.

Common Noddy (Migratory)

In Australia, the common noddy (A*nous stolidus*) occurs mainly in oceanic waters off the Queensland coast, although is also known from the north-west and central Western Australia coast. Based on the distribution and habitat preferences the species may be encountered within the MDP area, and occurs within the EMBA.

Curlew Sandpiper (Critically Endangered/Migratory)

In Australia, Curlew Sandpipers *(Calidris ferruginea*) occur around the coasts and are also quite widespread inland. Given the offshore location of activities and habitat preferences, the species is unlikely to be encountered within the MDP area other than occasional numbers during migration, although may be present within the EMBA.

Streaked Shearwater (Migratory)

The streaked shearwater (*Calonectris leucomelas*) is usually found over pelagic waters, and is known to breed on the coast and offshore islands mainly around Japan and Korea (Ochi et al 2010). Given the distribution of streaked shearwaters, this species may be present in the MDP area during operations, albeit in low numbers and will occur within the EMBA.

Lesser Frigatebird (Migratory)

The lesser frigatebird (*Fregata ariel)* is considered as the most common and widespread frigatebird over Australian seas (Lindsey 1986). A BIA has been identified for this species at Ashmore Reef and Cartier Island to highlight breeding and foraging behaviours in the area (DoEE 2017). The MDP does not over overlap with this BIA, however the BIA overlaps with the wider EMBA. Given its distribution and the large breeding population at nearby Ashmore Reef and Cartier, this species may be encountered within the MDP area, and will be present within the EMBA.

Great Frigatebird (Migratory)

Great frigatebirds (*Fregata minor)* are found in tropical waters globally. A BIA has been identified at Ashmore Reef and Cartier Island for the species to highlight breeding and foraging behaviours in the area (DoEE 2017). The MDP area does not overlap with this BIA, however the BIA overlaps with the EMBA.

Given the distribution of the species and its low population in nearby Ashmore Reef and Cartier Island, this species may be present in the MDP area in low numbers, and will be present within the EMBA.

Eastern Curlew (Critically Endangered/Migratory)

Within Australia, the eastern curlew (*Numenius madagascariensis*) has a primarily coastal distribution. The species nests in the Northern Hemisphere from early May to late June and does not breed in Australia. During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats.

Given the offshore location of activities and habitat preferences, the species is unlikely to be encountered within the MDP area other than occasional numbers during migration, although may be present within the EMBA.

4.5 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

4.5.1 Indigenous Heritage

There are no known Indigenous heritage sites within the MDP area and surrounds (DAA 2017).

4.5.2 Non-Indigenous Heritage

There are no national heritage places or areas of archaeological significance within, or in the immediate vicinity of, the MDP area and surrounds.

Within the EMBA, *West Kimberley* is listed on the National Heritage List, and *Ashmore Reef National Nature Reserve*, *Mermaid Reef – Rowley Shoals*, *Seringapatam Reef and Surrounds* and *Scott Reef and Surrounds* are listed on the Commonwealth Heritage List and are registered on the Register of the National Estate. The Ashmore Reef National Nature Reserve is also listed as a RAMSAR Wetland. The portion of Scott Reef within Commonwealth waters is listed as a Commonwealth Heritage Place. Sandy Islet, East Hook and the intertidal reef flat of south Scott Reef are included as an area of 'reserved land' (formerly 'C' Class Nature Reserve) which is vested in the WA Conservation Commission.

There are no known historical shipwrecks in the MDP area and surrounds. The closest shipwreck is the *Ann Millicent*, an iron hulled barque of 944 tons, which was wrecked on Cartier Island on 5 January 1888.

The Komodo National Park in Indonesia is a world heritage site and is within the furthest extent of the EMBA. It is located between the islands of Sumbawa and Flores and consists of volcanic islands with fringing coral reefs. The marine fauna and flora are generally the same as that found throughout the Indo Pacific area, though species richness is very high (UNESCO, 2017). Komodo National Park is managed by the central government of Indonesia through the Directorate General of Forest Protection and Natural Conservation of the Ministry of Forestry.

4.5.3 Defence Activities

The EPBC Protected Matters search identified three Defence sites: Mount Goodwin Radar Site, Quail Island Bombing Range, and Rimbija Island RAAF Radio Beacon. However, these sites are all onshore and are therefore not expected to be impacted by project activities.

4.5.4 Commercial Fisheries

The north coast of Western Australia (Pilbara/Kimberley) and the Northern Territory support a number of commercial fisheries (Department of Agriculture, Fisheries and Forestry (DAFF), 2013; AFMA, 2016). The Commonwealth-managed and State/Territory-managed fisheries that overlap with the MDP area or may be present within the wider EMBA are listed in Table 4.4.

Table 4.4 Commercial Fisheries that may overlap with the MDP or be present in the wider EMBA

Management Area	Fishery
Commonwealth-Managed Fisheries	• Northwest Slope Trawl Fishery • Western Tuna and Billfish Fishery • Western Skipjack Tuna Fishery • Southern Bluefin Tuna Fishery • Northern Prawn Fishery
Western Australia State-Managed Fisheries	• Abalone Fishery • Beche-de-Mer (Trepang) Fishery • Broome Prawn Managed Fishery • Northern Demersal Scalefish Fishery • Northern Shark Fishery • Kimberley Prawn Managed Fishery • North Coast Nearshore and Estuarine Fishery • Mackerel Managed Fishery • Pearling Oyster Managed Fishery • West Coast Deep Sea Crustacean Managed Fishery • Marine Aquarium Fish Managed Fishery • Specimen Shell Managed Fishery • North Coast Crab Fishery • Kimberley Developing Mud Crab Fishery • Kimberley Gillnet and Barramundi Fishery • Nickol Bay Prawn Fishery • Onslow Prawn Fishery • Pilbara Line Managed Fishery • Pilbara Trap Managed Fishery • Pilbara Fish Trawl Fishery • Trochus Fishery
Northern Territory-Managed Fisheries	• Beche-de-Mer (Trepang) Fishery • Barramundi Fishery • Coastal Line Fishery • Coastal Net Fishery • Offshore Net and Line Fishery • Spanish Mackerel Fishery

4.5.5 Traditional and Subsistence Fisheries

Along the north-western coastline of Australia, traditional and subsistence fishing is generally limited to shorelines, creeks and nearshore reefs (LeProvost Dames and Moore 1997). Customary fishing occurs in the Dambimangari IPA, Djelk IPA and Uunguu IPA. The importance of customary fishing in WA and NT is to recognise Aboriginal cultural heritage and needs.

Australia and Indonesia have entered into a number of agreements and arrangements relating to the maritime area between Australia and Indonesia including the i) Memorandum of Understanding between the Government of Australia and the Government of the Republic of Indonesia Regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Exclusive Fishing Zone and Continental Shelf, 7 November 1974 (the MOU) and

ii) Treaty between the Government of Australia and the Government of the Republic of Indonesia establishing an Exclusive Economic Zone Boundary and Certain Seabed Boundaries (Perth, 14 March 1997) (1997 Perth Treaty) that has been signed but is not yet in force.

4.5.6 Tourism and Recreational Activities

The MDP area is located in offshore waters that are not likely to be accessed for tourism activities (e.g. recreational fishing and boating and charter boat operations). Such activities tend to be focussed around nearshore waters, islands and coastal areas and will therefore occur within the wider EMBA.

4.5.7 Petroleum Exploration and Production

Oil and gas exploration activities in the Indian Ocean off WA commenced in the late 1960s. There are a number of oil and gas companies holding petroleum permits in the vicinity of the MDP area. The closest current activity is Talbot oil field (AC/RL1 retention license), currently under development, as a tie back operation to Puffin, operated by Sinopec in Joint Venture with AED Oil. Other proponents in the Timor Sea are at various stages of appraisal, planning and approval in advance of Final Investment Decision.

4.5.8 Ports and Commercial Shipping

The majority of the major commercial shipping through the Timor Sea passes well to the north of the MDP area. The Darwin Port is the supply base for the activity, approximately 692 km west of the MDP area. PTTEP AA has a materials/logistics support base in Darwin that will be used to service the proposed activities. The Darwin Port services the Kimberley Region of Western Australia. The deepwater port is the import and distribution destination for most cargoes used in the oil and gas industry in the Arafura Sea, Timor Sea and waters off the coast of Western Australia.

4.5.9 Summary of Values and Sensitivities

A summary of values and sensitivities within the EMBA including Australian jurisdiction and Indonesian/Timor Leste jurisdiction is provided in Table 4.5 and Table 4.6 respectively.

Table 4.5 Summary of values and sensitivities within the EMBA in Australian Jurisdiction

Values and Sensitivities		Sensitive Habitats within the EMBA															
		Adele Island	Browse Island	Scott Reef North	Scott Reef South	Sandy Islet	Seringapatam Reef	Cartier Island	Ashmore Reef	Hibernia Reef	Tiwi Islands	Joseph Bonaparte Gulf	Christmas Island	Camden Sound	Vernon Islands	Kimberley Coast and Offshore Islands	NT Coast and Offshore Islands
Marine fauna	Cetaceans	✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓
	Dugongs							✓	✓							✓	✓
	Marine turtles (including nesting sites)		✓	✓	✓	✓		✓	✓		✓	✓		✓		✓	✓
	Sea snakes	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓					✓	
	Sharks, sawfish and rays	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	
	Seabirds	✓	✓			✓		✓	✓	✓	✓	✓	✓	✓		✓	✓
Benthic communities	Submerged reefs and shoals		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
Intertidal sensitivities	Coastal reefs and shoals		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Values and Sensitivities		Sensitive Habitats within the EMBA															
		Adele Island	Browse Island	Scott Reef North	Scott Reef South	Sandy Islet	Seringapatam Reef	Cartier Island	Ashmore Reef	Hibernia Reef	Tiwi Islands	Joseph Bonaparte Gulf	Christmas Island	Camden Sound	Vernon Islands	Kimberley Coast and Offshore Islands	NT Coast and Offshore Islands
	Sandy beaches	✓	✓			✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
Intertidal and subtidal benthic primary producers	Mangroves										✓	✓		✓	✓	✓	✓
	Seagrasses			✓	✓		✓	✓	✓							✓	
Fisheries	Commercial	✓	✓					✓	✓	✓		✓				✓	
	Traditional Indonesian			✓	✓		✓	✓	✓								
	Recreational			✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
Protected areas	Commonwealth Marine Reserve							✓	✓			✓					
	State and Territorial Reserve	✓	✓										✓	✓	✓		
	KEFs		✓	✓	✓	✓	✓	✓	✓			✓					

Table 4.6 Summary of values and sensitivities within the EMBA in Indonesian/Timor Leste Jurisdiction

Values and Sensitivities		Sensitive Habitats within the EMBA					
		Indonesian Jurisdiction				Timor Leste Jurisdiction	
		East Nusa Tengarra Province	Maluku Province	West Nusa Tengarra Province	Java and Bali Province	West Timor	East Timor
Marine fauna	Cetaceans	✓	✓	✓	✓	✓	✓
	Dugongs	✓	✓	✓	✓	✓	✓
	Marine turtles (including nesting sites)			✓	✓		✓
	Sea snakes		✓	✓	✓	✓	✓
	Sharks, sawfish and rays	✓	✓	✓	✓	✓	✓
	Seabirds	✓	✓	✓	✓	✓	✓
Benthic communities	Submerged reefs and shoals	✓	✓	✓	✓	✓	✓
Intertidal sensitivities	Coastal reefs and shoals	✓	✓	✓	✓	✓	✓
	Sandy beaches	✓	✓	✓	✓	✓	✓
Intertidal and subtidal benthic primary producers	Mangroves	✓	✓	✓	✓	✓	✓
	Seagrasses	✓	✓	✓	✓	✓	✓
Fisheries	Commercial	✓	✓	✓	✓	✓	✓
	Traditional Indonesian	✓	✓	✓	✓	✓	✓
	Recreational	✓	✓	✓	✓	✓	✓

5 ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY

The environmental risk assessment process, as defined in the PTTEP AA SSHE Risk Management Procedure, is comprised of several stages as follows:

- Hazard Identification process, including:
  - Identifying specific tasks associated with the activity;
  - Understanding the existing environment;
  - Identifying which aspects could cause a potential environmental impact;
- Qualitative Analysis, including:
  - Identifying potential hazards associated with each aspect of the activity;
  - Identification and evaluation of appropriate Control Measures in relation to the overall context of the activity;
  - Assess predicted residual risk (with the application of Control Measures);
  - Demonstration of ALARP; and
  - Determination of risk acceptability.

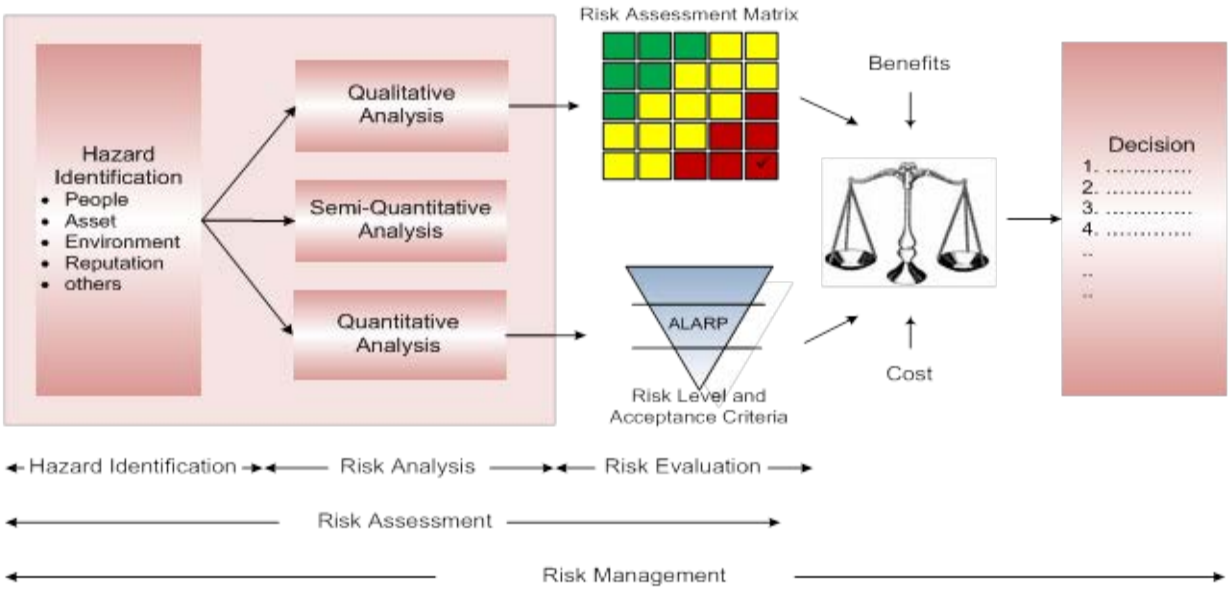

Figure 5.1 Risk Assessment Process

Hazard Identification

Hazard identification involves identification of potential sources of risk i.e. aspects of the activity which could cause potential environmental impacts to the particular values and sensitivities identified within the Environment That May be Affected (EMBA) by the petroleum activity.

Potential Sources of Risk

Activities are reviewed to identify the potential effects that they could have on various aspects of the environment. A systematic assessment of the impact that these effects could have, arising from either planned i.e. routine, or unplanned events i.e. non-routine leaks and spills, associated with the various activities, upon environmental, socio-economic and cultural receptors, is then undertaken.

The assessment considered normal and abnormal emergency conditions including, for example, the occurrence of cyclones.

Qualitative Analysis (Risk Assessment Matrix)

The qualitative analysis component assesses the aspects and particular values and sensitivities using a risk matrix (see Figure 5.1 and Table 5.1). Two key factors underpin the qualitative environmental risk assessment process:

- The likelihood of the particular values and sensitivities being impacted based on knowledge/historical data of similar events/incidents occurring within PTTEP AA or in the exploration and petroleum industry as a whole; and
- The severity of the consequences of the potential impact.

The qualitative analysis process is used to assign the consequence and likelihood of an impact occurring to a particular value or sensitivity and provides a relative level of risk. PTTEP AA's Risk Assessment Matrix is detailed in Table 5.1.

This process provides contextual information to assess the suitability and number of control measures required to reduce potential impacts and risks (either direct or indirect) to ALARP and acceptable levels.

Assessment of Potential Consequence

To further supplement the environmental consequence definitions within Table 5.1, and to provide specific regional context when undertaking the environmental risk assessment for this proposed drilling activity, additional definitions of the potential environmental impacts, including the level of severity, to particular values and sensitivities are presented in Table 5.2. As such, the 'Environmental Effect' column within Table 5.1 of the PTTEP corporate risk matrix has not been applied for this proposed drilling activity. In evaluating the level of (worst-case) consequence of a potential event, the following factors have been considered (see Table 5.2):

- Extent of impacts: Whether the impact affects the local or wider regional environment;
- Severity of Impacts;
- Duration & Frequency of the impact: How often the impact will occur and how long it will interact with the receiving environment; and
- Sensitivity of the receiving environment: Nature, importance (local, national or international significance) and the sensitivity or resilience to change of the receptor that could be affected.

Additionally, to provide context and clarity when evaluating potential consequence, specific definition is provided on extent, severity, and duration of potential impacts, and of the relative sensitivity of the receiving environment and is presented in Table 5.3.

Likelihood of Impact Occurrence

The likelihood (probability or frequency) of an impact occurring takes into account the effective implementation of the proposed control measures. The likelihood of a top-level event occurring that could give rise to the impact is based upon knowledge/historical data of similar events/incidents occurring within PTTEP AA or in the industry as a whole. Definitions of likelihood are detailed in the risk assessment matrix (Table 5.1).

Determining Residual Risk

The residual risk is determined by assessing the consequence of the potential impact in relation to a particular value or sensitivity and the likelihood of that consequence occurring with proposed control measures in place. The residual risk is an indicator of the relative overall risk posed to the environment and is used to place context around risk-related decision, such as the level and type of controls required to manage impacts to ALARP and acceptable levels, or indeed if a potential risk is acceptable in the context of the environment that may be affected.

ALARP Decision Context

In alignment with NOPSEMA's ALARP Guidance Note (N-04300-GN0166, June 2015), PTTEP have adapted the approach developed by Oil and Gas UK (OGUK) (formerly UKOOA) Guidance on Risk Related Decision Making (Issue 2, July 2014) for use in an environmental context to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (Figure 5.2). The application of this methodology also provides context for the overall nature and scale of the activity in relation to its potential impacts and risks. Specifically, the framework considers impact severity based upon contextual information in relation to the following factors:

- activity type;
- potential (environmental) risk and (engineering / scientific) uncertainty; and
- stakeholder influence (objects or claims)

Once the overall decision context for each hazard is established it is allocated to one of the three "Types" defined below. This categorisation also aligns with the PTTEP AA approach to the low, medium and high residual risk levels as outlined in the SSHE Risk Assessment Standard (SSHE-106-STD-400) shown in Figure 5.2. When allocating a decision type, PTTEP AA also considers the timing of the activity in relation to seasonal sensitivities for matters protected under Part 3 of the EPBC Act, i.e., matters of national environmental significance (MNES).

A Type A (Low Risk) decision is made if the risk is relatively well understood, the potential impacts are low (including those to MNES when considering seasonal sensitivities), activities are well practised, and there is no significant stakeholder interest. However, if good practice is not sufficiently well-defined, additional assessment may be required.

A Type B (Medium Risk) decision is made if there is greater uncertainty or complexity around the activity and/or risk, the potential impacts are moderate (including those to MNES when considering seasonal sensitivities), or the risk generates several concerns from stakeholders. In this instance, established good practice is not considered sufficient and further assessment is required to support the decision and ensure the risk is ALARP.

A Type C (High Risk) decision typically involves sufficient complexity, high potential impact (including those to MNES when considering seasonal sensitivities), uncertainty, or stakeholder interest to require a precautionary approach. In this case, relevant good practice still has to be met, additional assessment is required, and the precautionary approach applied for those controls that only have a marginal cost benefit.

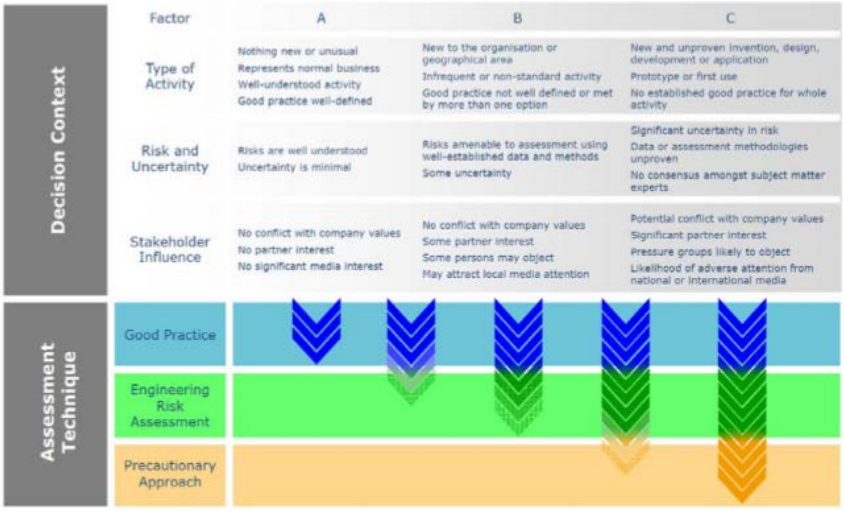

Figure 5.2 Decision support framework used to demonstrate ALARP (NOPSEMA, 2015)

In accordance with the regulatory requirement to demonstrate that environmental impacts and risks are managed to ALARP, PTTEP has considered the above decision context in determining the level of assessment required.

The assessment techniques considered include:

- good practice;
- engineering risk assessment; and
- precautionary approach.

If the decision context is categorised as 'Type A', PTTEP considers the application of 'Good Practice' to be sufficient to demonstrate potential impacts and risk are managed to ALARP and further assessment ('Engineering Risk Assessment') is not necessarily required to identify additional controls. However, PPTEP may apply additional controls (over and above 'Good Practice') when there is the potential to further reduce environmental impacts and risks for a small or negligible cost i.e., in relation to time, effort, money.

If the decision context is categorised as 'Type B', PTTEP undertakes an analysis of alternate and/or additional control measures to those identified by 'Good Practice' based on a cost-benefit analysis approach. The analysis is based upon:

- Predicted level of impact and risk (with adopted control measures implemented);
- The balance and weight of evidence in relation to the possible environmental benefit and the costs of adopting alternate, additional and/or improved control measures;
- Relative (and overall) cost associated with alternate, additional and/or improved control measures when compared with adopted control measures; and
- The potential environmental benefit of industry collaboration (where appropriate) in relation to research, resource, shared equity etc.

If the decision context is categorised as 'Type C', PTTEP applies a precautionary approach to hazard management, should available engineering and scientific evidence be insufficient, inconclusive or uncertain, or if relevant Stakeholders have significant concerns relating to the aspect of the activity. The precautionary approach means that uncertainty is counterbalanced with the use of conservative assumptions when undertaking environmental risk assessment and that additional control measures will more likely be adopted.

ALARP Justification

The overall ALARP assessment for each aspect of the proposed activity is based upon the range of considerations as described above, with consideration given to the Decision Context and

Assessment Techniques adopted for this proposed activity in alignment with NOPSEMA's ALARP Guidance Note (N-04300-GN0166, June 2015), and OGUK Guidance on Risk Related Decision Making (Issue 2, July 2014).

Determination of Acceptability

In alignment with the NOPSEMA Environment Plan Decision Making Guideline (GL1721 Rev 3 May 2017), the Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations 2009 (Sub-regulation 10A(c) and Part 1, Section 3 – Objects of the Regulations), and Part 3 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), PTTEP have established a set of acceptability criteria when evaluating the acceptability of aspects of the activity:

1. The aspect of the activity is deemed to have a low (1-3) or medium (4) risk ranking and the environmental consequence/severity does not exceed a ranking of 4. If ranked medium risk additional control measures have been applied to manage potential environmental impacts and risks to ALARP;
2. The aspect of the activity does not compromise relevant principles of Ecologically Sustainable Development (ESD) or breach relevant requirements for environmental approvals (EPBC Act Part 3, Division 1).
3. The management of the activity is consistent with any relevant plan of management for a Commonwealth Marine Reserve (CMR) and/or a recovery plan for a threatened species that include specific management and conservation requirements.
4. All relevant legislative and other requirements have been met or considered in context, as discussed above;
5. All relevant internal PTTEP requirements have been met;
6. All valid objections or claims made by relevant (potentially affected) Stakeholders have been sufficiently addressed; and
7. The predicted level of impact is equal to or below the defined acceptable impact (DAI) threshold (as described below).

Defined Acceptable Impact

In alignment with NOPSEMA's Environment Plan Decision Making Guideline (GL1721 Rev 3 May 2017), and to allow for the demonstration that an impact is below a given tolerance threshold, a defined acceptable impact (DAI) is established taking into consideration:

- The relative risks posed to particular values and sensitivities;
- The input (if any) of relevant stakeholders;
- The demonstration of ALARP based upon the decision context (as described above); and
- The principles of ESD.

As per the ALARP decision context (described above) PTTEP AA have adopted an aligned approach to the definition of an acceptable impact. As such, impacts and risks that have been classified as a 'Type A' are inherently at or below an acceptable level, provided it is demonstrated that the impacts and risks are reduced to ALARP. This is based on a 'Type A' decision context representing a low risk of potential impact from activities that are well practised, with risk relatively well understood and no significant stakeholder interest.

Activities with potentially elevated impacts and risks are classified as a 'Type B' (medium risk) or 'Type C' (high risk) decision context. For these activities, PTTEP AA provides a comparison between the predicted levels of impact and the defined acceptable impact threshold.

For routine activities, the predicted level of impact is equal to or below the DAI when:

1. Acceptability criteria 1-5 have been met, and

2. Control measures have been demonstrated to be ALARP, and
3. Impacts and risks are 'Type A'; or
4. Impacts and risk are 'Type B' or 'Type C'; and
5. A qualitative or quantitative comparison demonstrates the predicted level of impact is equal to or below the DAI and any scientific or engineering uncertainty is address with a degree of conservatism, and control measures can be expected to achieve the defined Environmental Performance Outcome.

For non-routine discharges (including emergency conditions), the DAI threshold is taken to be the conservative environmental impact threshold(s) and the outer geographical limits of the EMBA relevant to the discharge type. For emergency conditions, the predicted level of impact is equal to or below the DAI when:

1. Acceptability criteria 1-5 have been met, and
2. Control measures have been demonstrated to be ALARP; and
3. Preventative control measures can be expected to achieve an Environmental Performance Outcome (EPO) of no impact;

For non-routine activities, including those implemented to respond to an emergency condition, the predicted level of impact is equal to or below the DAI when:

1. Acceptability criteria 1-5 have been met; and
2. Control measures have been demonstrated to be ALARP; and
3. Response control measures can be expected to achieve the stated EPO for the response strategy; or
4. The emergency response control measures do not afford the impact to exceed the conservative environmental impact threshold(s) or extend beyond the outer geographical limits of the EMBA (the emergency condition DAI threshold).

The DAI is also considered as a benchmark when establishing the Environmental Performance Outcome and the expected level of performance of proposed control measures.

To provide additional assurance of the acceptable level of impact associated with the implementation of 'Type B' or 'Type C' oil pollution emergency strategies, PTTEP AA commit to engaging with relevant stakeholders to establish external context during the 'Net Environmental Benefit Analysis' (NEBA) process (outlined in the 'Oil Pollution Emergency Plan' (OPEP)). Pending the outcome of this engagement, the upper limit of acceptable impact on a stakeholder's interest or functions can be evaluated holistically considering the overall cost-benefit of response strategy implementation.

Determination of Unacceptable Impact or Risk

PTTEP considers an unacceptable environmental impact or risk exists when:

- despite the application of a 'Precautionary Approach' to hazard management, and the application of all reasonably practicable control measures, there remains a 'Credible' chance of a 'Major' environmental effect occurring or a "Likely' chance of a 'Serious' environmental effect occurring; or
- Any of the above 'Acceptability Criteria' have not been met.

To establish internal context, as per Section 4.4 of the PTTEP SSHE Risk Management Procedure (Standard ID: S32-501965-CORP), higher order risks are governed by a Technical Authority Standard, which identifies a register of local subject matter Technical Authorities (TA1s) and corporate subject matter Technical Authorities (TA2s) authorised to review and verify risk assessments.

TA1s review and verify risk assessments performed by the Asset and Project teams where the risk is classified as Medium Risk with a severity of Serious (4) or Major (5); and TA2's are responsible for reviewing and verifying Asset / Project risk assessments where the assessment is in the Red Zone of the Risk Assessment Matrix after mitigation. PTTEP Chief Executive Officer (CEO) approval and sign off is required for high residual risk activities to proceed. The Technical Authorities for environmental risk for this proposed activity are:

- TA1 – PTTEP Senior Environmental Advisor; and
- TA2 – PTTEP Vice President for Environment

For this proposed activity, the PTTEP CEO shall use the acceptance criteria for determining acceptability of impact and risk as defined within the Montara Production Drilling EP.

Table 5.1 Risk Matrix

Risk Matrix									
Consequences					Frequency of Occurrence (chance of event occurring per year)				
					Rare (A)	Unlikely (B)	Credible (C)	Likely (D)	Frequent (E)
Severity	People (*)	Asset Production / Property (*)	Environmental Effect (*)	Reputation	Event occurrence is remote OR never heard of in the E&P industry	Event occurrence is possible but unlikely OR has happened few times in the E&P industry	Event has occurred several times in E&P industry OR occurred in PTTEP	Event has occurred several times per year in E&P industry OR more than once per year in PTTEP OR occurred at the location.	Events are frequent in the E&P industry OR occurred more than once per year at the location
Major (5)	Multiple fatalities	Loss > $50M AUD	Spill > 100,000 bbl OR Tier 3 OR International assistance	International TV International papers					
Serious (4)	Multiple LWDC OR one or more Permanent Disability OR 1 fatality	Loss between $10M – $50M AUD	Spill > 10,000 bbl OR Tier 2 OR Regional assistance	National TV National papers				HIGH RISK	
Significant (3)	Single LWDC OR multiple RWDC	Loss between $1M – $10M AUD	Spill > 80 Litres OR Tier 1 OR Localised effect	Local TV Local written media			MEDIUM RISK		
Moderate (2)	MTC OR Single RWDC	Loss between $50K – $1M AUD	Spill < 80 Litres OR Moderate effect	Local media interest		LOW RISK			
Minor (1)	Minor Injury with First Aid	Loss < $50K AUD Insignificant	Spill in containment OR Minor effect	No reaction					

MAE

HPI

*, Refer to qualitative explanation overleaf

Low Risk	Medium Risk	High Risk
Broadly acceptable	Risk reduction measures required to achieve ALARP Residual risk with Severity of (4) and (5) require TA1 sign-off to conduct task	Risk reduction measures required to achieve ALARP Residual High Risk requires TA1 verification, TA2 and PTTEP AA CEO sign-off to conduct task

Table 5.2 Qualitative Measures of Consequence: Effect on the Environment

Number	Description
1	**Minor Effect** – Localised change to the environment (nuisance or sub-lethal) – practically indistinguishable from existing baseline, within immediate vicinity of the installation. Impact to individual or small number of non-listed species. No or negligible financial consequences (<$50K AUD). Little to no potential impacts to relevant external stakeholders.
2	**Moderate Effect** – Localised to wide-spread change to the environment (nuisance, chronic or sub-lethal) – negligible and reversible change to baseline of population / community (no lasting effect). Impact to individual listed species or large number of non-listed species. Negligible to small financial consequence ($50K - $1M AUD). Single breach of statutory or prescribed limit, or cause for single complaint/objection from relevant external stakeholder.
3	**Significant Effect** – Wide-spread change to the environment (chronic, acute or lethal) – noticeable but reversible change to baseline – population / community (short-term effect). Impact to individual or multiple listed species or population of non-listed species. Moderate financial consequence ($1M - $10M AUD). Potential for multiple breaches of statutory of prescribed limits, or cause for multiple complaints/objections from relevant external stakeholders.
4	**Serious Effect** – Wide-spread to regional change to the environment (chronic, acute or lethal) – persistent but reversible change to baseline – population, community or species. Impact to multiple or population of listed species and/or non-listed species. High financial consequence ($10M - $50M AUD). Potential remediation required. Likely multiple breaches of statutory of prescribed limits, or cause for multiple complaints/objections from relevant external stakeholders and other interested parties.
5	**Major Effect** – Wide-spread or regional change to the environment (chronic, acute and/or lethal) – irreversible change to baseline – populations, communities, species. Impact at population and/or species level of listed and/or non-listed species. Potential threat to ecological integrity of listed species. Potential serious or irreversible damage to World Heritage, National Heritage, Ramsar wetland, Values within a Commonwealth Marine Reserves or on Commonwealth Land. Very high financial consequence (>$50M AUD). Potential for significant level of remediation required. Likely multiple breaches of statutory of prescribed limits, or cause for multiple complaints/objections from relevant external stakeholders and other interested parties. Potential for legal proceedings.

Table 5.3 Supporting Contextual Definitions for Qualitative Measures of Consequence

Context	Term	Definition
Extent	Localised	The area directly affected by the petroleum activity and the immediate vicinity of the activity i.e., the MDP area
	Wide-spread	The area well outside the immediate vicinity of the activity i.e., outside the MDP area
	Regional	Immediate Region / Bio-Regional
Severity	Nuisance	Change to function of an individual or population
	Disruption	Change to function of a species or ecosystem
	Chronic	Persisting for a long time or constantly recurring
	Acute	Severe but of short duration
	Sub-Lethal	Having an effect less than lethal
	Lethal	Sufficient to cause death
Duration	Short-term	< 2 years
	Medium-term	2-5 years
	Long-term	5-10 years
	Persistent	> 10 years
	Irreversible	Detectable & permanent changes to baseline
EPBC Act 1999	Serious	For this proposed activity 'serious' is considered interchangeable with the term 'major effect' as defined in Table 5.2 above.
	Ecosystem	Ecosystem means a dynamic complex of plant, animal and micro organism communities and their non-living environment interacting as a functional unit.
	ESD	3A Principles of ecologically sustainable development. The following are principles of ecologically sustainable development: (a) decision making processes should effectively integrate both long term and short term economic, environmental, social and equitable considerations; (b) if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation; (c) the principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations; (d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision making; (e) improved valuation, pricing and incentive mechanisms should be promoted.

Context	Term	Definition
	Biodiversity	Biodiversity means the variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part) and includes: (a) diversity within species and between species; and (b) diversity of ecosystems.
	Ecological Character	Ecological character has the meaning given by subsection 16(3).
	Ecological Community	Ecological community means the extent in nature in the Australian jurisdiction of an assemblage of native species that: (a) inhabits a particular area in nature; and (b) meets the additional criteria specified in the regulations (if any) made for the purposes of this definition.
	Ecologically Sustainable Use	Ecologically sustainable use of natural resources means use of the natural resources within their capacity to sustain natural processes while maintaining the life support systems of nature and ensuring that the benefit of the use to the present generation does not diminish the potential to meet the needs and aspirations of future generations.
	Precautionary Principle	The precautionary principle is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.
Other	Significant	Important, notable or of consequence having regard to its context or intensity
	Damage	Physical harm that impairs the value, usefulness, or normal function of something.

6 ENVIRONMENTAL IMPACTS AND RISKS EVALUATION

This section provides the results of the risk evaluation based on the environmental hazards and risks identified during typical production drilling operations (Table 6.1). Impacts are segregated into routine (planned) and non-routine (unplanned) activities.

Table 6.1 Routine and Non-Routine Activities Summary

Routine Activities	
R1	Establishment of Rig Safety Exclusion Zone
R2	Physical Presence of MODU and Support Vessels
R3	Mobilisation of MODU and Support Vessels from International Waters
R4	Light emissions
R5	Positioning of the MODU on the Seafloor
R6	Underwater Noise Emissions from MODU and Support Vessels
R7	Atmospheric Emissions from MODU and Support Vessels
R8	Putrescible Wastes, Sewage and Greywater
R9	Deck Drainage and Bilge Water
R10	Routine Discharges of Cooling Water and Brine
R11	Discharge of Drill Cuttings and Fluids
R12	Discharges of Cement
Non-Routine Activities	
N1	Discharges to Marine Environment: Accidental release of chemicals or waste from MODU and vessels during general operations and bulk transfers
N2	Hydrocarbon Spills: Uncontrolled Well Blowout - Crude oil spill (maximum 236,349 m^3 over 77 days)
N3	Hydrocarbon Spills: Vessel collision resulting in large diesel spill (maximum 250 m^3)
N4	Hydrocarbon Spills: Loss of hydrocarbons –refueling incident (diesel spill max 5m^3)
N5	Disturbance to Natural Habitat
N6	Introduction of Dispersants to the Marine Environment
N7	In Situ Burning Impacts – Fire, Smoke and Residues
N8	Oiled Fauna Displacement and Handling

6.1 ROUTINE ACTIVITY ASPECTS

R1 - Physical Presence of MODU/Support Vessels and Establishment of Rig Safety Exclusion Zone

Potential Hazard Identification – Establishment of Nature & Scale
The MODU is located over the Montara H5 ST-2 well centre within the Montara Development Project (MDP) area. Once on location, the MODU will remain in a fixed position for the duration of drilling. Support vessels will be used to supply the MODU on a regular basis, transiting every few days. A rig safety exclusion zone is established around the MODU once on location in order to control the potential for physical interaction with other marine users. A support vessel will remain on location (just outside the 500m rig safety exclusion zone) during drilling activities. Support vessels may enter the 500m rig safety exclusion zone once authorised for safe entry under the PTTEPAA Permit to Work system. Entry of vessels is at low speed and communication is maintained with the MODU during these support / supply activities. The MDP area overlaps or occurs in the vicinity of five commercial, Commonwealth managed fisheries: Northwest Slope Trawl Fishery, Western Tuna and Billfish Fishery, Western Skipjack Tuna Fishery, Southern Bluefin Tuna Fishery and Northern Prawn Fishery, and a number of State/Territory managed fisheries. While there may be some overlap of the fisheries with the MDP area, active fishing is not expected for all fisheries. In order to reduce any potential impacts, consultation has been undertaken with Commonwealth and State management authorities and with specific fisheries and operators. No known tourist, recreational or traditional/subsistence fishing occurs in the area. There is the possibility of occasional passing private motor vessels or yachts. The majority of major commercial shipping routes pass well to the north of the MDP area. • The potential hazard(s) associated with the physical presence of the MODU/support vessels and establishment of a rig safety exclusion zone are: o Physical interference with other marine users through the physical presence of MODU /support vessels creating a potential navigation hazard; o Socio-Economic impacts (loss of revenue due to disruption) to other marine users through the establishment of a 500m exclusion zone; • The potential exposure of commercial fishing, shipping and other marine users to the physical presence of the MODU/support vessels and exclusion zone is: o For the duration of the proposed drilling activities i.e., from September 2017 to potentially February 2018, on a 24 hr basis. o For a 500m radius from Montara H5 ST-2 well centre whilst the MODU is on location. o Within the MDP area for the project support vessels. Feedback received from the stakeholder consultation program suggested little impact to potential users, and shipping in the area is not significant. Fisheries and operators in the area have been alerted to the proposed activities. There have been no objections or claims made by relevant stakeholders in relation to the physical presence of the MODU/support vessels and establishment of a 500m rig safety exclusion zone.

Detailed Environmental Impact Assessment					
Identified Value or Sensitivity Potentially Exposed to Hazard	**Potential Severity / Consequence Discussion**	**Rating**	**Likelihood of Impact Occurrence**	**Rating**	**Risk**
Commercial Fisheries • Commonwealth-Managed • State/Territory-Managed	Any overlap with active fisheries is relatively small and the potential for interference from the physical presence of the drilling rig and support vessels will be limited to localised displacement/avoidance by commercial fishing vessels i.e. within the 500 m safety exclusion zone for a relatively short time period (60 to 150 days). Any potential impact to commercial fisheries would therefore be highly localised, limited to individual marine users and have a negligible financial consequence.	Minor (1)	Given the low fishing effort exhibited by commercial fisheries within the MDP area, it is deemed unlikely that there will be an impact on commercial fisheries (State, Territory or Commonwealth).	Unlikely (B)	Low (1B)
Traditional & Subsistence Fisheries	Physical presence poses no known hazard or risk of interference with traditional or subsistence fishing, given none is known to occur in the area. Should traditional fishers enter the MDP area, any potential impact would be highly localised, limited to individuals with negligible financial consequence.	Minor (1)	Given there are no know traditional/subsistence fisheries within the MDP area, it is unlikely for any impact to occur.	Unlikely (B)	Low (1B)
Tourism & Recreation	Physical presence poses no known hazard or risk of interference with tourism or recreation activities. Should a private vessel enter the MDP area, any potential impact would be highly localised, limited to individuals with negligible financial consequence.	Minor (1)	Given there are no know tourism operators within the MDP area, it is unlikely for any impact to occur.	Unlikely (B)	Low (1B)
Ports & Commercial Shipping	Physical presence poses no hazard to port activities. Should physical presence create a navigation hazard, and/or a commercial vessel enters the 500 m exclusion zone, the potential for collision could result in damage to vessels and/or equipment.	Significant (3)	Given commercial shipping lanes are located well north of the MDP area, and with the application of rules of the sea by commercial shipping, it is considered rare for an impact of this nature to occur.	Rare (A)	Low (3A)

Summary of Control Measures, ALARP and Acceptability
The decision context for impacts and risks associated with physical presence of MODU/support vessels and the establishment of a Rig Safety Exclusion Zone is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice. The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels: • Compliance with maritime safety and navigation requirements to prevent collisions including Marine Orders 30 (prevention of Collisions) and 21 (Safety of Navigational and Emergency Procedures); • A Cautionary Area has been established around the Montara Venture, Montara Wellhead Platform and associated subsea infrastructure by the Australian Maritime Safety Authority (AMSA) and notated on the Admiralty Chart covering the region by the Australian Hydrographic Service. This area extends out 2.5 nm from the Wellhead Platform in all directions with the exception of north where it extends out 1 nm due to the presence of a shipping lane; • As part of the PTTEP AA Stakeholder Engagement Process, fisheries and operators in the area have been alerted to the proposed operations as part of the consultation process; and • As part of the PTTEP AA Project Induction, the rights of commercial fishers to operate safely within the Cautionary Area to be communicated to relevant personnel aboard the MODU and Support Vessels. **ALARP and Acceptability** Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R2 - Physical Presence of MODU and Support Vessels – Disturbance to the Marine Environment

Potential Hazard Identification – Establishment of Nature & Scale
Once on location, the MODU remains in a fixed position for the duration of drilling, fixed to the seabed by three telescopic legs, each with a base plate (spud can). Support vessels will be used to supply the MODU on a regular basis, transiting every few days, with a support vessel remaining on location (just outside the 500m rig safety exclusion zone) during drilling activities. Support vessels may enter the 500m rig safety exclusion zone once authorised under the PTTEPAA Permit to Work system. Entry of vessels is at low speed and communication is maintained with the MODU during these support / supply activities. Vessel strikes contribute to the mortality of large marine fauna, notably whales (Knowlton and Kraus, 2001; Laist et al., 2001), marine turtles (Lutcavage et al., 1997; Hazel and Gyuris, 2006; Hazel et al., 2007) and sea birds. However, the risk of vessel strikes is greatest in areas where there are large numbers of fast moving vessels, particularly small vessels, operating in shallow or confined waters with high concentrations of marine fauna (Laist et al., 2001). Vessel speed has been reported to be a key factor in collisions with marine fauna such as cetaceans and turtles with a higher likelihood of injury or mortality from vessel strikes on marine mammals when vessel speeds are greater than 14 knots (Laist et al. 2001.

Whale sharks are subject to a Conservation Advice which reports that a threat to the recovery of the species includes strikes from vessels. A control measure requiring compliance with the Whale Shark Wildlife Management Program no. 57 addresses avoidance of whale sharks and, as such, is considered to align with the Conservation Advice for whale sharks. The foraging area for whale sharks (BIA) intersects the MDP area however, based on the reported levels of abundance the likelihood of whale shark presence within this BIA is considered low, with no specific seasonal pattern of migration.

No other critical habitats and/or fauna or BIAs overlap the MDP area and therefore there is a low likelihood of encountering protected species including cetaceans and turtles. Numerous species of birds frequent the region of the MDP area or fly through the area on annual migrations. There is no emergent land within the MDP area to support roosting or breeding, but foraging activity may occur.

- The potential hazard(s) associated with the physical presence of the MODU and support vessels are:
  - Physical interaction with marine fauna by project support vessels;
  - Physical alteration of benthic communities through the placement of MODU on seabed.
- The potential exposure of marine fauna or avifauna to the physical presence of the MODU and support vessels is:
  - Limited to transit activities of project support vessels within the MDP area i.e., a few times per week whilst supporting / supplying the MODU;
  - Limited to 2-3 hours for vessel transit in the MDP area to reach the 500 m rig safety exclusion zone;
  - Limited to less than 30 minutes for the support vessel to enter the rig safety exclusion zone and engage with the MODU;
  - Transit activities may be conducted on a 24-hr basis.

Relevant stakeholders have been engaged as part of the project stakeholder consultation program. There have been no objections or claims made by relevant stakeholders in relation to the physical presence of the MODU and project support vessels.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Potential Severity / Consequence Discussion	Rating	Likelihood of Impact Occurrence	Rating	Risk
Marine Fauna • Marine Mammals	Support vessels within the MDP area will be travelling at low speeds and the chance of a vessel collision with a marine mammal (cetacean or dugong) resulting in a lethal outcome is reduced as individuals are expected to display avoidance behaviour. There are no known key aggregation areas (resting, breeding or feeding) located within or immediately adjacent to the MDP area; however, occasional individuals may be present.	Moderate (2)	Given the short-duration of transit activities, and that no critical habitats and/or BIAs for marine mammals (cetaceans and dugong) overlap the MDP area, it is considered unlikely to encounter marine mammals resulting in a fauna strike incident.	Unlikely (B)	Low (2B)

	Should a support vessel strike a marine mammal, the worst-case consequence would be a potentially lethal effect on a single individual with no lasting effect to population or community baseline.				
Marine Fauna • Whale Sharks	Although whale sharks do not breach the surface, they are known to swim near to the water surface and are susceptible to vessel interactions. Should a project support vessel strike a whale shark at the surface, the worst-case consequence would be a potentially lethal effect on a single individual with no lasting effect to population or community baseline.	Moderate (2)	The foraging BIA for whale sharks overlaps the MDP area; however, only occasional individuals are expected to occur, with no known aggregation areas for feeding or breeding in the region. It is considered unlikely to encounter a whale shark resulting in a fauna strike incident.	Unlikely (B)	Low (2B)
Marine Fauna • Marine Reptiles • Other Sharks, Sawfish & Rays • Other Listed Fish Species	Should individuals of EPBC listed and non-listed marine fauna species transit through the MDP area, the worst-case consequence of a fauna strike would be a potentially lethal effect on a single individual of a listed species with no lasting effect to population or community baseline.	Moderate (2)	Given the short-duration of transit activities, and that no other critical habitats and/or BIAs overlap the MDP area, it is considered unlikely to encounter protected species (marine reptiles; sharks, sawfish and rays; and listed fish species) resulting in a fauna strike incident.	Unlikely (B)	Low (2B)
Avifauna	Should individuals of listed or migratory bird species transit through the MDP area, the worst-case consequence of a bird strike would be localised, with a potentially lethal effect on a single individual with no lasting effect to population or community baseline.	Moderate (2)	Given the mobile nature of listed or migratory bird species, it is considered unlikely for a strike incident to occur.	Unlikely (B)	Low (2B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks to the marine environment associated with physical presence of MODU and support vessels is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.

The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- EPBC Regulations 2000 – Part 8 Division 8.1 'Interacting with cetaceans': [support vessels] to travel at a speed not greater than 6 knots within 300 m of a cetacean and approach no closer than 100 m from a whale and no closer than 50m from a dolphin, where possible; and
- Whale Shark Wildlife Management Program no. 57: [support vessels] will not travel faster than 8 knots within 250 m of a whale shark (exclusive contact zone) and not approach closer than 30 m of a whale shark.

ALARP and Acceptability

Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R3 - Mobilisation of MODU and Support Vessels from International Waters

Potential Hazard Identification – Establishment of Nature & Scale

The MODU is to be mobilised from international waters into Australian Commonwealth waters. The MODU contracted for the proposed drilling is not self-propelled and will be mobilised with the aid of a support vessel. The MODU is a new-build (2014) and was in dry-storage during transit for an extended period (21+ days) prior to being contracted to PTTEP AA.

Invasive marine pest (IMP) species could potentially be introduced into the region either through marine fouling on the MODU and project support vessels, or as a component of ballast water and associated sediments. Ballast water may contain a variety of organisms such as fish, invertebrate larvae, and phytoplankton from the location from which it was taken onboard. Should IMPs be introduced and take hold they have the potential to alter local ecosystems with possible impacts on native populations through an increase in competition, predation of native/endemic species/food sources and possible impacts on human uses/resources (e.g. biofouling).

Despite the use of antifouling systems, there is a potential for marine fouling on the MODU and project support vessels. Colonisation by IMP species would require suitable environmental conditions such as water temperature, water depth and habitat range, which could enable a marine pest to establish a new population. The likelihood of IMPs being introduced and establishing a colony at the MDP area is dependent on successful IMP establishment on a vessel or presence in ballast water; survival of IMPs during transit (potentially across varying temperature and salinity gradients); the spread of viable IMP propagules and larvae from a vessel; the IMPs' arrival at a suitable habitat; and establishment of a viable IMP population (Commonwealth of Australia 2009).

The marine species recognised as representing an elevated pest risk in Australia are typically coastal or shallow-water species. It has been found that highly disturbed environments (such as marinas) are more susceptible to colonisation than open-water environments where the number of dilutions and the degree of dispersal are high (Paulay et al. 2002). Environmental conditions at the MDP location are unlikely to support the establishment of a new population due to remote location, distance to land, water depth and lack of suitable substrate.

- The potential hazard(s) associated with mobilisation of the MODU and support vessels from international waters are:
  - Biological alteration of local or endemic species / communities through the introduction of IMS;
  - Physical displacement of local or endemic species / communities through the introduction of (and subsequent competition with) IMS;
  - Socio-Economic implications associated with direct / indirect disturbance to commercially or socially valuable fish stocks.

- The potential exposure of marine species / communities to IMS:
  - Extends from the MDP in Commonwealth waters to within port limits during transit activities of project support vessels;
  - May extend up to 75 days following the initial arrival of MODU and project support vessels (as per WA DOF engagement);
  - Is limited to the duration of the proposed drilling activities i.e., from September 2017 to potentially February 2018; and
  - Generally, is limited to areas <12nm from the nearest coastal waters and water depth <50m.

Consultation with Western Australian Department of Fisheries (DOF) resulted in a request to manage residual risk of biofouling after arrival in WA waters (follow-up marine pest inspection conducted around 75 days after arrival) if project support vessels continue to transit to WA State waters. No other relevant stakeholders have made any objection or claim in relation to the mobilisation of the MODU and support vessels from international waters.

A risk assessment was undertaken of the well locations in accordance with National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009). The results of the risk assessment are detailed below.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Severity / Consequence Discussion	Rating	Likelihood (of Exposure to Hazard)	Rating	Risk
Marine Fauna • Marine Mammals • Marine Reptiles • Sharks, Sawfish & Rays • Listed Fish Species	Should IMP species establish either within the MDP area in Commonwealth waters or within State / Territory waters, there is potential for a localised to wide-spread but negligible effect on marine fauna populations or communities as a result of indirect effects e.g. through competition or effects on prey species.	Moderate (2)	Invasion and establishment of IMP species is unlikely to occur due to their inability to establish at the remote location of the area (> 12 nm from coastal waters) and water depth (> 50 m) and because MODU was in dry storage during transit for 21+ days prior to arrival at the MPD area.	Unlikely (B)	Low (2B)
Benthic Communities	Should IMS establish either within the MDP area in Commonwealth waters or within State / Territory waters, there is potential for a wide-spread persistent change to benthic populations or communities.	Serious (4)	Invasion and establishment of IMP species is unlikely to occur due to their inability to establish at the remote location of the area (> 12 nm from coastal waters) and water depth (> 50 m) and because MODU wasin dry storage during transit for 21+ days prior to arrival at the MPD area.	Unlikely (B)	Medium (4B)

Commercial Fisheries • Commonwealth-Managed • State/Territory-Managed	Should IMS establish either within Commonwealth waters or within State / Territory waters, there is potential for a wide-spread persistent change to commercial fish stocks. There may also be high financial implication due to loss of revenue and/or the application of remediation requirements, with potentially multiple complaints / objections from affected stakeholders.	Serious (4)	Due to the lack of commercial fishing effort and inability for IMS to establish in locations remote from coastal waters and water depths >50 m, and because MODU was in dry storage during transit for 21+ days, impacts to commercial fisheries have been deemed unlikely.	Unlikely (B)	Medium (4B)
Traditional & Subsistence Fisheries	Should IMS establish either within Commonwealth waters or within State / Territory waters, there is potential for a wide-spread persistent change to traditional or subsistence fish stocks. There may also be high financial implication due to loss of ability to undertake traditional fishing and/or the application of remediation requirements, with potentially multiple complaints / objections from affected stakeholders.	Serious (4)	Due to the lack of traditional fishing grounds and inability for IMS to establish in locations remote from coastal waters and water depths >50 m, and because MODU was in dry storage during transit for 21+ days, impacts to traditional fisheries have been deemed unlikely	Unlikely (B)	Medium (4B)
Tourism & Recreation	Should IMS establish either within Commonwealth waters or within State / Territory waters, there is potential for a wide-spread persistent change to recreational fish stocks. There may also be high financial implication associated with loss of tourism revenue and/or the application of remediation requirements, with potentially multiple complaints / objections from affected stakeholders.	Serious (4)	Due to the lack of tourism and recreation activities and inability for IMS to establish in locations remote from coastal waters and water depths >50 m, and because MODU will have been in dry storage during transit for 21+ days, impacts to tourism and recreation have been deemed unlikely.	Unlikely (B)	Medium (4B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with the mobilisation of the MODU and support vessels from international waters is 'Type A' as defined in Section 5. However, as the Western Australian Department of Fisheries (DoF) has expressed some interest in relation to the residual risk of biofouling, additional control measures have been evaluated in alignment with a 'Type B' decision context. As such, the demonstration of ALARP is based on assessment against industry good practice and an engineering risk assessment to further evaluate a range of control measure options.

The following 'good practice' controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Adherence to Australian Ballast Water Management Requirements (Version 6) – Section 2 General ballast water requirements;
- Adherence to Australian Ballast Water Management Requirements (Version 6) – Section 3 Ballast water management options;

- Adherence to the Offshore Petroleum Installations – Biosecurity Guide (Version 0.1), Commonwealth of Australia, DoAWR, June 2016; and
- Adherence to the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry, Commonwealth of Australia, 2008.

No additional control measures evaluated as part of the engineering risk assessment were determined to be reasonably practicable in the context of further risk reduction and therefore no further controls have been adopted.

ALARP and Acceptability

As described above, the demonstration of ALARP for a 'Type B' decision context is based on assessment against industry good practice and analysis of alternate and/or additional control measures through an engineering risk assessment. Given that no additional control measures evaluated as part of the engineering risk assessment were determined to be reasonably practicable in the context of further risk reduction, the adoption of the 'Good Practice' measures above adequately provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R4 - Light Emissions

Potential Hazard Identification – Establishment of Nature & Scale

For safety and navigational reasons, lighting on the MODU and support vessels will be required 24 hours a day, in accordance with the Navigation Act 2012. Fluorescent lights will be used that meet required navigational and occupational safety standards. As the nearest coastline is over 200 km away, lighting will not be visible at sea level from any mainland or island beaches. The offshore waters of the MDP are not a known important feeding, breeding or aggregation area for marine fauna and are distant from islands used as rookeries for seabirds or hatchling sea turtles (Cartier Island 109 km away is the closest). The MDP area is distant from coral reefs or shoals that could be impacted by lighting (Goeree and Vulcan Shoals being the closest, approximately 30 km to the southwest.

- The potential hazard associated with light emission is:
  - Behavioural change to marine fauna and avifauna species / communities through attraction to lighted areas and amassed food source (plankton);
- The potential exposure of marine and avifauna species / communities to light sources is:
  - Limited to the MDP area in Commonwealth waters;
  - Limited to night time operations, i.e. approximately 12 hours per day; and
  - Limited to the duration of the proposed drilling activities i.e., from September 2017 to potentially February 2018.

Relevant stakeholders have been engaged as part of the project stakeholder consultation program. There have been no objections or claims made by relevant stakeholders in relation to light emissions from the MODU and project support vessels.

Detailed Environmental Impact Assessment					
Identified Value or Sensitivity Potentially Exposed to Hazard	**Potential Severity / Consequence Discussion**	**Rating**	**Likelihood of Impact Occurrence**	**Rating**	**Risk**
Marine Fauna • Marine Mammals • Marine Reptiles • Sharks, Sawfish & Rays • Other Listed Fish Species	Marine fauna within the MDP area are predominantly pelagic fish and zooplankton, with occasional transient species such as marine turtles, whale sharks and cetaceans. There are no known critical habitats for EPBC listed species. The MDP area overlaps with the northern most section of the whale shark foraging BIA; however only low numbers are likely to be present as there are no whale shark aggregations in the region and attraction to amassed food sources (i.e. plankton) around facilities is expected to be minimal given associated noise. Any impact from lighting to marine fauna is expected to be localised and negligible as evident during similar drilling activities in the MDP area.	Minor (1)	Given the temporary nature of light emissions, and the sparsity of individuals within the MDP area, it is considered unlikely for light emissions to have an adverse consequence on marine fauna.	Unlikely (B)	Low (1B)
Avifauna	There is potential for light to attract birds in the vicinity of the MDP area, either directly by the light source or indirectly as lighted structures may provide enhanced foraging opportunities for seabirds at night. Light from the MODU and support vessels is unlikely to attract a significant number of seabirds or migratory shorebirds as the MDP area is located distant from key aggregation areas, such as Ashmore Reef and Cartier Island (>100 km away). Any impact from lighting to avifauna is expected to be localised and negligible as evident during similar drilling activities in the MDP area.	Minor (1)	Given the temporary nature of light emissions, and the transient nature of seabirds and migratory shorebirds, it is considered unlikely for light emissions to have an adverse consequence on avifauna.	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability
The decision context for impacts and risks associated with light emissions is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice. The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels: • Application of minimum lighting requirements to meet navigation and occupational safety requirements in accordance with the Commonwealth of Australia, *Navigation Act 2012*. **ALARP and Acceptability** Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R5 - Positioning of the MODU on the Seafloor

Potential Hazard Identification – Establishment of Nature & Scale

The 'jack up' MODU will be towed to the well site by support vessels and positioned alongside the Montara WHP with the drill centre over the H5 slot. Three legs on the MODU (169 m in length) are lowered to the sea floor to elevate the working platform above the sea surface. 'Spud cans' (18 m diameter) at the base of each leg penetrate the seabed sediments to provide stability for the MODU. On completion of drilling, the legs will retract and the rig will move off location. Penetration into the seabed will impact benthic infauna directly below the cans. Geotechnical and geophysical data will be reviewed prior to selecting spud can positions. The footprint of the drilling activity will be defined by the combined footprint of the three spud cans. All proposed activities are located in an area previously disturbed by exploration and production activities.
 	
• The potential hazard associated with positioning the MODU on the seafloor is:
  o Physical alteration to benthic communities (seabed disturbance) through direct contact with MODU (spud cans) or via temporary increase in turbidity due to seabed disturbance;
• The potential exposure of positioning the MODU on the seafloor on benthic communities is:
  o For the duration of the proposed drilling activities i.e., from September 2017 to potentially February 2018;
  o Within the area directly adjacent to the Montara H5 ST-2 well centre; and
  o A combined total of approximately 750 m^2 for the three spud cans.
There are no potentially affected stakeholders in relation to positioning the MODU on the seafloor.

Detailed Environmental Impact Assessment					
Identified Value or Sensitivity Potentially Exposed to Hazard	**Potential Severity / Consequence Discussion**	**Rating**	**Likelihood of Impact Occurrence**	**Rating**	**Risk**
Marine Fauna • Sharks, Sawfish & Rays • Listed Fish Species	Any impacts to mobile demersal marine fauna species (potentially including EPBC listed pipefish and seahorses) would be a highly localised and negligible, with no lasting effect to population or community baseline.	Minor (1)	Given the mobile nature of demersal marine fauna species and limited footprint of the MODU spud cans it is considered unlikely that placement on the seabed would have an adverse consequence on marine fauna.	Unlikely (B)	Low (1B)
Benthic Communities	The MDP area is distant from key habitats of ecological importance such as coral reefs or shoals, which will therefore not be disturbed by positioning or retrieval activities. Given there are no sensitive or unique marine habitats in the area and the diversity and coverage of epibenthos is low (ERM 2011), benthic communities are expected to rapidly recolonise once the rig has left (Currie and Isaac, 2004). MODU footprint scars would typically be recolonised by benthic organisms over a period of 2-3 years. Given the limited footprint and abundance of benthic communities within the MDP area, the consequence to benthic communities would be a highly localised, negligible, and reversible change to a very small proportion of the of the overall benthos.	Minor (1)	Given the placement of spud cans on the seabed is required to stabilise the MODU above the Montara H5 ST-2 well location, it is considered credible that there may be a highly localised impact to benthic communities, should they be located within the area of disturbance.	Credible (C)	Low (1C)

Summary of Control Measures, ALARP and Acceptability
The decision context for impacts and risks associated with positioning of the MODU on the seafloor is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice. The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels: • MODU Contractor's Rig Move Procedure, which includes detailed requirements for accurate positioning and placement of the jack-up legs of the MODU in a controlled manner, thereby reducing potential benthic disturbance. **ALARP and Acceptability** Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R6 – Underwater Noise Emissions from MODU and Vessels

Potential Hazard Identification – Establishment of Nature & Scale
Low intensity underwater noise of a continuous nature will be emitted from the drilling rig and support vessels. Noise will be generated during drilling activities from a number of sources: vessel engine, rotation of propellers, the drill bit, drill string and associated equipment and by machinery operated on the decks and working areas. Noise produced from active drill rigs is predominantly below 2 kHz, with peak frequencies below 500 Hz. A range of broadband source values (157 - 162 dB re 1 µPa) with various tones have been quoted for drill rigs (Hannay et al. 2004; McCauley 1998). Levels are expected to decrease rapidly with distance, with radiated underwater noise from a drilling rig in the Timor Sea reporting noise levels of 117 dB re 1 µPa at 125 m and 115 dB re 1 µPa at 405 m from the rig (McCauley, 1998). Vessel noise varies with the size, speed, and engine type and the activity being undertaken. Highest noise levels from vessels are during rig loading and unloading activities where thrusters are used to maintain position. Noise levels for a range of vessels have been measured at 164-182 dB re µPa at 1 m (Wyatt 2008). Vessel noise is expected to decrease rapidly with distance from the source. Underwater noise may potentially impact sensitive marine fauna in the vicinity of activities. Underwater noise emissions are listed as a potential threat in conservation management documents for a number of sensitive receptors including marine mammals, turtles and fish. Given no high energy impulsive sound sources will be used (such as airguns), physiological effects on fauna are not anticipated. Localised behavioural disturbance of fauna may occur in the immediate vicinity of the MODU and operating vessels, with potential masking or interference with other biologically important sounds such as communication or echolocation. Behavioural responses to noise are likely to be limited to temporary effects due to avoidance. Marine mammals, reptiles and fish have the highest sensitivity to underwater sound, although a review of studies by Southall et al. (2007) reported indications of no (or very limited) responses of cetaceans at received noise levels below 120 dB re 1 µPa. • The potential hazard associated with underwater noise emission is: o Behavioural change to marine fauna species / communities due to the attenuation of underwater noise.

- The potential exposure of marine species / communities to noise from the MODU:
  - Is limited to the MDP area in Commonwealth waters;
  - Extends over a 24-hour period for the duration of the proposed drilling activities i.e., from September 2017 to potentially February 2018;
  - Is limited to frequencies generally below 2 kHz, with peak frequencies below 500 Hz
  - Is potentially limited to below 120 dB re 1 µPa at 125 m from the rig
- The potential exposure of marine species / communities to noise from support vessels is:
  - Intermittent (within 24-hour window) while the vessel is on location for the duration of activities i.e. September 2017 to potentially February 2018; and
  - Potentially 164-182 dB re µPa at 1 m

There are no potentially affected stakeholders in relation to the generation of underwater noise.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Potential Severity / Consequence Discussion	Rating	Likelihood of Impact Occurrence	Rating	Risk
Marine Fauna • Marine Mammals	The proposed activities are not located within key habitats for feeding or breeding for any of the listed cetaceans or dugong identified in Section 4, and the nearest BIAs are greater than 100 km away. Any impacts to cetaceans are therefore expected to be limited to localised avoidance by occasional individuals. Given the ability for marine mammals to exhibit avoidance measures to excessive noise, the potential consequence to transient marine mammals is considered a highly localised nuisance.	Minor (1)	The MDP area is not known to represent critical habitat for marine mammals, but transient individuals are expected pass through the area. It is considered credible for minor impacts to marine mammals to occur	Credible (C)	Low (1C)
Marine Fauna • Whale Sharks	The MDP area overlaps with the northern most section of the whale shark foraging BIA. However, only occasional individuals are expected to occur. Cartilaginous fish (such as whale sharks and rays) lack a swimbladder and are considered less sensitive to sound than bony fish.	Minor (1)	Given the overlap with whale shark foraging BIA, it is considered credible for minor impacts to whale sharks to occur.	Credible (C)	Low (1C)

	Given the ability for whale sharks to exhibit avoidance measures to excessive noise, the potential consequence to transient individuals is considered a highly localised nuisance.				
Marine Fauna • Marine turtles • Fish	Other marine fauna that may be sensitive to underwater noise within the MDP area include marine turtles and fish. There are no BIAs for turtles within the MDP area. Any impacts to turtles are therefore expected to be limited to localised avoidance by occasional individuals. Disturbance to fish is likely to be minimal as impacts are also expected to be limited to localised changes in schooling behaviour and possible avoidance of the MODU and support vessels.	Minor (1)	Marine turtles and fish are understood to be less sensitive to noise that marine mammals, and given the deep, open water location of the MDP area there are no key habitats for turtle or fish aggregations such as reefs or shoals. It is considered unlikely for minor impacts to turtles or fish to occur	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with underwater noise emissions from the MODU and vessels is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.

The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- EPBC Regulations 2000 – Part 8 Division 8.1 'Interacting with cetaceans': [support vessels] to travel at a speed not greater than 6 knots within 300 m of a cetacean and approach no closer than 100 m from a whale and no closer than 50m from a dolphin, where possible;
- Whale Shark Wildlife Management Program no. 57: [support vessels] will not travel faster than 8 knots within 250 m of a whale shark (exclusive contact zone) and not approach closer than 30 m of a whale shark;
- Contractor Rig Maintenance System: MODU power generation units (engines) to be maintained as per manufacturer's specification; and
- Vessel Operator Maintenance Schedule: Vessel engines to be maintained as per manufacturer's specification.

ALARP and Acceptability

Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R7 - Atmospheric Emissions from MODU and Support Vessels

Potential Hazard Identification – Establishment of Nature & Scale

Fuel is used on the MODU, support vessels and helicopters. Routine combustion emissions to atmosphere are produced from power generation equipment and machinery onboard the MODU. CO_2 makes up the majority of emissions plus pollutants including nitrogen oxides, sulphur dioxide (SO_2), carbon monoxide (CO) and unburnt hydrocarbons. Waste incineration on-board MODU and vessels may be undertaken and generate atmospheric emissions. The MDP area is remote from land and far from sensitive receptors; however emissions could present potentially localised and temporary impacts to air quality in the MDP area, but are not expected to contribute significantly to pollution and the deterioration in air quality.

As described in Section 4, no avifauna BIAs overlap the MDP area. Seven threatened and/or migratory seabirds were identified as potentially occurring, or with habitat potentially occurring, within the MDP area. These species may be impacted by a deterioration in air quality if transiting through the area. Symptoms of exposure could include irritation of eyes and respiratory tissues or breathing difficulties. There are no known air quality standards or guidelines for marine avifauna; however, it is expected they would only be exposed to changes in air quality for short periods and chronic exposures are not considered likely.

- The potential hazard associated with the generation of atmospheric emissions is:
  - Potential for sub-lethal effects to avifauna through a change to ambient air quality within the direct vicinity of the MODU and support vessels
- The potential exposure of avifauna to atmospheric pollutants is:
  - Within the MDP area in Commonwealth waters; and
  - Over a 24-hour period for the duration of the proposed drilling activities i.e., from September 2017 to potentially February 2018.

There have been no objections or claims made by relevant stakeholders in relation to atmospheric emissions associated with the proposed drilling activities.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Potential Severity / Consequence Discussion	Rating	Likelihood of Impact Occurrence	Rating	Risk
Avifauna	Highly localised and temporary changes in air quality may create a nuisance effect to a small number of transient marine avifauna individuals. Given the short duration and open ocean location resulting in rapid dispersion of atmospheric emissions, any potential impacts are expected to be minor.	Minor (1)	Given the emission source is located at and around exhaust locations, and this represents a negligible volume of air space, it has been deemed unlikely that avifauna will be exposed to exhaust emissions.	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability
The decision context for impacts and risks associated with atmospheric emissions from MODU and support vessels is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice. The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels: • Adherence to MARPOL 73/78 (Annex VI, regulation 14); • Adherence to AMSA Marine Orders – Part 97: Marine Pollution Prevention – Air Pollution – Division 7; • Adherence to MARPOL 73/78 (Annex VI, regulation 16); • Adherence to AMSA Marine Orders – Part 97: Marine Pollution Prevention – Air Pollution – Division 4; • Adherence to MARPOL 73/78 (Annex VI, regulation 9) – Duration and Validity of certificate; • Adherence to AMSA Marine Orders – Part 97: Marine Pollution Prevention – Air Pollution – Division 2; • Contractor Rig Maintenance System: MODU power generation units (engines) to be maintained as per manufacturer's specification; and • Vessel Operator Maintenance Schedule: Vessel engines to be maintained as per manufacturer's specification. **ALARP and Acceptability** Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R8 - Putrescible Wastes, Sewage and Greywater

Potential Hazard Identification – Establishment of Nature & Scale
Grey water, sewage and putrescible wastes (i.e. kitchen waste) will be discharged to the marine environment in accordance with MARPOL Annex V (Regulation 3). Effects are focussed on impacts to water quality and changes to fauna behaviour leading to short term impacts on local populations. Fish and other marine biota may also be attracted to discharges as a food source. The primary concerns relating to sewage discharge are increases in nutrient availability and biological oxygen demand (BOD) resulting in biostimulation of marine organisms and slight increase in algal growth near the outlet. Effects will be temporary during drilling (60 to 150 days) and localised, with the MDP area being distant from coral reefs or shoals. • The potential hazard associated with the routine discharge of putrescible waste, sewage, and greywater is: o Potential change to ambient water quality through nutrient loading and increase in BOD within the direct vicinity of the MODU and support vessels.

- The potential exposure of marine fauna to treated waste is:
  - Within the MDP area in Commonwealth waters;
  - Over a 24-hour period for the duration of the proposed drilling activities i.e. from September 2017 to potentially February 2018; and
  - Limited to an estimated discharge of 15,000 litres of grey water, 6,300 litres of sewage and 100 kg food waste per day (based on 110 persons on board).

There have been no objections or claims from potentially affected relevant stakeholders regarding routine discharge of putrescible waste, sewage, and greywater.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Potential Severity / Consequence Discussion	Rating	Likelihood of Impact Occurrence	Rating	Risk
Marine Fauna	Given the open oceanic environment effects on seawater oxygen concentrations is expected to be insignificant. The mass of nutrients in sewage is likely to be small, with rapid dilution resulting in a highly localised influence (Black et al., 1994). The potential impact to marine fauna is considered to be a highly localised change to the surrounding environment practically indistinguishable from existing baseline, with negligible direct or indirect effects. Any effects will be temporary over the short-duration of drilling activities (60 to 150 days).	Minor (1)	Given the standard treatment controls for waste discharges in the open ocean, and the remote location of the Montara H5 ST-2 well, PTTEP AA considers it unlikely to have an adverse impact on marine fauna.	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with putrescible wastes, sewage and greywater discharge is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.

The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Adherence to MARPOL Annex V (Regulation 3):
  - Grey water and putrescible wastes (those wastes that are liable to decay, i.e. kitchen wastes) will only be released to the sea after the material has passed through a comminutor or grinder such that the material to be released is capable of passing through a screen with openings no greater than 25mm.

- MARPOL 73/78 Annex IV:
  - Food scraps or putrescible wastes will not be discharged within 12 nautical miles of land and only biodegradable detergents will be used (Regulation 11).
  - Sewage waste generated will be treated by a certified onboard sewage treatment facility (Regulation 8 and 11).
  - The MODU and support vessels must have a valid International Sewage Pollution Prevention Certificate applicable to vessel class (Regulation 8 and 11).
- Contractor Rig Maintenance System and Vessel Operator Maintenance Schedule: preventative maintenance will be undertaken on the sewage treatment facility and food macerator as per manufacturer's specifications.

ALARP and Acceptability

Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R9 - Deck Drainage and Bilge Water

Potential Hazard Identification – Establishment of Nature & Scale

Deck drainage from the MODU and support vessels includes stormwater and deck wash-down oily water, which may contain small amounts of detergents, oil and grease, chemical residues, used machinery chemicals and dirt. The volume of drainage will depend on the rainfall and frequency of deck washing. Oily water from the bilge machinery spaces and contaminated deck drainage water from bunded areas on the MODU will be treated prior to discharge via an oil-water separator (OWS) in accordance with MARPOL requirements (<15 ppm oil-in-water). Once separated, oil and grease will be stored for transfer ashore and treated water discharged to sea. The volume of deck drainage and bilge water likely to be discharged from the OWS is expected to be low. The discharges of treated oily water from the OWS could introduce hazardous substances (water, oily fluids, lubricants, cleaning fluids, etc.) into the water column, albeit in low concentrations, resulting in a reduction in water quality, and potential impacts to marine fauna.

The presence of marine fauna is expected to be limited to individuals transiting through the area. The whale shark foraging BIA overlaps the MDP area therefore there is potential for exposure although this is limited to individuals close to the discharge point at the time of the discharge. Worst-case impacts may include direct toxic effects from exposure to oil at the sea surface (AMSA 2015). Considering the low concentrations of oil and the location of the discharges in the dispersive open-ocean environment, a surface slick is not anticipated and therefore there is a low likelihood of impacting protected species including cetaceans and turtles.

The likelihood of deck drainage and bilge water leading to a short term, localised environmental impact is highly dependent on the rate and concentration of the discharge. The expected contaminants include detergents, oil and grease, chemicals and dirt, likely to be present in low amounts. Good house-keeping and maintenance of bunding around machinery and chemical storage areas will limit the potential for releases.

- The potential hazard associated with the discharge of treated deck drainage and bilge water is:
  - Potential change to ambient water quality through chemical loading within the direct vicinity of the MODU and support vessels; and
  - Potential chemical toxicity to marine species within the direct vicinity of the MODU and support vessels.
- The potential exposure of marine species to deck drainage and bilge water is:
  - Within the MDP area in Commonwealth waters;
  - Highly intermittent over a 24-hour period for the duration of the proposed drilling activities i.e., from September 2017 to potentially February 2018; and
  - Limited to ≤15 ppm (v) oil-in-water concentration at point of discharge with further dilution in open water.

There have been no objections or claims from potentially affected relevant stakeholders in relation to the discharge of treated deck drainage and bilge water.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Potential Severity / Consequence Discussion	Rating	Likelihood of Impact Occurrence	Rating	Risk
Marine Fauna	The consequence of potential impacts from discharge of deck drainage and bilge water is highly localised and sub-lethal with no lasting effect to individuals or a small number of species.	Minor (1)	With standard industry control measures in place and the high dilution factor, it is unlikely there would be sufficient concentration of chemical discharge to cause an impact to marine species.	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with deck drainage and bilge water is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.

The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Adherence to MARPOL 73/78 Annex I – Oil;
- Contractor Rig Maintenance System and Vessel Operator Maintenance Schedule: Preventative maintenance will be undertaken to ensure functionality of oil/water treatment system as per manufacturer's specifications.
- PTTEP AA will apply inspection procedures to ensure that the MODU/support vessels have a functioning deck drainage system.

ALARP and Acceptability

Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R10 - Routine discharge of cooling water and brine

Potential Hazard Identification – Establishment of Nature & Scale

As both cooling water and desalination brine discharges are from a single point the following assessment has been combined. Cooling water is used for cooling machinery then discharged at a temperature higher than the ambient seawater (Black et al., 1994). The cooling water discharge system is segregated, with no hydrocarbons or chemical content. Desalination brine (from onboard water treatment) has a salinity of 50 ppt in comparison to seawater with a salinity of 35 ppt. Brine is also used as a weighting fluid down hole during well clean-up due to its high density. The brine is pumped down the well from a vessel and then discharged to sea at the end of well completion operations, including small quantities of chemical additives (e.g. biocide), which have a Gold Offshore Chemical Notification Scheme (OCNS) / Chemical Hazard Analysis and Risk Management (CHARM) rating.
 	
Cooling water discharges to the marine environment will result in a localised and temporary increase in ambient water temperature. The volume of water discharged will be small and environmental effects are predicted to be insignificant due to the large buffering capacity of the ocean. The plume will quickly lose heat and only a small volume of water around the outfall will have a substantially elevated temperature (Black et al., 1994). Elevation in seawater temperature can cause a range of behavioural responses in marine fauna including attraction and avoidance. There are no key habitats for feeding or breeding for any listed marine mammals or turtle species in the MDP area, and the nearest BIAs are greater than 100 km away, therefore, only occasional individuals are expected to pass through the area. The whale shark BIA overlaps the MDP and may result in the presence of individuals, however given the open-ocean location, water depth of approximately 77 m and the short-duration of activities (60 to 150 days) any impacts to marine fauna from elevated water temperatures are expected to be highly localised and temporary.
 	
Any increase in salinity within the receiving environment as a result of desalination brine discharges is expected to be limited to the immediate point of discharge. As brine is higher density than seawater it is expected to sink and rapidly disperse in the currents. For desalination brine discharges from vessels or the MODU, the increase in salinity will be further reduced due to combining brine with return seawater from the cooling water system prior to discharge.
 	
• The potential hazard associated with the discharge of cooling water and brine is:
  o Potential localised increase to ambient water temperature resulting in behavioural change in marine species;
  o Potential chemical effects to marine species due to elevated salinity within the direct vicinity of the MODU and support vessels; and
  o Potential chemical effects to marine species due to the use of completion brine chemicals within the direct vicinity of the MODU.
• The potential exposure of marine species to cooling water is:
  o Within the MDP area in Commonwealth waters; and
  o Approximately 2088 m^3 per day for the duration of drilling i.e. from September 2017 to potentially February 2018.
• The potential exposure of marine species to brine is:
  o Within the MDP area in Commonwealth waters;
  o Highly intermittent over a 24-hour period for the duration of drilling i.e. from September 2017 to potentially February 2018;
  o Approximately 40 m^3 per day of 50 ppt desalination brine from each vessel;
  o Approximately 150 m^3 per day of 50 ppt desalination brine from the MODU; and

- Approximately 700 m^3 of completion brine (9-9.5 ppg sodium chloride with small quantities of biocide, oxygen scavenger and corrosion inhibitors with a Gold OCNS /CHARM rating) for the Montara H5 ST-2 well.

There have been no objections or claims from potentially affected relevant stakeholders in relation to the discharge of cooling water and brine.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Potential Severity / Consequence Discussion	Rating	Likelihood of Impact Occurrence	Rating	Risk
Marine Fauna	The consequence of a temporary and highly localised increase in salinity from discharge of brine is considered practically indistinguishable from the existing baseline and limited to a small number of individuals within the immediate vicinity of the discharge location. Furthermore, any effects will also be temporary over the short-duration of drilling activities (60 to 150 days).	Minor (1)	Given the low level and temporary increase to salinity within a remote open ocean environment, it is unlikely that there will be any adverse impact on marine fauna.	Unlikely (B)	Low (1B)
	The consequence of a temporary and highly localised increase in water temperature from discharge of cooling water is considered to be practically indistinguishable from the existing baseline and limited to a small number of individuals within the immediate vicinity of the discharge location. Furthermore, any effects will also be temporary over the short-duration of drilling activities (60 to 150 days).	Minor (1)	Given the low level and temporary increase to ambient water temperature within a remote open ocean environment, it is unlikely that there will be any adverse impact on marine fauna.	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with routine discharge of cooling water and brine is ‘Type A’ as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.

The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Practice measures outlined in the PTTEP AA Chemical Management Procedure;
- Practice measures outlined in the PTTEP AA Chemical Assessment Guideline; and

- Contractor Rig Maintenance System and Vessel Operator Maintenance Schedule: Preventative maintenance will be undertaken on the Reverse Osmosis (RO) as per manufacturer's specifications.

ALARP and Acceptability

Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R11 – Discharge of Drill Cuttings and Fluids

Potential Hazard Identification – Establishment of Nature & Scale

The Montara H5 ST-2 well is planned to be drilled using water-based drill fluids (WBM). As a contingency measure (based on operational or technical requirements whilst drilling), PTTEP is also providing for the use of non-aqueous drill fluids (NADF). If NADF is required, it would be limited to a single section of well (8½" section), and industry 'Good Practice' would be applied to both the chemical assessment of the fluid and the potential discharge of drill cuttings with residual levels of adhered NADF. All hole sections of the Montara H5 ST-2 well will be drilled using a riser which returns drill cuttings to the MODU for processing and recycling of mud prior to discharge just below the water surface. An estimated 166 m^3 of cuttings is expected to be discharged over the campaign period. If used, an estimated 13 m^3 of NADF on cuttings is expected to be discharged. Discharged NADF will be limited to 10 % on average by dry weight residual on cuttings (ROC) after treatment with solids control equipment. Residual WBM is discharged from the mud tanks on the MODU at the end of the well. The anticipated maximum volume of WBM discharged throughout the well is 1400 m^3.

The proposed WBM's consist of approximately 80-90% fresh or saline water, with the remaining 10-20% comprising of drilling fluid additives that are generally inert or readily biodegradable organic polymers. Small quantities of chemical additives will be used to control borehole stability and to improve drilling performance and reliability. These include viscosifiers, fluid loss additives, weighting agents (including barite), corrosion control, alkalinity control and engineered bridging materials. With the application of a Chemical Assessment process aligned to industry 'Good Practice' and the preferential use of OCNS PLONOR and CHARM-rated drilling chemicals, the fluid systems are likely to be non-toxic to almost non-toxic.

Drill cuttings discharge may potentially result in a minor localised increase in concentrations of organic compounds and metals near the well. Upon cessation of drilling, concentrations of most contaminants would be expected to gradually return to within the range of background conditions through mechanisms including dissolution, biodegradation and resuspension and transport by bottom currents. A potential exception to this is barium from barium sulphate (barite) present in drilling fluids, which is insoluble and relatively persistent in the marine environment. Concentrations of barite (a non-toxic PLONOR substance) will, however, be sufficiently low and not in a readily bioavailable form. The barite component discharged for this well would constitute approximately 2.4% and 8.8% by volume of the total fluid volume required for the 12¼" and 8½" intervals respectively. The maximum volume of barite required would be 69 m^3 (289 mt) over an approximate 16 day period. Should a contingent NADF system be required to drill the 8.5" hole section of the Montara H5 ST-2 well, barite would not constitute a materially larger quantity than for WBM. The heavy metal components within barite constitute a total maximum volume of no greater than: Mercury (Hg): max 1 mg/kg dry weight in stock barite; Cadmium (Cd): max 3

mg/kg dry weight in stock barite; and Lead (Pb) max 1000mg/kg dry weight in stock barite for WBM and for the use of contingent NADF.

In general, barite is not considered harmful when used in accordance with recommended workplace precautions and is usually deemed as safe. In almost all geographic areas, drilling grade barites are environmentally acceptable from the standpoint of disposal as part of used drilling fluid. Barite used in oilfield application is regulated for chemical purity as it is recognized that some sources of barite may contain heavy metals ranging from trace amounts to some exceeding 3% by weight. The industry has recognized that discharges of heavy metals may cause environmental damage and potentially human health problems. Due to the allowable and significant discharge of barite-laden drilling fluids, most countries' regulatory bodies set maximum allowable levels of heavy metals in barite such as mercury (Hg) and cadmium (Cd) and some are considering regulating lead (Pb) content. The U.S. Environmental Protection Agency limits mercury at no greater than 1 mg/kg and cadmium at no more than 3 mg/kg. Mined and processed barite containing low trace heavy metal content below these limits are currently considered not to impose a significant environmental threat. Source: The Future of Drilling-Grade Barite Weight Material - A Case for a Substitute Specification https://www.onepetro.org/conference-paper/SPE-103135-MS

The potential hazards associated with drilling fluids and cuttings discharge are further described below.

Seafloor

Extent

IOGP Report 543 *'Environmental fates and effects of ocean discharge of drill cuttings and associated drilling fluids from offshore oil and gas operations'* (March 2016) reports the following summary of drill cuttings fates based on field studies, that can be used to identify a conservative extent of cuttings accumulation on the seabed:

- Cuttings were detected visually or as elevated barium concentrations in seafloor sediments within 10 to 150m of the discharge. Maximum height of the cuttings pile usually is less than 50cm.
- WBDF cuttings discharged near the sea surface tend to accumulate on the seafloor down-current from the discharge at distances of about 0.1 to 1 km, or occasionally more in deep water in excess of 300m depth.
- NADF cuttings discharges to water less than about 300m usually are deposited in sediments within about 100 to 200m of the discharge [CSA, 2004; Dorn et al., 2007; Correa et al., 2010].

Numerous additional studies support this report and its findings of a conservative maximum extent of deposition in shallower waters of 1km by indicating that biological effects from seabed communities associated with the deposition of cuttings are limited to ~500 m from a well site (Davies et al 1994; Daniels, C.B. 1998; Limia, J.M. 1996; Oliver et al 1999; Terrens et al.1998). Based on a review of currently available literature it is considered that a cuttings pile spreading out to an extent of 1km from the drill site, to a maximum depth of approximately 50cm, was a conservative extent for this drilling activity given it is in shallow water of less than 300m depth (77m).

Physical alteration to benthic communities through smothering;

Hinwood et al. (1994) explains that the main environmental disturbance from discharging drilling cuttings and fluids is associated with the smothering and burial of sessile benthic and epibenthic fauna. These impacts are generally localised (100 to 250m from the drill site) and short-lived, less than 24 months. The smothering

effects depend on the mobility of benthic fauna and the rate of cuttings deposition (Kjeilen-Eilertsen et al 2004). Generally, most species present in high-energy environments are well adapted to changes in substrate, especially species with burying behaviour, and experience hardly any effect from sediment deposition (Bijkerek 1988 cited in Kjeilen-Eilertsen et al 2004).

Threshold points for benthic fauna tolerance to sedimentation depends on the species and sediment type. Epibenthic fauna are generally unable to escape more than a 1 cm burial depth, whereas infauna, which are adapted to be covered with sediment, may escape from burial up to 10 cm depth or more. Kjeilen-Eilertsen et al. (2004] compiled a list of sediment burial threshold levels for different benthic species. These thresholds ranged from 1 to >50 cm, depending upon taxon and their size and mobility. These data are almost exclusively from shallow-water studies and are largely based on laboratory experimentation associated with dredged material disposal.

It has been found that the 50% hazardous level for burial of deepwater benthic fauna was at a depth of 5.4 cm. In summarizing burial depths and potential harm to benthic macrofauna due to deposition of drilling fluids and cuttings, a more conservative threshold depth of 0.65 cm of deposited sediment below which would be the Predicted No Effect Concentration (PNEC) was established (i.e. greater than 0.65 cm burial needed before benthic mortality occurred). Neff (2010) found that recolonisation of NADF piles in cold-water marine environments began within one to two years of cessation of discharges, once the hydrocarbon component of the cutting piles biodegraded. Additional studies indicate that benthic infauna and epifauna recover relatively quickly, with substantial recovery in deep water benthic communities within 3–10 years (Jones et al, 2012). Ten years (long term) is considered a conservative recovery evaluation for this activity. This indicates there is the potential for smothering impacts to result in benthic mortality over an area of ~1.5 km^2 (based on cutting piles with a 1km radius) around the drill site. However, any disturbance is expected to be limited to soft sediment infauna communities. Because these communities are known to recover over a longer period of time (Jones et al, 2012), the potential impacts are considered to be limited to localised long-term degradation of habitat.

Potential sediment chemical toxicity

Terrens et al. (1998) reported that after a period of 11 months NADF was not detectable in sediments, indicating that recovery of the seabed is through a combination of dispersion and biodegradation. Some components of NADF are potentially bioaccumulative. Although there is potential for bioaccumulation, Melton et al. (2000) reason that the ability of organisms to oxidise and expel aromatics means that while hydrocarbons may be bioavailable, they are not expected to bioconcentrate.

When studying the impacts of drilling in Bass Strait, Terrens et al. (1998) observed biological effects within 100 m of the drilling site shortly after drilling; recovery of seabed communities across the area were reported within four months. After 11 months, NADF was not detectable in sediments. Terrens et al. (1998) reported that recovery of the seabed is through a combination of dispersion and biodegradation. Two years is therefore considered a conservative recovery evaluation for this impact for this activity at the Montara site. Based on the potential for biological impacts within 1km of the well, it is expected that discharges would result in toxicity impacts to benthic infauna. However, benthic infauna within soft sediment communities are not restricted to the operational area and are well represented in the wider region. These communities are known to recover from chemical toxicity effects over relatively short periods (within two years) and consequently, the potential impacts are considered to be limited to localised short-term degradation of habitat.

Water Column

Increased Turbidity

Neff (2005) states that although the total volumes of muds and cuttings discharged to the ocean during the drilling of a well are large, the impacts in the water column

environment are minimal, because discharges of small amounts of materials are intermittent. When cuttings are discharged to the ocean, the larger particles, which represent ~90% of the mass of the mud solids, form a plume that settles quickly to the bottom. Hinwood et al. (1994) indicates that larger particles of cuttings and adhered muds (90–95%) fall to the seabed close to the release point. The American Chemistry Council (2006) found that as NADF adhered to cuttings, the cuttings tended to clump together in particles that rapidly settle to the sea bed, suggesting that NADF cuttings tend to be less likely to increase water column turbidity.

About 10% of the mass of mud solids forms another plume in the upper water column that drifts with prevailing currents away from the platform and is diluted rapidly in the receiving waters (Neff 2005; Neff 2010). Hinwood et al. (1994) and Neff (2005) note that within 100 m of the discharge point, a drilling cuttings and fluid plume released at the surface will have diluted by a factor of at least 10,000, whilst Neff (2005) states that in well-mixed ocean waters (likely to be the case within the drilling area), drilling mud is diluted by more than 100-fold within 10 m of the discharge point.

Jenkins and McKinnon (2006) reported that levels of suspended sediments greater than 500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods greater than 96 hours. Jenkins and McKinnon (2006) also indicate that levels of 100 mg/L are likely to affect the larvae of several marine invertebrate species and that fish eggs and larvae are more vulnerable than older life stages.

Assuming that solids control equipment reduces residual mud on solids to below 20% (IOGP Report 2016 reports that WBDF cuttings typically contain between 15-20% WBDF) leaving the material discharged comprising 80% solid cuttings, and based upon dilutions identified by Hinwood et al. (1994) and Neff (2005), turbidity in the water column is expected to be reduced to below 20 mg/L (18 ppm) within 100-200m of release. Consequently, any impact to fish larvae would be limited due to the small exposure footprint, high natural mortality of larvae (McGurk 1986), and dispersive characteristics of the open water in the operational area.

Considering the relatively short-lived nature of the intermittent plumes, and that concentrations of suspended solids rapidly dissipate with the prevailing currents, the potential impacts on fish and their larvae are expected to be minimal. Thus, there is the potential for localised, short-term impact on species.

Potential chemical toxicity to fauna in the water column

Only transient marine fauna would have the potential to be exposed to these discharges. Although some chemicals used within and discharged as part of drilling and completion fluid systems can be toxic, their dilution within the system and at the point of discharge means that only organisms very close to the discharge point will be exposed to chemical concentrations above toxicity thresholds (Melton et al 2000; Boehm et al 2001; Kinhill 1998; IRCE 2003; SKM 1996).

Hinwood et al. (1994) and Neff (Ref. 74) note that within 100 m of the discharge point, a drilling cuttings and fluid plume will have diluted by a factor of at least 10,000, and Neff (Ref. 74) states that in well-mixed ocean waters (as is likely to be the case within the drilling area), drilling mud is diluted by more than 100-fold within 10 m of the discharge point. This analysis is consistent with studies (Melton et al 2000; Boehm et al 2001; Kinhill 1998; IRCE 2003; SKM 1996) that indicate fluid concentrations and toxicity effects are limited to the discharge location. Consequently, any potential impact is expected to be limited to transient individuals, with recoverable concentrations resulting in localised, short-term impacts on species.

No relevant stakeholders have made any objection of claim in relation to PTTEP AA using or discharging drill fluids or cuttings.

Detailed Environmental Impact Assessment					
Identified Value or Sensitivity Potentially Exposed to Hazard	**Potential Severity / Consequence Discussion**	**Rating**	**Likelihood of Impact Occurrence**	**Rating**	**Risk**
Marine Fauna • Marine Mammals • Marine Reptiles • Whale Sharks • Sharks, Sawfish & Rays • Listed Fish Species	The potential for toxicity effects to fish and pelagic organisms, including larvae, due to impacts to water quality will be limited due to the use of WBM and NADF with a rating of non-toxic, slightly toxic or low toxicity. The consequence to marine fauna is considered in the context of a sub-lethal, localised nuisance to individuals or small populations. Given that fish and pelagic organisms are mobile and would have temporary exposure to the plume, the potential for toxicity effects is considered negligible. Turbidity impacts are also likely to be minimal. Thus, there is the potential for localised, short-term impact on species for both toxicity or turbidity in the water column.	Moderate (2)	Given the tendency for discharged drill cuttings and fluid to settle rapidly, and given the upper limit of ROC for the well will be limited to 10 % or less (by dry weight per well section) following treatment, and the discharge of drill cuttings with residual NADF in the upper water column would rapidly dilute and disperse to below levels that could elicit a toxic response, it is considered unlikely that marine fauna would be moderately affected.	Unlikely (B)	Low (2B)
Benthic Communities	Cuttings and fluid discharged to seabed may lead to toxic impacts or the smothering of sediment dwelling i.e. benthic and epibenthic fauna, substrate modification. This indicates there is the potential for smothering impacts over an area of ~1.5 km^2 around the drill site. However, any disturbance is expected to be limited as the Montara H5 ST-2 well location is pre-disturbed from previous drilling.	Significant (3)	Cuttings and fluid discharged to seabed may lead to toxic impacts or the smothering of sediment dwelling i.e. benthic and epibenthic fauna, substrate modification. This indicates there is the potential for smothering impacts over an area of ~1.5 km2 around the drill site. However, any disturbance is expected to be limited as the Montara H5 ST-2 well location is pre-disturbed from previous drilling.	Credible (C)	Medium (3C)
Commercial Fisheries • Commonwealth-Managed • State/Territory-	The potential for toxicity effects to commercially valuable fish, including larvae, due to impacts to water quality will be limited due to the use of WBM and NADF with a rating of non-toxic, slightly toxic or low toxicity, therefore the consequence to	Moderate (2)	It is recognised that the offshore waters around the MDP area are within broad spawning areas for commercial fish species including the red emperor and goldband snapper. However, given the	Unlikely (B)	Low (2B)

Managed	commercial fisheries is considered in the context of a sub-lethal, localised nuisance to individual or small populations of fish and not the fishery in entirety. Also, given that fish are mobile and would have a temporary, transient exposure to the plume, the potential for toxicity effects to occur is considered negligible. Turbidity impacts are also likely to be minimal. Thus, there is the potential for localised, short-term impact on fisheries for both toxicity or turbidity in water column.		wide area over which spawning may occur, the extended length of spawning periods and that discharges will be localised and readily diluted and dispersed, the potential for impacts to larval fish and other planktonic communities is limited and will not occur at a population level, therefore is considered unlikely commercial fisheries would be affected.		

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with discharge of drill cuttings and fluids is 'Type B' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice and an engineering risk assessment to further evaluate a range of control measure options.

The following 'good practice' controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Adherence to Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development - Drilling Fluids and Drilled Cuttings Guidance Number 53 (requires that the direct loss system is to be considered an interim solution for the first drilling phase and applied only when the chemical content is low and water-based drilling mud is used);
- Adherence to Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development - Drilling Fluids and Drilled Cuttings Guidance Number 55 and Table 1 (requires that disposing spent NADF by discharge to the sea must be avoided);
- Adherence to Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development – Emissions and Effluent Guideline Number 134 (Table-1) (presents effluent guidelines for offshore oil and gas development);
- Adherence to Environmental, Health, and Safety Guidelines Offshore Oil and Gas Development - Drilling Fluids and Drilled Cuttings Guidance Number 59 (requires that operators carefully select drilling fluid additives, taking into account their concentration, toxicity, bioavailability, and bioaccumulation potential);
- Adherence to Western Australia's Department of Industry and Resources (DoIR), Petroleum Guidelines: Drilling Fluids Management (Section 2 – Regulating the use of Drill Fluids);
- Schlumberger 'Barite Quality Control Specifications': Pb: max 1000 mg/kg dry weight in stock barite;
- Practice measures outlined in the PTTEP AA Chemical Management Procedure; and
- Practice measures outlined in the PTTEP AA Chemical Assessment Guideline.
- For the use and discharge of drill fluids and cuttings, PTTEP has adopted a number of the 'Good Practice' measures detailed within the World Bank Group Environmental, Health, and Safety Guidelines (the EHS Guidelines) issued by the International Finance Corporation (IFC). The EHS Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). Specific reference is made to the EHS Guideline - Offshore Oil and Gas Development (June 5, 2015):

http://www.ifc.org/wps/wcm/connect/f3a7f38048cb251ea609b76bcf395ce1/FINAL_Jun+2015_Offshore+Oil+and+Gas_EHS+Guideline.pdf?MOD=AJPERES

For the establishment of maximum concentrations of heavy metals within barite, PTTEP AA considers the application of the EHS Guidelines described above as representing industry 'Good Practice' for establishing upper limits on mercury (Hg) and Cadmium (Ca) concentrations. As no maximum Lead (Pb) concentration is provided in either the US EPA regulatory framework, or within the EHS Guidelines (that reflect US EPA standards), PTTEP AA considers the application of a 'Barite Quality Control Specification' administered by its principle Drill Fluid Supply company in alignment with the American Petroleum Institute (API) 13A – Oil-Well Drilling-Fluid Materials and the API Monogram Program as representing industry 'Good Practice'.

PTTEP apply 'Good Practice' in relation to assessment of chemicals for offshore discharge in alignment with guidance provided by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS). CEFAS administer the OCNS and apply the CHARM model to rank offshore chemicals: https://www.cefas.co.uk/.

The following additional control measures evaluated as part of the engineering risk assessment were determined to be reasonably practicable and will also be adopted:

- Eliminate use of NADF to prevent potential environmental impact or risk;
- No discharge of whole NADF;
- Substitute higher-risk profile chemicals with lower-risk profile chemicals;
- Installation of package of solids control equipment to limit the ROC% prior to cuttings discharge. The level of performance of the solids control package has been evaluated for a range of ROC from 1-10% on dry cuttings for the 8.5" well section, with an expected level of performance at ROC <10% deemed reasonable;
- Documented chemical assessment process in alignment with industry 'Good Practice' applied for the evaluation of all drilling chemicals;
- Consolidate all requirements for the management of drill fluids and cuttings discharge into a management plan;
- Compliance Engineer aboard MODU to monitor ROC% in relation to encountered formation and advise solids control equipment Operator of potential efficiencies;
- Solids control equipment operator to maintain optimal efficiency by monitoring and maintaining shaker screen size and centrifuge and dryer operations; and
- Implement HES inspections including chemical reconciliation to validate only assessed and accepted chemicals are in use aboard the MODU.

ALARP and Acceptability

As described above, the demonstration of ALARP for a 'Type B' decision context is based on assessment against industry good practice and analysis of alternate and/or additional control measures through an engineering risk assessment. The adoption of 'Good Practice' measures and the additional control measures identified through the engineering risk assessment above provide for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

R12 – Cement

Potential Hazard Identification – Establishment of Nature & Scale

Cement is mixed on board the MODU and used to secure the casings in place to ensure well integrity. Normally the first hole section of a well (the conductor) is drilled riserless with cement returns made at the seafloor. However, in this case the conductor has already been installed and therefore there will be no cement returns to the seafloor. Subsequent casing strings will be cemented with the top of cement below the mud-line and with no discharge to the sea floor. Excess cement (200%) as per the drilling program will be used in all well bore sections and abandonment plugs to account for potential wash outs, over gauge hole and small seepage losses into the formation in accordance with the PTTEP AA Drilling Management System Std ID D41-502432-WC- Well Engineering Standards (WES).
 	
Cement volumes used in the Montara H5 ST-2 well are estimated to be approximately 50 m^3. At the end of each cement job up to 3 m^3 of dry cement may be blown overboard from the hopper. In addition up to 2 m^3 of cement slurry will be discharged as a result of cleaning the cement pump and lines. This discharge is released at the sea surface at a rate of approximately 0.3 m^3/min and will disperse within the water column.
 	
There are potential environmental impacts relating to the toxicity of the cement and cement additives. A number of additives with different chemical functions are required during cementing operations, including defoaming agents, dispersants and fluid loss control additives.
 	
Impacts associated with cement discharges include smothering of benthic habitats and communities in the vicinity of the discharge at the wellhead and toxicity associated with cement additives. As outlined in Section 4, benthic habitats in the MDP area are generally dominated by soft sediments with low and patchy abundance of macrobenthic faunal assemblages.
 	
• The potential hazard associated with the discharge of cement is:
  o Potential smothering of benthic habitats and communities within the direct vicinity of the wellhead from discharge of excess cement;
  o Potential chemical effects to benthic and pelagic marine species in the localised area of discharges due to toxicity associated with cement additives.
• The potential exposure of marine species to discharged cement is:
  o Within the MDP area in Commonwealth waters;
  o Approximately 5m^3 associated with excess cement discharge at the seafloor;
  o Up to 3 m^3 of dry cement blown overboard from the hopper at the end of the cement job;
  o Up to 2 m^3 of cement slurry discharged at a rate of approximately 0.3 m^3/min as a result of cleaning cement pump and lines.
There have been no objections or claims from potentially affected relevant stakeholders in relation to the discharge of cement.

Detailed Environmental Impact Assessment					
Identified Value or Sensitivity Potentially Exposed to Hazard	**Potential Severity / Consequence Discussion**	**Rating**	**Likelihood of Impact Occurrence**	**Rating**	**Risk**
Marine Fauna	The potential for toxicity effects to fish and pelagic organisms due to impacts to water quality will be limited due to the use of cement additives with a rating of non-toxic, slightly toxic or low toxicity, as per the PTTEP AA Chemical Environmental Assessment Guidelines (S32-506218-CORP). Furthermore, effects will be limited to a small number of individuals within the immediate vicinity of the discharge location given the minor quantities involved, the expected localised mixing zone and high level of dilution into the open water marine environment of the MDP area.	Minor (1)	Given the small discharge volumes, localised mixing zone and the mobile nature of fish and pelagic organisms, exposure is expected to be temporary and transient. The potential for toxicity effects to occur is considered unlikely.	Unlikely (B)	Low (1B)
Benthic Communities	The absence of sensitive benthic communities in the vicinity of the well should result in limited impacts to benthic communities as a result of smothering or toxicity effects from cement discharges. Any smothering or toxic effects to benthic communities or habitats will be highly localised around the well head and recovery is expected to commence shortly after drilling finishes (Neff, 2005; IOGP, 2016). The closest shoals are located 30 km south west of the MDP and therefore due to the localised nature of the cement discharges, no impacts are anticipated.	Minor (1)	Given the limited discharge volumes at the seabed of excess cement and localised extent of potential smothering or toxicity effects, the likelihood of a minor consequence of impact occurring is considered unlikely.	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with the discharge of cement is ‘Type A’ as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.

The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Practice measures outlined in the PTTEP AA Chemical Management Procedure; and

- Practice measures outlined in the PTTEP AA Chemical Assessment Guideline.

ALARP and Acceptability

Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

6.2 NON-ROUTINE ACTIVITY ASPECTS

N1 - Accidental Release of Chemicals or Waste from MODU and Vessels during General Operations and Bulk Transfers

Potential Hazard Identification – Establishment of Nature & Scale

Accidental releases of chemicals or waste to the marine environment may include: solid wastes such as plastics, cardboard, small quantities of vented powders e.g., cement during transfers, dropped objects etc; and liquid wastes such as NADF drilling fluids or other small leaks, can occur during drilling operations. Accidental discharges could involve a range of fluids (hydraulic and fuel) and mostly likely result from failure of mechanical fittings or hoses.

Both the water-based fluids and non-aqueous base fluids proposed for this drilling program are considered to have low to no toxicity (based upon CEFAS / CHARM characterisation), therefore many products to be transferred are not considered environmentally harmful given their chemical make-up and/or volume, with the exception of some ancillary chemicals and hydrocarbon fuels and oils. The potential release quantities are minimised through measures such as dry-break couplings for hoses and the prompt shutting off of pumps in the event of a problem. Potential environmental impacts arising from any spills and leaks from inboard fittings and connections would be contained within designated bunded areas, these areas drain to a sump through the closed drain system. Any spill to deck will be cleaned up using absorbents contained within dedicated spill kits strategically positioned around the MODU in accordance with the Shipboard Oil Pollution Emergency Plan (SOPEP).

Solid wastes generated during drilling operations have to be stored on the rig prior to onshore treatment and/or disposal. Unsecured or incorrectly stored waste may be windblown or displaced into the ocean where it has the potential to impact the marine environment. Adherence to waste management plans including hazardous substances control and emergency procedures will reduce risks however there are no other viable alternatives other than safe storage and use on the MODU prior to vessel transfer to shore. Marine fauna can become entangled in waste plastics, which can also be ingested when mistaken as prey (Ryan et al. 1988), potentially leading to injury or death. Indiscriminate foraging behaviour in turtles has resulted in turtles mistaking plastic for jellyfish (Mrosovsky et al. 2009). The accidental release of waste may result in injury or even death to individual marine fauna but is not expected to result in a threat to population viability.

- The potential hazard associated with the accidental release of liquid chemicals or solid waste is:
  - Potential deterioration in water quality within the direct vicinity of the MODU and support vessels resulting in behavioural change in marine species;
  - Potential toxic effects to marine species due to chemicals in the vicinity of the MODU and support vessels
  - Physicals effects to marine species due to ingestion of solid waste or entanglement in solid waste or direct impact from smothering

- The potential exposure of marine species to liquid chemical is:
  - within the MDP area in Commonwealth waters, based upon the limited volumes of the potential release;
  - from September 2017 to potentially February 2018; and
  - Based upon the standard flow rates and volumes for transfer operations, and a conservative shut-in time of 5 min (given operations are constantly monitored, the total worst-case volume of base fluid or diesel spill would be 8.5 m^3
- The potential exposure of marine species to solid waste is:
  - within the MDP area in Commonwealth waters for non-buoyant waste streams, or more widespread for individual pieces of waste that are buoyant and prone to drift;
  - from September 2017 to potentially February 2018; and
  - 3m^3 solid waste based upon the size of a standard offshore skid – assuming full release of contents

There have been no objections or claims from potentially affected relevant stakeholders in relation to the accidental release of chemicals or waste from the MODU or support vessels.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Potential Severity / Consequence Discussion	Rating	Likelihood of Impact Occurrence	Rating	Risk
Marine Fauna	Given the limited potential volume of release from transfer operations and the low toxicity or high volatility of liquid wastes the consequence of an accidental release of chemicals from bulk transfer operations within the MDP are considered to be practically indistinguishable from the existing baseline and limited to a nuisance effect to a small number of individuals within the immediate vicinity of the discharge location.	Minor (1)	Given the low-level toxicity of drilling chemicals and high-volatility and propensity to evaporate rapidly of marine diesel and given the remote open ocean environment, it is unlikely that there be any adverse impact on marine fauna.	Unlikely (B)	Low (1B)
	The accidental release of solid waste to the marine environment has the potential to impact individuals of a number of marine species, including marine reptiles, mammals and fish species that may ingest or become entangled in waste resulting in death.	Moderate (2)	Given the low level and temporary increase to ambient water temperature within a remote open ocean environment, it is unlikely that there be any adverse impact on marine fauna.	Unlikely (B)	Low (2B)

Avifauna	The accidental release of chemicals from bulk transfer operations within the MDP area poses no hazard to avifauna, however, the accidental release of solid waste to the marine environment has the potential to impact individuals that may ingest or become entangled in waste resulting in death.	Moderate (2)	Given the standard containment of solid waste, the remote location of the activity and the sparsity in transient avifauna, it is deemed unlikely that avifauna be adversely affected.	Unlikely (B)	Low (2B)
Benthic Communities	The accidental release of chemicals or waste from bulk transfer operations within the MDP area may pose a highly localised nuisance impact to individual benthic assemblages.	Minor (1)	Given the low-toxicity of weighted fluids, the propensity of fluids to disperse in the marine environment, the inert nature of any non-buoyant solid waste, and the sparsity in populations of benthic fauna assemblages in the area surrounding the H5 well location, it is considered unlikely that benthic communities would be adversely affected by an accidental release of chemicals or waste from the MODU or support vessels.	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with the accidental release of chemicals or waste from the MODU and vessels during general operations and bulk transfers is ‘Type A’ as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.

The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Assessment of chemicals for offshore use in alignment with guidance provided by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) (CEFAS administer the Offshore Chemical Notification Scheme (OCNS) and apply the Chemical Hazard and Risk Management (CHARM) model to rank offshore chemicals); through application of the PTTEP AA Chemical Management Procedure and PTTEP AA Chemical Assessment Guideline.
- Application of the Montara H5 ST-2 Drilling SSHE Campaign Plan in relation to chemical and waste storage and use, and chemical transfers.

ALARP and Acceptability

Given the decision context is ‘Type A’ the adoption of ‘Good Practice’ measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

N2 - Uncontrolled well blow out – Montara crude oil spill

Potential Hazard Identification – Establishment of Nature & Scale

The basis for the hazard identification described within this section is the inputs and subsequent outputs from stochastic spill modelling for a credible spill scenario. PTTEP AA commissioned RPS (2017) to model a 236,349 m^3 surface release of Montara crude over 77 days to represent a maximum credible "well blow out" spill. The flow rate varied from a peak of 16,799 m^3/day down to 1,454 m^3/day over the 77 day period. A summary is provided below to provide context to the risk assessment process and outcomes for a full loss of well containment (blow-out). It is noted that the modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that PTTEPAA propose to have in place during the drilling activity. The modelling makes no allowance for intervention following a spill to reduce volumes and/or prevent hydrocarbons from reaching sensitive areas. Spill response arrangements that will be in place are outlined in Section 8.

A surface hydrocarbon threshold of 10 g/m^2 has been used to estimate the potential spatial extent of ecological impacts, and a threshold of 100 g/m^2 has been used for shoreline impacts. A surface hydrocarbon threshold of 0.5 g/m^2, which represents a visible oil (rainbow) sheen, has been used to provide an indication of the extent to which stakeholders may visually observe an expression of oil on the sea surface. This is considered to provide a more relevant and conservative extent of potential impacts to socio-economic receptors associated with visual amenity.

The potential hazards associated with a significant spill of Montara crude oil include:

- Physical oiling and toxicity effects to marine fauna and flora.
- Habitat loss, impact on tourism and fisheries, issue of waste disposal
- Accumulation of oil in the food chain and in sediments. Loss of biodiversity and revenue.

A detailed risk assessment against all relevant values and sensitivities within the EMBA is provided below. The evaluation is based upon exposure mechanism in the water column (dissolved / entrained) at surface or via shoreline accumulation as relevant to each receptor.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Severity / Consequence Discussion	Rating	Likelihood (of Exposure to Hazard)	Rating	Risk
Marine Fauna • Cetaceans	**Surface Hydrocarbons:** The area that may be affected by a worst-case hydrocarbon spill contains open waters to a maximum distance of 1,474 km (976 km for the 99th percentile) from the release site based on the impact threshold of 10 g/m^2 (assuming no spill response is implemented to reduce volumes and/or prevent hydrocarbons from reaching sensitive areas). This area is not likely to contain significant numbers of cetaceans transiting through the area. There are BIAs for pygmy blue whales, humpback whales and coastal	Significant (3)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and	Unlikely (B)	Medium (3B)

	dolphins within the EMBA and as such individuals are likely to be present along with other cetacean species. Surface concentrations above the impact threshold of 10 g/m^2 are predicted from the stochastic modelling to reach the BIA for pygmy blue whale distribution in a minimum time of 67 hours (2.79 days), and the BIA for migration in a minimum time of 113 hours (4.71 days). For humpback whales, surface concentrations greater than 10 g/m^2 are predicted to reach the BIAs for calving, nursing, resting and migration in a minimum time of 424 hours (17.67 days), with a low probability of contact (13%). For coastal dolphin species (Australian snubfin and Indo-pacific humpback dolphins), surface concentrations greater than 10 g/m^2 are predicted to reach BIAs ranging from a minimum time of 165 hours (6.88 days) to 1688 hours (70.33 days), with a likelihood of contact ranging from 7% to 41%. Cetaceans such as whales and dolphins are air breathing mammals and theoretically vulnerable to exposure to hydrocarbon spill impacts through the inhalation of evaporated volatiles once the crude has surfaced. Whales and dolphins are smooth-skinned, hairless mammals. Given the nature of their skin, hydrocarbons do not tend to stick to their skin and they are not expected to be sensitive to the physical effects of oiling. Ingested hydrocarbons, particularly dissolved aromatics can be toxic to marine mammals as they can remain within the gastro-intestinal tract and be absorbed into the bloodstream and thus irritate and/or destroy epithelial cells in the stomach and intestine. Marine mammals may also be susceptible to indirect toxic effects through ingestion of contaminated prey. Physiological effects of ingesting weathered hydrocarbon residues are unknown however are expected to be less severe than those attributed to dissolved aromatics given the lower levels of toxicity associated with paraffin waxes. The way in which whales and dolphins consume food may influence the likelihood of hydrocarbon ingestion. Baleen whales, which skim the surface, are more likely to ingest hydrocarbons than toothed whales, which are ‘gulp feeders’. Spilled hydrocarbon may also foul the baleen fibres of baleen whales, thereby impairing food-gathering efficiency or resulting in the ingestion of hydrocarbon or hydrocarbon-contaminated prey (AMSA 1998). Weathered oil residues from an oil spill event may persist for long periods,		sensitivities from a loss of well control scenario.		

	causing a potential risk to baleen whales' feeding systems. Studies of bottlenose dolphins found that they were able to detect and actively avoid a surface slick after a few brief contacts and that there were no observed adverse effects with the surface slick (Smith et al., 1983). It is not known if other marine mammals likely to be in the area are able to similarly detect and avoid hydrocarbon slicks. It has been proposed that even though whales and dolphins are able to detect a hydrocarbon slick, the strong attraction to specific areas for breeding, feeding or resting may override any tendency to avoid the noxious presence of hydrocarbon (AMSA 1998). The potential for significant impacts to cetaceans as a result of ingestion of hydrocarbons is limited due to the low numbers of cetaceans expected to transit through the area that may be contacted by hydrocarbons in the event of a well blowout. The oil slick would thin and spread out over time allowing for volatilisation of lighter more toxic hydrocarbon fractions and the remaining residues would become weathered to a semi-solid form which through wave and wind action would quickly become waxy flakes.				
	Entrained / Dissolved Hydrocarbons Entrained and/or dissolved hydrocarbons are not expected to reach any BIAs for cetaceans with a probability greater than 1% at concentrations above the thresholds for impact. However, occasional individuals may pass through the area of exposure above threshold levels (maximum 160 km from the release location) and may therefore be affected. Information on potential impacts to cetaceans from exposure to hydrocarbons is provided in the discussion of surface hydrocarbons above. In summary, cetaceans are smooth-skinned and hydrocarbons do not tend to stick to their skin and they are not expected to be sensitive to the physical effects of oiling from entrained droplets. Ingested hydrocarbons, particularly dissolved aromatics can be toxic to cetaceans as they can remain within the gastro-intestinal tract and be absorbed into the bloodstream and thus irritate and/or destroy epithelial cells in the stomach and intestine. Cetaceans may also be susceptible to indirect toxic effects through ingestion of contaminated prey. The potential of significant impacts to cetaceans as a result of ingestion of hydrocarbons is limited due to the low numbers of cetaceans expected to transit through the area of impact from entrained and/or dissolved				

	hydrocarbons. As a result, significant impacts to cetacean populations are not expected from exposure to entrained and/or dissolved hydrocarbons.				
Marine Fauna • Dugongs	**Surface Hydrocarbons** Dugongs will be present in the EMBA given their distribution off the northern coast of WA, extending around the Northern Territory coastline. Established seagrass habitats including Vulcan Shoal, Ashmore Reef, Cartier Island and shallow waters along the mainland coastline and islands of Australia and Indonesia may provide dugong habitat. Ashmore Reef is identified as a BIA for dugongs, with estimates of between ten and 60 individuals (Whiting and Guinea 2005). There is limited information regarding the effects of hydrocarbons on dugongs. As an air breathing mammal, it is expected that dugongs are most susceptible to hydrocarbon impacts from inhalation of evaporated volatiles and ingestion of hydrocarbons including weathered waxy residues, experiencing similar effects as cetaceans. Dugongs located at Vulcan Shoal, Ashmore Reef, Cartier Island and potentially other shallow shoals and islands in the EMBA may ingest hydrocarbons by feeding on spill affected seagrasses. A significant impact to dugong populations is not expected, as for cetaceans, from direct contact with a surface oil slick. This is due to the size and temporary nature of the slick as described above taking into account the potential time for exposure given the rapid weathering expected. Dugong populations may be indirectly affected by the loss of seagrasses meadows impacted by entrained or dissolved oil phases at a number of shoals and island locations and impacts to seagrasses are discussed later in this section.	Significant (3)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (3B)
	Entrained / Dissolved Hydrocarbons Dugongs may be present in the area and are predicted to exceed threshold concentrations of entrained and/or dissolved hydrocarbons, given the presence of established seagrass habitats at Vulcan Shoal, Ashmore Reef and Cartier Island. Although it is noted that the probability of hydrocarbons exceeding threshold concentrations at these locations is low (1 to 2%). Ashmore Reef is a BIA for				

	dugongs. Dugongs are not expected to be common in open water areas away from reefs or shoals in the region. Information on potential impacts to dugongs from exposure to hydrocarbons is provided in the discussion of surface hydrocarbons above. Similar to cetaceans it is likely that dugongs are more vulnerable to the effects of inhalation or ingestion of hydrocarbons rather than the physical effects of oiling from entrained droplets. Overall, significant impacts on dugong populations are not expected.				
Marine Fauna • Whale Sharks • Other Sharks, Sawfish & Rays	**Surface Hydrocarbons:** A range of sharks, sawfish and rays may occur in the EMBA. Generally, most species identified in the EPBC PMST search are not expected to be present in large numbers. However, it is acknowledged that the MDP area and wider EMBA overlap with the northern most section of the whale shark migratory BIA (Figure 4.1). Individuals may occur in the impacted area due to their widespread distribution and highly migratory nature, albeit in very low numbers as there are no whale shark aggregations (such as the Ningaloo Reef aggregation) in the region. Fish populations within open waters are not likely to be exposed to a surface slick, therefore impacts to sharks, sawfish and rays from entrained/dissolved hydrocarbons are discussed below. **Entrained / Dissolved Hydrocarbons** The blowout location is within the whale shark foraging BIA. However, it is noted that the area exceeding thresholds for impact is limited to approximately 160 km from the release site and this area is very small when compared to the full extent of the whale shark BIA. Individuals may occur in the impacted area due to their widespread distribution and highly migratory nature, albeit in very low numbers. Potential effects include damage to the liver and lining of the stomach and intestines, as well as toxic effects on embryos (Lee 2011). As whale sharks are filter-feeders they are expected to be highly vulnerable to entrained hydrocarbons (Campagna et al. 2011). However, as there are no whale shark aggregations (such as the Ningaloo Reef aggregation) in the region, the overall population viability is not expected to be threatened. BIAs for other fish species (sharks and sawfish) are not predicted to be exposed to entrained and/or dissolved hydrocarbons above the thresholds for impact.	Significant (3)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (3B)

Marine Fauna • Other Fish Species	**Entrained / Dissolved Hydrocarbons** Fish populations within open waters, and diverse fish assemblages associated with shallow water around shoals and reefs may be exposed to dissolved aromatic and entrained hydrocarbon phases. Modelling predicted concentrations exceeding the relevant thresholds for dissolved aromatics and entrained to be limited to within approximately 160 km from the release site for the top 0 to 10m surface layer of the water column. As water depth increased, the area and maximum distance for exposure diminished. Fish communities, both pelagic and demersal, in open waters live relatively deep in the water column. Fish also have a natural avoidance instinct for many of the aromatic hydrocarbons (Hoar et al. 1997) and are therefore unlikely to be exposed to high concentration of dissolved aromatic or entrained hydrocarbons. Following the Montara blowout, the Montara Environmental Monitoring Program included a study to determine effects of the spill incident on commercial fish species in Australian waters. The results of this study identified evidence of exposure of targeted fish species to petroleum hydrocarbons within the vicinity of the Montara well head platform but limited signs of adverse health or reproductive effects related to hydrocarbon exposure, as captured fish were in good physical condition. Based on this evidence from within the same geographical region, in the unlikely event of an uncontrolled well blowout, significant impacts on fish are considered to be unlikely. Potential impacts to commercial fish spawning are considered below with other planktonic communities.	Significant (3)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (3B)
Marine Fauna • Marine Reptiles	**Surface Hydrocarbons:** There is limited information regarding the effects of hydrocarbons on reptiles. Should reptiles come into contact with hydrocarbons, potential impacts include oiling of the body as well as irritations caused by contact with eyes, nasal and other body cavities and possibly ingestion or inhalation of toxic vapours (AMSA 1998). Significant marine turtle habitats, in particular nesting areas, are known to be present throughout the EMBA. Ashmore Reef and Cartier Island CMRs are critical habitats for breeding and feeding marine turtles and support large populations of marine turtles. Approximately 11,000 marine turtles are	Serious (4)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (4B)

	estimated to forage at Ashmore Reef (DOE 2015). The MDP area does not overlap with any turtle BIAs, however the EMBA intersects with a number of nesting, internesting and foraging BIAs in the region. Surface concentrations above 10 g/m^2 are predicted to reach a single nesting BIA for green turtles in a minimum time of 103 hours (4.3 days); internesting BIAs for hawksbill, leatherback, flatback and olive ridley turtles in a minimum time of 241 hours (10.04 days, hawksbill) to 1411 hours (58.79 days, flatback); and foraging BIAs for flatback, hawksbill, loggerhead, olive ridley and green turtles in a minimum time of 111 hours (4.63 days, flatback, olive ridley and loggerhead) to 273 hours (11.38 days, green). Therefore, a surface slick may be present in a number of turtle BIAs (the predicted timing of which assumes that no spill response is implemented to reduce volumes and/or prevent hydrocarbons from reaching sensitive areas). Turtles can be exposed to hydrocarbons if they surface within the spill, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (Milton et al. 2003). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large, pre dive inhalations, make them vulnerable (AMSA 2015). In addition, hatchlings spend more time on the surface than older turtles, thus increasing the potential for contact with oil slicks (Milton et al. 2003). Two species of listed sea snakes were identified that may occur in, or have habitat in the EMBA, while none were identified within the MDP area itself (short-nosed sea snake and leaf-scaled sea snake, both critically endangered). Sea snakes are known to occur at several locations in the EMBA including Cartier Island and Hibernia Island with established populations of several species present (Guinea, 2013). Sea snakes have also been reported in high abundance at Ashmore Reef in the past, but recent evidence has shown a significant decline in numbers. Based on colour patterns of the sea snake species observed during a recent survey there is thought to be very little gene flow between reefs implying that if a species is lost from a reef, recolonisation may take several years (Guinea, 2013). The short-nosed sea snake is known from Ashmore Reef and the leaf-scaled sea snake is known from both Ashmore Reef and the				

	reefs off Cartier Island. Limited information is available regarding the susceptibility or sensitivity of sea snakes to hydrocarbon spills, however given they spend time at the sea surface to bask in the sun and the fact that they are air breathers, sea snakes may be vulnerable to surface slicks. The Montara Commission of Inquiry reported one dead sea snake as a result of the Montara oil spill in 2009, during which surface hydrocarbons were present for more than 74 days, with an accumulative area exposed to Montara crude wax and sheen of 95,554 km^2 (PTTEP AA 2012).				
	Entrained / Dissolved Hydrocarbons Entrained and/or dissolved hydrocarbons are not expected to reach any BIAs for marine turtles with a probability greater than 1% at concentrations above the thresholds for impact. Transient turtles and sea snakes may pass through the area of exposure above threshold levels (maximum 160 km from the release location) and may therefore be affected. Should reptiles come into contact with hydrocarbons, potential impacts include oiling of the body as well as irritations caused by contact with eyes, nasal and other body cavities and possibly ingestion or inhalation of toxic vapours (AMSA 1998). Further information on potential impacts to marine reptiles from exposure to hydrocarbons is provided in the discussion of surface hydrocarbons and shoreline accumulation. On this basis, it is anticipated that in the unlikely event of an uncontrolled well blowout turtles and sea snakes may be impacted by exposure to entrained and/or dissolved hydrocarbons, but significant population level effects are not expected.				
	Shoreline Accumulation There are several known turtle nesting areas of high conservation value in the region. Nesting sites are typically on sandy beaches, which, if oiled, can lead to the following potential effects on turtles (AMSA 1998): • Digestion or absorption of oil through food contamination or direct physical contact, leading to damage to the digestive tract and other organs; • Irritation of mucous membranes (such as those in the nose, throat and eyes) leading to inflammation and infection;				

	• Contamination of eggs, either because there is oil in the sand high up on the beach at the nesting site, or because the female turtle becomes oiled whilst moving across the oiled beach to the nesting site - oiling of eggs may inhibit development; and • Newly hatched turtles, after emerging from the nests, make become oiled as they make their way over the beach to the water or, the oil may act as a barrier, preventing hatchlings reaching the sea. BIAs for nesting turtles in the EMBA include Browse Island, Ashmore Reef, Cartier Island, Cassini Island, and Sandy Islet (Scott Reef). Ashmore Reef, Cartier Island, and Browse Island are considered important feeding and/or nesting sites for green, loggerhead and hawksbill turtles. Other sandy beaches that may support nesting turtles occur throughout the EMBA. There is therefore the potential for impacts on nesting populations, which has the potential to affect species recruitment at a local population level. Based on the earliest predicted shoreline contact of 6.8 days at the Kimberley coast (assuming no spill response is implemented) it is anticipated that within this time period the surface oil will be highly weathered before shoreline contact is made and only waxy residues of a lesser toxicity are expected to accumulate on the shoreline. Turtles on the shoreline, in particular hatchlings, may be impacted by exposure to weathered hydrocarbons where impacts are more likely to be physical smothering rather than acute toxicity. However, it is noted that while less toxic to eggs and embryos than freshly spilled oil, weathered oil residues can still have significant impacts on hatchlings and adult turtles. Hatchlings that contact oil residues while crossing a beach can exhibit a range of effects, from acute toxicity to impaired movement and normal bodily functions (Shigenaka, 2003). Lutz (1989) reported that hatchlings have been found apparently starved to death, their beaks and esophagi blocked with tarballs. Hatchlings sticky with oil residue may have greater difficulty crawling and swimming, rendering them more vulnerable to predation. Both hatchlings, juveniles, and adult turtles can be effected through the ingestion of tarballs typically through starvation from gut blockage, decreased absorption efficiency, absorption of toxins, and buoyancy problems caused by the build-up of fermentation gases (floating prevents turtles from feeding and increases their vulnerability to predators and boats)				

	(Shigenaka, 2003). However, turtles have been shown to have a well-developed hepatic system of enzymes (cytochocrome P450-1A) to metabolise organic contaminants and aid in elimination from the body. Glutathione transferases (a cellular defence against electrophilic DNA damage by such toxicants as PAHs) have also been isolated from green sea turtles. Therefore, when turtles are exposed to PAHs in crude oil in low dosages, endogenous mechanisms exist to enhance elimination of xenobiotics compounds out of the organism (Gagnon and Rawson, 2010). Based on the above information, it is anticipated that in the unlikely event of an uncontrolled well blowout turtles, in particular hatchlings, may be impacted by exposure to hydrocarbons. Stranded oil with its proximity to sandy beaches with known turtle nesting habitats, in excess of the threshold, may have effects on populations, turtle nesting and juveniles.				
Plankton	**<u>Entrained / Dissolved Hydrocarbons</u>** As a consequence of their presence close to the water surface, plankton may be exposed to entrained/dissolved hydrocarbons. The effects of oil on plankton have been well studied in controlled laboratory and field situations. The different life stages of a species often show widely different tolerances and reactions to oil pollution. Usually, eggs, larval and juvenile stages will be more susceptible than adults (Harrison 1999). Post spill studies on plankton populations are few, but those that have been conducted typically show either no effects, or temporary minor effects (Kunhold 1978). The lack of observed effects may be accounted for by the fact that many marine species produce very large numbers of eggs, and therefore larvae, to overcome natural losses (such as through predation by other animals; adverse hydrographical and climatic conditions; or failure to find a suitable habitat and adequate food). A possible exception to this would be if a shallow entrained/dissolved hydrocarbon plume were to intercept a mass, synchronous spawning event. Recently spawned gametes and larvae would be particularly vulnerable to oil spill effects, since they are generally positively buoyant and would be exposed to surface spills. Under most circumstances, impacts on plankton are expected to be localised and short term; however, if an entrained/dissolved surface expression reached a coral or fish spawning	Moderate (2)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Low (2B)

	location during a spawning event, localised short to medium term impacts could occur. Commercial target fish species have been reported to spawn in offshore waters within the MDP area and wider EMBA, with spawning and juveniles most likely to occur around reefs and bays in nearshore shallow waters. Of note is the single known spawning ground for southern bluefin tuna in the Indian Ocean, extending between northern WA and Java from 7° S to 20° S, approximately 200 km to the west of the MDP area, raised as an issue of potential concern in consultation with the Australian Southern Bluefin Tuna Industry Association. Spawning occurs between August and April (with a peak period from October to February) (DOE 2015). In the unlikely event of a spill occurring there is potential for a reduction in successful fertilization and larval survival. However, the EMBA for entrained and dissolved hydrocarbons does not extend as far west as the spawning ground. Therefore any incidental impacts to fish larvae beyond the predicted area for impact are unlikely to be of consequence to fish stocks, particularly compared with significantly larger losses through natural predation and other processes.				
Avifauna	**Surface Hydrocarbons:** Numerous species of birds frequent the Timor Sea area or fly through the area on annual migrations. Seabird feeding grounds, roosting and nesting areas are found at the offshore atolls in the wider region. In particular, Ashmore Reef, Cartier and Browse Islands support internationally significant numbers of breeding seabirds and migratory shorebirds with all species variously listed under the EPBC Act. Ashmore Reef is also a Ramsar wetland of international importance. Numbers of breeding seabirds have been reported to potentially exceed 100,000 individuals during a single year at Ashmore Reef (Clarke and Herrod 2016). Up to 33 migratory shorebirds species and 18,000 individuals have also been documented using the reserves (Clarke 2010). Peak migration time of migratory shorebirds is between October and December (Clarke 2010). It is expected that some individuals of these species may pass through the MDP area and wider EMBA during their annual migrations. A number of BIAs in addition to Ashmore Reef, Cartier and Browse Islands	Serious (4)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (4B)

	for seabirds have been identified within the EMBA (Figure 4.3). Surface concentrations above the impact threshold of 10 g/m^2 are predicted to reach breeding BIAs for crested terns; greater frigatebirds; lesser crested terns; little terns; red-footed boobys; roseate terns; wedge-tailed shearwaters and white-tailed tropicbirds; and a resting BIA for little terns. Surface concentrations at this threshold are expected to reach BIAs in a minimum time of 44 hours (1.83 days) to 756 hours (31.5 days) depending on the location of the BIA (assuming no spill response is implemented). Birds foraging at sea have the potential to directly interact with oil on the sea surface some considerable distance from terrestrial habitats in the course of normal foraging activities. Surface plunging species such as terns and boobies and species that readily rest on the sea surface such as shearwaters are most at risk. Direct contact with surface hydrocarbons may result in dehydration, drowning and starvation and is likely to foul feathers, which may result in hypothermia (AMSA 2015). Impacts may include damage to external tissues, including skin and eyes, and internal tissue irritation in lungs and stomachs (Clark 1984). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (Jenssen 1994). Weathering of hydrocarbons on the sea surface will reduce the levels of toxicity that seabirds may be exposed to and, over time, the hydrocarbons on the surface will become patchy rather than continuous.				
	Shoreline Accumulation Potential impacts to resting/foraging seabirds from exposure to surface oil have been discussed above. In relation to impacts from shoreline accumulation, mainland coastlines and offshore islands in the EMBA provide nesting habitat for seabirds and foraging habitat for shorebirds. It has been estimated that as little as four microliters of petroleum contaminating a fertile egg can cause the embryo to die (AMSA 1998), and there is potential for serious impact of oiling of birds from shoreline hydrocarbon contact. BIAs for twelve bird species in the EMBA may be impacted by stranded hydrocarbons. Ashmore Reef, Cartier Island and Browse Island support a large population of seabirds, including some of the most important seabird				

	rookeries on the North West Shelf (Clarke 2010). As described above, numbers of breeding seabirds have been reported to potentially exceed 100,000 individuals during a single year at Ashmore Reef (Clarke and Herrod 2016). Up to 33 migratory shorebirds species and 18,000 individuals have also been documented using the reserves (Clarke 2010). Ashmore Reef, Cartier Island and Browse Island are also important foraging areas for migratory shorebirds, with numbers highest between October and April (Clarke 2010). Given the earliest shoreline contact, during any season is 6.8 days at the Kimberley coast, hydrocarbons are expected to have weathered resulting in stranded hydrocarbons containing lower amounts of toxic volatile components. However, weathered oil has been shown to reduce hatching success in exposed mallard eggs (Finch et al. 2011), and adverse effects from the leaching of PAHs from weathered oil have been observed years after the Exxon Valdez oil spill (Esler et al. 2002, 2010). Documentation of the long-term effects of residual oil, however, is difficult and requires many years of research. Shorebirds foraging and feeding in intertidal zones are at potential risk of exposure to shoreline hydrocarbons, potentially causing acute effects. Following an uncontrolled well release from the Montara well between August and early November 2009, an oil slick formed and petroleum-based products were reported in the vicinity of Ashmore Reef and Cartier Island. Small numbers of oiled seabirds were recovered both at sea and on the islands at Ashmore Reef, although search effort was limited (Clark and Herrod 2016). In a post-impact study of the effects of the spill on bird populations, the total number of seabirds breeding at Ashmore Reef was found to increase after the spill event when compared to pre-impact data (Clark and Herrod 2016). This trend also applied to breeding populations of individual seabird species. Declines in non-breeding seabirds during were detected and some of these declines met the *a priori* definition of significant impact. As breeding populations increased over the same time period, Clark and Herrod (2016) conclude that these declines likely reflect variability in seasonal response rather than evidence for significant impact arising from the Montara oil spill. Declines in migratory shorebird numbers were detected at Ashmore Reef following the spill, however, this response was anticipated				

	given ongoing declines of migratory shorebirds throughout the flyway. When compared with control sites at Eighty-mile Beach, WA, the decline in numbers was not found to be significantly different and therefore no significant impact as a result of the Montara Oil Spill was detected.				
Benthic Communities • Banks & Shoals	**Surface Hydrocarbons:** The nearest shoals to the MDP area are Goeree and Vulcan Shoals, located approximately 30 km to the southwest. Other shoals in close proximity to the MDP area include Eugene McDermott Shoal (approximately 45 km south) and Barracouta Shoal (approximately 60 km northwest). Extensive surveys to characterise the habitats and ecosystems of the Barracouta and Vulcan Shoals between 2010 and 2013 confirm these shoals rise steeply from 100 to 200 m depths on the outer continental shelf and are elliptical in shape with the long axis running approximately east-west (Heyward et al. 2010). The shoals are reported to plateau at approximately 40 to 50 m depth with the plateau area of each shoal covering several square kilometres (10 to 15 km^2) at depths of 20 to 30 m (Heyward et al. 2011). Occasional higher ground rises to within approximately 10 m of the sea surface. Given the submerged nature of these shoals, in the unlikely event of a hydrocarbon spill submerged banks and shoals will not be contacted by a surface slick. Additional impacts from entrained/dissolved hydrocarbons on banks and shoals are discussed in the subsection below.	Moderate (2)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Low (2B)
	Entrained / Dissolved Hydrocarbons Contact with entrained hydrocarbons above the 700 ppb (67,200 ppb.hrs) threshold is not predicted at shoals in the EMBA other than a single unnamed shoal with a 1% probability of contact (Table 23, RPS 2017). Consequently impacts to benthic habitats are not anticipated. Exposure to dissolved aromatics above the 50 ppb (4,800 ppb.hrs) threshold is predicted at four shoals (Unnamed Timor Sea, Barracouta, Goeree and Vulcan Shoals), but with a probability of only 1 to 2%. In the unlikely event of exposure, filter feeders present at submerged reefs and shoals, including corals, are especially liable to ingest entrained hydrocarbons and absorb dissolved aromatics with lethal and various sub-lethal effects. The latter include alteration in respiration rates, decreases in filter feeding activity, reduced growth rates, biochemical effects, increased				

	predation, reproductive failure and mechanical destruction by waves due to inability to maintain a hold on substrate (Ballou et al. 1989; Connell and Miller 1981). Further information on the effects of hydrocarbon exposure on corals is discussed above in relation to surface hydrocarbons. Any contact by oil at coral reef locations during spawning events (October/November) has the potential to cause significant population level impacts. The Montara Environmental Monitoring Program included a study to determine the level of impact of the Montara spill incident on the marine life of various submerged banks, shoals and coral reefs that are within the EMBA (Heyward et al. 2010, 2011). Key findings of this study identified that shoal and reef communities showed no obvious signs of recent disturbance (Heyward et al 2010, 2011). A review of the depth at which submerged reefs and shoals in the area surrounding the title area reach a plateau indicates that the area of highest biodiversity is at a water depth of 20 to 40 m. At this depth, exposure to entrained and dissolved aromatics above the impact thresholds were predicted at a probability of 1% or less for any shoals or reefs in the EMBA.				

Benthic Communities • Coral Reef Communities	**Surface Hydrocarbons:** Emergent coral reef communities, including protected areas at Ashmore Reef, Cartier Island, Seringapatam Reef, Browse Island, Scott Reef, Adele Island and Mermaid Reef (Rowley Shoals), may be impacted by exposure to surface hydrocarbons. The regionally important coral reef communities present within the EMBA are described in Section 4. The closest are Ashmore Reef and Cartier Island located approximately 170 km and 110 km respectively from the MDP area. Hydrocarbon contamination can result in reduced colonisation of corals and contribute to bleaching (Heyward et al., 2010). The effects of hydrocarbons on corals range from short or long-term sub-lethal effects to irreversible tissue necrosis and death. The timing of an oil spill event in relation to other environmental stresses, such as ambient temperature or reproductive stage, may also be of importance in that corals are likely to be more sensitive to oil spill events at times of physiological stress. For instance, the larvae of corals are more sensitive to dissolved hydrocarbons than adult colonies (Heyward et al. 1997; Harrison 1999; Epstein et al. 2000). Shallow-water communities are at a greater risk of exposure than deep-water communities (NRC 1985). Physical oiling of coral tissue can cause a decline in metabolic rate and may cause varying degrees of tissue decomposition which can lead to death (Negri and Heyward 2000).	Significant (3)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (3B)
	Entrained / Dissolved Hydrocarbons Contact with entrained hydrocarbons above the 700 ppb (67,200 ppb.hrs) threshold is not predicted at any coral reefs in the EMBA. Consequently impacts are not anticipated. Exposure to dissolved aromatics above the 50 ppb (4,800 ppb.hrs) threshold is predicted at Ashmore Reef and Cartier Island with a probability of only 1 to 2%.				
Benthic Communities • Seagrass	**Surface Hydrocarbons:** There is no seagrass within the MDP area due to water depth and lack of suitable habitat. However, within the broader EMBA, seagrasses occur along the mainland coastline of the Northern Territory and Western Australia and within the protected coastal areas of islands, including the Tiwi Islands, outer Darwin Harbour and in the waters surrounding the Van Diemen Gulf adjacent to Arnhem Land (Roelofs et al. 2005).	Serious (4)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to	Unlikely (B)	Medium (4B)

	The largest known seagrass locations for the NWMR have been reported from around the Buccaneer Archipelago located north of the Dampier Peninsula (Wells et al. 1995). Ashmore Reef has a high coverage of seagrass that supports a small dugong population (Whiting and Guinea 2005). Recent surveys of the Barracouta and Vulcan Shoals recorded a small representation of seagrass at Barracouta Shoal. Vulcan Shoal located approximately 30 km southwest of the MDP area supports an extensive area with up to 36% seagrass cover (*Thallasodendron ciliatum*) (Heyward et al. 2010). As seagrasses are generally not emergent, impacts from entrained/dissolved hydrocarbons are discussed in the subsection below.		values and sensitivities from a loss of well control scenario.		
	Entrained / Dissolved Hydrocarbons In the event of an uncontrolled well blowout entrained and dissolved aromatic hydrocarbons have the potential to contact seagrass habitats above impact thresholds at shoals and reefs as described above. Coastal seagrass communities around islands and mainland coastlines are outside the area of potential impact. Ashmore Reef has a high coverage of seagrass that supports a small dugong population (Whiting and Guinea 2005). Recent surveys as part of the Montara Environmental Monitoring Program recorded a small representation of seagrass at Barracouta Shoal and more extensive areas of seagrass at Vulcan Shoal (up to 36% seagrass cover) (Heyward et al. 2010). A significant loss of seagrass was recorded at Vulcan Shoal in 2011 when compared with data from surveys conducted in 2010, six months after the Montara oil spill. The cause of seagrass loss at Vulcan Shoal cannot be determined, however is noted that a delayed effect from the Montara incident resulting in a change sometime between 6 and 18 months after the incident is considered unlikely to be due to the Montara spill (Heyward et al. 2011). Direct contact with entrained and dissolved aromatic hydrocarbons can smother and kill seagrasses if it coats their leaves and stems (Taylor and Rasheed 2011). Stress response has also been demonstrated for seagrass at low hydrocarbon concentrations similar to that expected to occur in oil spill situations. The susceptibility of seagrass to hydrocarbon spills will depend largely on their distribution.				

	Deeper communities will be protected from oiling under all but the most extreme weather conditions. Shallow seagrasses are more likely to be affected by entrained hydrocarbon droplets. It is anticipated that, in the unlikely event of entrained and/or dissolved oil reaching shoals or reefs that support seagrass habitats, seagrass is unlikely to be significantly impacted. Physical smothering effects, sub lethal effects or toxicity and light reduction impacts are not expected due to the dispersed nature of the hydrocarbons in the water column and the depth of the seagrass at each habitat location. The potential impacts are not considered likely to significantly modify, destroy, fragment, isolate or disturb an important or substantial area of seagrass meadows at these locations. Based on the results of the Montara Environmental Monitoring Program, in the unlikely event of an uncontrolled well blowout the resultant hydrocarbon spill is unlikely to impact seagrass habitats.				
Shoreline Habitats • Intertidal Coral Reef Communities	**<u>Shoreline Accumulation</u>** A surface slick of hydrocarbons will impact coastal areas, including coastal reef locations, upon contact with the shoreline. The effects of hydrocarbon exposure on corals are discussed above in relation to surface hydrocarbons. Based on French-McCay (2009), the shoreline accumulation impact threshold was determined to be 100 g/m^2 for invertebrates on hard substrates (such as corals). However, given the minimum shoreline contact time of 6.8 days any stranded oil reaching coastal coral communities is expected to be weathered. Therefore, the weathered hydrocarbon residues that will contact emergent corals are expected to comprise of biodegradable, waxy paraffin flakes of low toxicity with very limited potential to adversely affect biological resources. Any potential stranded oil interaction with sensitive resources would be limited to the physical effects of accumulation of waxy paraffin flakes, such as smothering rather than toxicity. However, as spills disperse, intertidal communities are expected to recover (Dean et al. 1998). The rate of recovery of coral reefs depends on the level or intensity of the disturbance, with recovery rates ranging from 1 or 2 years, to decades (Fucik et al. 1984, French McCay 2009). Any contact by oil at coral reef locations during spawning events (October/November) has the potential to cause significant population level impacts.	Significant (3)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (3B)

Shoreline Habitats • Mangroves	**Shoreline Accumulation** Stranded oil was predicted to contact mangrove habitat along the WA/NT coast and coasts of Indonesia and Timor Leste. Mangroves are considered to be an important component of tropical ecosystems as they provide nursery areas for a wide range of marine species and a source of organic matter and nutrients. The impacts of hydrocarbons on mangroves include damage as a result of smothering of lenticels (breathing pores) on pneumatophores or prop roots or by the loss of leaves (defoliation) due to chemical burning (Duke et al. 1999). Thorhaug (1987) concluded that while defoliation of mangroves was a common occurrence when exposed to hydrocarbon slicks, massive mortality was not always the ultimate outcome. Mangrove death is predicted whenever more than 50% of the leaves are lost (Evans 1985). It is also known that mangroves take up hydrocarbons from contact with leaves, roots or sediments, and it is suspected that this uptake causes defoliation through leaf damage and tree death (Wardrop et al. 1987). The recovery of mangroves from shoreline oil accumulation can be a slow process, due to the long term persistence of oil trapped in anoxic sediments and subsequent release into the water column. (Burns et al. 1993). Given the minimum shoreline contact time of 6.8 days any stranded oil reaching coastal mangrove communities is expected to be weathered. It is therefore anticipated that shorelines will be exposed to Montara crude wax, which could coat and smother mangrove breathing pores and cause some sub-lethal effects from toxicity. These impacts may be reduced as a result of tidal flushing removing stranded oil on mangroves.	Significant (3)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (3B)
Shoreline Habitats • Sandy Beaches	**Shoreline Accumulation** Stranded oil was predicted to contact sandy beaches along the WA/NT coast and coasts of Indonesia and Timor Leste. All these locations have the potential to provide habitat for EPBC Act listed reptiles and seabirds but also habitat for invertebrates including polychaetes, molluscs, marine crustaceans, semi-terrestrial crustaceans and insects. Potential impacts to reptiles and seabirds are discussed under marine fauna below. In 2002, De La Huz et al. (2005) investigated the impacts of the Prestige oil	Serious (4)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a	Unlikely (B)	Medium (4B)

	tanker spill off the Galician coast on 17 exposed sandy beaches. The study investigated species richness of polychaetes, molluscs, marine crustaceans, semi-terrestrial crustaceans and insects on the affected beaches, by comparing the total number of species in each group before and after the oil spill. The investigation identified that the most affected beaches lost up to 66.7% of the total species richness after the oil spill and dry sand areas received the highest volumes of hydrocarbons ashore. Based on the earliest predicted shoreline contact of 6.8 days at the Kimberley coast it is anticipated that shorelines will be exposed to weathered Montara crude waxy sheets or flakes that are biodegradable and generally of lower toxicity than the oil itself, due to containing less of the more toxic lighter hydrocarbon fractions, which tend to be lost through volatilisation. Therefore impacts on sensitive receptors at sandy beaches are limited to the physical effects from the presence of such waxy residues and smothering as opposed to toxicity effects. Thomas (1978 cited in French-McCay 2009) observed recovery of invertebrates after three years on sandy beaches oiled by the 1970 Arrow spill of Bunker Oil. Additionally, Judd et al. (1991 cited in French McCay 2009) observed dune vegetation recovery after three years following removal experiments.		loss of well control scenario.		
Protected Areas • CMRs • State/Territory Reserves • Ramsar wetlands	Protected areas within the EMBA are identified in Section 4. Potential impacts to the values and sensitivities of protected areas are incorporated in the impact assessment sections above for marine fauna, benthic communities and shoreline communities. The minimum time before exposure to surface hydrocarbons above the impact threshold of 10 g/m^2 for any protected area is predicted to be 91 hours (3.8 days) at the Kimberley CMR. The minimum time before shoreline accumulation at the impact threshold of 100 g/m^2 is 6.8 days for the Kimberley coast. Considerable weathering of hydrocarbons will therefore occur before reaching protected areas as described above. These timings assume no spill response is implemented to reduce volumes and/or prevent hydrocarbons from reaching sensitive areas. The consequence of impacts from a hydrocarbon spill to protected areas	Serious (4)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (4B)

	reflects the consequence of impacts to the ecological values and sensitivities of the protected areas. Based on the worst-case consequences from the impact assessments outlined above for marine fauna, benthic communities and shoreline communities, the consequence for protected areas is considered to be serious.				
Protected Areas • KEFs	KEFs within the EMBA are identified in Section 4. Potential impacts to the ecological values of the KEFs are incorporated in the impact assessment sections above for marine fauna, benthic communities and shoreline communities. The minimum time before exposure to surface hydrocarbons above the impact threshold of 10 g/m^2 for any KEF is predicted to be 22 hours for the Carbonate bank and terrace system of the Sahul Shelf. Contact with entrained hydrocarbons above the 700 ppb (67,200 ppb.hrs) threshold is not predicted at any KEFs in the EMBA. Consequently impacts are not anticipated. Exposure to dissolved aromatics above the 50 ppb (4,800 ppb.hrs) threshold is predicted at two KEFs (Carbonate bank and terrace system of the Sahul Shelf and Continental Slope Demersal Fish Communities) with a probability of only 1 to 2%. Only small areas of the two KEFs would be reached by dissolved aromatics above the threshold. These timings assume that no spill response is implemented to reduce volumes and/or prevent hydrocarbons from reaching sensitive areas The consequence of impacts from a hydrocarbon spill to KEFs reflects the consequence of impacts to their ecological values. Based on the worst-case consequences from the impact assessments outlined above for marine fauna, benthic communities and shoreline communities, the consequence for KEFs is considered to be serious.	Serious (4)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (4B)
Heritage Places	Heritage areas within the EMBA are identified in Section 4. Potential impacts to the values and sensitivities of heritage areas are incorporated in the impact assessment sections above for marine fauna, benthic communities and shoreline communities. The minimum time before exposure to surface hydrocarbons above the impact threshold of 10 g/m^2 for any heritage area is predicted to be 91 hours (3.8 days) at the West Kimberley National Heritage area. The minimum time before shoreline accumulation at the impact threshold of 100 g/m^2 is 6.8	Serious (4)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and	Unlikely (B)	Medium (4B)

	days for the Kimberley coast. These timings assume that no spill response is implemented to reduce volumes and/or prevent hydrocarbons from reaching sensitive areas. It is noted that the modelling predicts a 2% probability of shoreline accumulation of hydrocarbons above the impact threshold of 100 g/m^2 within the Komodo National Park World Heritage Site, with a minimum time of 100 days before exposure. Minimum time before visible sea surface exposure (0.5 g/m^2) is predicted to be 72.1 days. Considerable weathering of hydrocarbons will occur before reaching heritage areas as described above. The consequence of impacts from a hydrocarbon spill to heritage areas reflects the consequence of impacts to the ecological values and sensitivities of the heritage areas. Based on the worst-case consequences from the impact assessments outlined above for marine fauna, benthic communities and shoreline communities, the consequence for protected areas is considered to be serious.		sensitivities from a loss of well control scenario.		
Fisheries • Commonwealth-Managed • State/Territory-Managed • Recreational • Traditional/ Subsistence	The values and sensitivities associated with commercial, traditional and recreational fisheries (seafood quality and employment) could be impacted due to exposure to entrained/dissolved/ and surface hydrocarbons. Implementing an exclusion zone during the response operation may impede access to fishing areas for a short to medium term, and nets and lines could become oiled (ITOPF 2011). Fisheries are likely to experience loss of financial revenue in the unlikely event of an uncontrolled well blowout. Generally, there is little recreational fishing that occurs within the MDP area due to its distance from land and deep waters. Recreational day fishing is concentrated around the population centres of Broome, Derby and Wyndham, as well as other readily accessible coastal settlements which are generally at the edge of the EMBA some distance away from the well location. These areas are predicted through stochastic modelling to be reached by a surface slick above the visible threshold of 0.5 g/m^2. Commercial fisheries that transect the EMBA predominantly operate in shallower waters with generally low levels of fishing activity reported (AMFA	Serious (4)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (4B)

	2012). The MOU, within the Australian Fishing Zone encompasses Scott Reef and associated reefs, including Seringapatam Reef, Browse Island, Ashmore Reef, Cartier Island and various banks within the EMBA. These areas are predicted through stochastic modelling to be reached by a surface slick above the threshold of 10 g/m^2. Under the MOU, Indonesian and Timorese fishermen are legally permitted to harvest marine products using traditional methods. The peak fishing season is between August and October with fishers departing the region at the onset of the northwest monsoon season. Therefore, traditional fishing could be affected by impacts to fish and benthic habitats (discussed in the above subsections).				
Tourism & Recreation	Most recreational and tourism activities in the region occur predominantly in WA State and NT waters. Coastal waters north of Broome, WA, are predicted through stochastic modelling to be reached by a surface slick above the threshold of 0.5 g/m^2. Limited tourism activities occur at Scott Reef, Ashmore Reef and Cartier Island, which are predicted to be reached by a surface slick above the threshold of 10 g/m^2. Natural features visited by tourist fishing charters and bird watching tours may therefore be affected in the event of a well blow out. Shoreline exposure has the potential for localised short-term impacts to marine-based tourism and recreation in the area. Modelling predicts 48% probability that shoreline loads >10 g/m^2 will occur at the Kimberley coast, while 5% probability that such levels will occur at the Broome coast. The earliest predicted shoreline contact is 6.8 days at the Kimberley coast, therefore it is anticipated stranded oil is expected to weather naturally and breakdown with assistance of ocean currents and as a result, only waxy residues of a lesser toxicity are expected to accumulate on the shoreline. Tourism also has the potential to be impacted in the event that exclusion zones are implemented as AMSA's spill response strategy overlaps with key visiting areas.	Significant (3)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Medium (3B)

Petroleum Exploration & Production	There are a number of existing and planned petroleum exploration and production activities within and surrounding the MDP. During a hydrocarbon spill a surface slick has the potential to oil and coat petroleum exploration and drilling equipment.	Minor (1)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Low (1B)
Ports & Commercial Shipping	International shipping has the potential to be disrupted by any response efforts to combat surface slicks resulting from a well blow out. Shipping in and around the MDP area is sparse with no known shipping routes, while trading vessels may pass through on occasion to the north of the area. Thus, a low level of commercial shipping activity is expected. In the event of a hydrocarbon spill, surface slicks have the potential to oil and coat vessel hulls. Implementing an exclusion zone during the response operation may impede access to intended shipping routes in the area.	Minor (1)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Low (1B)
Defence	Customs Coastwatch, Navy and Customs vessels operating in the EMBA have the potential to be disrupted by any response efforts to combat surface slicks resulting from a well blow out. Implementing an exclusion zone during the response operation may impede access to a defined area.	Minor (1)	Given the preventative control measures in place, PTTEP AA deems it unlikely for the drilling activities to result in impacts to values and sensitivities from a loss of well control scenario.	Unlikely (B)	Low (1B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with uncontrolled well blow out is Type B as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice and an engineering risk assessment to further evaluate a range of control measure options.

The following 'good practice' controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Compliance with the NOPSEMA accepted Montara Well Operations Management Plan;
- Compliance with the PTTEP AA Well Integrity Manual (part of the PTTEP AA Drilling Management System and provides all standards, procedures and practices to manage well integrity);
- Compliance with the PTTEP AA Drilling Management System and the PTTEP AA Well Integrity Assurance management System;
- Maintenance and Inspection:
    - BOP secondary barrier tested approximately every 21 days;
    - Stress analysis has been undertaken to select the appropriate casing material for the well and casing is pressure tested to ensure well integrity is maintained; and
- MODU Management of Change procedure.

In the event of an uncontrolled well blow out, the following controls will be implemented:

- NOPSEMA approved PTTEP AA Montara Production Drilling OPEP will be initiated;
- PTTEP AA Blowout Contingency Plan / PTTEP AA Crisis and Emergency Response Plan will be initiated; and
- At present, in the unlikely event of a well blowout during Montara production drilling activities, drilling of a relief well will be the primary mitigation.

The following additional control measures evaluated as part of the engineering risk assessment were determined to be reasonably practicable and will also be adopted:

- Surface intervention (shut in the well) in the event of a worst case spill event.

ALARP and Acceptability

As described above, the demonstration of ALARP for a 'Type B' decision context is based on assessment against industry good practice and analysis of alternate and/or additional control measures through an engineering risk assessment. The adoption of 'Good Practice' measures and the additional control measures identified through the engineering risk assessment above provide for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

N3 - Vessel Collision Resulting in Large Diesel Spill

Potential Hazard Identification – Establishment of Nature & Scale

Project support vessel routinely supply the MODU with consumables from port, and backload used equipment or waste. As with all navigation operations, there is a risk of collision that may result in a release of diesel oil. To evaluate the potential impacts and risks associated with vessel operation for the proposed Montara H5 ST-2 drilling activity, PTTEP AA have adopted AMSA guidance (AMSA 2013) to inform the maximum credible volumes of hydrocarbons potentially spilled to the marine environment in the event of a vessel collision. The AMSA guidance specifies that the maximum credible spill volume for a vessel collision ('other vessel') should be based on the volume of the largest fuel tank. The maximum fuel tank capacity considered in the risk assessment is expected to be up to 250 m^3. Damage to the support vessel fuel tank would require direct collision at the side of the vessel with enough force to rupture a wing tank.

As part of the risk assessment, a drilling rig fuel tank rupture as a result of a vessel collision was considered however was deemed not credible. The drilling rig's fuel tanks are located internally and as a result of this fact are not considered a hazard during support vessel interactions based on this engineering avoidance measure.

It is anticipated that the fuel type used by the support vessels will be marine diesel. Diesel fuel oil (diesel) typically has a density of 829 kg/m^3 (API gravity of 38), and a dynamic viscosity of 1.15 cP at 15ºC. It is important to note that diesel contains some heavy components (or low volatile components) that have a strong tendency to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves, but can re-float to the surface if these energies abate. In the event of a substantial diesel spill, the heavier components of diesel can remain entrained or on the sea surface for an extended period.

Diesel is a light, refined petroleum product and is expected to undergo rapid spreading and evaporation resulting in relatively rapid slick break-up. When spilled on water, most of the diesel will evaporate or naturally disperse within a few days or less. General behaviours of diesel at sea include:

- Diesel will spread very rapidly with the slick elongated in the direction of prevailing wind and waves, and speed of physical dispersion increases with wind speed;
- Some diesel fuel oils may form an unstable emulsion at the thicker, leading edges of the slick;
- Evaporation is the dominant process contributing to the removal of spilled diesel from the sea surface and can account for 60-80% loss. Evaporation of diesel is likely to be enhanced in the EMBA due to the warm prevailing air and sea temperatures; and
- Diesel residues usually consist of heavy compounds which may persist longer and will tend to disperse as oil droplets in to the upper layers of the water column.

Description of oil spill modelling

Hydrocarbon spill modelling was undertaken to estimate the potential exposure to surrounding waters and shorelines from a 250 m^3 surface release of marine diesel oil from a vessel at the Montara Field. Modelling was conducted using a stochastic (random) approach, which involved running 100 spill simulations per season (transitional season: September to November, and summer season: December to March) to ensure that each simulation was subject to different wind and current conditions and, in turn, movement and weathering of oil. It is noted that the modelling did not take into consideration any of the spill prevention, mitigation and response capabilities that PTTEPAA propose to have in place during the proposed drilling campaign.

The modelling predicted the following outcomes in the event of a 250 m^3 marine diesel spill:

- Due to the spill volume and oil properties (5% persistent components) oil was not predicted to persist on the sea surface for extended periods.

- Oil was observed to travel up to 99.7 km from the release location (above the visible surface threshold of 0.5 g/m^2).
- At the ecological impact threshold of 10 g/m^2, oil on the sea surface was predicted to remain within 15 km of the release site during all conditions modelled.
- Within 24 hours of the initial release visible oil was predicted to travel a maximum distance of 38 km.
- Three shoals (Vulcan, Goeree and Eugene McDermott) were predicted to be exposed to visible oil (above 0.5 g/m^2) for a diesel spill at the location modelled. The probability of exposure to these receptors was between 1-2% per season. No sensitive receptors were predicted to be exposed to surface hydrocarbons above the ecological impact threshold (10 g/m^2).
- No shoreline contact was predicted above the minimum impact threshold for socio-economic receptors of 10 g/m^2.
- No in-water exposure above impact thresholds for dissolved or entrained hydrocarbons was predicted.

Surface Hydrocarbons

As outlined above, modelling of a 250 m^3 diesel spill scenario predicts that oil would not persist on the surface for extended periods. Surface hydrocarbons above the ecological threshold for impact are predicted to remain within the immediate vicinity of the release location (15 km). For the location modelled within the Montara field, no sensitive receptors were exposed above this threshold. Three shoals had a 1-2% probability of being exposed to visible oil. No shoreline contact from this spill scenario is predicted. The particular values and sensitivities with the potential to be exposed to surface hydrocarbon exposures are:

- Migrating cetaceans (specifically pygmy blue whales and humpback whales) and other transient cetaceans;
- Transient marine reptiles (specifically turtles);
- Foraging seabirds; and
- Commercial fishing.

The potential hazard associated with the accidental release of diesel fuel to surface waters is:

- Potential deterioration in water quality within the vicinity of the support vessels resulting in behavioural change in marine species;
- Potential toxic effects to marine species due to chemicals in the vicinity of support vessels;
- Potential toxic effects to air-breathing marine species due to the inhalation of vapours; and
- Physiological impacts to avifauna (sea birds) due to oiling from direct contact leading to loss of buoyancy and the potential for hypothermia.

The potential exposure of marine species to diesel fuel is:

- within the MDP area in Commonwealth waters, based upon the limited volumes of the potential release;
- from September 2017 to potentially February 2018;
- Based upon AMSA guidance (2013) up to 250m3 of diesel; and
- For approximately 12 hours

Entrained/Dissolved Hydrocarbons

As outlined above, given the properties of diesel, volatiles are likely to evaporate quickly; however, persistent hydrocarbon components have the potential to remain in

the environment between one and 12 months (Etkin 2003). These residues will tend to disperse as oil droplets into the upper layers of the water column. Worst case impacts from entrained concentrations would be limited to chronic impacts to juvenile fish, larvae, and planktonic organisms that might be entrained with the plume (based upon OSPAR 2014). Particular values and sensitivities identified with the potential to be exposed to entrained and/or dissolved hydrocarbons are mobile fauna that are not expected to remain within plumes for extended periods of time and subsequently are not expected to be impacted at concentrations that persist beyond the initial plume.

The spill modelling undertaken by RPS (2017b) within the Montara Field does not predict any in-water exposure above impact thresholds for dissolved or entrained hydrocarbons and therefore impacts to sensitive receptors are not anticipated.

Shoreline Accumulation

The nearest shorelines to the MDP area are at Ashmore Reef and Cartier Island, located approximately 110 and 170 km from the MDP area respectively. Beyond this the nearest shorelines are the mainland Kimberley coast and Browse Island, approximately 200 km away. The spill modelling undertaken by RPS (2017b) within the Montara Field does not predict any shoreline contact.

There have been no objections or claims from potentially affected relevant stakeholders in relation to the accidental release of diesel from a support vessel.

Detailed Environmental Impact Assessment

Identified Value or Sensitivity Potentially Exposed to Hazard	Potential Severity / Consequence Discussion	Rating	Likelihood of Impact Occurrence	Rating	Risk
Marine Fauna • Marine mammals • Marine reptiles • Sharks, sawfish and rays • Other fish species	Impacts to transient marine fauna within the vicinity of the spill include the potential to impact air breathing animals such as cetaceans, turtles and sea snakes due to of inhalation of vapours if they surface in the diesel slick. The interaction of marine fauna with surface hydrocarbons above the ecological threshold for impact is expected to be limited due to the localised area of the spill and because weathering will limit the duration of exposure resulting in only short-term and/or temporary effects.	Moderate (2)	Fresh surface slick is not expected to reach inshore waters of sensitive receptors at concentrations that will elicit toxic effects to marine biota given the rapid rates of evaporation.	Unlikely (B)	Low (2B)

Avifauna	Seabirds have also been identified as at risk if they contact the diesel slick by oiling their feathers leading to loss of buoyancy and the potential for hypothermia. Should seabirds, contact the diesel slick there may be a localised and lethal effect on a number of individuals.	Moderate (2)	Given the transient nature of avifauna, the rapid dispersion and evaporation of diesel, and the remote well location away from rookeries, it is unlikely that avifauna would be exposed to a diesel spill in the open ocean.	Unlikely (B)	Low (2B)
Commercial Fisheries	A number of commercial fisheries are known to overlap the MDP area and wider EMBA. Where active effort is reported to occur, these fisheries have the potential to be affected by surface hydrocarbons in the event of a diesel spill. Any impacts are expected to be localised and short-term	Moderate (2)	Due to low level of effort reported, it is unlikely that such a spill would impact the commercial fisheries currently in operation in the region. In addition, due to its greater volatility, diesel is unlikely to persist for an extended period in offshore waters.	Unlikely (B)	Low (2B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts associated with vessel collision resulting in a large diesel spill (maximum 250 m^3) is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.

The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- A 500 m safety zone will be maintained around the MODU in accordance with OPGGS Act – Section 616 (2) Petroleum safety zones;
- Compliance of MODU and supply vessels with maritime safety and navigation requirements to prevent collisions (in alignment with the Navigation Act 2012, relevant Marine Orders, MARPOL 73/78 (Annex I – prevention of pollution by oil, and Annex II – Control of pollution by noxious liquid substances in bulk) and International Regulations for Preventing Collisions at Sea 1972);
- In the event of a spill, the NOPSEMA approved PTTEP AA Montara Production Drilling OPEP will be initiated; and
- In the event of a spill from a project support vessel, the vessel SOPEP shall be implemented.

ALARP and Acceptability

Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

N4 - Loss of Hydrocarbons – Refuelling Incident

Potential Hazard Identification – Establishment of Nature & Scale
There is a potential for small spills (<5 m^3) of diesel during refuelling operations. The main causes for such spills are hose breaks, coupling failures or overfilling which can be managed by regular inspection of hose integrity, limiting volumes of fuel held in the transfer hose and by the use of fail-safe valves to ensure rapid shutdown of fuel pumps. The potential spill volume has been calculated as follows: • 2.5 minutes to shutdown fuel transfer (30 seconds to realise the spill, 30 seconds to report the spill, 90 seconds to shut in the fuel transfer); • Transfer rate (100 m^3 per hour) multiplied by 2.5 minutes results in 4.17 m^3 of spilt diesel plus the transfer hose volume of 0.45 m^3; and • Total worst case spill volume of 4.62 m^3. The potential impact associated with this non-routine event is the localised and temporary reduction in water quality. As described above, diesel is a light, refined petroleum product and is expected to undergo rapid spreading and evaporation resulting in relatively rapid slick break-up. When spilled on water, most of the diesel will evaporate or naturally disperse within a few days or less. Given the rapid rates of evaporation, the resultant surface slick for a 5 m^3 diesel spill is not expected to reach inshore waters of sensitive receptors at concentrations that will elicit toxic effects to marine biota. Impacts to transient marine fauna within the vicinity of the spill include the potential to impact air breathing animals such as cetaceans and turtles as risk of inhalation impacts if they surface in the diesel slick. Seabirds are also at risk if they contact the diesel slick by oiling their feathers leading to loss of buoyancy and the potential for hypothermia. Given the small volume (5 m^3) involved with a spill during refuelling operations, the associated impacts and risks are likely to be confined to a small area and will be of short-duration. They will be considerably less than those described above for a well blow out scenario. A detailed impact assessment provided for a large diesel spill of 250m3 (as detailed above in N3) has been used a s a worst-case proxy for the risk assessment of a 5m3 loss of hydrocarbons due to a refuelling incident. The overall consequence for the receptors assessed is presented as part of the impact assessment and was ranked as Moderate (2) with a residual likelihood of ‘unlikely’ (B) assigned given the safeguards/controls outlined below that will be in place. The residual risk of impact is assessed to be low (2B). There have been no objections or claims from potentially affected relevant stakeholders in relation to the accidental release of diesel from a support vessel. The activities will comply with industry standards, best practice and relevant refuelling guidelines. Several conservation management plans identify oil spills as a key threatening process, through both direct/acute impacts of oil, as well as indirect impacts through habitat degradation (which is a potential consequence of an oil spill). The prevention of spills and implementation of refuelling guidelines demonstrates alignment with the various conservation management plans.

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with loss of hydrocarbons – refuelling incident (maximum 5 m^3) is 'Type A' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice.
 	
The following controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:
 	
• All refuelling operations will be carried out under the Noble permit to work system that includes requirements for:
  o Constant surveillance, communication protocols and daylight refuelling.
  o Dry-break couplings and non-return valves on fuel transfer hoses that are to be maintained regularly.
  o Small deck spills shall be managed by trained personnel using the available onboard spill kits.
• In the event of a spill, MODU and support vessel SOPEPs that includes procedures for minimising losses to sea will be implemented.
 	
ALARP and Acceptability
 	
Given the decision context is 'Type A' the adoption of 'Good Practice' measures above provides for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

6.2.1 Implementation of Response Strategies

Response strategies implemented in the event of a hydrocarbon spill include:

- Source Control
- Monitor and evaluate
- Dispersant application
- In-situ burning
- Containment and recovery
- Protection and deflection
- Shoreline clean-up
- Responding to oiled wildlife

All potential hazards that may arise through implementation of response strategies are summarised below in Table 6.2. The outcome was the identification of four additional hazards, N5 – N8 that are further discussed below.

Table 6.2 Summary of Aspects Associated with Implementation of Response Strategies

	Hazard Ref	Source Control	Monitor & Evaluate	Contain & Recover	Protect & Deflect	Shoreline Clean up	Dispersant Application	In-Situ Burning	Oiled Wildlife
Increased Vessel Movements	R1, R2, R3, R4, R5, R6	X	X	X	X	X	X		
Hazardous Waste Management	N1	X		X	X	X	X		
Atmospheric Emissions	R7	X	X	X	X		X		
Disturbance to Natural Habitat	N5	X			X	X			X
Introduction of Dispersants to the Marine Environment	N6						X		
In Situ Burning Smoke, Fire & Residue	N7							X	
Oiled Fauna Displacement and Handling	N8								X

N5 – Implementation of Spill Response - Disturbance to Natural Habitat

Potential Hazard Identification – Establishment of Nature & Scale
Hydrocarbon spill trajectory modelling indicates the potential for shoreline contact under a range of scenarios. Accessing shorelines will have associated ecological constraints, especially if accessing uninhabited, sensitive coastal habitats. Environmentally intrusive or potentially damaging activity should only be considered if there is a positive net environmental benefit. If significant shoreline oiling occurs, removal of vegetation may be required. Habitat removal will have significant impacts on the function of coastal ecosystems. Physical clean-up methods can alter the profile of beaches and lead to their erosion following the completion of clean-up activities, particularly if heavy machinery is used. The use of equipment, machinery and personnel in some coastal environments, e.g. mangroves and mudflats, can cause more damage than the hydrocarbon itself, thereby reducing the recovery and net environmental benefit of that clean-up approach. Shoreline clean up may generate significant quantities of hydrocarbon mixed with sediment and debris that must be properly disposed of, or treated. Decontamination of spill response equipment may also produce hydrocarbon wastewater that must be treated properly. The worker's personal protective gear is usually disposed of daily or decontaminated, and the resulting oily wastewater will also need to be treated appropriately. During source control, protection and deflection, containment and recovery, shoreline clean-up and oiled wildlife response operations there is potential to disturb natural habitat in the following ways: • Shorelines and nearshore habitat disturbed from booms; • Trampling of habitat from response personnel; • Shoreline and nearshore habitat disturbance from landing vessels; • Removal of vegetation; • Mechanical tillering of stranded shorelines; • Alteration of beach profiles can lead to erosion; • Waste storage and decontamination; and • Other aspects and with the potential to disturb the natural habitat associated with routine operations as described in Sections R1-R12 should a relief well be drilled as part of a source control response strategy. There have been no objections or claims from potentially affected relevant stakeholders in relation to the disturbance of the natural environment when responding to a spill.

Detailed Environmental Impact Assessment					
Identified Value or Sensitivity Potentially Exposed to Hazard	**Potential Severity / Consequence Discussion**	**Rating**	**Likelihood of Impact Occurrence**	**Rating**	**Risk**
Marine Fauna	There is potential for interaction with marine fauna with response vessels, especially in near-shore environments. However, vessel strikes of marine fauna would be limited to individuals rather than communities, and the overall response would be short-term.	Moderate (2)	With the continued application of EPBC guidelines relating to vessel and marine fauna interactions, it is considered unlikely that marine fauna would be adversely impacted by the implementation of response strategies.	Unlikely (B)	Low (2B)
Avifauna	Disturbance of nesting (protected) avifauna is related to the disturbance to shoreline habitats detailed below.	Significant (3)	With the application of detailed oiled wildlife response management in alignment with industry 'Best Practice' the likelihood of adverse impacts to avifauna is greatly reduced.	Unlikely (B)	Medium (3B)
Shoreline Habitats	The extent of physical disturbance to shoreline habitats from people and equipment mobilisation and clean-up operations is largely dependent on the extent of shoreline oiling. It is acknowledged that rookeries for list avifauna species, and nesting marine reptiles are present within the EMBA. Given the managed and targeted nature of potential clean-up operations by trained responders, it is reasonable to expect that impacts to shoreline habitats may be short-term, but could impact multiple listed species.	Significant (3)	With the application of the NEBA process (as described in the OPEP), and targeted response operations undertaken in a managed approach, it is unlikely that shoreline habitats are adversely affected.	Unlikely (B)	Medium (3B)

Heritage Places	It is acknowledged that both indigenous and non-indigenous heritage places are within the EMBA. Disturbance of damage to a heritage place is considered serious.	Serious (4)	With the application of the NEBA process as detailed within the project OPEP, potentially affected stakeholder will be engaged prior to the implementation of response strategies, these would include both indigenous and regulatory groups to consider heritage places in the incident planning cycle. As such, it is considered unlikely that heritage places would be adversely impacted during response operations.	Unlikely (B)	Medium (4B)

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with the implementation of spill response - disturbance to natural habitat is 'Type B' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice and an engineering risk assessment to further evaluate a range of control measure options.

The following 'good practice' controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Spill responses that could result in disturbance to natural habitats will be undertaken in accordance with the OPEP; and
- Spill responses that could result in disturbance to natural habitats will be undertaken with consideration given to EPBC Management Plans whilst undertaking operational NEBA.

The following additional control measures evaluated as part of the engineering risk assessment were determined to be reasonably practicable and will also be adopted:

- Correct equipment and personnel deployed to key shorelines areas for clean-up in accordance with Kimberley Shoreline Concept of Operations;
- Develop a Kimberley Shoreline Concept of Operations Plan prior to drilling activities commencing;
- Sensitive receptors protected from shoreline contact through deployment of booms, skimmers and other equipment identified through NEBA;
- Induction and training of clean-up team will ensure disturbance to sensitive areas is minimised by instructing the spill response teams to avoid disruption of environmental sensitivities as far as possible by restricting vehicle and foot traffic to and from spill response sites;
- Implement shoreline clean-up activities at priority and other sites in accordance with associated shoreline type, controls and clean-up methods specified in the OPEP, and where NEBA determines the implementation to be of net benefit;
- Operational and Scientific Monitoring Program (OSMP) undertaken to identify sensitivities at risk and inform NEBA; and
- Defined waste areas established.

ALARP and Acceptability

As described above, the demonstration of ALARP for a 'Type B' decision context is based on assessment against industry good practice and analysis of alternate and/or additional control measures through an engineering risk assessment. The adoption of 'Good Practice' measures and the additional control measures identified through the engineering risk assessment above provide for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

N6 – Implementation of Spill Response - Introduction of Dispersants to the Marine Environment

Potential Hazard Identification – Establishment of Nature & Scale

Dispersant is a potential response strategy in the event of a Tier 3 spill with the aim to minimise the volume of the spill in as short duration as possible that could impact sensitive locations.

Dispersant application during the Montara incident in 2009 and dispersant amenability testing indicates that it is effective on Montara crude. Modelling studies and the Montara Incident Report (AMSA, 2010) indicate that dispersant usage minimises the volume of hydrocarbon that could impact sensitive shorelines in the region.

Dispersants applied to oil spills have the potential to cause toxicological and physical threat to populations of protected species within sensitive and protected marine environments. However, dispersants selected for a response will be those which have been tested and approved by AMSA for efficacy and toxicity, and are listed on the Oil Spill Control Agent Register. The toxicity testing requirements for AMSA approval detailed in the AMSA Protocol for the Register of Oil Spill Control Agents (AMSA, December 2012). These requirements have been reviewed by PTTEP AA and are considered appropriate for the selection of dispersants for this activity to ensure the impacts to the environment are acceptable and ALARP. This is due to the Oil Spill Responses Atlas register ensuring high acute toxicity (4-day LC50 less than 10 ppm) (NRC, 1989) dispersants are not utilised and based on the available literature, dilution and dispersion will occur once applied that will significantly reduce the concentration to levels considered unlikely to have significant effects on marine organisms or habitats.

Sufficient stocks of dispersants meeting these criteria are currently available for use in the event of a well blowout associated with this activity. There is an adequate quantity of Dasic Slickgone NS available, that has been tested for effectiveness on the Montara crude and is on the Oil Spill Control Agents Register.

Dispersed oil fate modelling by APASA (2013c) indicates that the amount of oil impacting the shorelines at sensitive locations containing bird and turtle rookeries, mangroves and intertidal coral and seagrass habitats can be reduced significantly and that no additional impacts on sensitivities including shoals in the region from entrained oil or dissolved aromatics would likely result.

Dispersant application will also reduce the volume of hydrocarbon to be contained and recovered and consequently reduce the magnitude of waste that will be produced. Through effective application of dispersant, the aim is to prevent any hydrocarbons from reaching the shoreline. This approach is considered ALARP if undertaken with the controls for both surface and subsurface application listed above as it will provide a greater net environmental benefit compared to if no dispersant is applied to the spill.

The aim of the response strategies for a spill from the Montara production drilling activities is to prevent oil reaching shorelines so that no habitat is required to be disturbed.

The consequence of potential impacts from introduction of dispersants to the marine environment is assessed to be 'moderate' (2), with a residual likelihood of 'unlikely' (B) given the safeguards/controls outlined below that will be in place. The residual risk of impact is assessed to be low (2B).

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with the implementation of spill response - introduction of dispersants to the marine environment is 'Type B' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice and an engineering risk assessment to further evaluate a range of control measure options.

The following 'good practice' controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Dispersant application undertaken in accordance with the Montara Production Drilling OPEP:
    - Undertake a NEBA Assessment including Oil Spill Trajectory Modelling;
    - Use of dispersants on AMSA Oil Spill Responses Atlas Register, and passed efficacy testing on Montara crude;
    - Application of dispersant as close to source as possible to optimise performance and reduce potential shoreline contact;
    - Exclusion zones to avoid impacts on sensitive areas including shoals, i.e. Red zone;
    - Monitoring of quantities of dispersant used;
    - Undertake a dispersant amenability test to highlight optimal effectiveness conditions; and
    - Stakeholder engagement process.

The following additional control measures evaluated as part of the engineering risk assessment were determined to be reasonably practicable and will also be adopted:

- Dispersant will not be applied within the area defined as the Red zone in the OPEP;
- Efficacy testing of dispersant (pre-event);
- Volumes of dispersant will be monitored;
- Dispersant will only be applied in the area defined as the Amber zone in the OPEP where NEBA is undertaken to determine whether there will be a net environmental benefit of dispersing the slick; and
- Monitor and evaluate the effectiveness of a dispersant response technique.

ALARP and Acceptability

As described above, the demonstration of ALARP for a 'Type B' decision context is based on assessment against industry good practice and analysis of alternate and/or additional control measures through an engineering risk assessment. The adoption of 'Good Practice' measures and the additional control measures identified through the engineering risk assessment above provide for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

N7 – Implementation of Spill Response - In-Situ Burning Smoke, Fire and Residue

Potential Hazard Identification – Establishment of Nature & Scale
The use of in-situ burning as a response strategy is expected to be limited to within the first 24 hours after which time Montara crude is likely to become unsuitable for burning. Given the mobilisation times for in-situ burning equipment in-situ burning is not expected to be used as a response strategy. However, an assessment of potential impacts from smoke, fire and residue from in-situ burning is considered in order to maintain this response as a possible option. There is the potential for environmental impacts from the flames and heat from the burn, the emissions generated by the fire and the residual material left on the surface after the fire extinguishers. Nesting birds and mammals could be disturbed by the operations supporting in-situ burning; however, the same disturbances would occur with conventional response operations. Based on many detailed ecological risk evaluations previously conducted for numerous scenarios, the preferred decision would be to burn an oil spill, rather than not to burn it (Buist, et al, 1994). in-situ burning has the potential to greatly reduce the ecological effect of oil impact on the shoreline, which is a more sensitive marine ecosystem. In addition, shoreline cleanup costs are on the order of 10 times more expensive than at-sea recovery operations for the same volume of oil. The black smoke plume generated by in-situ burning is likely to be highly visible from several kilometres away. Despite public concern, the likely environmental impacts of the smoke are low. Although the plume contains combustion gases (mainly CO_2), carbon particles, and some unburned hydrocarbons (including small concentrations of polyaromatic hydrocarbons (PAHs)), the concentrations of these gases and particles have been shown to quickly dilute to levels below environmental concern. The key component of the smoke plume is the particulate matter. An in-situ fire will yield about 5 to 15 percent of the mass of the oil burned as smoke particles. Case studies of accidental fires in major tanker spills have resulted in little or no lasting environmental impact from the smoke plume. Even the massive, long-lasting Kuwait oil fires of 1991 did not appear to have caused any lasting environmental impact (US Coast Guard In-Situ Burn Operations Manual, 2003). Based on limited experience, birds and mammals are more capable of surviving the temporary smoke plume than they are an oil slick. Birds flying in a smoke plume could become disoriented and suffer some toxic effects; however, this risk is believed to be minimal when compared to oil coating and ingestion. The effects of in situ burning (ISB) on marine mammals have yet to be observed; however, the effects of smoke on mammals are likely to be minimal, compared to the effects of contact with unburned oil residues (US Coast Guard In-Situ Burn Operations Manual, 2003). While heat from the flames is radiated downward as well as outward, much of the heat that is radiated downward is absorbed by the oil slick. Most of this energy vaporizes the hydrocarbons for further burning, but a portion of the heat is transmitted to the underlying water. In a towed boom or in a stationary boom situation in current, the water under the slick does not remain in contact with the slick long enough to be heated appreciably; however, under static conditions (the slick does not move relative to the underlying water), the upper few centimetres of the underlying water is heated in the latter stages of the burn. In a prolonged static burn, the upper few millimeters of the water column can be heated to near boiling temperatures, but the water several centimetres below the slick is normally heated only a few degrees for burns lasting 1 to 2 hours. The Alaska RRT recognizes that this heating can eliminate the small life forms that exist in the surface layer of water, but they concluded that the areas involved are small and that the lost biota will quickly be replaced, with negligible overall impact (US Coast Guard In-Situ Burn Operations Manual, 2003). If greater amounts of oil are vaporized than can be burned, more residue (or soot) is produced as a result of incomplete combustion and residue formation is an issue that has been studied by several scientists over many years (Fingas, 2011).

The residue from an efficient burn of crude oil on water is generally environmentally inert although the potential environmental impacts of burn residues are related to their physical properties, chemical constituents and tendency to float or submerge. Burn residues may submerge only after cooling. Based on modelling the heat transfer, it is likely that the temperature of a 1cm thick burn residue will reach that of ambient water within approximately 20 to 30 minutes. Even for thicker slicks, it is likely that this cooling would occur within approximately 2 hours (API, 2002).

Physical properties of burn residues depend on burn efficiency and oil type. Efficient burns of heavier crudes generate brittle, solid residues (like peanut brittle). Residues from efficient burns of other crudes are described as semi-solid (like cold roofing tar). Inefficient burns generate mixtures of unburned oil, burned residues and soot that are sticky, taffy-like or liquid. Burns of light, distilled fuels result in a residue that is similar to the original fuel but contains precipitated soot (US Coast Guard In-Situ Burn Operations Manual, 2003). Based on the above, Montara crude oil is Group 3 oil with relatively high wax content and can be considered likely generate a more solid residue with less likelihood of rapid submersion.

Chemical analyses of crude oil burn residues show relative enrichment in metals and the higher molecular weight PAHs, which have high chronic toxicity but are thought to have low bioavailability in the residue matrix. Bioassays with water from laboratory and field-generated burn residues of crude oil showed little or no acute toxicity to marine life (US Coast Guard In-Situ Burn Operations Manual, 2003).

The residue is largely unburned oil, with some lighter or more volatile products removed, oil subject to high heat and weathered, and heavier particles reprecipitated into the fire that may sink (Fingas, 2011).

The amount of soot produced is believed to be about 0.3% to 3% for crude oil fires and consist of agglomerations of spherical particles. Although consisting largely of carbon particles, soot particles contain a variety of absorbed and adsorbed chemicals and measurements of these components have been made and are evaluated based on Fingas (2011) as follows:

- PAH's – Crude oil burns result in polyaromatic hydrocarbons downwind of the fire but the concentration is often an order of magnitude less than the concentration of PAH's in the starting oil. There may be a slight increase in the concentration of multiringed PAH's in the residue however most (over 95%) are destroyed by the fire in an efficient combustion.
- VOC's – Volatile organic compounds are organic compounds that have high enough vapour pressure to be gaseous at normal temperatures. These are evaporated and released when oil is burned. The emission of these was measured at several test burns and found to be relatively low when compared to the evaporating slick and appear to be below human health levels of concern even very close to the fire and not considered to constitute a major environmental threat.
- Dioxins and Dibenzofurans – These are highly toxic compounds often produced by burning chlorine containing organic material but found at background levels at test fires indicating no production by crude fires.
- Carbonyls – Oil burns produce low amounts of partially oxidised material but found in oil fires in very low concentrations and not considered an environmental threat.

Any residues that float or become submerged could be ingested by fish, birds, mammals, and other organisms and may be a source for fouling of gills, feathers, fur, or baleen; however, these impacts would be expected to be much less severe than those manifested by exposure to a large, unconstrained oil spill (US Coast Guard In-Situ Burn Operations Manual, 2003). It considered that the potential effects of smothering at the Montara location from ISB residues are highly unlikely to be significant given the depth of water and absence of sensitive benthic habitats that may be contacted by localised residue.

The consequence of potential impacts from in-situ burning smoke, fire and residue is assessed to be 'moderate' (2), with a residual likelihood of 'unlikely' (B) given the safeguards/controls outlined below that will be in place. The residual risk of impact is assessed to be low (2B).

There have been no concerns raised by relevant stakeholders in relation to the potential application of in-situ burning as an oil spill response strategy.

Summary of Control Measures, ALARP and Acceptability

The decision context for impacts and risks associated with the implementation of spill response - in-situ burning smoke, fire and residue is 'Type B' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice and an engineering risk assessment to further evaluate a range of control measure options.

The following 'good practice' controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- In-Situ burning undertaken in accordance with the OPEP.

The following additional control measures evaluated as part of the engineering risk assessment were determined to be reasonably practicable and will also be adopted:

- In-Situ burning excluded from the area defined as the Red zone in the OPEP;
- Trained personnel will be used for in situ burning operations; and
- Operational procedures for commencing in situ burning such as undertaking observations for cetacean presence within 500m exclusion zone around proposed burning operation.

ALARP and Acceptability

As described above, the demonstration of ALARP for a 'Type B' decision context is based on assessment against industry good practice and analysis of alternate and/or additional control measures through an engineering risk assessment. The adoption of 'Good Practice' measures and the additional control measures identified through the engineering risk assessment above provide for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

N8 – Implementation of Spill Response - Oiled Fauna Displacement and Handling

Potential Hazard Identification – Establishment of Nature & Scale
In the event of a hydrocarbon release, wildlife response may be implemented as part of the oil spill response. Potential impacts to the environment (specifically fauna) may result from hazards associated with fauna displacement, interaction and handling, these include: 1. Displacing fauna to prevent wildlife from becoming oiled using hazing deterrents such as: • visual techniques such as balloons, reflectors and flags; • auditory techniques such as loud noise, alarms; • sensory techniques such as the use of wildlife distress calls; and • pre-emptive capture aims at capturing animals before they have the opportunity to become oiled. Utilising hazing techniques to prevent wildlife from becoming oiled may impact fauna migratory route patterns, nesting, separate fauna within aggregations and corralling of fauna which may increase risk of predation and exposure to environmental conditions. These potential impacts are considered trivial compared to the potential oiling effects on fauna if wildlife were to get in contact with hydrocarbons ranging from irritation from inhalation of toxic vapours to death. As a result, implementing hazing techniques will result in a net environmental benefit provided hazing efforts do not inadvertently move animals into the oiled area or cause oiled animals to scatter. 2. Collection of live oiled wildlife to treat in captivity. The collection and physical handling of live oiled wildlife has the potential to cause stress and suffering to the oiled animal. However, the removal of oiled wildlife will reduce the risk of the animal dying in the natural environment hence will reduce the impact on preying or scavenging animals that may be contaminated by the oiled carcass. Additionally, when a significant percentage of a population of a threatened or endangered species is oiled successful rehabilitation can make a different in that species' survival. As a result, implementing the collection of oiled wildlife to treat in captivity will result in a net environmental benefit regardless of the oiled animal surviving (successful release back into nature) or being humanely euthanised (which removes the oiled carcass which is a hazard to preying or scavenging animals). The consequence of potential impacts from oiled fauna displacement and handling is assessed to be 'moderate' (2), with a residual likelihood of 'unlikely' (B) given the safeguards/controls outlined below that will be in place. The residual risk of impact is assessed to be low (2B). There have been no stakeholder concerns in relation to oiled wildlife response in the event of a loss of well control.
Summary of Control Measures, ALARP and Acceptability
The decision context for impacts and risks associated with the implementation of spill response - oiled fauna displacement and handling is 'Type B' as defined in Section 5. As such, the demonstration of ALARP is based on assessment against industry good practice and an engineering risk assessment to further evaluate a range of control measure options.

The following 'good practice' controls will be adopted to manage potential environmental impacts and risks to ALARP and acceptable levels:

- Wildlife response operation undertaken (as outlined in the OPEP).

The following additional control measures evaluated as part of the engineering risk assessment were determined to be reasonably practicable and will also be adopted:

- A dedicated treatment centre will be set-up to treat and rehabilitate oiled birds /other wildlife;
- Additional personnel secured via contracts with specialist organisations or Universities;
- Implement the WA Oiled Wildlife Management Plan; and
- Offshore hazing is implemented only when aggregations of fauna (if present) are intact, and the vessel is positioned between animals and the spill.

ALARP and Acceptability

As described above, the demonstration of ALARP for a 'Type B' decision context is based on assessment against industry good practice and analysis of alternate and/or additional control measures through an engineering risk assessment. The adoption of 'Good Practice' measures and the additional control measures identified through the engineering risk assessment above provide for multiple layers of engineering and administrative controls to manage potential environmental impacts and risks to ALARP. All acceptability criteria have been met and the potential environmental risks and impacts are determined to be acceptable.

7 ONGOING MONITORING OF ENVIRONMENTAL PERFORMANCE

All activities associated with the Montara Production Drilling EP are identified, planned and implemented in accordance with relevant legislation, commitments within the Environment Plan and internal PTTEP AA health and safety standards and procedures. Processes are in place to verify that these controls and requirements are being implemented to manage environmental impacts and risks associated with the proposed activities to ALARP over the course of the activities stated in the EP.

For each environmental aspect and associated environmental risks and impacts (identified and assessed in the Environmental Impacts and Risks Evaluation of the EP) specific environmental performance outcomes, controls, environmental performance standards and measurement criteria have been developed. The control measures (outlined in Section 6) will be implemented in accordance with the relevant environmental performance standards to achieve the environmental performance outcomes. The specific measurement criteria provide the evidence base to demonstrate that the environmental performance standards and outcomes are achieved.

The implementation strategy detailed in the Montara Production Drilling EP identifies the roles/responsibilities and training/competency requirements for all personnel (PTTEP AA and its contractors) in relation to implementing controls, managing non-conformance, emergency response and meeting monitoring, auditing, and reporting requirements during the activity.

PTTEP AA and its contractors will undertake a program of periodic monitoring, audit and review during the activity. The objective of the monitoring, audit and review programme is to ensure that the management of environmental impacts and risks is regularly monitored against the performance outcomes, standards and criteria in the Montara Production Drilling EP. Monitoring and measurement of environmental performance must be appropriate to the activity and the results systematically recorded. These activities assist PTTEP AA to review environmental performance over time with a view to continuous improvement of environmental management systems and implementation strategies.

PTTEP AA shall store and maintain the following documents or other records:

(a) the Montara Production Drilling EP;

(b) revisions to the EP;

(c) written reports (including monitoring, audit and review reports) about environmental performance, or about the implementation strategy, under the EP;

(d) records of emissions and discharges into the environment made in accordance with the EP;

(e) records of calibration and maintenance of monitoring devices used in accordance with the EP;

(f) records and copies of reports under regulations 26 and 26A of the OPGGS(E)R, relating to reportable incidents; and regulation 26B of the OPGGS(E)R, relating to recordable incidents.

During the life of the project, audits against the Montara Production Drilling EP will be conducted at least once per operation but may be conducted more often if required. Audits of the EP will consider:

- Compliance with regulatory requirements, applicable international standards, codes of practice and approval conditions;
- Compliance with the outcomes, standards and criteria set in this Environment Plan (see Section 8);
- Compliance with monitoring and reporting requirements; and
- Compliance with all commitments made in the EP.

As detailed in the PTTEP Audit and Review Standard (SSHE-106-STD-700), any corrective actions identified in the audit will be identified and the Functional Manager is responsible for ensuring that the agreed corrective actions are entered in the Cintellate database (via the action tracking module). Progress in completing corrective actions is to be reported monthly.

As the drilling activities are for a relatively short period of time it is not anticipated that the Montara Production Drilling EP will be subject to a review during the activity. A review of the outcomes of the drilling activity will be undertaken once completed. Should a revision to the EP be required, it is the responsibility of the PTTEP AA SSHE Manager to prepare and submit to NOPSEMA.

PTTEP AA employees and contractors are required to report all environmental incidents and non-conformance with environmental performance outcomes and standards in the Montara Production Drilling EP. All incidents that have caused or have the potential to cause moderate to significant environment damage effects on the environment must be reported and investigated according to legislative requirements, vessel procedures and the procedures laid down in the EP. Incidents, near misses and hazards that have the potential to cause environmental damage will be reported using the Vessel Incident Reporting Forms available to the vessel's master and PTTEP AA Incident Report Forms available to the PTTEP AA Drilling Supervisor.

7.1 MANAGEMENT OF CHANGE

PTTEP AA's Management of Change Procedure provides guidance for evaluating changes to Environment Plans consistent with the requirements set out in NOPSEMA guideline on "when to submit a proposed revision of an EP". The purpose is to provide clarity on how PTTEP AA change assessment process aligns with the requirements of Regulation 17:

Regulation 17 - Triggers for Revision of the EP

- 17(7). If there is a change in titleholder that will result in a change in the manner in which the environmental impacts and risks of an activity are managed.
- 17(1). Before commencement of a new activity. A proposed revision of an EP may be submitted with NOPSEMA's approval, as an alternative to submitting a new EP.
- 17(5). Before the commencement of any significant modification or new stage of the activity that is not provided for in the accepted EP.
- 17(6). Before, or as soon as practicable after the occurrence of any significant new or significant increase in environmental impact or risk, including a series of new or increases in impact or risk.

The PTTEP AA Management of Change framework provides for assessing technical changes and the decision criteria for determining if a technical change is significant to require a resubmission of the EP. The Management of Change procedure defines technical change as temporary or permanent engineering changes or modifications, and deviations; technical changes are initiated via the Engineering Change Request Procedure. The decision criteria for assessing the significance of change include:

- Impact on or changes to accepted environmental performance outcomes in the EP
- New or increased environmental risks
- Cumulative risk profile change
- Change in the way the accepted activity would be managed or conducted

8 EMERGENCY RESPONSE ARRANGEMENTS

8.1 CRISIS AND EMERGENCY MANAGEMENT PLAN

PTTEP AA has prepared a Crisis and Emergency Management Plan. The purpose of the plan is to clearly define the roles and responsibilities of the Emergency Management Team during an actual or potential incident that could create and emergency and/or crisis for PTTEP AA and its stakeholders. The plan identifies the major risks potentially impacting business operations and local communities, describes the response strategies and management organisation for a number of potential emergencies, sets out roles and responsibilities of key personnel, contains internal and external notification procedures and describes how PTTEP AA will establish communications in the event of an emergency. This plan covers all operations and activities carried out by PTTEP AA including contracted services for incidents of (but not limited to) the following nature:

- Operational Incidents;
- Environmental incidents;
- Security Incidents;
- Health & Safety Incidents; and
- PTTEP AA Personnel Incidents.

8.2 OIL POLLUTION EMERGENCY PLAN

PTTEP AA has prepared an Oil Pollution Emergency Plan (OPEP) for the proposed Montara Production Drilling. The OPEP provides project specific information to assist with the response in the event of a spill. The OPEP provides a background on the appropriate and readily available oil spill response strategies for the proposed drilling operations covered in the EP. This section provides a summary of emergency response arrangements, initial response actions, spill response strategy and operational and scientific monitoring programs outlined in the OPEP.

8.2.1 Emergency Response Arrangements

Crisis and emergency response is managed by a hierarchy of teams within PTTEP AA, supported by the resources of PTTEP's Head Office in Bangkok, Thailand. The structure and operations of the PTTEP AA Emergency Management Team (EMT) are consistent with the Oil Spill Response Incident Control System (OSRICS) as set out in the National Marine Oil Spill Contingency Plan. The EMT addresses tactical response issues in an emergency, interfacing with and providing information to internal and external parties including the Crisis Management Team (CMT), Contractors, Joint Venture Partners and the relevant regulatory authorities.

The Control Agency for an oil spill response is the government agency or company assigned by legislation, administrative arrangement or within the relevant contingency plan to control response activities to an oil spill. While the Control Agency is responsible for control of response activities, including appointing the Incident Controller, the Control Agency may have arrangements in place for another government agency or company to provide oil spill response services during an emergency. In the event of a spill potentially reaching international waters, PTTEP AA will contact the Department of Foreign Affairs and Trade (DFAT) to ensure the appropriate notifications are made.

Reporting and notification will be in accordance with PTTEP AA's Incident Reporting and Investigation Procedure.

8.2.2 Spill Response Strategy

Response strategies have been developed on the basis of good current industry practice, predictive modelling and effectiveness during the Montara drilling incident in 2009. The response strategies that may be implemented are dependent on the volume of hydrocarbon, location of the spill event, environmental conditions at the time of the spill, and sensitivities in the EMBA.

For all levels, source control is undertaken to ensure no further release of hydrocarbons to the marine environment. There are six potential response options:

1. **Monitor and Evaluate**: this is applicable to all spill scenarios. In the event that a surface spill does not threaten any environmental sensitivity, it may be the only strategy that is deployed.
2. **Dispersant Application**: samples of Montara hydrocarbons have undergone weathering and dispersant testing. During a Level 3 spill incident, dispersant amenability testing and a NEBA assessment will be undertaken to confirm the applicability of the strategy. This strategy is likely to be the primary strategy for the reduction of hydrocarbons reaching environmental sensitivities.
3. **In-situ Burning**: this strategy may be considered in the event of a loss of well control if there are high concentrations of surface oil on the sea surface and the environmental conditions are suitable.
4. **Containment and Recovery**: this strategy may be useful to recover any persistent weathered residues floating on the sea surface and prevent them from reaching shore providing sea states permit. Weathering assessment of Montara crude oil samples have been undertaken to determine the properties of the weathered product, in addition to the observations of weathering during the Montara incident in 2009, these are detailed in the EP.
5. **Protection and Deflection**: this strategy will only be deployed when surface hydrocarbons threaten environmental sensitivities due to the failure or inability to deploy dispersant application and/or containment and recovery techniques. A NEBA assessment will determine whether deployment of the strategy will have an overall environmental benefit to protecting shorelines which may be sensitive to the protection and deflection activities.
6. **Shoreline Clean-up**: this is a strategy of 'last resort' and will only be deployed in the event of surface hydrocarbons impacting shorelines. A NEBA assessment will determine whether deployment of the strategy will have an overall benefit to shorelines (which may be sensitive to shoreline clean-up techniques).
7. **Oiled Wildlife Response**: this strategy will be considered for deployment where surveillance activities identify the potential for marine fauna to be impacted by the spill.
8. **Waste Management**: this strategy will be required to support all active response strategies.

8.2.3 Operational and Scientific Monitoring Program

PTTEP AA has prepared an Operational and Scientific Monitoring Program (OSMP) for its activities in the Timor Sea for use in the event of a large spill. Together the OPEP, OSMP and EP provide a clear, robust approach to efficiently and effectively manage a potential hydrocarbon spill while achieving PTTEP AA's environmental performance criteria. Specifically, the OSMP provides guidance on how and when monitoring data will be collected in the event of a Level 2 or Level 3 hydrocarbon spill.

9 STAKEHOLDER CONSULTATION

9.1 OVERVIEW

PTTEP AA is committed to engaging in an open and transparent manner with stakeholders. Our objectives are to:

- Maintain positive working relationships with our stakeholders;
- Keep stakeholders abreast of our activities;
- Seek feedback from stakeholders to inform our decision-making processes and activities; and
- Proactively manage any concerns or issues that stakeholders may have.

9.2 IDENTIFICATION OF RELEVANT STAKEHOLDERS

For the purposes of the Montara Production Drilling EP, and in line with Regulation 11A of the OPGGS (Environment) Regulations, 'relevant' stakeholders are those that:

- Undertake activities , including business operations, in the vicinity of the production drilling activities;
- Have a role in regulating activities that take place in the vicinity of the production drilling activities; and
- Have a role in oil spill management arrangements.

Based on this definition, a stakeholder mapping exercise was undertaken to identify relevant stakeholders. Table 9.1 provides the list of stakeholders identified during this process.

Table 9.1 Relevant Stakeholders

Undertake Activities in the Vicinity / Concerned with Impacts to Environment	Regulate Activities in the Vicinity	Oil Spill Arrangements
Australian Southern Bluefin Tuna Industry Association	Australian Fisheries Management Authority	Australian Maritime Safety Authority
NT Seafood Council	Australian Hydrographic Service	Darwin Port Corporation
Northern Prawn Fishery Industry	Australian Maritime Safety Authority	Australian Marine Oil Spill Centre
Joint Authority Northern Shark Fishery	Department of Agriculture and Water Resources, Australian Quarantine Inspection Service	Oil Spill Response Limited
Pearl Producers Association	Department of Defence	
Recfishwest	Department of Foreign Affairs and Trade	
Western Australian Fishing Industries Council	Department of Industry, Innovation and Science	
Bounty Oil and Gas NL	Department of Education	

Undertake Activities in the Vicinity / Concerned with Impacts to Environment	Regulate Activities in the Vicinity	Oil Spill Arrangements
Melbana Energy Limited/ Vulcan Exploration Pty Ltd	Department of the Environment	
Sinopec Oil and Gas Australia Pty Ltd	Department of Immigration and Border Protection, Australian Border Force	
North Australian Indigenous Land and Sea Management Alliance	WA Department of Environment Regulation	
NT Guided Fishing Industry Association	WA Department of Fisheries	
Relevant Fishing Industry Licence Holders and Representative Bodies	WA Department of Mines and Petroleum - Petroleum Environment Branch	
Conservation Council WA	WA Department of Parks and Wildlife	
World Wildlife Fund	WA Department of Transport	
	NT Department of Primary Industry and Resources – Mines and Energy	
	NT Department of Primary Industry and Resources – Primary Industries and Fisheries	
	NT Department of Infrastructure, Planning and Logistics – Marine Safety Branch	

9.3 CONSULTATION APPROACH

PTTEP AA contacted relevant stakeholders (via email and telephone) at the start of March 2017 to notify stakeholders about the upcoming engagement process, and confirm the stakeholder's point of contact and preferred engagement method.

This was followed, in late-March 2017, with an email detailing the proposed drilling activity, and asking for feedback. The email included a factsheet, which described the activity, including the location and potential risks and impacts and corresponding control measures. Stakeholders were contacted via email and/ or telephone, depending on the stakeholder's preference, to confirm receipt of the email.

Stakeholders were asked to provide feedback by late-April 2017. The feedback received from stakeholders has been fed into development of the Montara Production Drilling EP, including the controls that have been selected to minimise potential impacts.

An updated factsheet was issued in June 2017. The factsheet included an update on the method used for calculating 10% oil on cuttings.

PTTEP AA worked with Western Australian Fishing Industries Council (WAFIC) to engage with the WA commercial fishing stakeholders. This involved WAFIC contacting relevant stakeholders on behalf of PTTEP AA to notify stakeholders about the activity and seek feedback. The feedback was consolidated and provided to PTTEP AA. This feedback informed development of the Montara Production Drilling EP.

9.4 CONSULTATION RESULTS

Details of the engagement process and responses received are provided in Appendix A. In terms of feedback, key topics raised by stakeholders during the engagement process included:

- Oil spill response. A number of stakeholders expressed an interest in PTTEP AA's oil spill response process, which is outlined in its OPEP. PTTEP AA received feedback from the Australian Marine Oil Spill Centre, AMSA, WA Department of Transport and NT Department of Infrastructure, Planning and Logistics – Marine Branch which has been incorporated into the OPEP;
- Interaction with other operators/ operations. A number of fishing stakeholders expressed concern about potential interaction between PTTEP AA's activity and their operations. PTTEP AA is committed to notifying relevant fishing stakeholders, including WAFIC, three weeks prior to commencement, and where interest exists, meeting with key stakeholders, such as representatives from the Joint Authority Northern Shark Fishery. PTTEP AA has also recognised the rights of commercial fishers to operate safely, and has been embedded this in the EP;
- Protection of the environment. In accordance with the objectives of the OPGGS (Environment) Regulations, the purpose of the EP is to demonstrate that:
    - Potential environmental impacts and risks (planned (routine and non-routine) and unplanned) that may result from the production drilling activity are identified;
    - Appropriate management controls are identified and implemented to reduce impacts and risks to an acceptable level; and
    - The production drilling activity is carried out in a manner consistent with the principles of ecologically sustainable development (as defined in Section 3A of the EPBC Act); and
- Biosecurity. PTTEP AA has reviewed its procedures, including biosecurity relating to the MODU, to ensure that items raised by relevant stakeholders, including the Department of Agriculture and Water Resources and WA Department of Fisheries have been captured.

9.5 ONGOING CONSULTATION

PTTEP AA is committed to engaging with stakeholders throughout the proposed activity. This includes ongoing consultation to inform stakeholders about key milestones and activities and with any other relevant information.

PTTEP AA welcomes ongoing stakeholder feedback. Stakeholders have been provided contact details (including an email address, postal address and telephone number) that can be used to ask questions or lodge queries or concerns. These contact details are also available on PTTEP AA's website (http://www.au.pttep.com/contact-us/) and the project factsheet.

All inputs received from stakeholders will be acknowledged in a timely manner, and reviewed to determine if the feedback triggers a management of change under PTTEP AA's Management of Change Procedure. PTTEP AA will notify stakeholders of the results, and take appropriate action if a management of change is required, including further engagement with relevant stakeholders. This includes notifying relevant stakeholders about any changes in the EP.

10 DEFINITIONS AND ABBREVIATIONS

Abbreviation/Definition	Description
AFMA	Australian Fisheries Management Authority
ALARP	As Low As Reasonably Practicable
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
BIA	Biologically Important Area
BOD	Biological Oxygen Demand
BOP	Blowout Preventer
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CHARM	Chemical Hazard Assessment and Risk Management
CMRs	Commonwealth Marine Reserves
CO	Carbon monoxide
CO_2	Carbon dioxide
DA	Designated Authority
DAI	Defined Acceptable Impact
DAFF	Department of Agriculture, Fisheries and Forestry
dB	Decibel
DEWHA	Department of Environment, Water, Heritage and the Arts (now Department of Environment and Energy)
DoAWR	Department of Agriculture and Water Resources
DoEE	Department of the Environment & Energy (formerly Department of the Environment)
DoF (WA)	Department of Fisheries (WA)
DP	Dynamic Positioning
DSD	Department of State Development
EMBA	Environment that May Be Affected
EP	“Environment Plan” – refers to this Montara Production Drilling Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ESD	Ecological Sustainable Development
FPSO	Floating Production, Storage and Offtake facility
Hz	Hertz
IAP	Incident Action Plan
IMP	Invasive Marine Pests
ISB	In situ Burning
IPA	Indigenous Protected Areas
ITOPF	International Tanker Owners Pollution Federation
KEFs	Key Ecological Features
Km	Kilometres
LAT	Lowest Astronomical Tide

Abbreviation/Definition	Description
MDP	Montara Development Project
MDP area	Refers to activity area for the development of Montara, Skua, Swift and Swallow fields, located in the Timor Sea in Production Licence Areas AC/L7 and AC/L8.
M	Metre
Mm	Millimetre
MNES	Matters of National Environmental Significance
MARPOL	Marine Pollution Convention (International Convention for the Prevention of Pollution from Ships)
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
MPAs	Marine Protected Areas
NADF	Non Aqueous Drilling Fluid
NEBA	Net Environmental Benefit Analysis
Nm	Nautical mile
NMR	North Marine Region
NWMR	North West Marine Region
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
OCNS	Offshore Chemical Notification Scheme
OPGGS	*Offshore Petroleum and Greenhouse Gas Storage*
OPGGSA	*Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPGGS(E)R	*Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*
OPEP	Oil Pollution Emergency Plan
OWS	Oily Water Separator
PAH	Polyaromatic Hydrocarbons
PMST	Protected Matters Search Tool
PNEC	Predicted No Effect Concentration
Ppm	Parts per million
Ppb	Parts per billion
PTTEP AA	PTTEP Australasia (Ashmore Cartier) Pty Ltd being the operator or the title holder of AC/L7 and AC/L8 or being the Australian subsidiaries of PTT Exploration and Production Public Company Ltd as the context requires
RAMSAR	International Convention on Wetlands of International Importance
ROC	Residual on Cuttings
SOPEP	Shipboard Oil Pollution Emergency Plan
SSHE	Safety, Security, Health and Environment
SSHE MS	Safety, Security, Health and Environment Management Systems
VSP	Vertical Seismic Profile
WAFIC	Western Australian Fishing Industries Council
WBM	Water based mud

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APPENDIX A – STAKEHOLDER CONSULTATION REGISTER

PTTEP AA Montara Drilling Environment Plan 2017

Stakeholder Consultation Register

Relevant Stakeholder	Rationale for Engagement	Record of Consultation	Record of Response	Required Follow-up / Actions
Australian Government Departments				
Australian Fisheries Management Authority (AFMA)	Australian Government agency responsible for the management of Commonwealth fish resources and advocates for fisheries with concerns around any potential impacts caused by third parties.	**Email: AFMA #1, Tuesday 28 February** - PTTEP AA email to AFMA requesting confirmation of Commonwealth fisheries with whom PTTEP plans to engage. Email also requesting confirmation of preferred engagement method with stakeholders. **Email: AFMA #3, Tuesday 28 March** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period. **Telecom: Wednesday 19 April** - Telecom with the Environment Manager to discuss actions to date with respect to Commonwealth fisheries licence holders, specifically engagement with WAFIC. **Email: AFMA #4, Wednesday 19 April** - Email follow-up to provide summary of actions to date with respect to Commonwealth fisheries licence holders. Provided the activity factsheet.	**Email: AFMA #2, Wednesday 1 March** - Confirmation email of 28 February received by AFMA with review underway of Commonwealth fisheries with whom PTTEP AA plans to engage. **Email: AFMA #5, Wednesday 19 April** - AFMA confirms it does not require any additional information.	No further action required. Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Australian Hydrographic Service, Department of Defence	Responsible for the production and maintenance of navigational charts and associated products in Australia. Will be interested in the impact of vessel movements to and around the proposed drilling area on its day to day activities	**Email: Defence - AHS #1, Wednesday 8 March** - PTTEP AA email to AHS requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: Defence - AHS #3, Friday 24 March** - PTTEP provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: Defence - AHS #2, Friday 10 March** - Confirmation of contact for engagement. **Email: Defence - AHS #4, Tuesday 28 March** - Activity noted by Defence - AHS: 'Please keep us in the loop as you get closer to the activity taking place (at least 4 weeks) to allow us to publish an appropriate notice to mariners action.'	PTTEP AA will contact AHS 4 weeks prior to commencement of activity to allow sufficient time for AHS to publish appropriate notice to mariners.
Australian Marine Oil Spill Centre (AMOSC)	AMOSC operates Australia's major oil spill response equipment stockpile on 24-hour stand-by for rapid response anywhere around the Australian coast.	**Email: AMOSC #1, Wednesday 19 April** - PTTEP AA provided AMOSC with a copy of the OPEP to review. This provided an opportunity to confirm the role and requirements of AMOSC.	**Email: AMOSC #2, Thursday 27 April** - AMOSC Technical Officer provides consultation letter and marked up version of OPEP with minor comments for PTTEP AA's consideration.	PTTEP AA reviewed mark ups to OPEP and incorporated changes as required. A copy of OPEP to be provided to AMOSC upon acceptance and prior to drilling commencement.
Australian Maritime Safety Authority (AMSA)	AMSA is responsible for promoting maritime safety and the protection of the marine environment. Directly involved in development of Oil Spill Contingency Plan.	**Email: AMSA #1, Tuesday 11 April** - PTTEP AA requested guidance on current consultation arrangements with AMSA.	**Email: AMSA #2, Wednesday 12 April** - AMSA confirms the existing MOU between AMSA and PTTEP covers consultation and requires PTTEP AA to provide a copy of the approved OPEP.	PTTEP AA to provide approved OPEP in accordance with conditions of existing MOU.

Relevant Stakeholder	Rationale for Engagement	Record of Consultation	Record of Response	Required Follow-up / Actions
Department of Agriculture and Water Resources, Australian Quarantine Inspection Service (AQIS)	The Department of Agriculture and Water Resources administers the *Biosecurity Act 2015, Export Control Act 1982, Imported Food Control Act 1992* and various other Acts in order to protect Australia's animal, plant and human health status and to maintain market access for Australian food and other agricultural exports.	**Group Email: Wednesday 8 March 11:17am** - PTTEP AA email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: DAWR - AQIS #1, Tuesday 11 April** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period. **Telecom: Wednesday 19 April** - Following no response, PTTEP AA phoned Compliance Officer Andrew Fountain to confirm contact. Discussed Biosecurity Act and requirements for offshore petroleum installations. **Email: DAWR - AQIS #3, Wednesday 19 April** - Follow-up email provided factsheet with specific reference to risk and control measures for invasive marine species. **Email: DAWR - AQIS #5, Tuesday 2 May** - Following telecom between PTTEP AA and AQIS Assistant Director of Maritime Vessels Operational Policy. PTTEP AA confirmed planned action regarding status confirmation for rig and other regulatory requirements.	**Email: DAWR - AQIS #2, Wednesday 19 April** - Email from a Compliance Officer providing a link to relevant department website page – i.e. http://www.agriculture.gov.au/biosecurity/avm/vessels/offshore_installations **Email: DAWR - AQIS #4, Friday 28 April** - Reply from the Assistant Director of Maritime Vessels Operational Policy as DAWR - AQIS point of contact to progress regulatory requirements.	PTTEP AA reviewed information provided by AQIS to ensure procedures and regulatory requirements are consistent.
Department of Defence	Department of Defence potentially has operations in the vicinity of the activity.	**Group Email: Wednesday 8 March 11:17am** - PTTEP AA email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: DoD #1, Friday 24 March** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period. **Email: DoD #2, Tuesday 18 April** - No response received to above email. Reminder sent with fact sheet. Email advises comment closing date of Friday 21 April.	No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Department of the Environment and Energy (DoEE)	PTTEP AA must keep the Department of Environment updated regarding the progress of its Environment Plan. Relevant legislation *Environment Protection and Biodiversity Conservation (EPBC) Act* 1999.	**Email: Environment #1, Thursday 20 April** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Advised updates to the OPEP and OSMP would be resubmitted to the Department of Environment for consideration prior to the activity occurring, in accordance with EPBC conditions 2002/755. **Email: Environment #2, Tuesday 15 August** – PTTEP AA have provided additional information to the Department, allowing the Department to have sufficient and suitable information to be able to accept rev 6 of the Montara Production Drilling OPEP and rev 8 of the Timor Sea OSMP. PTTEP AA provided the Department with a table detailing the relevant EPBC Conditions and how PTTEP AA has addressed each condition in relation to both revisions of the OPEP and OSMP. **Email: Environment #4, Wednesday 16 August** – PTTEP AA informing the Department that PTTEP AA are happy to provide a final version of the OPEP and OSMP to assist the Department in their decision brief. The final documents will be forwarded by PTTEP AA Document Controller. **Email: Environment #5 Tuesday 29 August** – PTTEP AA provided the Department with the Montara Drilling OPEP (Rev 7) and the Timor Sea OSMP (Rev 8).	Receipt of information received on 20 April was acknowledged. **Email: Environment #3, Wednesday 16 August** – Department acknowledging receipt of information received from PTTEP AA. The Department requesting a version of the OPEP document containing the modifications. The Department will then progress the decision brief. **Email: Environment #6, Tuesday 29 August** – Department acknowledging receipt of the documents sent by PTTEP AA. **Email: Environment #7, Friday 1 September** – The Department provided PTTEP AA with an attachment to the decision letter approving the Montara Production Drilling OPEP (Rev 7) and the Timor Sea OSMP (Rev 8).	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once the date is confirmed.
Department of Foreign Affairs & Trade (DFAT)	PTTEP AA regularly keeps DFAT informed of its activities in relation to Montara due to its proximity to Indonesia waters.	**Email: DFAT #1, Friday 21 April** – PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email requested response within 14 days. **Email: DFAT #4, Monday 8 May** - PTTEP AA confirmed AMSA has been consulted.	**Email: DFAT #2, Monday 24 April** - DFAT provides confirmation of receipt of email and contact for consultation to coordinate DFAT comments. **Email: DFAT #3, Friday 5 May -** DFAT Executive Officer, Infrastructure, Indonesia confirmed no comments at this time and requested to be kept informed as project proceeds. Requested confirmation that AMSA has been consulted.	Ensure DFAT is keep informed as project proceeds. Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.

Relevant Stakeholder	Rationale for Engagement	Record of Consultation	Record of Response	Required Follow-up / Actions
Department of Immigration and Border Protection, Australian Border Force	The Department of Immigration and Border Protection reviews potential impact of vessel movements to and around the permit area on its day to day activities.	**Group Email: Wednesday 8 March 11:17am** - PTTEP AA email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: DIBP - ABF #1, Thursday 9 March** - Following an undeliverable email received in reply to the above, PTTEP AA phoned Australian Border Force in an attempt to identify the appropriate contact and was provided with an email optusswitchboard@border.gov.au requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: DIBP - ABF #2, Tuesday 18 April** - No response received to above email; however, PTTEP AA provided the activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April.	**Email: DIBP - ABF #3, Tuesday 9 May -** ABF Inspector District Operations, Regional Command WA provided relevant contacts for (1) vessel movements from Darwin, (2) helicopter transfers from Truscott Airbase, and (3) matters in the field. Also, information about visa requirements for offshore industry work was provided.	Contacts noted and incorporated into PTTEP AA and contractor regulatory procedures as required. This includes induction material for owners of support and supply vessels.
Department of Industry, Innovation and Science	Commonwealth department with political oversight of NOPSEMA and must be kept informed of PTTEP AA's plans and timetable.	**Group Email: Wednesday 8 March 11:17am** - PTTEP email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: DIIS #1, Friday 24 March** - PTTEP provides activity fact sheet including description of risks, potential impacts and management controls. Email advises comment closing date of Friday 21 April and welcomes ongoing input from stakeholders outside this formal consultation period. **Email: DIIS #2, Tuesday 18 April** - No response received to above email. Reminder sent with fact sheet. Email advises comment closing date of Friday 21 April.	**Email: DIIS #3, Wednesday 19 April** - Email from the General Manager of the Offshore Petroleum Branch confirming receipt of information.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
WA Government Departments				
Department of Environment Regulation (WADoER)	While the WA government has no direct legislative authority over EP approvals, it must be kept informed of PTTEP AA's plans and timetable.	**Group Email: Wednesday 8 March 11:17am** - PTTEP email to WADoER requesting confirmation of contact for upcoming engagement and preferred engagement method. **Email: WADoER #2, Friday 24 March** - PTTEP provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: WADoER #1, Wednesday 8 March** - Confirmation of contact for engagement. **Email: WADoER #3, Monday 10 April -** WADER REF: CEO974/17 Letter received via email dated 7 April 2017 noting that PTTEP AA operations are outside the State's jurisdiction and that no further action would be taken.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Department of Fisheries (WADoF)	WADoF Responsible for the sustainable use of fish resources. Primarily concerned with the impacts on marine life.	**Email: WADoF #1, Tuesday 28 February** - Email to WADoF Biodiversity Branch Manager requesting confirmation of WA fisheries within EMBA whom PTTEP AA plans to engage and requesting confirmation of preferred engagement method with stakeholders. **Email: WADoF #2, Thursday 9 March** - attached EMBA map of oil spill modelling following telecom with WADoF. **Email: WADoF #4, Tuesday 28 March** - PTTEP AA confirming with WADoF that WAFIC has been engaged to facilitate engagement with WA and Commonwealth Fisheries Licence Holders. Email provided activity factsheet including risks, potential impacts and management controls. Email included request to provide more specific information on 'potential impacts to fisheries, fish and fish habitats' contained within Draft EP. **Email: WADoF #5, Wednesday 19 April** - Telecom message to Biodiversity Branch Manager and email follow-up to confirm if formal response expected. **Email: WADoF #7, Monday 1 May** - Provided WADoF with relevant sections of the EP as they relate to potential impacts on fisheries, fish and fish habitats from the activity and its risks based on oil spill modelling (EMBA). **Email: WADoF #9, Wednesday 10 May** – PTTEP AA provided a preliminary response to WADoF, indicating a more detailed response was to follow**.** **Email: WADoF #10, Tuesday 30 May** - PTTEP provided a detailed response addressing WADoF's feedback.	**Email: WADoF #3, Tuesday 14 March** - WADoF provided a list of WA Fisheries within the EMBA. **Email: WADoF #6, Wednesday 19 April** - Email reply from Senior Fisheries Management Officer requesting all information on the 'potential impacts to fisheries, fish and fish habitats'. **Email: WADoF #8, Wednesday 10 May -** WADoF provided detailed feedback on the EP, including: • Consultation – request to maintain ongoing consultation with WAFIC • Fishing activity in the area – lists commercial fisheries operating in the permit area and in EMBA zone • Oil spill response – collection of baseline data and identification of spawning fish species within North Coast bioregion (within the EMBA zone) • Biosecurity – demonstrate commitment to minimising risks. **Email: WADoF #11, Tuesday 30 May -** WADoF acknowledged response.	WADoF raised several issues, including concerns about biosecurity and oil spill response. WADoF provided insights about fishing activities in the area, and asked to be kept informed about PTTEP AA's activities. PTTEP AA responded to each issue and confirmed consistency with EP. Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once the date is confirmed.

Relevant Stakeholder	Rationale for Engagement	Record of Consultation	Record of Response	Required Follow-up / Actions
Department of Mines and Petroleum - Petroleum Environment Branch	While the WA government has no direct legislative authority over EP approvals, it must be kept informed of PTTEP AA's plans and timetable.	**Group Email: Wednesday 8 March 11:17am** - PTTEP AA email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: WADMP #3, Friday 25 March** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period. **Email: WADMP #4, Tuesday 11 April** - Email resent to DMP Acting General Manager - Petroleum Environment Branch following out of office replay PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: WADMP #5, Thursday 13 April** - DMP thanked PTTEP AA for keeping the Department informed of PTTEP's activities in Commonwealth waters and acknowledges the proposed activity will be regulated by NOPSEMA. No specific comments on the information provided and no further information required at this stage.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Department of Parks and Wildlife (WA DPaW)	The WA DPaW is Responsible for conserving biodiversity and managing the State's national parks, marine parks and other reserves of coastal areas adjacent to field development area and/or in Zone of Potential Impact.	**Email: WADPaW #1, Friday 21 April** - PTTEP provided: • Consultation Fact Sheet including description of risks, potential impacts and management controls. • The DoT Initial Consultation Information (includes the WA shoreline modelling summary) • Relevant sections of the Oil Pollution Emergency Plan and Operational and Scientific Monitoring Program where DPaW is mentioned • Relevant sections on Oiled Wildlife Response • Relevant section of the OSMP regarding baseline information (I am happy to provide further detail on this on request)	No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Department of Transport (WA DoT)	The WA DoT's key focus is on operational transport functions and strategic transport planning. Should be consulted throughout EP process. Directly involved in development of OSCP.	**Meeting: Wednesday 26 April, Friday 21 April** - Meeting between PTTEP and WADoT to discuss DoT's draft Offshore Petroleum Industry Guidance Note - Marine Oil Pollution: Response and Consultation Arrangements (January 2017) and the Montara Drilling Program. **Email: WADoT #2, Friday 28 April** - PTTEP provided response to WADoT information requests communicated at meeting. **Email: WADoT #4, Tuesday 2 May** - PTTEP confirms 5 items to be included in OPEP. **Email: WADoT#5, Wednesday 28 June** – PTTEP provided a copy of the revised OPEP to WADoT. , with all changes highlighted in the text. **Email: WADoT #7 Monday 14 August** – PTTEP AA acknowledged and addressed all 8 comments presented by the WADoT. **Email: WADoT #9 Wednesday 16 August –** PTTEP AA confirms that the changes have been incorporated into the OPEP document. Once NOPSEMA has completed the final assessment and accepted the EP, PTTEP AA will provide the Department with a controlled version of the Montara Drilling OPEP.	**Email: WADoT #1, Friday 21 April** - From DoT outlining requirements for the OPEP and requesting meeting to progress. **Email: WADoT #3, Tuesday 2 May** - Email from DoT highlighting 5 items to be included in OPEP. **Email: WADoT #6, Friday 28 July** – Email from WADoT, acknowledging receipt of Rev 6 OPEP. WADoT provided PTTEP AA with 8 comments to be addressed by from WADoT assessment of the OPEP. **Email: WADoT #8, Wednesday 16 August** – Response from the WADoT acknowledging that PTTEP AA has addressed the comments and do not have any further comments at this stage. WADoT have requested the final version of the Montara Drilling OPEP for the Departments records.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed. Provision of Final OPEP for Department records.
NT Government Departments				
Darwin Port Corporation (DPC)	While the DPC has no direct legislative authority over EP approvals, PTTEP AA seeks to keep the Port informed as the company maintains operational activities in Darwin. It is also possible that in the event of an incident the Port may play a role in assisting coordination of vessel movement.	**Email: DPC #1, Wednesday 8 March** - PTTEP AA email to DPC requesting confirmation of contact for upcoming engagement and preferred engagement method. **Email: DPC #3, Tuesday 11 April** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period. **Email: DPC #4, Thursday 27 April** - Forward to General Manager of Port Development for information **Email: NTDIPL #5, Thursday 27 April** from Darwin Regional Harbourmaster including correction to the relevant sections of the EP regarding NT response agencies in event of an oil spill incident.	**Email: DPC #2, Friday 10 March** - Confirmation of contact for engagement. No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.

Relevant Stakeholder	Rationale for Engagement	Record of Consultation	Record of Response	Required Follow-up / Actions
NT Department of Infrastructure, Planning and Logistics - Marine Safety Branch (NTDIPL)	While the NT Government has no direct legislative authority over EP approvals, PTTEP AA seeks to keep informed as the company maintains operational activities in Darwin.	**Email: NTDIPL #1, Wednesday 8 March** - PTTEP email to NTDIPL - Marine Branch requesting confirmation of contact for upcoming engagement and preferred engagement method. **Email: NTDIPL #3, Friday 24 Marc**h - PTTEP provides activity fact sheet including description of risks, potential impacts and management controls. Email advises comment closing date of Friday 21 April and welcomes ongoing input from stakeholders outside this formal consultation period. **Email: NTDIPL #4, Thursday 20 April** - PTTEP AA provides NTDIPL with additional information showing references within the OPEP and the Operational & Scientific Monitoring Program to the Department's role as a response agency. **Email: NTDIPL #6, Thursday 27 April** - PTTEP AA responded to clarify the Control Agency in the event of a spill in Commonwealth Waters that enters NT waters.	**Email: NTDIPL #2, Thursday 9 March** - Confirmation of contact for engagement. **Email: NTDIPL #5, Thursday 27 April** - Darwin Regional Harbourmaster replied including correction to the relevant sections of the EP. **Email: NTDIPL #7, Friday 28 April** - Darwin Regional Harbourmaster replied with relevant section of the draft NTOSCP confirming the Controlling Authority is determined based on the spill source.	Updated relevant sections of the EP to reflect feedback from NTDIPL. Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
NT Department of Primary Industry and Resources - Mines and Energy (NTDPIR)	While the NT Government has no direct legislative authority over EP approvals, PTTEP AA seeks to keep informed as the company maintains operational activities in Darwin.	**Email: NTDPIR - Energy #1, Wednesday 8 March** - PTTEP AA email to NTDPIR - Energy Division requesting confirmation of contact for upcoming engagement and preferred engagement method. **Email: NTDPIR - Energy #3, Friday 24 March** - PTTEP provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: NTDPIR - Energy #2, Thursday 9 March** - Confirmation of contact for engagement. **Email: NTDPIR - Energy #4, Saturday 25 March** - DPIR advises they appreciate the update, and indicated that if no comment received by PTTEP by 21 April, assume DPIR have considered the project and have no concerns.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
NT Department of Primary Industry and Resources - Primary Industries and Fisheries (NTDPIR)	The NTFPIR Fisheries Division will assess the potential impact of PTTEP AA proposal on Territory-operated commercial fisheries.	**Email: NTDPIR - Fisheries #1, Tuesday 28 February** - PTTEP AA email to NTDPIR requesting confirmation of NT fisheries within EMBA whom PTTEP plans to engage and requesting confirmation of preferred engagement method. **Email: NTDPIR - Fisheries #4, Friday 24 March** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advises comment closing date of Friday 21 April and welcomes ongoing input from stakeholders outside this formal consultation period. **Telecom: Wednesday 19 April** - PTTEP AA telecom with Senior Licensing Officer drawing attention to Friday 24 March email to confirm if formal response is to be received. **Email: NTDPIR - Fisheries #5, Wednesday 19 April** - Follow-up email provided information and summary of actions to date with respect to relevant fishing licence holders.	**Email: NTDPIR - Fisheries #2, Wednesday 1 March** - Confirmation email of 28 February received by NTDPIR and redirected enquiry to Fisheries Licensing section. **Email: NTDPIR - Fisheries #3 - Thursday 2 March** - Licensee list for NT Fisheries within EMBA provided by NTDPIR Fisheries Licensing. Note the fisheries do not overlap the Montara Production Drilling specific location and therefore are not potentially affected parties to this activity. Consequently, consultation is not required. Identification of commercial fisheries overlapping the EMBA is important in the event of a serious spill incident.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Fishing Industry				
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Montara is in close proximity to single global spawning ground of the target species.	**Email: ASBTIA #1, Wednesday 8 March** – PTTEP AA email to ASBTIA requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: ASBTIA #3 - Tuesday 28 March** - PTTEP AA provided ASBTIA with activity factsheet including risks, potential impacts and management controls. **Email: ASBTIA #4 - Wednesday 19 April** - Email reminder to Research Officer requesting confirmation of response. **Email: ASBTIA #6 - Wednesday 7 June -** ASBTIA requested to provide feedback. No response received.	**Email: ASBTIA #2, Wednesday 8 March** - Confirmation of contact for engagement. **Email: ASBTIA #5, Saturday 22 April** - Research Officer replies: '... while this area does not overlap our physical fishing operations in the Great Australian Bight this area is in close proximity to the single global spawning ground of our target species. We will be putting forth a list of items that we request information for, in the meantime please continue to provide updates as your EP, OPEP and WOMP plans are being developed.' No further details have been received from ASBTIA regarding spawning.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Joint Authority Northern Shark Fishery (JANSF)	The JANSF represents a commercial fishery located in the vicinity of the activity.	**Email: JANSF #2, Wednesday 1 March -** PTTEP provided response to Joint Authority Northern Shark Fishery via WAFIC to answer the questions.	**Email JANSF #1, Monday 24 April** - Request for additional information, including answers to the following questions: • Are crew transfers helicoptered in and out (and therefore no on-water interactions)? • How often do supply vessels deliver to the drilling site? Are supplies bought in from Broome (less impact with the JANSF) or from Darwin (across the full breadth of the JANSF)? • How many support vessels will be in the area of the Montara Wellhead platform for the duration of this 60 day campaign • Will support and supply vessels be briefed on the need to respect the right of and where possible, give way to commercial fishers?	PTTEP AA offered to meet with Atlantis Fisheries Consulting Group Managing Partner, ahead of the activity to confirm specific details of crossings to minimise the likelihood of inconvenience. PTTEP AA to include the rights of commercial fishers to operate safely within the cautionary zone in their induction material for support and supply vessels in particular operating within the cautionary zone.

Relevant Stakeholder	Rationale for Engagement	Record of Consultation	Record of Response	Required Follow-up / Actions
North Australian Indigenous Land and Sea Management Alliance (NAILSMA)	The NAILSMA supports Indigenous people to manage their land and sea resources. PTTEP AA keeps NAILSMA up to date on its activities.	**Group Email: Wednesday 8 March 11:17am** - PTTEP AA email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: NAILSMA #1, Friday 24 March** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period. **Email: NAILSMA #2, Tuesday 18 April** - No response received to above email. Reminder sent with factsheet. Email advised comment closing date of Friday 21 April.	No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Northern Prawn Fishery Industry (NPFI)	The NPFI represents a commercial fishery operating in the vicinity of the activity.	**Email: NPFI #1, Wednesday 8 March** - PTTEP AA email to NPFI requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: NPFI #3, Thursday 30 March** - PTTEP AA provided activity factsheet including risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: NPFI #2, Thursday 9 March** - Confirmation of contact for engagement. No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
NT Guided Fishing Industry Association (NTGFIA)	The NTGIA represents tour operators that may be active in the vicinity of the activity.	**Group Email: Wednesday 8 March 11:17am** - PTTEP email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: NTGFIA #1, Friday 24 March** - PTTEP provides activity fact sheet including description of risks, potential impacts and management controls. Email advises comment closing date of Friday 21 April and welcomes ongoing input from stakeholders outside this formal consultation period. **Email: NTGFIA #2, Tuesday 18 April** - No response received to above email. Reminder sent with fact sheet. Email advises comment closing date of Friday 21 April. Undeliverable message received in reply. **Email: NTGFIA #3, Tuesday 18 April** - Email sent to alternative email for NTGFIA.	No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
NT Seafood Council (NTSC)	The NTSC represents a commercial fishery operating in the vicinity of the activity.	**Group Email: Wednesday 8 March 11:17am** - PTTEP AA email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: NTSC #1, Friday 24 March** - PTTEP AA provided activity fact sheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period. **Email: NTSC #2, Tuesday 18 April** - No response received to above email. Reminder sent with fact sheet. Email advises comment closing date of Friday 21 April. Out of office reply received from the CEO. **Telecom: Wednesday 19 April** - PTTEP AA telecom to NTSC reception to clarify contact. **Email: NTSC #3, Wednesday 19 April** - Follow-up email providing information and summary of relevant actions with respect to fishing licence holders.	**Email: NTSC #4, Thursday 20 April** - NTSC indicated that the factsheet had been sent out to one of its Board members and NTSC had not received any feedback to date. The NTSC indicated that the fishers potentially active in that area would be WA fishers – including WA Spanish Mackerel.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Pearl Producers Association (PPA)	PPA represents a commercial fishery operating in the vicinity of the activity. Montara is located in Zone 3 of the fishery.	**Email: PPA #1, Wednesday 8 March** - PTTEP AA provided activity factsheet including risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: PPA #2, Monday 12 June -** Confirmation from PPA Executive Officer that he distributed the fact sheet to members and received no response: 'It would seem that members don't see any issues with respect to this project.' Further details are provided in the Consultation Report of the Western Australian Fishing Industry Council (p.38).	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.

Relevant Stakeholder	Rationale for Engagement	Record of Consultation	Record of Response	Required Follow-up / Actions
Recfishwest	Recfishwest represents recreational fishers operating along coastal areas in the vicinity of the activity.	**Group Email: Wednesday 8 March 11:17am** – PTTEP AA email to Recfishwest requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: Recfishwest #3, Friday 24 March** – PTTEP AA provided activity fact sheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period. **Email: Recfishwest #4, Wednesday 19 April** - Email reminder was sent to the Regional Policy Officer Matt Gillett.	**Email: Recfishwest #2, Wednesday 8 March** - Confirmation of contact for engagement. **Email: Recfishwest #5, Wednesday 19 April** - Recfishwest Regional Policy Officer advises that 'Given the remoteness (>200km to nearest point of land as I see it) this activity is extremely unlikely to affect recreational fishers.'	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Relevant Fishing Industry Licence Holders and Representative Bodies	Fisheries that are located in the vicinity of the activity.	PTTEP AA engaged the Western Australian Fishing Industries Council (WAFIC) to engage with relevant fishing industry licence holders and representative organisations on its behalf.	Appendix D3 provides the Consultation Report from the Western Australian Fishing Industry Council (WAFIC), which details the outcomes of the consultation process undertaken by WAFIC.	PTTEP AA will work with WAFIC to undertake ongoing engagement with fishing industry stakeholders. Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Western Australian Fishing Industry Council	WAFIC represents commercial fisheries operating in the vicinity of the activity.	**Email: WAFIC #1, Tuesday 28 February** - Note multiple early engagement via email and telecom with WAFIC Executive Officer Resource Access, to review planned consultation program and materials. WAFIC was engaged to coordinate direct engagement with fisheries licence holders and a number of fishing industry representative organisations. **Meeting: Monday 13 March** - Meeting with WAFIC, in Fremantle, to confirm consultation program with fishing industry. Provision of DoFWA fisheries list and EMBA map to WAFIC to assist identification of relevant stakeholders. **Email: WAFIC #3, Tuesday 28 March** - PTTEP AA provided WAFIC with activity factsheet including risks, potential impacts and management controls.	**Email: WAFIC #2, Wednesday 1 March** - WAFIC provided input to Montara Production Drilling Factsheet prior to production. **Email: WAFIC #4, Wednesday 26 April** - Formal response from WAFIC including action items: 1. PTTEP AA to ensure the EP includes appropriate mitigations to protect the broader environment in and around the activity and around the EMBA zone. This includes potential impacts to fish spawning, migratory species, food chain and other broader ecosystem. 2. PTTEP AA to include the rights of commercial fishers to operate within the cautionary zone within their induction material for support and supply vessels in particular operating within the cautionary zone. For a full report of consultation activities and outcomes coordinated by WAFIC is contained in Appendix D3.	PTTEP AA to ensure the EP includes appropriate mitigation to protect the broader environment in and around this activity and around the EMBA zone regarding. PTTEP AA to include the rights of commercial fishers to operate safely within the cautionary zone in their induction material for support and supply vessels in particular operating within the cautionary zone. Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed. Ongoing engagement with WAFIC as primary point for direct engagement with Commonwealth and WA fisheries licence holders and many of the fishing industry representative bodies.
Environmental NGOs				
Conservation Council WA	NGO with a keen interest in the impact of any proposed PTTEP AA activity on the environment.	**Email: CCWA #1, Friday 24 March** - PTTEP AA provides activity fact sheet including description of risks, potential impacts and management controls. Email advises comment closing date of Friday 21 April and welcomes ongoing input from stakeholders outside this formal consultation period.	No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
World Wildlife Fund	NGO with a keen interest in the impact of any proposed PTTEP AA activity on the environment.	**Email: WWF #1, Friday 24 March** - PTTEP AA provides activity fact sheet including description of risks, potential impacts and management controls. Email advises comment closing date of Friday 21 April and welcomes ongoing input from stakeholders outside this formal consultation period. **Email: WWF #2, Tuesday 11 April** - Reminder sent to Program Leader West	No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.

Relevant Stakeholder	Rationale for Engagement	Record of Consultation	Record of Response	Required Follow-up / Actions
O&G Industry				
Bounty Oil & Gas NL	Bounty Oil and Gas NL holds adjacent permit AC/P 32.	**Email: Bounty #1, Wednesday 8 March** - PTTEP AA email to Bounty Oil and Gas NL requesting confirmation of contact for upcoming engagement and preferred engagement method. **Email: Bounty #3, Friday 24 March** - PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: Bounty #2, Friday 10 March** - Confirmation of contact for engagement. No formal response was received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Melbana Energy Limited (formerly MEO) / Vulcan Exploration Pty Ltd	Melbana Energy Limited has operations in an adjoining permit area through subsidiary Vulcan Exploration.	**Email: Melbana #1, Wednesday 8 March** - PTTEP AA email to Melbana Energy Limited requesting confirmation of contact for upcoming engagement and preferred engagement method. **Email: Melbana #3, Friday 24 March** - PTTEP AA provided activity fact sheet including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: Melbana #2, Thursday 9 March** - Confirmation of contact for engagement. No formal response was received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Oil Spill Response Limited	Oil Spill Response Limited would provide PTTEP AA with resources and technical support in the event of a marine oil spill.	**Group Email: Wednesday 8 March 11:17am** - PTTEP AA email requesting confirmation of contact for upcoming engagement and preferred engagement method with stakeholders. **Email: OSR #1, Friday 24 March** - PTTEP AA provided activity factsheet, including description of risks, potential impacts and management controls. Email advised comment closing date of Friday 21 April and welcomed ongoing input from stakeholders outside this formal consultation period.	No formal response received to request for feedback on information provided.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.
Sinopec Oil & Gas Australia	Sinopec Oil and Gas Australia holds a permit under development in the vicinity of the permit area.	**Email: Sinopec #1, Wednesday 7 June** – PTTEP AA provided activity factsheet including description of risks, potential impacts and management controls. Email advised comment closing date of Monday 26 June and welcomed ongoing input from stakeholders outside this formal consultation period.	**Email: Sinopec #1, Thursday 8 June** - Group General Counsel and Company Secretary acknowledged receipt of information.	Provide link to EP summary following approval. Advise of drilling commencement date and any further updated information once date is confirmed.