



Northern Endeavour FPSO Operations Environment Plan Summary

February 2015

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Controlled Ref No: M1000AH9935711

Revision: 2

Native file DRIMS No: 9935711

Page 3 of 34

Uncontrolled when printed. Refer to electronic version for most up to date information.

THIS PAGE HAS BEEN INTENTIONALLY LEFT BLANK

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Controlled Ref No: M1000AH9935711

Revision: 2

Native file DRIMS No: 9935711

Page 4 of 34

Uncontrolled when printed. Refer to electronic version for most up to date information.

TABLE OF CONTENTS

1.	INTRODUCTION.....	6
2.	DESCRIPTION OF THE ACTIVITY	6
2.1	Location of the Activity.....	6
2.2	Timing of the Activity.....	7
2.3	Operational Area	7
2.4	Operational Details.....	7
3.	DESCRIPTION OF THE ENVIRONMENT.....	9
3.1	Physical Environment.....	9
3.2	Biological Environment	9
3.3	Socio-Economic Environment.....	12
4.	ENVIRONMENTAL HAZARDS AND CONTROLS	15
5.	ONGOING MONITORING OF ENVIRONMENTAL PERFORMANCE	19
6.	OIL SPILL CONTINGENCY PLANNING.....	21
6.1	Woodside’s Oil Spill Response Arrangements	21
6.2	Oil Spill Preparedness and Response Mitigation Assessment for the Timor Sea Region...	21
7.	CONSULTATION.....	26
8.	CONTACT DETAILS	28
9.	REFERENCES.....	29

LIST OF FIGURES

Figure 2-1: Location of the Activity	7
Figure 3-1: Established and Proposed Commonwealth and State Marine Protected Areas in relation to the Operational Area.....	12
Figure 3-2: North Western Commonwealth and State Fisheries Related to the NE FPSO Operational Area (AFMA, 2011 and DoF, 2011)	14
Figure 4-1: Key Steps in Woodside’s Risk Management Framework	15
Figure 4-2: Risk Related Decision Support Framework (UKOOA, 1999).....	16

LIST OF TABLES

Table 3-1: Summary of Established and Proposed Marine Protected Areas and other sensitive locations in the region relating to the NE FPSO Operational Area.....	10
Table 6-1: Potential environmental impacts of Oil Spill Response Strategies for the Northern Endeavour FPSO	23
Table 6-2: Summary of Australian Receptors which could be impacted in a variety of oil spill scenarios	25
Table 7-1: Stakeholders Engaged for the NE FPSO EP	26

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

1. INTRODUCTION

Woodside Energy Ltd (Woodside) is operator of the Northern Endeavour Floating Production Storage and Offloading (NE FPSO) facility, which has been in production since 1999. The NE FPSO is located offshore in the Timor Sea approximately 550 km West North West of Darwin and 250 km East South East of Kupang in West Timor within the Australian Commonwealth Territory of the Ashmore and Cartier Islands. It produces oil from the Laminaria-Corallina fields located in petroleum production licence area AC/L5. The NE FPSO is a purpose-built, non-propelled vessel / barge designed to extract, process, store and offload oil from the Laminaria and Corallina reservoirs in the Timor Sea. The NE FPSO is permanently moored by a Bottom Mounted Internal Turret (BMIT) mooring system which enables the FPSO to weather vane around the turret and remains on station in all weather conditions.

Woodside is the nominated titleholder on behalf of the Production Licence Area AC/L5 joint venture participants (Woodside and Talisman Oil and Gas (Australia) Pty Ltd (Laminaria split 59.90%/40.10% and Corallina split 66.67%/33.33%)).

The NE FPSO development consists of subsea wells tied back to the FPSO through a system of subsea manifolds, flowlines, umbilicals and dynamic risers. Well fluids from both Laminaria and Corallina fields are routed to dedicated three phase separators where oil, gas and water are separated. Stabilised oil is offloaded to trading tankers for export.

This Environment Plan (EP) summary has been prepared as per the requirements of Regulation 11 of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Commonwealth) (Environment Regulations). This document summarises the NE FPSO Operations EP, which was accepted under the Environment Regulations by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 7 January 2015.

2. DESCRIPTION OF THE ACTIVITY

2.1 Location of the Activity

The NE FPSO and associated infrastructure is located in Production Licence Area AC/L5 in Commonwealth waters, within the Timor Sea, approximately 550 km West North West of Darwin and 250 km East South East from Kupang in West Timor (Figure 2-1). The NE FPSO is located in approximately 380 m of water, and depths over the Laminaria and Corallina wells range from 350 to 410 m respectively. The coordinates and permit area for the NE FPSO are outlined in Figure 2-1.

The closest nearshore sensitive habitats to the NE FPSO are the Ashmore Reef Commonwealth Marine Reserve (346 km South West) and the Cartier Island Commonwealth Marine Reserve (333 km South West). The closest offshore sensitive habitats to the NE FPSO are the Submerged Shoals / Banks of the Sahul Shelf (11 km South) and the Oceanic Shoals Commonwealth Marine Reserve (94 km South).

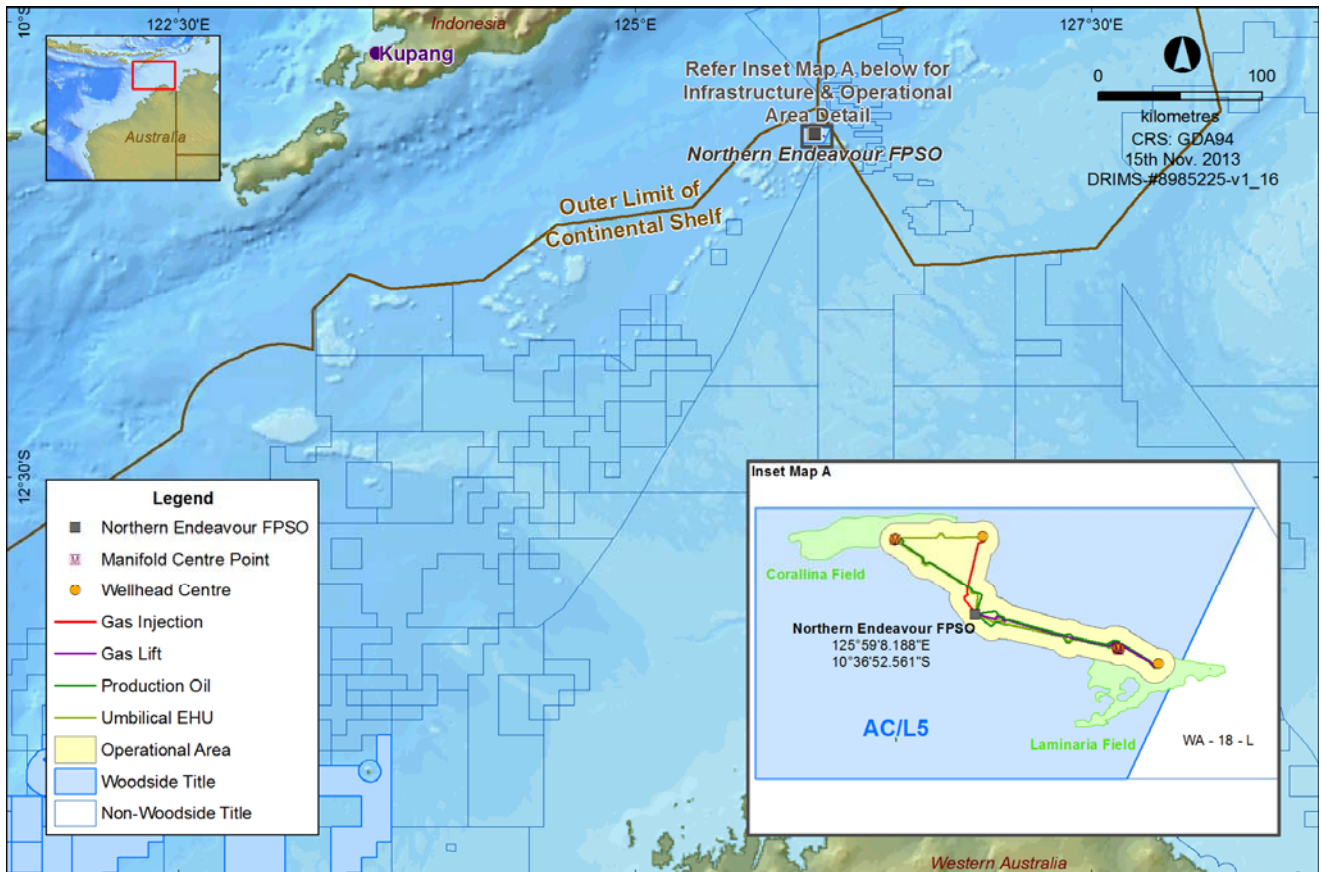


Figure 2-1: Location of the Activity

2.2 Timing of the Activity

The NE FPSO was commissioned in 1999 and operates 24 hours per day, 365 days per year. Supporting operations, such as maintenance activities, take place as required.

Any future decommissioning or tieback plans for the Laminaria and Corallina fields will be the subject of a separate EP.

2.3 Operational Area

The Operational Area applicable for the scope of the NE FPSO Operations EP is shown in Figure 2-1. This area includes:

- The NE FPSO and the area within a 500 m exclusion zone around the facility and extending out to 1500 m, to allow for offtake activities; and
- The NE FPSO subsea infrastructure, including wells and flowlines, and an area within 1500 m around the infrastructure.

Vessel related activities within the Operational Area will comply with the NE FPSO Operations EP.

2.4 Operational Details

The NE FPSO is a non-standard barge of double walled construction with an overall length of 273 m, breadth of 50 m and cargo capacity of approximately 1,400,000 barrels. The topsides processing facilities consist of oil, water and gas separation systems, and gas reinjection equipment.

The oil produced, stored and offloaded at the NE FPSO, is considered to be a light crude oil. Crude oil produced from topsides processing is stored in 12 tanks before stabilised oil is offloaded to trading tankers for export.

The NE FPSO has two flare systems, the High Pressure (HP) flare and the Low Pressure (LP) flare. The main purpose of the flare systems is to safely discharge gas streams during an emergency depressurisation. However, there are also a number of process streams which continuously or intermittently pass gas to the flare as a method of safe disposal.

Produced formation water (PFW) is brought to the surface with oil and gas from the reservoir and separated out from the hydrocarbon components in the crude oil separation process. The PFW is treated through the NE FPSO produced water treatment system which cools, degasses and removes residual oil. After treatment, PFW is disposed of directly from the process to the marine environment in accordance with relevant discharge criteria.

Normal operations at the NE FPSO fall under the following modes of operation:

- Production and maintenance - Production covers hydrocarbon receipt from the reservoir via subsea wells and equipment, topside separation and processing of oil, water and gas and the storage of oil within the FPSO cargo tanks for subsequent offloading to export tankers. Gas is utilised for power generation as well as lift gas to support oil extraction. Separated water (Produced Formation Water) is processed and discharged within required limits.

Maintenance covers a range of Inspection, Maintenance and Repair (IMR) activities which are undertaken at regular and/or planned intervals to maintain performance, reliability and prevent deterioration or failure of equipment and ensure safe and reliable operation of the facility. This includes maintenance of the topside component of the FPSO as well as subsea infrastructure and may include, for example, activities such as cycling of valves, pressure and leak testing, lubrication of rotating equipment and painting activities for corrosion protection.

- Production and major projects - Major Projects involve refurbishment, modification or major maintenance on the facility. These activities are generally managed by a specific project group which involves a specific environmental assessment to ensure the activity and associated potential impacts and risks are in accordance with the accepted EP.

Additional operational activities in relation to the EP include:

- Operational and emergency flaring of excess gas through flare systems;
- Processing and discharge of drainage, cooling and brine water; and
- Processing and discharge of Produced Formation Water (PFW) within discharge limits.

A number of activities also support the overall operation of the facility, these include:

- Utility systems such as lighting, heating, ventilation and air conditioning, water systems, inert gas system, power generation, safety system, accommodation facilities and sand management system;
- Collection, treatment and disposal of sewage and putrescible wastes;
- Lifting operations;
- Transfer of supplies from vessels including food, equipment and fuel;
- Support vessel operations;
- Helicopter operations for transporting personnel and urgent freight;
- Subsea inspection, maintenance and repair activities; and
- Well Management and Maintenance Activities.

3. DESCRIPTION OF THE ENVIRONMENT

The NE FPSO Operational Area is located within the Commonwealth waters of the Timor Sea close to the Australian and Indonesian maritime boundary. It is located approximately 360 km north of the Kimberley coast, 340 km north east of Cartier Island and approximately 155 km south east of Timor Island, in water depths of approximately 380 m. The location is outside Australia's Exclusive Economic Zone (EEZ) in Australian territorial water classified as Extended Continental Shelf. The facility also lies outside areas defined under the Integrated Marine and Coastal Regionalisation of Australia (IMCRA v4.0). However the adjacent Sahul Shelf area to the south of the facility is contiguous with that of the Northwest Shelf Transition Province, which straddles the North-West Marine Region and the North Marine Region (DSEWPaC 2012a; DSEWPaC 2012b) (Figure 3-1). The NE FPSO Operational Area does not overlap with any established or proposed marine protected areas.

3.1 Physical Environment

The climate within the Timor Sea region is humid tropical, characterised by seasonal reversals of the prevailing wind. The region experiences a summer wet season from November to March and a milder drier winter season between April to September. During the wet season, north-west winds are associated with higher moisture and generate regular thunderstorm activity and high rainfall. During the dry season, steady south-easterly winds generated over inland Australia dominate the region resulting in dry and warm conditions and are associated with calmer less variable conditions and less rainfall and low relative humidity (BOM, 2012).

Tropical cyclones generally form south of the equator in the eastern Indian Ocean and in Arafura and Timor Seas during the summer. In the Timor Sea most of the storms are tropical lows or developing storms passing to the south of the NE FPSO Operational Area. Tropical cyclone activity can occur between November and April, with on average 1.24 storms per year pass within 300 km of the Northern Endeavour facility and an average of 3.99 storms per year pass within 1000 km (Woodside, 2011b).

Throughout the year, water circulation in the region is dominated by the southwest flowing ITF and this is the predominant current flow affecting the NE FPSO Operational Area. The ITF dominates the majority of the water column and generally flows westwards through the Timor Trench (also known as the Timor Trough). During the summer, south westerly winds cause a weakening of the ITF by pushing some of its waters eastwards building a pressure gradient in adjacent the Banda and Arafura Seas (DEWHA, 2008). During this period, short lived mixing and upwelling processes can occur around the shelf break in the Timor Trench delivering cold deep water onto the shelf (DEWHA, 2008; Brewer *et al*, 2007; Holloway and Nye, 1985). At the end of the summer (March/April), this pressure is released, causing a south-westerly flow of water across the Sahul Shelf known as the Holloway Current (DEWHA, 2008; Holloway and Nye, 1985; James *et al*, 2004). The Indonesian Throughflow contributes to the westward flowing South Equatorial Current and the continued southward flow of currents along the coast of the North West Shelf via the Holloway Current or via the Eastern Gyral Current.

The NE FPSO Operational Area itself lies on the outer shelf/continental slope in an area of uniformly smooth seabed ranging in depth from approximately 330 to 390 m. Surface sediments at the NE FPSO Operational Area are composed primarily of calcium carbonate material (approximately 80%) typically comprising approximately 50% silt, 30% clay and 20% sand particles, forming a layer tens of meters thick. Survey footage collected in May 2001 indicated that the muddy seabed immediately around the NE FPSO is characterised as flat and featureless.

3.2 Biological Environment

No Critical Habitats or Threatened Ecological Communities, as listed under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), occur within the NE FPSO Operational Area.

The Commonwealth Protected Matters database includes a total of 20 listed marine species that may occur within or traverse the NE FPSO Operational Area. Of the listed species identified, eight are threatened marine species and 13 are migratory species.

Twenty cetacean species may occur within the NE FPSO Operational Area, including two threatened and six migratory species. The Endangered Pygmy Blue Whale (*Balaenoptera musculus breviceauda*) and the Vulnerable Humpback Whale (*Megaptera novaeangliae*) are two whale species that undertake seasonal migrations as they travel between northern breeding grounds and southern feeding grounds. The Pygmy Blue whale may migrate through the Timor Sea, whereas humpback whales complete their northern migration in the Camden Sound area of the West Kimberley. Other cetacean species (as listed) are likely to occur at low densities and may transverse the NE FPSO Operational Area infrequently throughout the year.

Six marine turtle species are recorded for the region and may occur in the NE FPSO Operational Area and adjacent waters. The marine turtles identified were: the Green Turtle (*Chelonia mydas*), Leatherback Turtle (*Dermochelys coriacea*), Loggerhead turtle (*Caretta caretta*), Hawksbill Turtle (*Eretmochelys imbricata*), Olive Ridley Turtle (*Lepidochelys olivacea*) and the Flatback Turtle (*Natator depressus*). Given the distance offshore (approximately 360 km north of the Kimberley and 155 km south east from Timor Island), distance from shallow shoals (10 km), depth range of surrounding offshore waters (330 to 390 m), and absence of potential nesting or foraging sites (i.e. no emergent islands, reef habitat or shallow shoals), the NE FPSO Operational Area is not considered an important habitat for marine turtles. While there are significant nesting sites along the mainland coast and islands of the region, the primary nesting locations (such as Ashmore Reef) are at least 300 km from the NE FPSO Operational Area.

No teleost fish species that are listed under the EPBC Act were identified as potentially occurring within the NE FPSO Operational Area, however it is highly possible that listed species (such as seahorses and pipefish species) will occur in the wider region. The NE FPSO Operational Area comprises featureless, flat soft sediment seabed, and consequently the natural fish fauna are not expected to be abundant and diversity is expected to be limited due to the lack of hard substrate/ habitat complexity. It is noted however that fish abundance and diversity increases with presence of artificial infrastructure.

The NE FPSO Operational Area may be occasionally visited by migratory and oceanic birds but does not contain critical habitats for any species and there are no Ramsar Convention protected sites in the surrounding area (DEWHA, 2010a). The nearest Ramsar sites, Ashmore Reef National Nature Reserve and the Cobourg Peninsula, are located over 300 km to the West and approximately 700 km to the Southeast respectively. There are a number of notable offshore island locations that include important seabird (e.g. Terns, Shearwaters, Boobies and Tropicbirds) and shorebird (e.g. Sandpipers and Greenshanks) feeding, breeding and nesting sites including Ashmore Reef, Cartier Island, Adele Island and Browse Island (DSEWPAC 2012a; Clarke, 2010). The NE FPSO is located over 300 km from the closest of these locations.

Migratory shorebirds travelling the East Asian-Australasian Flyway may transit through the NE FPSO Operational Area en route to these staging areas before moving onto the mainland South in the spring or Indonesia in the North in the autumn. It is possible that many of the birds on migration may also take advantage of ships and offshore facilities in the NE FPSO Operational Area to rest. Migratory shorebirds may be present in the region between July and December and again between March and April as they complete migrations between Australia and offshore locations (Environment Australia, 2002). The Streaked Shearwater (*Calonectris/Puffinus leucomelas*) is listed as Migratory under the EPBC Act and is likely to be present in the NE FPSO Operational Area on occasion during the Australian summer but the area is not considered critical habitat for this species.

3.2.1 Marine Protected Areas and other sensitive locations

The NE FPSO Operational Area does not overlap with any established or proposed marine protected areas (Figure 2-1). The nearest marine protected areas to the operational area are the Oceanic Shoals Commonwealth Marine Reserve, Kimberley Commonwealth Marine Reserve, Ashmore Reef and Cartier Island Commonwealth Marine Reserves. A summary of the existing Marine Protected Areas of relevance to the NE FPSO facility are presented in Table 3-1.

Table 3-1: Summary of Established and Proposed Marine Protected Areas and other sensitive locations in the region relating to the NE FPSO Operational Area

Distance from NE

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Controlled Ref No: M1000AH9935711

Revision: 2

Native file DRIMS No: 9935711

Page 10 of 34

Uncontrolled when printed. Refer to electronic version for most up to date information.

		FPSO Operational Area boundary (km)
Commonwealth Marine Reserves/Ramsar Wetland Site		
Established		
Oceanic Shoals Commonwealth Marine Reserve		~94 km
Ashmore Reef Commonwealth Marine Reserve/Ramsar Site		~346 km
Cartier Island Commonwealth Marine Reserve		~333 km
Kimberley Commonwealth Marine Reserve		~288 km
Argo-Rowley Terrace Commonwealth Marine Reserve		~720 km
Commonwealth Heritage Area		
Established		
Scott Reef and Surrounds		~576 km
Seringapatam and Surrounds		~550 km
Other		
Submerged Shoals/Banks of the Sahul Shelf		~11 km
Hibernia Reef		~316 km
Timor Leste		~160 km
Timor Island (Indonesia)		~156 km
Roti Island		~280 km

3.2.2 Shoreline and Benthic Habitats

The wider receiving environment also includes shoreline and benthic habitats that provide valuable ecological services such as coral reefs, mangroves, seagrass meadows and macroalgae.

The Big Banks Shoals are the closest of these sensitivities and are part of an extensive series of submerged shoals/banks that occur in a northeast/southwest alignment along the outer edge of the Sahul Shelf spanning between Ashmore Reef in the southwest to Sunset Shoal in the north-east. Surveys of these shoals have documented biologically diverse primary producer habitats comprising of macroalgae and corals communities that support diverse fish assemblages (Heyward et al, 2007). The shoals may also serve as foraging habitat for the marine turtle species identified in Section 3.2.

Coral reefs within the wider region include Ashmore Reef, Mermaid Reef, Rowley Shoals, Scott Reef, Seringapatam Reef, Cartier Reef and Hibernia Reef. Ashmore Reef was also designated as a Ramsar Wetland of International Importance in 2003 as its islands providing a resting place for migratory shorebirds and supporting large seabird breeding colonies such as the brown booby and great frigatebird. These reefs provide important biophysical environments in the region that support diverse aggregations of marine life as well as high primary productivity and species richness. A shallow-water survey (0–20 m) of Ashmore, Scott and Seringapatam reefs and Mermaid Reef (Rowley Shoals) in 2006 recorded 211 species of corals at Mermaid Reef, 159 species at Seringapatam, 255 species at Ashmore Reef, and 201 and 224 species at North and South (Scott) reefs respectively (WAM 2009).

Timor, Savu and Roti are the closest near-shore habitats to the NE FPSO and are included in the Lesser Sunda Ecoregion (Wilson et al, 2011). Sensitivities include fringing reefs, seagrass, mangrove and sandy beaches important for turtle nesting. Fringing reefs are located around the islands but are less well-developed on the southern, more wave-exposed areas.

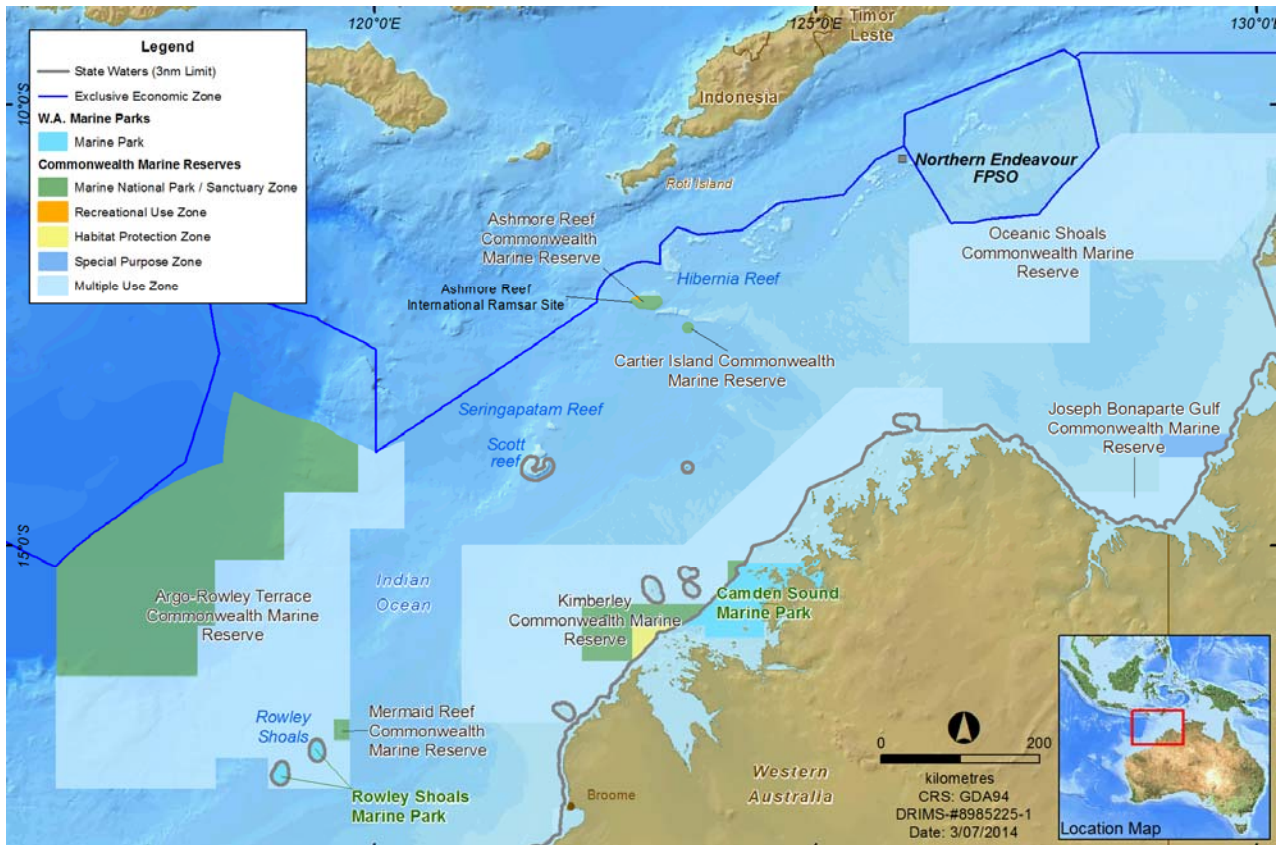


Figure 3-1: Established and Proposed Commonwealth and State Marine Protected Areas in relation to the Operational Area.

3.3 Socio-Economic Environment

There are no known sites of Indigenous or European cultural or heritage significance within or in the vicinity of the NE FPSO Operational Area. The islands of several oceanic reef systems, namely Ashmore Reef and Cartier Island do contain Indonesia artefacts (ceramics and graves) within the protected reserve areas. There are no listed historic and other shipwrecks or heritage sites within the NE FPSO Operational Area, however, it is noted that the National Shipwreck Database lists three shipwrecks for the Timor Sea and several for the Northwest of Western Australia and other examples in the coastal waters of the Northern Territory.

Given the offshore location of the NE FPSO Operational Area and the deepwater area of the Timor Sea no tourism activities are known to take place in the offshore Timor Sea region. Recreational fishing generally tends to be concentrated in state waters adjacent to coastal population areas (DEWHA, 2008). Commercial tour operators and recreational fishing charters visit the Ashmore Reef and Cartier Island areas intermittently, primarily for scuba diving and bird watching (Environment Australia, 2002) and game fishing.

The NE FPSO Operational Area is located within an area of established oil and gas operations. The closest subsea infrastructure includes flowlines, umbilicals, manifolds and wellheads associated with the BHP Petroleum operated Buffalo platform to the south-east, Eni operated Glas Dowr FPSO to the east and the ConocoPhillips operated Bayu-Undan platform to the south-east.

The NE FPSO Operational Area is situated outside the limit of the Australian Fishing Zone but adjacent to a number of Commonwealth and State managed fishery areas, as listed below:

- Commonwealth North West Slope Trawl Fishery (NWSTF);
- Commonwealth Western Tuna and Billfish Fishery;

- Commonwealth Western Skipjack Tuna;
- Commonwealth Southern Bluefin Tuna Fishery;
- Commonwealth Northern Prawn Fishery
- State West Australian Mackerel Fishery
- State Kimberley Trap Fishery (part of the North Coast Demersal Scalefish Fishery);
- State Kimberley Prawn Managed Fishery
- State Broome Prawn Managed Fishery and,
- State Kimberley Gillnet and Barramundi Managed Fishery

As these fisheries are located outside the NE FPSO Operational Area (refer to Figure 3-2), no consultation with individual fisheries was undertaken in support of the Environment Plan development. Refer to Section 7 for the full list of stakeholders who were consulted in relation to the Environment Plan.

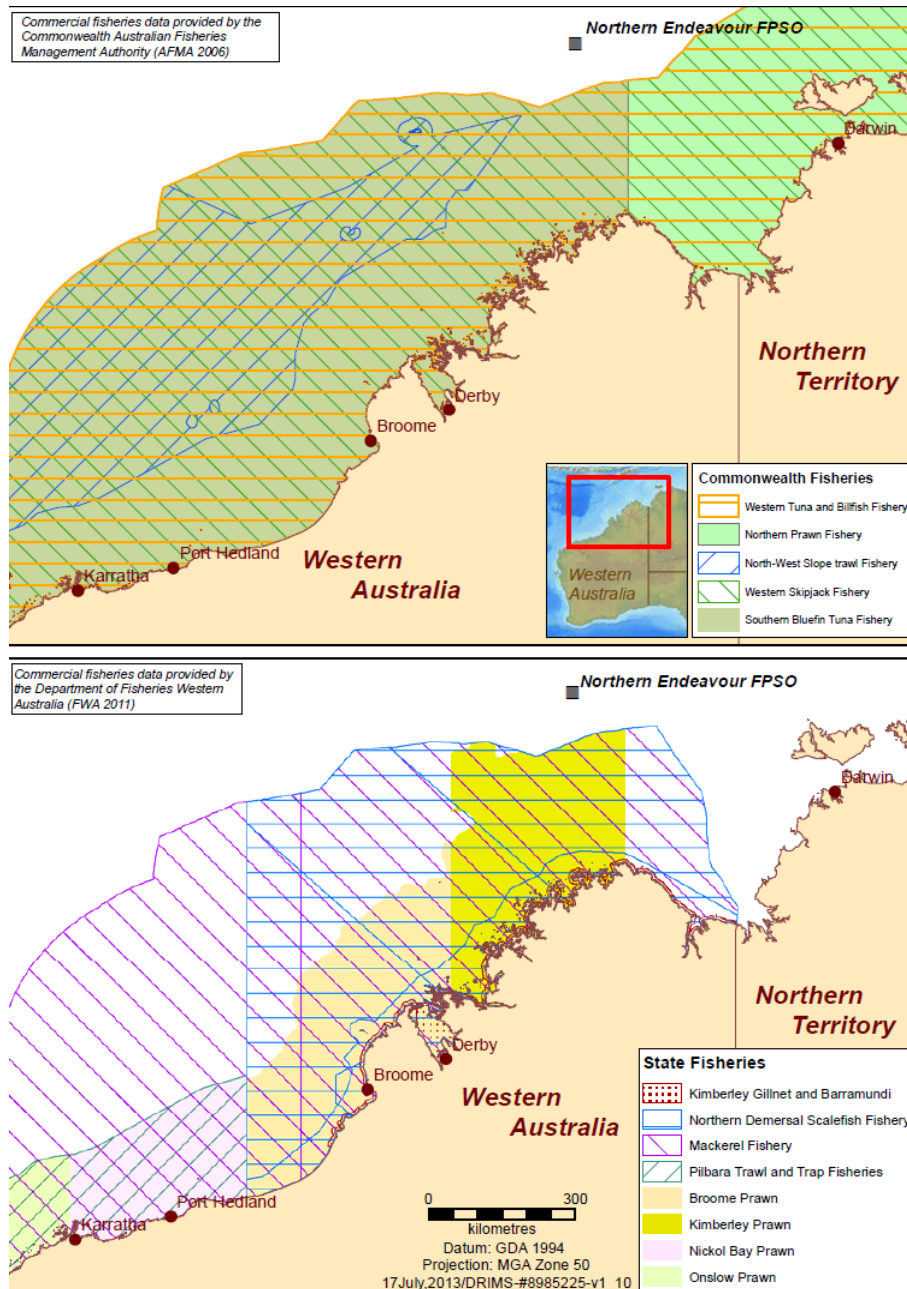


Figure 3-2: North Western Commonwealth and State Fisheries Related to the NE FPSO Operational Area (AFMA, 2011 and DoF, 2011)

In 1974, MoU 74 was agreed between the Australian and Indonesian governments to permit fishing by traditional methods within a designated area in Australian Waters. The MoU 74 area is located on the north-west continental shelf and includes the emergent reefs and associated cays/islands of Ashmore Reef, Cartier Island, Seringapatam, Scott Reef and Browse Island. Fisheries under Indonesian jurisdiction in the vicinity of the Northern Endeavour facility are not actively managed.

The region supports significant commercial shipping activity, mostly associated with the mining and oil and gas industries. Major shipping routes in the area are associated with entry to the ports of Darwin, Port Hedland and Dampier.

4. ENVIRONMENTAL HAZARDS AND CONTROLS

4.1.1 Risk identification and evaluation

Woodside recognises that risk is inherent to its business and that effective risk management is vital to delivering objectives, success and continued growth. Woodside is committed to managing all environmental risks in a proactive and effective manner.

Woodside undertook an environmental risk assessment to identify the potential environmental impacts and risks associated with the proposed Program and identification of the control measures to manage the identified environmental impacts and risks to as low as reasonably practicable (ALARP) and an acceptable level. This risk assessment and evaluation was undertaken using Woodside’s Risk Management Framework.

The key steps of Woodside’s Risk Management Framework are shown in **Figure 4-1**. A summary of each step and how it is applied to operation of the NE FPSO is provided below.

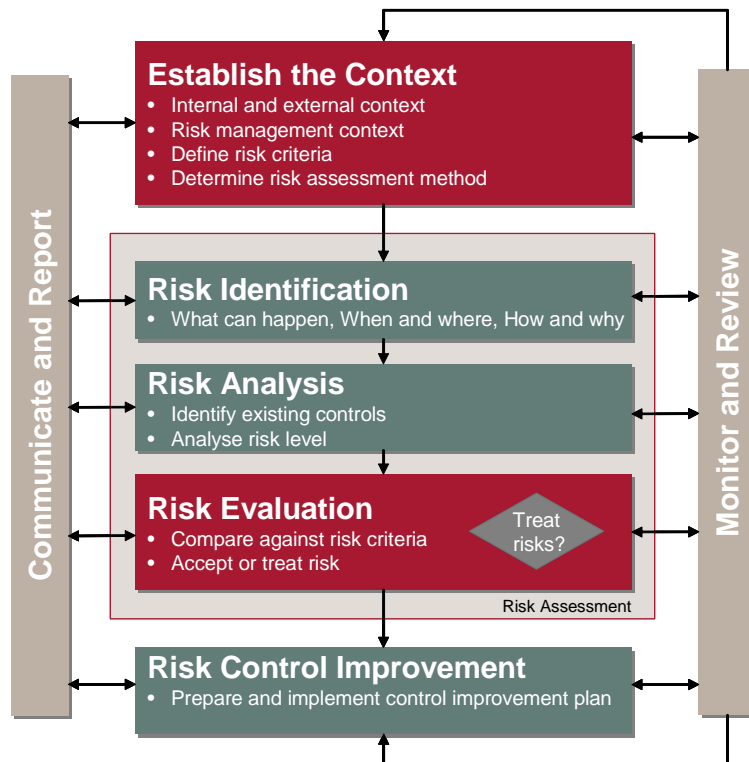


Figure 4-1: Key Steps in Woodside’s Risk Management Framework

1. Establish the Context

The objective of a risk assessment is to assess identified risks and apply appropriate control measures to eliminate, control or mitigate the risk to ALARP and to determine if the risk is acceptable.

Hazard identification workshops aligned with NOPSEMA’s Hazard Identification Guidance Note (N-04300-GN0107) were undertaken by multidisciplinary teams made up of relevant personnel with sufficient breadth of knowledge, training and experience to reasonably assure that risks and associated impacts were identified and assessed.

2. Risk Identification

The risk assessment for the NE FPSO was used to identify risks with the potential to harm the environment. Risks were identified for both planned (routine and non-routine) and unplanned (accidents/incidents) activities.

3. Risk Analysis

Risk analysis further develops the understanding of a risk by defining the impacts and assessing the appropriate controls. Risk analysis for the NE FPSO considered previous risk assessments for the facility, review of relevant studies, review of past performance, external stakeholder consultation feedback and review of the existing environment.

4. Risk Evaluation (Decision Support Framework)

To support the risk assessment process, Woodside applied the UKOOA (1999) *Industry Guidelines on a Framework for Risk Related Decision Support* (HS006) (Figure 4-2) during the workshops to determine the level of supporting evidence that may be required to draw sound conclusions regarding risk level and whether the risk is acceptable and ALARP.

This is to ensure:

- Activities do not pose an unacceptable environmental risk;
- Appropriate focus is placed on activities where the risk is anticipated to be tolerable and demonstrated to be ALARP; and
- Appropriate effort is applied to the management of risks based on the uncertainty of the risk, the complexity and risk rating.

The framework provides appropriate tools, commensurate to the level of uncertainty or novelty associated with the risk (referred to as the decision type A, B or C). The decision type is selected based on an informed discussion around the uncertainty of the risk.

This framework enables Woodside to appropriately understand a risk, determine if the risk is acceptable and can be demonstrated to be ALARP. As part of this process, the decision making tools as depicted in Figure 4-2 are applied, as appropriate, to assist with identifying control measures. To then determine that the selection of alternatives and the control measures applied are suitable, the decision calibration tools may be used.

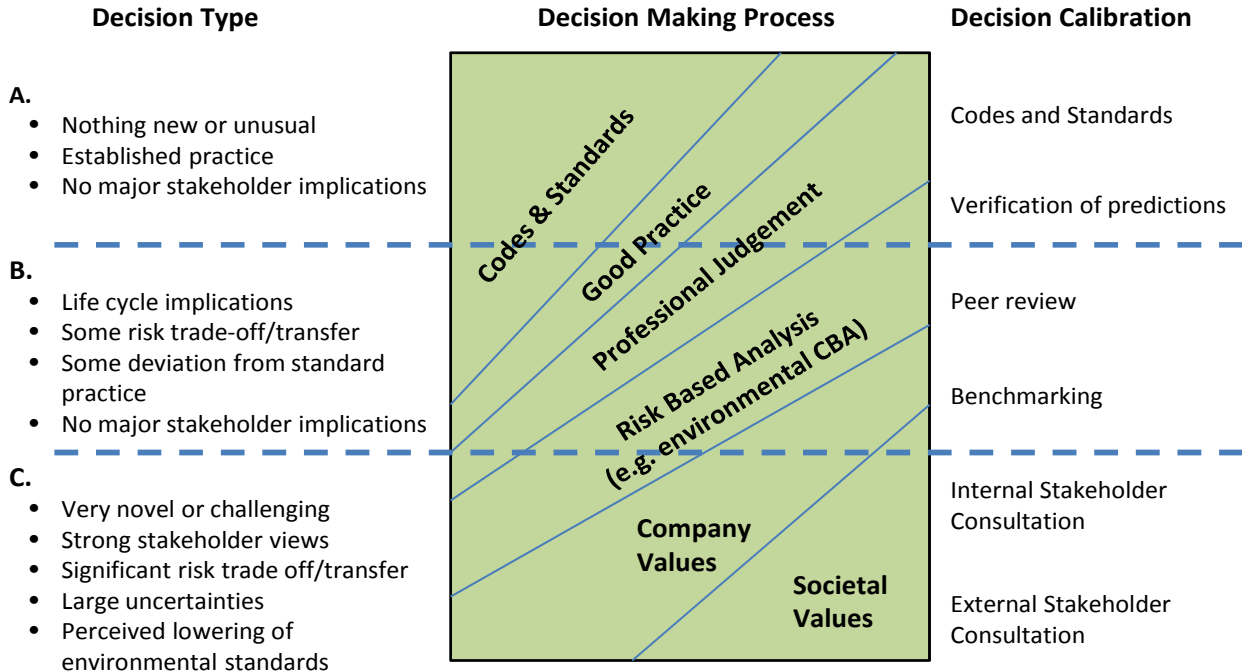


Figure 4-2: Risk Related Decision Support Framework (UKOOA, 1999)

5. Identification of Control Measures

Woodside applies a hierarchy of control measures when considering Good Practice and Professional Judgement. The hierarchy of control is applied in order of importance as follows; elimination, substitution, engineering control measures, administrative control measures and mitigation of consequences/impacts.

6. Risk Rating Process

The risk rating process is undertaken to assign a level of risk to each impact measured in terms of consequence and likelihood. The assigned risk level is the residual risk (i.e. risk with controls in place) and is therefore undertaken following the identification of the Decision Type and appropriate control measures.

The environmental risk assessment for the NE FPSO identified 29 sources of environmental risk. These risks are divided into two broad categories: Planned (routine and non-routine); and Unplanned (accidents/incidents) activities.

4.1.2 Planned (Routine and Non-Routine) Activities

The majority of the sources of environmental risk identified for the NE FPSO relate to those activities which are planned and either undertaken on a routine or non-routine basis. These sources of risk include:

- Physical presence of the platform and support vessels generating light and noise emissions;
- Atmospheric emissions from gas flaring, fuel combustion and fugitive emissions;
- Discharge of Produced Formation Water (PFW), drainage, cooling and brine water;
- Routine discharges to the marine environment, including subsea chemicals, sewage and putrescible wastes;
- Storage, handling and disposal of waste; and
- Chemical selection and use.

Generally, the sources of risk from planned activities present a lower environmental consequence compared to the potential impact from unplanned accident or incident events (Refer to Appendix A). However, as these sources of risk relate to planned activities which occur routinely or more frequently, the EP contains a variety of control and mitigation measures which ensure potential impacts and risks will be reduced to ALARP and will be of an acceptable level. A summary of the key environmental hazards and control measures for planned activities, as well as the residual risk assigned through the risk ranking process, have been presented in **Appendix A**.

4.1.3 Unplanned (Accidents/Incidents) Activities

During the risk assessment process, a number of potential environmental impacts which may occur from unplanned activities were also identified. These sources of risk range from small-scale chemical spills with a low environmental consequence to large-scale hydrocarbon spill events with high environmental consequence.

Unplanned activities with a lower source of risk include:

- Introduction of invasive marine species;
- Unplanned venting and release of atmospheric emissions;
- Chemical spills; and
- Hydrocarbon releases during bunkering operations.

The risk assessment for the NE FPSO identified that there are eight unplanned activities which would be considered a Major Environment Event (MEE), should they occur. The classification of a MEE is based on the potential for a higher level of environmental consequence if a credible worst case scenario was to occur.

Although the likelihood of such an event occurring is extremely low, a further level of rigour is applied to the assessment due to the potential consequence of a MEE. The process used in the assessment assists in identifying the critical barriers to prevent the event occurring as well as mitigation measures to limit the potential consequence.

The MEEs identified for the NE FPSO are:

- Hydrocarbon release caused by a well loss of containment;

- Hydrocarbon release caused by a subsea loss of containment;
- Hydrocarbon release caused by a topside loss of containment;
- Hydrocarbon release caused by a offloading equipment loss of containment;
- Hydrocarbon release caused by a cargo tank loss of containment;
- Hydrocarbon release caused by a loss of structural integrity;
- Hydrocarbon release caused by loss of marine vessel separation; and
- Hydrocarbon release caused by loss of control of suspended load.

A summary of the key environmental hazards and control measures for unplanned activities, as well as the residual risk assigned through the risk ranking process, is presented in **Appendix A**.

5. ONGOING MONITORING OF ENVIRONMENTAL PERFORMANCE

Operation of the NE FPSO will be managed in compliance with the *Northern Endeavour FPSO Operations Environment Plan* accepted by NOPSEMA under the Environment Regulations, other relevant environmental legislation and Woodside's Management System (e.g. Woodside Environment Policy).

The objective of the EP is to ensure that potential adverse impacts on the environment associated with the operation of the NE FPSO, during both routine and non-routine operations, are identified, reduced to ALARP and of an acceptable level.

The NE FPSO EP details for each environmental aspect, the specific performance outcomes and standards and control/mitigation measures (controls are summarised in **Appendix A**) to be implemented and measurement criteria to demonstrate performance outcomes are achieved.

The implementation strategy detailed in the *Northern Endeavour FPSO Operations Environment Plan* identifies the roles/responsibilities and training/competency requirements for all personnel (Woodside and its contractors) in relation to implementing controls, managing non-conformance, emergency response and meeting monitoring, auditing, and reporting requirements during the activity.

The EP also details the types of monitoring and auditing that will be undertaken to ensure environmental performance outcomes and standards are being met. Key systems include:

- Annual Environmental Compliance and Performance Reports which are submitted to NOPSEMA to assess and confirm compliance with the accepted environmental performance outcomes, standards and measurement criteria outlined in the EP;
- Annual site based inspections undertaken by Woodside's Environment Function to review compliance against the EP, verify effectiveness of the EP implementation strategy and to review environmental performance;
- Performance Assessment Tool (PAT) reviews and self assessments related to the management of environmental risks and impacts of the NE FPSO which are completed to verify competency and compliance;
- Environmental performance is also monitored daily by key personnel via the Production Accounting System; and
- Senior management regularly monitor and review environmental performance of the NE FPSO via a variety of monthly reports which detail environmental performance and compliance with Woodside standards.

Woodside employees and Contractors are required to report all environmental incidents and non-conformance with environmental performance outcomes and standards in the EP. Incidents will be reported using an Incident and Hazard Report Form, which includes details of the event, immediate action taken to control the situation, and corrective actions to prevent reoccurrence. An internal computerised database is used for the recording and reporting of these incidents. Incident corrective actions are monitored to ensure they are closed out in a timely manner.

The EP is supported by an assessment of the environmental impacts and risks associated with potential oil spill scenarios and oil spill preparedness and response measures in relation to the risk assessment and the identified oil spill scenarios. A summary of Woodside's response arrangements in the Oil Pollution Emergency Plan is provided in Section 6.

Environment Plan Revisions

Revision of the NE FPSO Operations EP will be undertaken in accordance with the requirements of the Environment Regulations. Woodside will submit a proposed revision of the NE FPSO Operations EP to NOPSEMA as a result of the following:

- When any significant modification or new stage of the activity that is not provided for in the EP is proposed;
- Before, or as soon as practicable after, the occurrence of any significant new or significant increase in environmental risk or impact not provided for in the EP;
- At least 14 days before the end of each period of five years commencing on the day in which the original and subsequent revisions of the EP is accepted under Regulation 11 of the Environment Regulations; and
- As requested by NOPSEMA.

6. OIL SPILL CONTINGENCY PLANNING

6.1 Woodside's Oil Spill Response Arrangements

Woodside's Oil Pollution Emergency Plan (OPEP) for the NE FPSO consists of the following documents:

6.1.1 Woodside Oil Pollution Emergency Arrangements (Australia)

This document outlines the emergency and crisis management incident command structure (ICS) and Woodside's response arrangements to competently respond to and escalate an oil spill event. The document interfaces externally with Commonwealth, State and industry response plans and internally with Woodside's ICS.

The Oil Pollution Emergency Arrangements (Australia) describes Woodside's role as a Control agency and details the following support arrangements:

- Master services agreement with Australian Marine Oil Spill Centre (AMOSC) for the supply of experienced personnel and equipment, including a subsea first response toolkit and national dispersant stockpiles;
- Access to Wild Well Control's capping stack, SFRT equipment and experienced personnel for the rapid deployment and installation of a capping stack, where feasible.
- Participating membership with Oil Spill Resources Limited (OSRL), which allows access to OSRL's international holding of response equipment and response capabilities, including incident management expertise and specialist personnel;
- The Woodside and Australian Maritime Safety Authority (AMSA) Memorandum of Understanding (MoU) whereby AMSA, as managers of the National Plan for Maritime Environmental Emergencies, will provide support to Woodside such as response equipment from national stockpiles. The equipment stockpiles are located around Australia in strategic locations such as the ports of Dampier, Darwin and Fremantle.
- Other support services such as 24/7 oil spill trajectory modelling and satellite monitoring services as well as 'on-call' aerial, marine, logistics and waste management support.
- Mutual Aid Agreements with other oil and gas operators in the region for the provision of assistance in an oil spill response.

6.1.2 NE FPSO Oil Pollution First Strike Plan

The NE FPSO Oil Pollution First Strike Plan is a facility specific document providing details on the tasks required to mobilise a first strike response for the first 24 hours of a hydrocarbon spill event. These tasks include key response actions and regulatory notifications. The intent of the document is to provide immediate oil spill response guidance to the Incident Management Team until a full Incident Action Plan specific to the oil spill event is developed.

In accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009*, Woodside's oil spill arrangements are tested at least annually.

6.2 Oil Spill Preparedness and Response Mitigation Assessment for the Timor Sea Region

Woodside has developed an oil spill preparedness and response position for the Timor Sea Region in order to demonstrate that risks and impacts associated with loss of containment from the NE FPSO are mitigated and managed to as low as reasonably practicable (ALARP) and would be of an acceptable level.

6.2.1 Response Strategies

During consideration of response strategies, a pre-operational Net Environmental Benefit Assessment (NEBA) was undertaken to broadly evaluate each potential oil spill response strategy and decide whether implementation was of potential net environmental benefit, as well as considering its feasibility. The NEBA process allows for the identification of positive as well as negative impacts of response strategies relative to

unmitigated spill impacts. The underlying principle behind the NEBA is that response actions should result in an overall benefit to the environment, even in cases where there may be potential for some damage from the response action itself. Response strategies that are not beneficial are rejected at this stage and not assessed further.

The following oil spill response strategies were evaluated and subsequently pre-selected for a significant oil spill event (level 2 or 3 under the National Plan) from the NE FPSO. The potential environmental impacts of these strategies, identified during the pre-operational NEBA, are summarised in Table 6-1. Implementation of these response strategies would be assessed during a spill event, with consideration of the size of spill, weather conditions and other constraints:

Monitor and Evaluate - To gain an understanding of the spill event, its movement and to direct mitigation activities to the optimal locations, the following operational monitoring programs are available for implementation:

- Predictive modelling of hydrocarbons to assess resources at risk;
- Surveillance and reconnaissance to detect hydrocarbons and resources at risk;
- Monitoring of hydrocarbon presence, properties, behaviour and weathering in water;
- Pre-emptive assessment of sensitive receptors at risk; and
- Monitoring of contaminated resources and the effectiveness of response and clean-up operations.

Source Control (Well intervention) - Woodside's strategy is to minimise the volume of hydrocarbons released from an oil spill event. Woodside plans to deploy the following possible control specific to well loss of containment scenarios at the NE FPSO:

- Source control (well capping); and
- Well intervention (relief well drilling).

Open Water Containment and Recovery - Involves the physical containment and mechanical removal of hydrocarbons from the marine environment. Suitable vessels would be drawn from Woodside's integrated fleet, other operators in the region and from the charter market. Other open water containment and recovery equipment (e.g. booms and skimmers) would be sourced from AMSA, AMAOSC and OSRL stockpiles.

Shoreline Protection – Shoreline protection equipment would be deployed either from a vessel or from the shore, depending on the prevailing conditions, shoreline type and access. Additional resources would be mobilised depending on the scale of the event to increase the number of shorelines being protected.

Shoreline Cleanup – Woodside has access to equipment stockpiles to support initial response requirements and would supplement resources, depending on the type of cleanup required, through contractors. Some equipment maybe procured locally on the day with additional equipment being sourced within Western Australia, interstate and internationally, commensurate with the scale and progressive nature of shoreline impact.

Oiled Wildlife Response – Staging sites will be established for shoreline or vessel based oiled wildlife response teams. Once recovered to a staging site, wildlife will be transported to the designated oiled wildlife facility for stabilisation and treatment.

Waste Management – The objectives of Woodside's waste management response are:

- To mobilise waste storage and transport resources on day one of a potential oil spill event to support containment and recovery and shoreline protection responses; and
- Arrange for sufficient waste storage, handling, transport and disposal capability to support continuous response operations.

To achieve these objectives, Woodside has access to waste storage in Exmouth and Karratha as well as waste storage equipment from AMOSC, AMSA and OSRL.

Table 6-1: Potential environmental impacts of Oil Spill Response Strategies for the Northern Endeavour FPSO.

Source of Risk	Key Potential Environmental Impact considered as part of ALARP assessment
General Impacts relating to vessel, vehicle and aircraft activity	<p>Air Emissions</p> <ul style="list-style-type: none"> • Temporary reduction in air quality beyond localised area; • Contribution to global greenhouse gas emissions. <p>Physical presence of work activity, light and noise emissions</p> <ul style="list-style-type: none"> • Localised water column pollution and accumulation of toxicants in sediments affecting biota as a result of vessel operational discharges; • Collision with fauna resulting in injury or fatality; • Seabed disturbance including localised mortality/disturbance of benthos as a result of vessel anchoring; • Exclusion of other users including shipping and fishing; • Introduction of invasive marine species, possibly resulting in alteration of the natural ecosystem; • Disturbance to fauna, particularly whales, marine turtles and fish, potentially as direct physical damage or as a behavioural effect resulting from noise emissions; • Disturbance to fauna, particularly seabird's, marine turtles and fish as a result of light emissions.
Monitor and Evaluate	General Impacts relating to vessel, vehicle and aircraft activity
Well Intervention	If required, risks, impacts and controls will be identified within a separate Well Operational Management Plan.
Capping Stack	<p>General Impacts relating to vessel, vehicle and aircraft activity</p> <p>Physical presence of the capping stack</p> <ul style="list-style-type: none"> • Seabed disturbance including localised mortality/disturbance of benthos as a result of capping stack installation operations.
Containment and Recovery	<p>General Impacts relating to vessel, vehicle and aircraft activity</p> <p>Equipment/ materials/ worker transport</p> <ul style="list-style-type: none"> • Response equipment (booms and skimmers) may act as obstacles and restrict wildlife movement or trap wildlife; • Sorbent material could be consumed by wildlife.
Shoreline Protection	<p>Equipment/ materials/ worker transport</p> <ul style="list-style-type: none"> • Response equipment (booms and skimmers) may act as obstacles and restrict wildlife movement or trap wildlife; • Sorbent material could be consumed by wildlife. <p>General Impacts relating to vessel, vehicle and aircraft activity</p> <ul style="list-style-type: none"> • Vehicle and foot traffic to and from boom sites resulting in disturbance of wildlife, physical damage to habitat and compaction of shoreline. <p>Waste Generation/Disposal</p> <ul style="list-style-type: none"> • Pollution of the marine and terrestrial environment and potentially chronic and acute toxicity impacts on flora and fauna; • Secondary impacts on fauna (e.g. entanglement).
Shoreline Clean-up	<p>General Impacts relating to vessel, vehicle and aircraft activity</p> <ul style="list-style-type: none"> • Removal of vegetation for access pathways and work station set-up. <p>Chemical Cleaning</p> <ul style="list-style-type: none"> • Toxic effects of chemical cleaning agent and resulting fumes to the environment; • Run-off from cleaning activities back into the marine environment. <p>Mechanical Cleaning</p> <ul style="list-style-type: none"> • Secondary contamination from removed hydrocarbons by machinery or personnel movement; • Physical damage to shoreline and access paths from machinery and personnel movement; • Excessive removal of vegetation causing further penetration of hydrocarbons into substrate; • Shoreline compaction from heavy machinery and work activity resulting in further penetration of hydrocarbons into substrate; • Potential habitat depletion via removal of surface layers of intertidal sediments; • Excessive removal of substrate causing shoreline erosion and instability; • Physical abrasion to substrate and biota during hydrocarbon removal. <p>Waste Generation/Disposal</p>

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Source of Risk	Key Potential Environmental Impact considered as part of ALARP assessment
	<ul style="list-style-type: none"> • Pollution of the marine and terrestrial environment and potentially chronic and acute toxicity impacts on flora and fauna; • Secondary impacts on fauna (e.g. entanglement). <p>Sediment Disturbance</p> <ul style="list-style-type: none"> • Remobilising hydrocarbons resulting in impacts to marine water quality; • Remobilising hydrocarbons resulting in spread of impacted locations.
Oiled Wildlife Response	<p>General Impacts relating to vessel, vehicle and aircraft activity</p> <p>Wildlife Capture/ Treatment/ Release</p> <ul style="list-style-type: none"> • Pre-emptive capture of un-oiled wildlife causing undue impacts; • Physical injury and stress caused to wildlife during capture, transport, treatment and release; • Euthanasiation of wildlife; • Impacts to wildlife health due to captive diet; • Release of wildlife to unfamiliar sites resulting in health impacts; <p>Waste Generation/Disposal</p> <ul style="list-style-type: none"> • Pollution of the marine and terrestrial environment and potentially chronic and acute toxicity impacts on flora and fauna; • Secondary impacts on fauna (e.g. entanglement).
Waste Management	<p>General Impacts relating to vessel, vehicle and aircraft activity</p> <p>Waste Generation/Disposal</p> <ul style="list-style-type: none"> • Pollution of the marine and terrestrial environment and potentially chronic and acute toxicity impacts on flora and fauna; • Secondary impacts on fauna (e.g. entanglement).

6.2.2 Scientific Monitoring

In addition to the above response strategies, a scientific monitoring program (SMP) will be activated following a significant oil spill (defined as a level 2 or 3 spill). The nature and scale of the spill event would dictate the implementation and operational timing of the SMP. Ten targeted scientific monitoring programs may be implemented to address a range of physical-chemical (water and sediment) and biological receptors (species and habitats) including EPBC Act listed species, environmental values associated with Protected Areas and socio-economic values such as fisheries. The SMPs to be activated are as follows:

- Desk-based review and assessment of hydrocarbons in marine waters;
- Assessment of the presence, quantity and character of hydrocarbons in marine sediments;
- Assessment of impacts and recovery of subtidal and intertidal benthos;
- Assessment of impacts and recovery of mangroves / saltmarsh;
- Assessment of impacts and recovery of seabird and shorebird populations;
- Assessment of impacts and recovery of nesting marine turtle populations;
- Assessment of impacts to pinniped (seal and sea lion) colonies including haul-out site populations;
- Desk-based assessment of impacts to other non-avian marine megafauna;
- Assessment of impacts and recovery of marine fish associated with benthic habitats; and
- Assessment of physiological impacts to commercially important fish and shellfish species (fish health and seafood quality/safety) and recovery.

6.2.3 Key Receptor Areas

Oil spill modelling was undertaken using a three-dimensional oil spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program), which is designed to simulate the transport, spreading and weathering of specific oil types under the influence of changing meteorological and oceanographic forces. Results of a large number of replicate simulations were then statistically analysed and mapped to define the furthest (i.e. worst-case) possible extent from the release point within reach of hydrocarbons above defined threshold concentrations (i.e. the Zone of Consequence).

The outputs of the quantitative modelling are used to assess the environmental risk from multiple hydrocarbon spill scenarios, solely in terms of delineating which areas of the marine environment could be exposed to hydrocarbons concentrations at or exceeding threshold concentrations. In the unlikely event of a spill, the exact trajectory of the spill would be determined by prevailing oceanographic and meteorological conditions at the time. In compliance with regulatory requirements, this approach allows for sensitive areas that have the potential to be adversely impacted in the unlikely event of a major spill to be identified as key response areas.

Table 6-2 is the list of receptors within Australian waters that may be impacted by hydrocarbons at above threshold concentrations in the unlikely event of a spill in the Timor Sea Region. Of these potential receptors, the number and predicted impact is dependent on the spill scenario (ie. volume, hydrocarbon type and location).

Table 6-2: Summary of Australian Receptors which could be impacted in a variety of oil spill scenarios

Environmental setting	Location / name
Offshore	Commonwealth waters
Oceanic Reefs	Ashmore Reef and CMR
	Cartier Island and CMR
	Hibernia Reef
	Seringapatam
	Scott Reef (North and South)
Submerged Shoals	Oceanic Shoals CMR
	Sahul Shelf shoals

7. CONSULTATION

Woodside conducted an assessment to identify potentially affected stakeholders, based on activities associated with operation of the NE FPSO. This included location of the facility, timing of the activities and potential environmental and social impacts.

For the purposes of the NE FPSO Operations EP and consistent with Section 11A of the Environment Regulations, Woodside consulted with stakeholders that it considered relevant to the operation of the NE FPSO. The stakeholders engaged are listed in **Table 7-1**.

Table 7-1: Stakeholders Engaged for the NE FPSO EP

Organisation	Relevance
Minister for Resources and Energy	Resource Development
Department Industry (formerly the Department of Resources, Energy and Tourism (representing the Minister for Industry))	Department of relevant Commonwealth Minister
NT Minister for Mines and Energy	Department of relevant State Minister
Australian Maritime Safety Authority (marine pollution)	Commonwealth marine pollution response
Australian Hydrographic Office	Maritime Safety
Australian Customs Service – Border Protection Command	Maritime security
Department of Defence – Defence Property Services Group	Defence Estate Management
AMOSC	Oil Spill Response – industry contractor
Department of Agriculture, Fisheries and Forestry	Commercial Fisheries Management
Australian Maritime Safety Authority (maritime safety)	Maritime safety
Australian Fisheries Management Authority	Commonwealth fisheries management
WA Department of Transport	Marine Pollution Response
NT Department of Transport	Marine Pollution Response
Darwin Port Corporation	Marine Traffic

A consultation Fact Sheet was sent electronically to all identified stakeholders on 26 September 2013, prior to lodgement of the NE FPSO Operations EP with NOPSEMA for assessment and acceptance. Consultation following distribution of the Fact Sheet included engagement with potentially affected stakeholders, regulators and industry associations. Published data was also reviewed on other user activity in the vicinity of the facility to determine those stakeholders most relevant to the proposed activities. In support of the NE FPSO EP, Woodside has sought to:

- Ensure that all relevant stakeholders have been identified and communicated to in a timely and effective manner;
- Develop communications material in response to stakeholder needs; and
- Analyse stakeholder feedback to inform decision making and planning.

No objections or claims regarding the activity were raised by relevant persons. Woodside received only minor feedback on the proposed activity from stakeholders and responded appropriately to ensure queries about the continued operation of the NE FPSO were adequately addressed and resolved. Feedback from stakeholders was considered in the development of management measures specific to the activity and, where relevant, was incorporated in the NE FPSO EP. Stakeholder feedback and Woodside responses are summarised in **Table 7.2**.

Table 7-2: Summary of Stakeholder Feedback and Woodside Responses

Stakeholder Feedback	Woodside Response
Stakeholder requested drawing file to confirm charted information was correct.	Woodside provided relevant information.

Woodside will continue to accept and assess feedback from stakeholders during the activity via the contact details provided in Section 8. In the event there is a material change in the work scope, additional

stakeholder feedback will be undertaken with relevant stakeholders. A consultation fact sheet will remain published on Woodside's website (<http://www.woodside.com.au/Our-Approach/Pages/Consultation-Activities.aspx>).

8. CONTACT DETAILS

Under Regulation 15, the Nominated Liaison Person for this activity is:

Breyden Lonnie
Asset Manager
Woodside Energy Ltd
Woodside Plaza, 240 St Georges Terrace, Perth WA 6000

For further information about this activity, please contact:

Tony Johnson
Manager Corporate Affairs
Australia Oil and Pluto LNG
Woodside Energy Ltd
Woodside Plaza, 240 St Georges Terrace,
Perth WA 6000
T: +61 8 9348 4000
E: tony.johnson@woodside.com.au

Please direct email enquiries to our website;
<http://www.woodside.com.au/Pages/Contact-Us.aspx>

Toll free: 1800 442 977

9. REFERENCES

- Australian Fisheries Management Authority (AFMA). 2011. Annual Status Report 2010-11. Australian Fisheries Management Authority, Canberra. 213 pp.
- Brewer, D., Lyne, V., Skewes, T., Rothlisberg, P., Last, P., Ward, B., Meekan, M., Smith, L., and Steinberg, C. 2007. Trophic systems of the North-west Marine Region. *Report to the Department of the Environment, Water Heritage and the Arts, by CSIRO Marine and Atmospheric Research, Cleveland.*
- Bureau of Meteorology (BOM). 2013. Climate Statistics of Australian Locations Viewed 25 September 2012. <http://www.bom.gov.au/climate/data/index.shtml>
- Department of Fisheries (DoF). 2011. State of the Fisheries and Aquatic Resources Report 2010/2011, Department of Fisheries, Perth, WA.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). 2012a. Marine Bioregional plan for the North-west Marine Region.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). 2012b. Species Group report card – marine reptiles Supporting the marine bioregional plan for the North-west Marine Region.
- Department of the Environment, Water, Heritage and the Arts (DEWHA), 2008. North Marine Region Protected species group report cards: seasnakes. Appendix D4. The North Marine Bioregional Plan. Bioregional Profile. <http://www.environment.gov.au/coasts/mbp/publications/north/pubs/profile-appendixd4.pdf>
- Department of the Environment, Water, Heritage and the Arts (DEWHA). 2010a. Legislative changes for recreational fishing of three shark species. MAR21.0810. <http://www.environment.gov.au/coasts/species/sharks/publications/pubs/fs-three-sharks.pdf>
- Environment Australia. 2002. Ningaloo Marine Park (Commonwealth Waters) Management Plan. Department of Environment and Heritage, Canberra.
- Holloway, P.E. and Nye, H.C., 1985. Leeuwin Current and wind distributions on the southern part of the Australian North West Shelf between January 1982 and July 1983, *Australian Journal of Marine and Freshwater Research* 36: 123-137.
- James NP, Bone Y, Kyser TK, Dix GR and Collins LB, 2004, The importance of changing oceanography in controlling late Quaternary carbonate sedimentation on a high-energy, tropical, oceanic ramp: North-western Australia, *Sedimentology* 51: 1179-1205.
- Western Australian Museum (WAM), 2009. Marine Biodiversity Survey of Mermaid Reef (Rowley Shoals), Scott and Seringapatam Reef, Marine Survey Team, Aquatic Zoology, Western Australian Museum, Perth, Australia, Records of the Western Australian Museum Supplement No. 77.
- Wilson, J., Darmawan, A., Subijanto, J., Green, A., and S. Sheppard. 2011. Scientific design of a resilient network of marine protected areas. Lesser Sunda Ecoregion, Coral Triangle. The Nature Conservancy - Asia Pacific Marine Program. Bali.

APPENDIX A: Key environmental risks, impacts and control measures identified for the NE FPSO

Source of Risk	Key Potential Environmental Impact	Residual Risk	Controls/Mitigation Measures
PLANNED (ROUTINE AND NON-ROUTINE) ACTIVITIES			
Physical presence of the platform and support vessels, light and noise emissions	<ul style="list-style-type: none"> Exclusion of other users including shipping and fishing; Collision with marine fauna resulting in injury or fatality; Provision of artificial habitat; Seabed disturbance including localised mortality/disturbance of benthos; Disturbance to marine fauna, particularly seabird's marine turtles and fish as a result of light emissions; and Disturbance to marine fauna, particularly whales, marine turtles and fish, potentially as direct physical damage or as a behavioural effect resulting from noise emissions. 	Low	<ul style="list-style-type: none"> Opportunistic light spill inspections will verify that lighting is limited to that required for safe working conditions, with corrective actions implemented. A 500 m safety exclusion zone will be maintained around the NE FPSO at all times. Interactions between support vessels/helicopters and cetaceans and whale sharks will be consistent with Commonwealth environment Regulations and relevant code of conduct. A stakeholder fact sheet will be distributed during scheduled EP reviews; stakeholder feedback will also be assessed throughout the duration of the approved NE FPSO EP. Systems and equipment will detect and alert facility personnel of a potential collision with the facility. Anchoring in the facility exclusion zone will be prohibited except in emergency situations or under issuing of a specific permit. Lifting and lifted equipment will be in a safe and serviceable condition and lifting operations will be safely performed minimise the potential for dropped objects. A simultaneous operations plan will be developed for all support vessels interacting with the facility. Operators of powered lifting equipment will be trained and competent for that specific equipment and location.
Routine atmospheric emissions from gas flaring, fuel combustion and fugitive emissions	<ul style="list-style-type: none"> Temporary reduction in air quality beyond localised area; Contribution to global greenhouse gas emissions; Consumption of non-renewable natural resources; and Visual impact from flare flame and possibly dark smoke. 	Low	<ul style="list-style-type: none"> Flared gas will be combusted in an efficient manner and monitored at all times. Flare and fuel gas systems will be operated within design specifications. Flaring must be controlled by each facility in line with annual limits set within the internal operating plan and performance agreements. Fuel gas, fuel oil and diesel consumption will be monitored at all times. Compliance with relevant national emissions reporting legislation and maritime air pollution legislation (where relevant). Routine monitoring of the process plant will be undertaken by operators to identify, isolate and repair leaks. Systems will be leak tested prior to the introduction of hydrocarbons, such that systems are proved for leak tightness prior to commissioning or re-commissioning.

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Source of Risk	Key Potential Environmental Impact	Residual Risk	Controls/Mitigation Measures
Routine discharges to the marine environment, including subsea chemicals, sewage and putrescible wastes	<ul style="list-style-type: none"> Localised water column pollution or eutrophication; and Localised adverse effect to marine biota. 	Low	<ul style="list-style-type: none"> Compliance with Woodside's Environment Procedure for Offshore Chemical and Selection. Production Offshore Process and Subsea Chemical Register Maintained for the NE FPSO which contains details of chemical assessments and annual reviews. Subsea Inspection, Maintenance and Repair activities adhere to relevant procedures; Subsea control fluid use will be monitored and recorded and any discrepancies will be investigated to identify unplanned use and possible integrity issues. During subsea activities, any operational chemical use and discharge from the support vessel will be recorded. Sewage and putrescible wastes will be macerated prior to discharge to sea. For support vessels, compliance with MARPOL 73/78 Annex IV: Sewage (as implemented in Commonwealth waters by the <i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i>); Marine Orders - Part 96: Marine Pollution Prevention – Sewage. Sewage treatment system will be operated by competent personnel in accordance with Sewage System operating procedures to ensure operation of the system in line with design specifications.
Discharge of Produced Formation Water	<ul style="list-style-type: none"> Acute and chronic toxicity to marine biota; Accumulation of toxicants in sediments affecting biota; and Bioaccumulation of organic toxicants. 	Medium	<ul style="list-style-type: none"> The concentration of petroleum in any produced formation water discharged into the sea will not exceed an average of 30 mg/L over any daily (24 hour) period. PFW discharge volume and OIW concentration will be monitored and controlled. Routine assessment of potential PFW discharge impacts, including representative field based monitoring, will be undertaken. Additional verification assessment or monitoring will be initiated should there be potential for a change to discharge characteristics, which may alter existing compliance with the performance standard. PFW discharges will be assessed to meet 'no effect concentration' within an approved mixing zone around the facility. PFW chemical composition and toxicity shall be characterised to support this assessment.
Discharge of cooling, brine and drainage water	<ul style="list-style-type: none"> Alteration of physiological processes; Toxic effect to biota; and Localised water column pollution. 	Low	<ul style="list-style-type: none"> OIW concentration of discharges will be monitored and controlled. Chemical dosage of the reverse osmosis and cooling water systems is undertaken in a controlled manner to minimise dosage to the minimum required to achieve treatment efficiency. In relation to cooling water discharges, assessments will be undertaken to ensure localised temperature increases remain within an approved mixing zone. Drainage systems will be inspected and in a safe and serviceable condition to manage potential leaks and spills.

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Source of Risk	Key Potential Environmental Impact	Residual Risk	Controls/Mitigation Measures
Storage, handling and disposal of waste (including NORMS)	<ul style="list-style-type: none"> Pollution of the marine environment and potentially chronic and acute toxicity impacts on marine flora and fauna; Secondary impacts on marine fauna (e.g. entanglement); and Pollution of the terrestrial environment and potentially chronic and acute toxicity impacts on terrestrial flora and fauna. 	Low	<ul style="list-style-type: none"> Waste will be stored and segregated, and handling equipment kept in good working order, to prevent accidental loss to the environment. Records of waste transport, treatment, recycling or disposal will be maintained. Wastes, including hazardous wastes, will be transported and disposed of in a safe and environmentally responsible manner that prevents accidental loss to the environment and pollution or contamination of soil and water. Training will be provided to relevant operational personnel to educate on the correct waste management requirements i.e. storage, handling, segregation and disposal. Waste contractors will be audited to ensure they have the facilities and systems to be able to dispose of the waste in an environmentally responsible manner. Support vessels will comply with relevant marine pollution prevention legislation. Management measures will be in place to identify any Naturally Occurring Radioactive Materials (NORMs), and if so manage the handling, storage and disposal appropriately.
Chemical selection and use	<ul style="list-style-type: none"> Localised water column pollution; and Localised adverse effect to marine life. 	Low	<ul style="list-style-type: none"> Selection of operational process chemicals will include consideration of technical, commercial, health, safety and environment parameters. Compliance with Woodside's Environment Procedure for Offshore Chemical and Selection. Chemicals will be stored safely and handled to prevent the release to the marine environment. Facilities will maintain a hazardous chemicals register.
UNPLANNED ACTIVITIES (ACCIDENTS / INCIDENTS)			
Introduction of invasive marine species	<ul style="list-style-type: none"> Introduction of invasive marine species, possibly resulting in alteration of the natural ecosystem. 	Low	<ul style="list-style-type: none"> Compliance with AQIS Australian Ballast Water Management Requirements. Compliance with Woodside's Invasive Marine Species Management Procedure, where an IMS Risk Assessment is undertaken on support vessels for the NE FPSO that propose to enter and operate within nearshore waters around Australia. Compliance with the <i>Australian Quarantine Regulations (2000)</i>.
Unplanned venting and release of atmospheric emissions	<ul style="list-style-type: none"> Contribution to global greenhouse gas emissions; and Ozone depletion and contribution to atmosphere of gases with high global warming potential and atmospheric lifetime. 	Low	<ul style="list-style-type: none"> Compliance with Woodside operating procedure to ensure flare system is operated within design specifications. Woodside will hold a valid Refrigerant Trading Authority. Records of refrigerant inventories and equipment maintenance will be documented.
Chemical spills	<ul style="list-style-type: none"> Pollution of the marine environment; and Adverse effects on marine life (sea floor and open water) 	Low	<ul style="list-style-type: none"> Selection of operational process chemicals will include consideration of technical, commercial, health, safety and environment parameters. Compliance with Woodside's Environment Procedure for Offshore Chemical and Selection.

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Source of Risk	Key Potential Environmental Impact	Residual Risk	Controls/Mitigation Measures
			<ul style="list-style-type: none"> Chemicals will be stored safely and handled to prevent the release to the marine environment. Subsea equipment utilising hydrocarbons will be maintained to reduce the risk of loss of hydrocarbon containment to the marine environment. In ocean equipment (subsea equipment and towed equipment) utilising hydrocarbons will be inspected to ensure equipment is not leaking and critical hydraulic hoses are in good working order prior to deployment. Facilities will maintain a hazardous chemicals register. Support vessels will have onboard a current Shipboard Oil Pollution Emergency Plan (SOPEP) to respond to chemical spills.
Hydrocarbon Releases caused by: <ul style="list-style-type: none"> Bunkering Operations 	<ul style="list-style-type: none"> Localised water column pollution; and Localised adverse effect to marine biota. 	Medium	<ul style="list-style-type: none"> Compliance with facility bunkering procedure and operators competent in the activity. Support vessels will have onboard a current Shipboard Oil Pollution Emergency Plan (SOPEP) for responding to small diesel spills.
Major Environmental Events (MEE) - Hydrocarbon Releases caused by: <ul style="list-style-type: none"> Well loss of containment Subsea loss of containment Topside loss of containment Offloading equipment loss of containment Cargo tank loss of containment Loss of structural integrity Loss of marine vessel separation Loss of control of suspended load. 	<ul style="list-style-type: none"> Biological and ecological impacts to megafauna, plankton, deepwater benthic communities, offshore fish species, fisheries, coral reefs, mangroves, subtidal flats and sandy beaches and seagrass communities. 	High	Many of the critical barriers in place to prevent a hydrocarbon release from occurring are relevant across all MEE's and hydrocarbon release scenarios identified for the NE FPSO, a summary of which is provided below: <ul style="list-style-type: none"> Critical communication systems will facilitate prevention and response to accidents and emergencies. Emergency Shutdown (ESD) valves and systems will isolate hazardous inventories within pipework and riser systems and shut down plant and equipment. Reservoir isolation valves will isolate the reservoir from the facility. All primary and secondary barriers within the wells will isolate hydrocarbons from the reservoir. Acoustic sand detectors will ensure the integrity of pressure equipment is not compromised by the presence of sand. Pipeline and riser system will contain associated liquids and gases. Fire and gas detection systems will facilitate prevention and response to fire or gas hazards. Critical blowdown valves will safely depressurise inventories to avoid, or prevent the escalation of a loss of containment. The position of the facility and offtake tanker, and the ability to disconnect when required, will be maintained. Hull stress will be minimised and positive intact stability will be maintained. Structural integrity of topsides, surface structures and substructures will be maintained to ensure availability of critical systems during a major accident or environment event. Relief systems will protect pressurised equipment, equipment exposed to high pressures and piping from a loss of containment.

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.

Source of Risk	Key Potential Environmental Impact	Residual Risk	Controls/Mitigation Measures
			<ul style="list-style-type: none"> • Open hazardous drains will contain leaks and spills of hazardous liquids. • Integrity of pressure vessels, piping systems, heat exchangers and tanks will be maintained to safely contain liquids and gases as per design requirements. • Rotating equipment maintained to safely contain liquids and gasses as per design requirements. • Management of potentially flammable atmospheres either by inert gas blanketing or constant purge. • Navaid and warning lights will alert marine vessels and aircraft of the position of the facility. • Ship Intrusion Detection Systems and equipment will detect and alert facility personnel of a potential collision with the facility and respond to a potential collision with the facility. • Crane lifting operations will be safely performed to minimise potential for dropped objects. • Lifting and lifted equipment will be in a safe and serviceable condition to prevent dropped objects. • Satellite tracking drifter buoy will monitor the movement of significant hydrocarbon spills to sea.

This document is protected by copyright. No part of this document may be reproduced, adapted, transmitted, or stored in any form by any process (electronic or otherwise) without the specific written consent of Woodside. All rights are reserved.