



Nganhurra Floating Production Storage and Offloading Facility Environment Plan Summary

June 2014

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Page 3 of 17

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Page 4 of 17

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TABLE OF CONTENTS

1.	INTRODUCTION.....	7
2.	DESCRIPTION OF THE ACTIVITY	7
2.1	Location of the Activity.....	7
2.2	Timing of the Activity.....	8
2.3	Operational Area	8
2.4	Operational Details.....	9
3.	DESCRIPTION OF THE ENVIRONMENT.....	10
3.1	Physical Environment.....	10
3.2	Biological Environment	10
3.3	Socio-Economic Environment.....	11
4.	MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS.....	13
5.	MANAGEMENT APPROACH	14
6.	CONSULTATION.....	15
7.	CONTACT DETAILS	15

LIST OF FIGURES

Figure 2-1: Location of the Activities 7
Figure 3-1: Established and Proposed Commonwealth and State Marine Protected Areas in relation to the Operational Areas..... 12

LIST OF TABLES

Table 2-1: NY FPSO and associated infrastructure locations 8

1. INTRODUCTION

Woodside Energy Limited (Woodside) is operator of the Nganhurra (NGA) Floating Production Storage and Offloading (FPSO) facility, which has been in production since 2006. The FPSO is located offshore approximately 38 km north of Western Australia's North West Cape, in Production Licence WA-28-L in the Exmouth Sub-basin.

The NGA facility currently produces crude oil from the Enfield area reservoir. Crude oil produced from the reservoir is processed on the FPSO, and the processed stabilised crude oil is then offloaded to offtake tankers direct for export

This Environment Plan 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 Nganhurra Floating Production Storage and Offloading Facility Environment Plan (EP), which was accepted under the Environment Regulations by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) on 5 June 2014.

2. DESCRIPTION OF THE ACTIVITY

2.1 Location of the Activity

The NGA FPSO and sub-sea infrastructure is located in Commonwealth waters in the Exmouth Sub-basin, in Production Licence Area WA-28-L. It is located approximately 38 km north of the North West Cape of Western Australia (**Figure 2-1**). The FPSO is located in approximately 400 m of water.

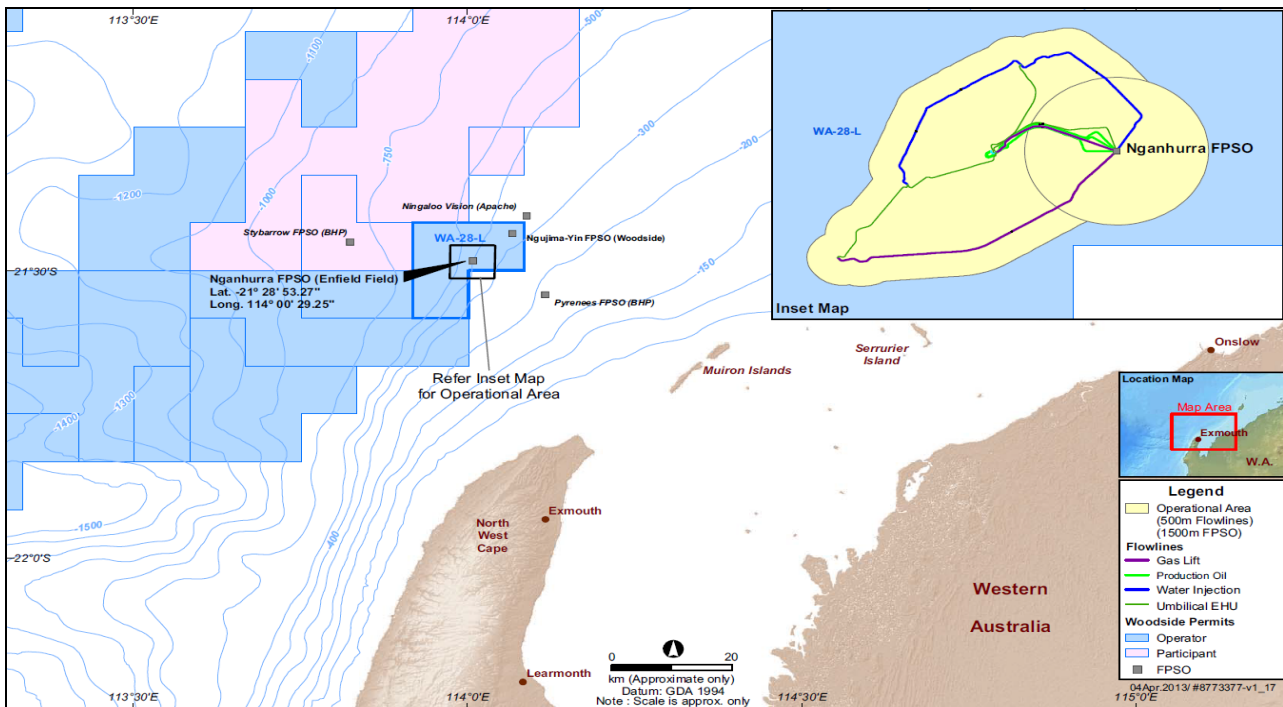


Figure 2-1: Location of the Activities

The coordinates and permit areas of the NGA FPSO facility and associated infrastructure are outlined in **Table 2-1**.

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Table 2-1: NGA FPSO and associated infrastructure locations

Structure	Latitude	Longitude	Title
NGA FPSO	21° 28' 53.268" S	114° 00' 29.249" E	WA-28-L
Production Well ENA01	21° 28' 54.064" S	113° 59' 21.678" E	WA-28-L
Production Well ENA02	21° 28' 53.564" S	113° 59' 21.236" E	WA-28-L
Production Well ENA03	21° 28' 54.289" S	113° 59' 20.402" E	WA-28-L
Production Well ENA04	21° 28' 55.221" S	113° 59' 21.573" E	WA-28-L
Production Well ENA05	21° 28' 54.803" S	113° 59' 21.012" E	WA-28-L
Production Well ENE01	21° 28' 53.335" S	113° 59' 17.083" E	WA-28-L
Production Well ENE02	21° 28' 53.958" S	113° 59' 17.693" E	WA-28-L
Production Well ENE03	21° 28' 52.842" S	113° 59' 17.851" E	WA-28-L
Water Injection Well ENB01	21° 27' 55.752" S	113° 59' 34.297" E	WA-28-L
Water Injection Well ENB02	21° 27' 55.337" S	113° 59' 34.719" E	WA-28-L
Water Injection Well ENB03	21° 27' 56.005" S	113° 59' 35.450" E	WA-28-L
Water Injection Well ENC01	21° 29' 14.814" S	113° 58' 30.698" E	WA-28-L
Water Injection Well ENC02	21° 29' 15.281" S	113° 58' 30.267" E	WA-28-L
Water Injection Well ENC03	21° 29' 15.457" S	113° 58' 31.396" E	WA-28-L
Water Injection Well ENC04	21° 29' 14.920" S	113° 58' 30.020" E	WA-28-L
Water Injection Well ENC05	21° 29' 15.920" S	113° 58' 31.392" E	WA-28-L
Gas Injection Well END01	21° 30' 3.582" S	113° 57' 51.152" E	WA-28-L
Gas Injection Well END02	21° 30' 3.853" S	113° 57' 50.826" E	WA-28-L

2.2 Timing of the Activity

The NGA facility commenced production in 2006. The facility operates 24 hours per day, 365 days per year. Supporting operations, such as maintenance activities, take place as required.

Tie-back opportunities are continuously being reviewed for Woodside's offshore facilities, which have the potential to extend the life of the field. Any future decommissioning or tieback plans will be the subject of a separate EP.

2.3 Operational Area

The Operational Area applicable to the scope of the NGA FPSO EP is shown in **Figure 2-1**. The area includes:

- The NGA FPSO and the area within a 500 m exclusion zone around the facility and extending out to 1,500 m, to allow for offtake activities; and
- The NGA FPSO subsea infrastructure, including wells and flowlines, and an area within 500 m around the infrastructure.

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

2.4 Operational Details

Normal operations fall under any one of the following modes of operation:

- production and maintenance;
- production and major projects; and
- FPSO Marine (Disconnected) Mode.

The NGA FPSO is designed to process crude oil for exports oil via offloading to offtake tankers. The first stage of processing is separation of the well fluids in two High Pressure separators. The fluids are then further separated in the Low Pressure separator/degasser and subsequently the electrostatic coalescer to achieve crude oil export specifications. The crude is then cooled and stored in the FPSO oil storage tanks for export.

Additional operational activities in relation to the Environment Plan include:

- Operational and emergency flaring and re-injection of surplus gas back into the reservoir; and
- Re-injection (primary method of disposal) or treatment and discharge of Produced Formation Water (PFW).

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

- Utility systems such as lighting, heating, ventilation and air conditioning, seawater treatment for cooling water and potable water and power generation;
- Collection, treatment and disposal of sewage and putrescible wastes;
- Lifting operations;
- Transfer of supplies from vessels including food, equipment and fuel;
- 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 NGA FPSO is located in Permit Area WA-28-L, in a water depth of approximately 400 m. It is located approximately 38 km north of Western Australia's North West Cape and approximately 20 km from the Commonwealth boundary of the Ningaloo Reef Marine Reserve. The offshore waters of this area are classified as the North West Province (NWP), which is a bioregion within the broader North West Marine Region (NWMR).

3.1 Physical Environment

The climate in the region is dry tropical, including hot dry summers and mild winters. Transition periods between summer and winter are characterised by relatively low winds. Cyclonic events may be experienced during summer periods, with cyclones originating closer to the equator and potentially moving through the region.

Water circulation in the NWMR is dominated by the south flowing Leeuwin Current, which originates in Indonesia and flows along the edge of the continental shelf at speeds of up to 0.3 m/s, bringing warm water down the coast. The flow of the Leeuwin Current is strongest in the winter months. The Ningaloo Current flows in the opposite direction to the Leeuwin Current and closer to shore.

The WA-28-L licence area is sited in an area of complex bathymetry, bounded to the south by the generally east/west oriented Enfield Canyon and divided through the middle by the generally north/south running Enfield Escarpment. Swathe bathymetry of Permit Area WA-28-L indicates that the area of the NGA FPSO Operational Area consists of a relatively flat and featureless seabed with depths ranging from approximately 250 m to 550 m.

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 NGA FPSO Operational Area. Critical life stage activities for a number of EPBC Act Listed Species (for example turtle nesting) occur in the wider region, outside of the Operational Area.

Benthic habitats of the North West Province comprise of predominantly bare, unconsolidated, muddy substrates (Baker et al. 2008). This habitat is broadly represented in the region and typically hosts a sparse assemblage of filter and deposit-feeding epibenthic fauna (Woodside 2005).

The Commonwealth Protected Matters database includes a total of 20 listed marine species that may occur within or traverse the NGA FPSO Operational Area. Of these, 10 are threatened marine species and 16 migratory species.

Twenty-three cetacean species may occur within the NGA FPSO Operational Area with seven categorised as threatened and/or migratory. The endangered blue whale, southern right whale and the vulnerable humpback whale are three species that seasonally migrate through the NGA FPSO Operational Area. Other cetacean species are likely to occur at low densities and may transverse the vicinity of the Operational Area infrequently throughout the year.

Five marine turtle species are recorded for the region and may occur in the NGA FPSO Operational Area and adjacent waters, however the deepwater environment does not support any critical habitats (including breeding, nesting or foraging habitats).

3.3 Socio-Economic Environment

There are no known sites of Indigenous or European cultural or heritage significance within the vicinity of the Operational Area.

Tourism is one of the major industries of the region and contributes significantly to the local economy in terms of both income and employment. The main marine nature-based tourist activities are snorkelling and scuba diving, whale shark encounters, manta ray encounters, whale watching and turtle nesting (Shire of Exmouth and Information on Ningaloo, located at <http://ningaloo.org/>).

The Operational Area is located within an area of established oil and gas operations. The closest oil and gas operation, the Ngujima-Yin FPSO operated by Woodside, is 10 km to the North East.

The Operational Areas are located within/adjacent to five Commonwealth and four State fisheries.

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

The Program Area is not located within any designated Defence practice areas.

There are no sensitive marine environments within the Operational Areas. The closest sensitivity is the boundary of the Ningaloo Commonwealth Marine Reserve (**Figure 3-1**).

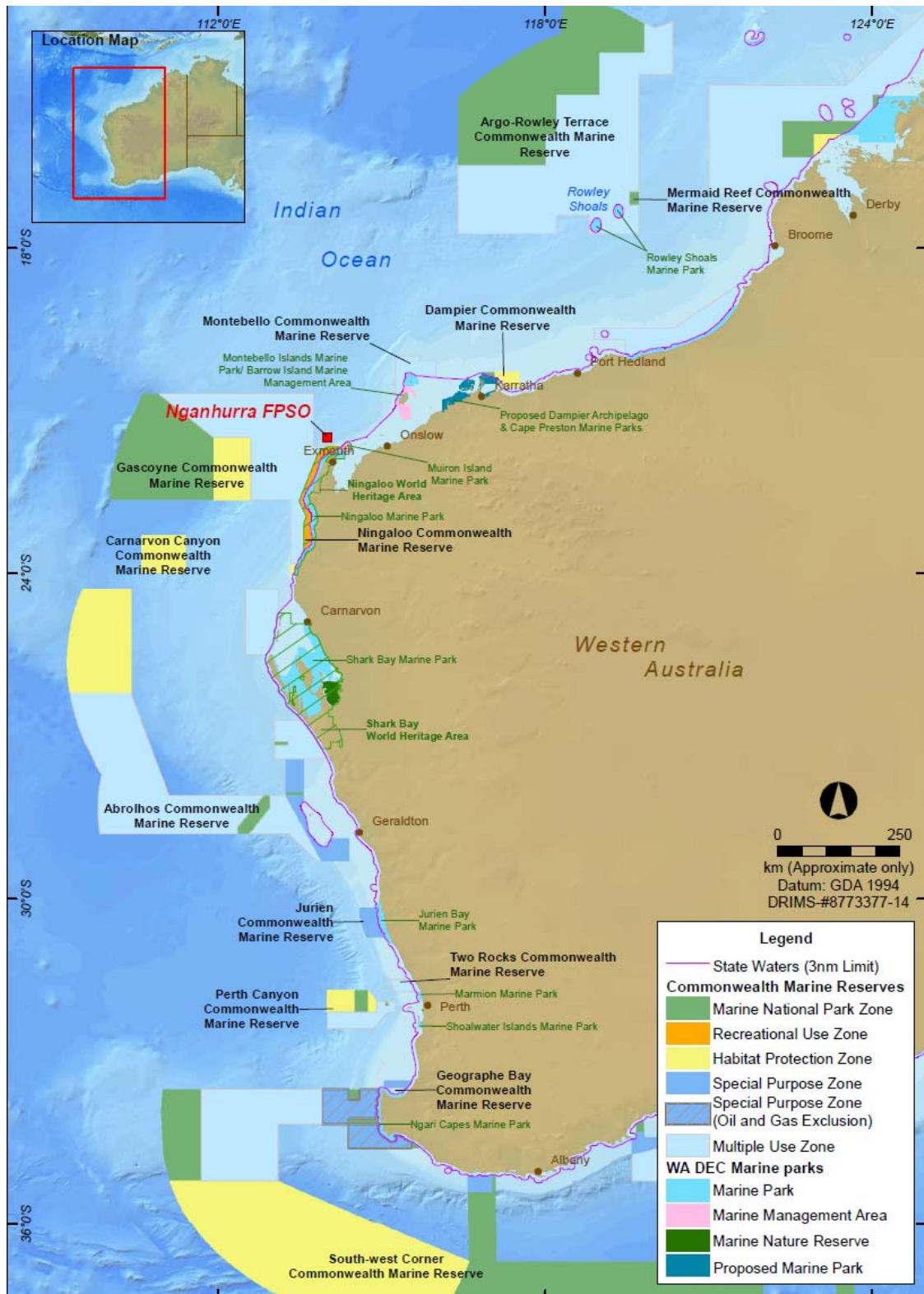


Figure 3-1: Established and Proposed Commonwealth and State Marine Protected Areas in relation to the Operational Areas.

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4. MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

Woodside undertook an environmental risk assessment to understand the potential environmental risks associated with the NGA FPSO to ensure they are reduced to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level using a method consistent with Woodside standards.

The environmental risk assessment for the NGA 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.

4.1.1 Planned (Routine and Non-Routine) Activities

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

- Physical presence of the FPSO generating light and noise emissions;
- Routine atmospheric emissions from gas flaring and fuel combustion;
- Routine discharges to the marine environment, including cooling water and PFW (when re-injection is unavailable); and
- Storage, handling and disposal of waste.

Generally, the sources of risk from planned activities present a lower environmental consequence compared to the potential impact from unplanned accident or incident events. However, as these sources of risk related to planned activities which occur routinely or more frequently, the EP contains a variety of mitigation and control measures which ensure potential impacts and risks will be reduced to ALARP and will be of an acceptable level.

For example, potential environmental impacts from the routine discharge of PFW (when re-injection is not possible) is managed by various controls, including;

- The oil in water content of PFW is continuously measured prior to discharge to ensure it is less than 30mg/l over a 24 hour period;
- The total volume of PFW reinjected and the amount discharged to ocean when re-injection is not possible is measured;
- Environmental toxicity of the PFW is measured on a regular basis, along with a field monitoring program to be conducted in 2014, to ensure potential impacts are acceptable; and
- The implementation of a Marine Discharges Adaptive Management Plan which includes triggers for additional assessments or monitoring should changes to discharge characteristics occur.

4.1.2 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.

The risk assessment for the NGA FPSO identified that of these unplanned activities, there are eight which would be considered a Major Environment Event (MEE). 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.

Due to the potential consequence of a MEE a further level of rigour is applied to the assessment, including analysis using the 'Bowtie Technique'. This process 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 NGA facility are:

- Hydrocarbon release caused by a well loss of containment;
- Hydrocarbon release caused by a subsea loss of containment;
- Hydrocarbon release caused by a topsides loss of containment;
- Hydrocarbon release caused by an 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 the MEEs identified for the NGA FPSO is presented in **Appendix A**.

5. MANAGEMENT APPROACH

Operation of the NGA facility will be managed in compliance with the *Nganhurra Floating Production Storage and Offloading Facility 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 NGA facility, during both routine and non-routine operations, are identified, and will be reduced to ALARP and will be of an acceptable level.

The NGA EP details for each environmental aspect (identified and assessed in the Environmental Risk Assessment – *Section 5 of the EP*) specific performance objectives and standards and control/mitigation measures (controls for MEE's summarised in **Appendix A**) to be implemented and measurement criteria to demonstrate performance objectives are achieved.

The implementation strategy detailed in the *Nganhurra Floating Production Storage and Offloading Facility 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 details the types of monitoring and auditing that will be undertaken, the reporting requirements for environmental incidents and reporting on overall compliance of the activities with the EP.

6. CONSULTATION

Woodside conducted a stakeholder assessment for the proposed activity to identify relevant and interested stakeholders based on the location, proposed activities and timing.

A consultation fact sheet was sent electronically to all identified stakeholders prior to lodgement of the EP with NOPSEMA for assessment and acceptance. This advice was supported by engagement with potentially affected stakeholders.

Woodside received feedback on the proposed activity from a range of stakeholders, including government agencies and commercial fishing organisations. Issues of interest or concern included the location of the proposed activities across commercial fishing areas.

Woodside considered this feedback in its development of management measures specific to the activities.

Woodside will continue to accept feedback from stakeholders during the activity.

7. CONTACT DETAILS

For further information about this activity, please contact:

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APPENDIX A: Key environmental hazards and control measures for the Major Environment Events (MEE) identified for the NGA Facility

Source of Risk (Hazard)	Potential Environmental Impact	Control / Mitigation Measures
<ul style="list-style-type: none"> • Hydrocarbon release caused by a well loss of containment; • Hydrocarbon release caused by a subsea loss of containment; • Hydrocarbon release caused by a topsides loss of containment; • Hydrocarbon release caused by an 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; • Hydrocarbon release caused by loss of control of suspended load. 	<p>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.</p>	<p>Many of the critical barriers in place to prevent a MEE from occurring are relevant across all MEEs identified for the NGA facility, a summary of which is provided below:</p> <ul style="list-style-type: none"> • Critical communication systems will facilitate prevention and response to accidents and emergencies. • Satellite tracking drifter buoy will monitor the movement of significant hydrocarbon spills to sea. • 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. • Relief systems will protect pressurised equipment, equipment exposed to high pressures and piping from a loss of containment. • Pipeline and riser system will contain associated liquids and gases. • The position of the facility and offtake tanker, and the ability to disconnect when required, will be maintained. • 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. • Facility drain systems will contain leaks and spills of hazardous liquids. • Integrity of pressure vessels will be maintained to safely contain liquids and gases as per design requirements. • Integrity of heat exchangers will be maintained to safely contain liquids and gases as per design requirements. • Structural integrity of topsides, surface structures and substructures will be maintained to ensure availability of critical systems during a major accident or environment event. • Hull stress will be minimised and positive intact stability will be maintained.

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Source of Risk (Hazard)	Potential Environmental Impact	Control / Mitigation Measures
		<ul style="list-style-type: none"> • Integrity of tanks will be maintained to safely contain liquids and gases as per design requirements. • Management of potentially flammable atmospheres either by inert gas blanketing or constant purge. • Maintain systems to ensure the facility's manoeuvrability under self propulsion. • Nav aids 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. • Rotating equipment maintained to safely contain liquids and gasses as per design requirements. • Corrosion inhibitor injection systems will prevent internal damage to equipment, piping and pipelines. <p>Oil Spill Response Framework</p> <p>Woodside maintains a detailed spill response framework to be implemented in the event of a major hydrocarbon spill incident. This framework includes the Woodside Corporate Oil Spill Contingency Plan, which is supported by Exmouth Regional Oil Spill Response Plan and NGA Activity First Strike Plan.</p> <p>The purpose of the Corporate Oil Spill Contingency Plan is to demonstrate Woodside's ability to competently respond to an oil spill. The plan is also used to support assessment of the NGA Facility EP.</p> <p>The Exmouth Regional Oil Spill Response Plan supports the Corporate Oil Spill Plan, and provides a concise outline of Woodside's proposed operational response strategies for hydrocarbon spills to the marine environment. The NGA Activity First Strike Plan outlines specific guidance for immediately responding to a spill from the NGA FPSO.</p>

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