Scarborough Drilling and Completions Environment Plan

November 2021

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1. INTRODUCTION

1.1 Overview

The Scarborough gas resource, located in Commonwealth waters approximately 375 km west-northwest of the Burrup Peninsula, forms part of the Greater Scarborough gas fields, comprising the Scarborough, North Scarborough, Thebe and Jupiter gas fields (**Figure 3-1**). Woodside Energy Scarborough Pty Ltd (Woodside), as Titleholder under the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth) (referred to as the Environment Regulations), proposes to undertake the following petroleum activities within Permit Area WA-61-L:

- drilling and development of eight to ten production wells
- Inspection, Monitoring, Maintenance and Repair (IMMR) activities for installed infrastructure.

These activities will hereafter be referred to as the Petroleum Activities Program and form the scope of this Environment Plan (EP).

This EP has been prepared by Woodside as part of the requirements under the Environment Regulations, as administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

The Petroleum Activities Program as defined in this EP is a part of the Scarborough Offshore Project Proposal (OPP) accepted by NOPSEMA on 30th March 2020.

1.2 Defining the Petroleum Activity

The Petroleum Activities Program to be undertaken within Permit Area WA-61-L comprises petroleum activities, drilling and completions, as defined in Regulation 4 of the Environment Regulations.

1.3 Purpose of the Environment Plan

In accordance with the objectives of the Environment Regulations, the purpose of this EP is to demonstrate that:

- the potential environmental impacts and risks (planned (routine and non-routine) and unplanned) that may result from the Petroleum Activities Program are identified;
- appropriate management controls are implemented to reduce impacts and risks to a level that is 'as low as reasonably practicable' (ALARP) and acceptable; and
- the Petroleum Activities Program is performed in a manner consistent with the principles of ecologically sustainable development (as defined in Section 3A of the *Environment Protection and Biodiversity Conservation Act, 1999* (Cth) (EPBC Act)).

This EP describes the process and resulting outputs of the risk assessment, whereby impacts and risks are managed accordingly.

The EP defines activity-specific Environmental Performance Outcomes (EPOs), environmental performance standards (EPSs) and measurement criteria (MCs). These form the basis for monitoring, auditing and management of the Petroleum Activities Program to be undertaken by Woodside and its contractors. The implementation strategy (derived from the decision support framework tools) specified within this EP provides Woodside and NOPSEMA with the required level of assurance that impacts, and risks associated with the activity are reduced to ALARP and are acceptable.

1.4 Scope of the Environment Plan

The scope of this EP covers the activities that define the Petroleum Activities Program, as described in **Section 3**. The spatial boundary of the Petroleum Activities Program has been described and assessed using two 'areas', the Operational Area and the Permit Area. The combination of the Operational Area and Permit Area defines the spatial boundary of the Petroleum Activities Program, as described, risk-assessed and managed by this EP.

This EP addresses potential environmental impacts from planned activities within the Operational Area and any potential unplanned events that originate from the activity within the Operational Area.

Transit to and from the Operational Area by MODU, installation vessels and support vessels as well as port activities associated with these vessels, are not within the scope of this EP. Vessels supporting the petroleum activities operating outside the Operational Area (e.g. transiting to and from port) are subject to all applicable maritime regulations and other requirements and are not managed by this EP.

1.5 Environment Plan Summary

An EP summary will be prepared based on the material provided in this EP, addressing the items listed in **Table 1-1** as required by Regulation 11(4).

Table 1-1: EP Summary

EP Summary material requirement	Relevant section of EP containing EP Summary material
The location of the activity	**Section 3.4**
A description of the receiving environment	**Section 4**
A description of the activity	**Section 3**
Details of the environmental impacts and risks	**Section 6**
The control measures for the activity	**Section 6.3**
The arrangements for ongoing monitoring of the titleholder's environmental performance	**Section 6**
Response arrangements in the oil pollution emergency plan	**Section 7.9**
Consultation already undertaken and plans for ongoing consultation	**Section 5**
Details of the titleholders nominated liaison person for the activity	**Section 1.8**

1.6 Structure of the Environment Plan

This EP has been structured to reflect the process and requirements of the Environment Regulations as outlined in **Table 1-2**.

Table 1-2: EP process phases, applicable regulations and relevant section of EP

Criteria for acceptance	Content requirements/relevant regulations	Elements	Section of EP
Regulation 10A(a): *Is appropriate for the nature and scale of the activity*	Regulation 13: *Environmental assessment* Regulation 14: *Implementation strategy for the environment plan* Regulation 16: *Other information in the environment plan*	The principle of 'nature and scale' is applicable throughout the EP.	**Section 2** **Section 3** **Section 4** **Section 54.9** **Section 6** **Section 7**
Regulation 10A(b): *Demonstrates that the environmental impacts and risks of the activity will be reduced to as low as reasonably practicable* Regulation 10A(c): *Demonstrates that the environmental impacts and risks of the activity will be of an acceptable level*	Regulation 13(1)–13(7): *13(1) Description of the activity* *13(2)(3) Description of the environment* *13(4) Requirements* *13(5)(6) Evaluation of environmental impacts and risks* *13(7) Environmental Performance Outcomes and standards* *Regulation 16(a) to 16(c):* *A statement of the titleholder's corporate environmental policy* *A report on all consultations between the titleholder and any relevant person*	Set the context (activity and existing environment). Define 'acceptable' (the requirements, the corporate policy, relevant persons). Detail the impacts and risks. Evaluate the nature and scale. Detail the control measures – ALARP and acceptable.	**Section 1** **Section 2** **Section 3** **Section 4** **Section 5** **Section 6** **Section 7**
Regulation 10A(d): *Provides for appropriate Environmental Performance Outcomes, environmental performance standards and measurement criteria*	Regulation 13(7): *Environmental Performance Outcomes and standards*	Environmental Performance Outcomes (EPO). Environmental performance standards (EPS). Measurement criteria (MC).	**Section 6**
Regulation 10A(e): *Includes an appropriate implementation strategy and monitoring, recording and reporting arrangements*	Regulation 14: *Implementation strategy for the environment plan*	Implementation strategy, including: • Environmental Management System (EMS) • Performance monitoring • Oil Pollution Emergency Plan (OPEP – per **Table 7-4**) and scientific monitoring • Ongoing consultation	**Section 7** **Appendix D**

Criteria for acceptance	Content requirements/relevant regulations	Elements	Section of EP
Regulation 10A(f): *Does not involve the activity or part of the activity, other than arrangements for environmental monitoring or for responding to an emergency, being undertaken in any part of a declared World Heritage property within the meaning of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)*	Regulation 13(1)–13(3): *13(1) Description of the activity* *13(2) Description of the environment* *13(3) Without limiting [Regulation 13(2)(b)], relevant values and sensitivities may include any of the following:* *(a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act;* *(b) the national heritage values of a National Heritage place within the meaning of that Act;* *(c) the ecological character of a declared Ramsar wetland within the meaning of that Act;* *(d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act;* *(e) the presence of a listed migratory species within the meaning of that Act;* *(f) any values and sensitivities that exist in, or in relation to, part or all of:* *(i) a Commonwealth marine area within the meaning of that Act; or* *(ii) Commonwealth land within the meaning of that Act.*	No activity, or part of the activity, undertaken in any part of a declared World Heritage property.	**Section 3** **Section 4** **Section 6**
Regulation 10A(g): *(i) the titleholder has carried out the consultations required by Division 2.2A* *(ii) the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate*	Regulation 11A: *Consultation with relevant authorities, persons and organisations, etc.* *Regulation 16(b):* *A report on all consultations between the titleholder and any relevant person*	Consultation undertaken in the preparation of this EP.	**Section 5**
Regulation 10A(h): *Complies with the Act and the regulations*	Regulation 13(4)a: *Describe the requirements, including legislative requirements, that apply to activity and are relevant to the environmental management of the activity* *Regulation 15:* *Details of the Titleholder and liaison person* *Regulation 16(a):* *A statement of the titleholder's corporate environmental policy* *Regulation 16(c):* *Details of all reportable incidents in relation to the proposed activity*	All contents of the EP must comply with the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and the Environment Regulations	**Section 1.6** **Section 1.7** **Section 1.8** **Section 6.7**

1.7 Description of the Titleholder

Woodside is Operator of the various joint ventures relating to the Scarborough Project, which comprises the Scarborough, North Scarborough, Thebe and Jupiter fields. The joint ventures comprise both Woodside and BHP Petroleum (Australia) Pty Ltd.

Woodside is the largest Australian natural gas producer. The company operates Australia's biggest resource development, the North West Shelf Project (NWS Project) in Western Australia.

The Woodside-operated producing LNG assets in the north-west of Australia are among the world's best facilities. The NWS Project has been operating for 35 years delivering one-third of Australia's oil and gas production from one of the world's largest LNG facilities. Pluto LNG also forms part of Woodside's outstanding base business, and since commissioning in 2012, has delivered over 500 LNG cargoes.

Woodside recognises that strong environmental performance is essential to success and continued growth. Woodside has an established methodology to identify impacts and risks and assess potential consequences of activities. Strong partnerships, sound research and transparency are the key elements of Woodside's approach to the environment.

1.8 Details of Titleholder, Liaison Person and Public Affairs Contact

In accordance with Regulation 15 of the Environment Regulations, details of the titleholders, liaison person and arrangements for the notification of changes are described below.

1.8.1 Titleholders

Woodside Energy Scarborough Pty Ltd:
11 Mount Street, Perth, Western Australia
Telephone: 08 9348 4000
Fax Number: 08 9214 2777
ABN: 650 177 227

1.8.2 Nominated Liaison Person

Ryan Felton
Senior Corporate Affairs Advisor
11 Mount Street, Perth, Western Australia
Phone: 08 9348 4000
Fax Number: 08 9214 2777
feedback@woodside.com.au

1.8.3 Arrangements for Notifying of Change

Should the titleholder, titleholder's nominated liaison person or the contact details for either change, then NOPSEMA is to be notified of the change in writing within two weeks or as soon as practicable.

1.9 Woodside Management System

The Woodside Management System (WMS) provides a structured framework of documentation to set common expectations governing how all employees and contractors at Woodside will work. Many of the standards presented in **Section 6** are drawn from the WMS documentation, which comprises of four elements: Compass and Policies, Expectations, Processes and Procedures, and Guidelines, outlined below (and illustrated in **Figure 1-1**):

- **Compass and Policies:** Set the enterprise-wide direction for Woodside by governing our behaviours, actions and business decisions and ensuring we meet our legal and other external obligations.

- **Expectations:** Set essential activities or deliverables required to achieve the objectives of the Key Business Activities and provide the basis for development of processes and procedures.
- **Processes and Procedures:** Processes identify the set of interrelated or interacting activities which transforms inputs into outputs, to systematically achieve a purpose or specific objective. Procedures specify what steps, by whom and when are required to carry out an activity or a process.
- **Guidelines:** Provide recommended practice and advice on how to perform the steps defined in Procedures, together with supporting information and associated tools. Guidelines provide advice on: how activities or tasks may be performed; information that may be taken into consideration; or, how to use tools and systems.

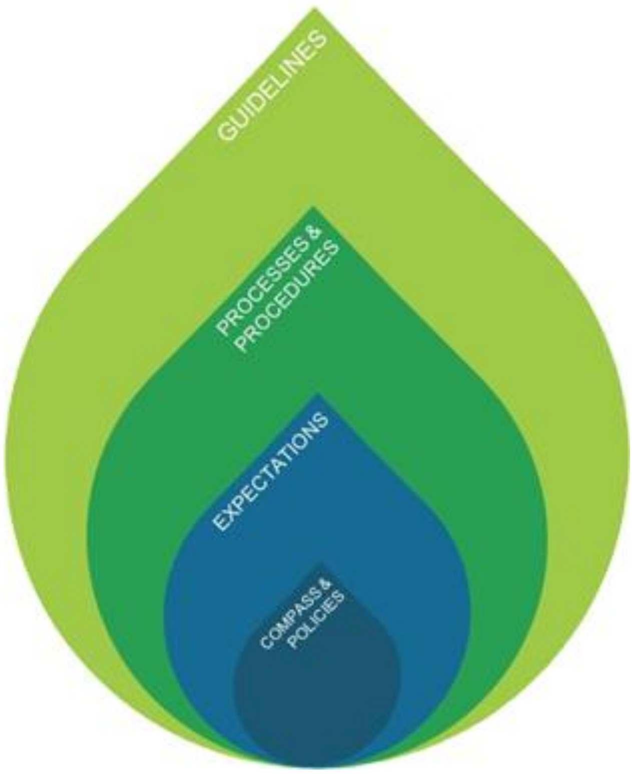


Figure 1-1: The four major elements of the WMS framework

The WMS is organised within a business process hierarchy based upon key business activities to ensure the system remains independent of organisation structure, is globally applicable and scalable wherever required. These business activities are grouped into management, support and value stream activities as shown in **Figure 1-2**. The value stream activities capture, generate and deliver value−through the exploration and production (E and P) lifecycle. The management activities influence all areas of the business, while support activities may influence one or more value stream activities.

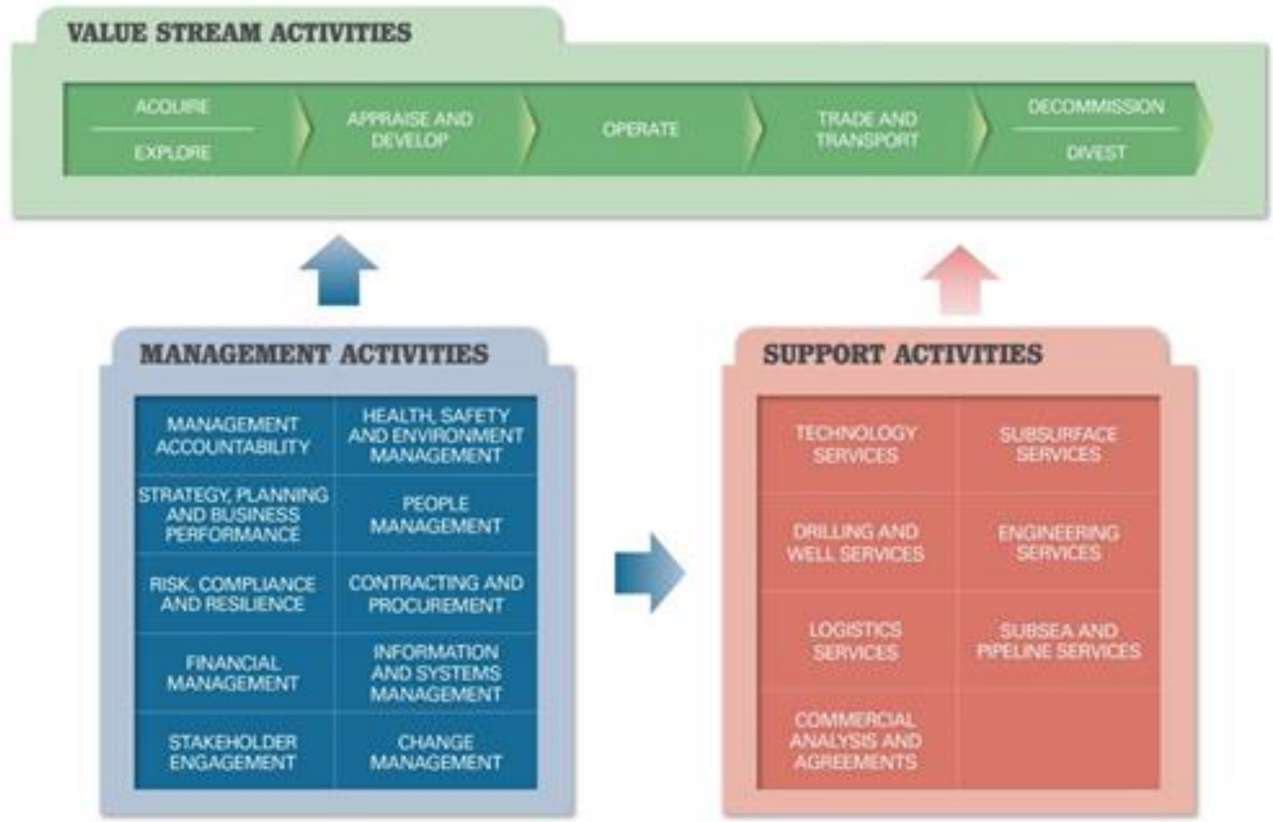


Figure 1-2: The WMS business process hierarchy

1.9.1 Health, Safety, Environment and Quality Policy

In accordance with Regulation 16(a) of the Environment Regulations, Woodside's Corporate Health Safety, Environment and Quality Policy is provided in **Appendix A** of this EP.

1.10 Description of Relevant Requirements

In accordance with Regulation 13(4) of the Environment Regulations, a description of requirements, including legislative requirements, that apply to the activity and relevant to the management of risks and impacts of the Petroleum Activities Program are detailed in **Appendix B.**

1.10.1 Offshore Petroleum and Greenhouse Gas Storage Act 2006

The Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) provides the regulatory framework for all offshore petroleum exploration and production and greenhouse gas activities in Commonwealth waters (the ocean area beyond three nautical miles to the outer extent of the Australian Exclusive Economic Zone at 200 nautical miles).

The Act manages all offshore petroleum activities, including decommissioning, under Section 572 and 270. While there are no immediate plans for decommissioning (the scope of this EP is for drilling production wells for future operations) all equipment being installed above the mudline has been designed to allow removal. Subsection 572(2) provides that while structures, equipment and other property remain in the title area, they must be maintained in good condition and repair. Inspection, maintenance and repair of the infrastructure installed for future production, under this Environment Plan, will be managed as described in **Section 3.9**.

The regulatory framework establishes the National Offshore Petroleum Safety and Environment Management Authority as the regulator. Under the OPGGS Act, the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations* 2009 (the Environment Regulations), apply to petroleum activities in Commonwealth waters and are administered by NOPSEMA. The objective of the Environment Regulations is to ensure petroleum activities are:

- consistent with the principles of ecologically sustainable development (as set out in the EPBC Act)
- by which the environmental impacts and risks of the activity will be reduced to ALARP
- by which the environmental impacts and risks of the activity will be of an acceptable level.

1.10.2 Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

One of the objectives of the EPBC Act is to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places in Australia. These are defined under Part 3 of the Act as "Matters of National Environmental Significance" (MNES). The EPBC Act sets a regime which aims to ensure actions taken on (or impacting upon) Commonwealth land or waters are consistent with the principles of ecological sustainable development. When a person proposes to take an action that they believe may need approval under the EPBC Act, they must refer the proposal to the Commonwealth Minister for Environment.

In relation to offshore petroleum activities in Commonwealth waters, in accordance with the "Streamlining Offshore Petroleum Approvals Program" (the Program), requirements under the EPBC Act are now administered by NOPSEMA, commencing February 2014. The Program requires any offshore petroleum activities, authorised by the OPGGS Act to be conducted in accordance with an accepted EP. The definition of 'environment' in the Program covers all matters protected under Part 3 of the EPBC Act.

1.10.2.1 Offshore Project Proposal

Woodside submitted the Scarborough OPP to NOPSEMA for assessment in February 2019 and received approval in March 2020. In accordance with Regulation 31 of the Environment Regulations, references to the Scarborough OPP have been made throughout this EP. The approved OPP is available on the NOPSEMA website: Scarborough Offshore Project Proposal » NOPSEMA.

The Scarborough OPP sets environmental performance outcomes (EPOs) for the project and this Petroleum Activity Program, where relevant. EPOs set the level of performance to be achieved, to ensure that environmental impacts and risks will be of an acceptable level and the project is consistent with the principles of ecologically sustainable development.

1.10.2.2 Recovery Plans and Threat Abatement Plans

Under s139(1)(b) of the EPBC Act, the Environment Minister must not act inconsistently with a recovery plan for a listed threatened species or ecological community or a threat abatement plan for a species or community protected under the Act. Similarly, under s268 of the EPBC Act:

"A Commonwealth agency must not take any action that contravenes a recovery plan or a threat abatement plan."

In respect to offshore petroleum activities in Commonwealth waters, these requirements are implemented by NOPSEMA via the commitments included in the Program. Commitments relating to listed threatened species and ecological communities under the Act are included in the Program Report (Commonwealth of Australia, 2014).

1.10.2.3 Australian Marine Parks

Under the EPBC Act, Australian Marine Parks (AMPs), formally known as Commonwealth Marine Reserves, are recognised for conserving marine habitats and the species that live and rely on these habitats. The Director of Marine Parks (DNP) is responsible for managing AMP's (supported by Parks Australia), and is required to publish management plans for them. Other parts of the Australian

Government must not perform functions or exercise powers in relation to these parks that are inconsistent with management plans (s.362 of the EPBC Act). Relevant AMPs are identified in **Section 4.8** and described in **Appendix I.** The North-west Marine Parks Network Management Plan (DNP, 2018a) describe the requirements for managing the marine parks that are relevant to this EP.

Specific zones within the AMPs have been allocated conservation objectives as stated below (International Union for Conservation of Nature (IUCN) Protected Area Category) based on the Australian IUCN reserve management principles outlined in Schedule 8 of the EPBC Regulations 2000:

- Special Purpose Zone (IUCN category VI)—managed to allow specific activities though special purpose management arrangements while conserving ecosystems, habitats and native species. The zone allows or prohibits specific activities.
- Sanctuary Zone (IUCN category Ia)—managed to conserve ecosystems, habitats and native species in as natural and undisturbed a state as possible. The zone allows only authorized scientific research and monitoring.
- National Park Zone (IUCN category II)—managed to protect and conserve ecosystems, habitats and native species in as natural a state as possible. The zone only allows nonextractive activities unless authorised for research and monitoring.
- Recreational Use Zone (IUCN category IV)—managed to allow recreational use, while conserving ecosystems, habitats and native species in as natural a state as possible. The zone allows for recreational fishing, but not commercial fishing.
- Habitat Protection Zone (IUCN category IV)—managed to allow activities that do not harm or cause destruction to seafloor habitats, while conserving ecosystems, habitats and native species in as natural a state as possible.
- Multiple Use Zone (IUCN category VI)—managed to allow ecologically sustainable use while conserving ecosystems, habitats and native species. The zone allows for a range of sustainable uses, including commercial fishing and mining where they are consistent with park values.

2. ENVIRONMENT PLAN PROCESS

2.1 Overview

This section outlines the process Woodside follows to prepare the EP once an activity has been defined as a petroleum activity. The process (**Section 2.2**) describes the environmental risk assessment methodology that is used to identify, analyse and evaluate risks to meet ALARP and acceptability requirements and to develop EPOs and EPSs. This section also describes Woodside's risk management methodologies applicable to implementation strategies applied during the activity.

Regulation 13(5) of the Environment Regulations requires the detailing of environmental impacts and risks, and evaluation appropriate to the nature and scale of each impact and risk associated with the Petroleum Activities Program. The objective of the risk assessment process, described in this section, is to identify risks and associated impacts of an activity, so that they can be assessed, and appropriate control measures applied to eliminate, control or mitigate the impact/risk to ALARP and determine if the impact or risk level is acceptable.

Environmental impacts and risks assessed include those directly and indirectly associated with the Petroleum Activities Program and includes potential emergency and accidental events.

Planned activities (routine and non-routine) have the potential for inherent environmental impacts. An environmental risk is an unplanned event with the potential for impact (termed risk 'consequence').

Herein, the potential result of planned activities are termed 'impacts', where-as 'risks' are associated with unplanned events with the potential for impact (should the risk be realised); with such potential impacts termed 'consequence'.

2.2 Environmental Risk Management Methodology

An assessment of the impacts and risks associated with the Petroleum Activities Program has been undertaken in accordance with Woodside's Environment Impact Assessment Guideline and Risk Management Procedure. This guideline and procedure set out the broad principles and high-level steps for assessing environmental impacts across the lifecycle of Woodside's activities and managing these during project execution.

The key steps of the Woodside impact and risk management process are comprised of the:

- environmental impact and risk assessment
- communication and consultation that informs the assessment and ongoing environmental performance of the activity
- steps required during implementation of the activity including to monitor, review and report.

2.2.1 Establish the Context

Context is established by considering the proposed activities associated with a Petroleum Activities Program, and the environment in which the activities are planned to take place.

Describing the activity involves the evaluation of whether the activity meets the definition of a "petroleum activity" as defined in the Environment Regulations. The activity is then described in relation to the location, what is to be undertaken and how - this allows for the identification of environmental **aspects** for each activity.

2.2.2 Review of the Significance/Sensitivity of Receptors and Levels of Protection

Sensitivity of receptors relevant to the Scarborough Project, and this Petroleum Activities Program, was determined during development of the Scarborough OPP. As set out within the OPP, the sensitivity of all project receptors, was determined to be either low, medium or high based on qualitative expert judgement.

During development of this EP, OPP receptor sensitivity determinations were reviewed in the context of any changing legislation or changed knowledge regarding the sensitivity of each receptor. No relevant factors that would change receptor sensitivity (from that determined in the OPP) were identified. Receptor sensitivity determinations from the OPP are used in the risk impact assessment summaries for each environmental risk assessment (refer to **Section 6**).

2.2.3 Environmental Legislation and Other Requirements

In preparing this EP, Woodside has ensured the proposed controls and impact and risk levels are consistent with national and international standards, law and policies (including applicable plans for management and conservation advices, and significant impact guidelines for MNES).

This has included developing the project in accordance with all applicable legislation as identified in **Section 1.10**, and ensuring the requirements of the species recovery plans and conservation advices have been considered to identify any requirements that may be applicable to the risk assessment.

2.2.4 Impact and Risk Identification

Terminology used for this impact and risk assessment has been taken from the impact and risk management process, which is aligned with ISO 13001:2018 and the requirements of Part 2 (regulations 6 to 25A) of the OPPGS Regulations.

Impacts and risks of the Scarborough Project were identified in the scoping phase of the Scarborough Project (and presented within the OPP). During this phase, the relationships between the environmental aspects identified for the proposed activities and the associated potential impacts and risks for each receptor are established. This EP considers relevant impacts and risks associated with the Scarborough Project's Drilling and Completions Campaign.

Using the OPP as a guide, all impacts and risks associated with the Petroleum Activities Program for this EP were identified during the EP scoping phase by undertaking an Environmental Risk and Impact Identification (ENVID) workshop. Impacts, risks and potential consequences were identified based on planned and potential interaction with the activity (based on the description in **Section 3**), the existing environment (**Section 4**) and the outcomes of Woodside's stakeholder engagement process (**Section 5**). The ENVID workshop was undertaken by a multidisciplinary team comprising personnel with sufficient breadth of knowledge, training and experience to reasonably assure that the hazards that may arise in connection with the Petroleum Activity Program in this EP were identified.

Impacts and risks were identified during the ENVID for both planned (routine and non-routine) activities and unplanned (accidents/incidents/emergency conditions) events. During this process, risks identified as not applicable (not credible) were removed from the assessment.

2.3 Impact and Risk Analysis and Evaluation

After identifying impacts and risks, analysis and evaluation is undertaken to determine the extent of the impacts and risks, whether they are acceptable or not, and to identify any impact and risk treatment (or controls) to be implemented.

Impact and risk evaluation are undertaken by assessing the magnitude (i.e. no lasting effect, slight, minor, moderate, major or catastrophic) of the credible environmental impacts from each aspect based on extent, duration, frequency and scale, and then either:

- assigning an impact significance level to each credible environmental impact based on the receptor sensitivity and the magnitude of the impact, OR

- assigning an environmental risk level to each environmental risk based on the receptor sensitivity, magnitude of the consequence, and the likelihood of occurrence.

2.3.1 Impact Evaluation

Impact assessment determines the impact significance of the potential impacts, based on the magnitude and the receptor sensitivity (**Figure 2-1**).

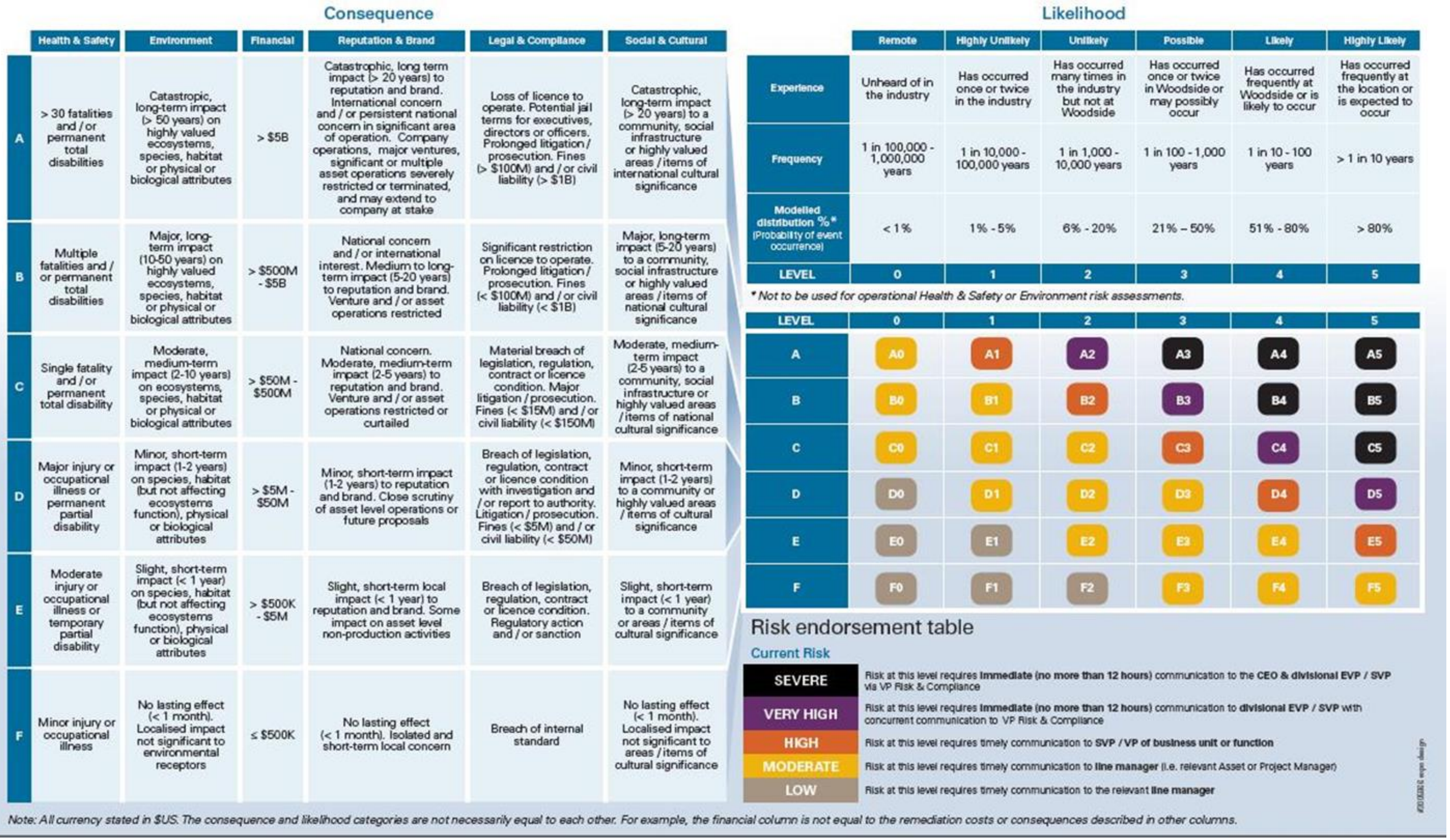
	Receptor Sensitivity		
Magnitude	Low	Medium	High
Catastrophic	B	A	A
Major	C	B	A
Moderate	D	C	B
Minor	E	D	C
Slight	F	E	D
No lasting effect	F	F	E

Significance Level
Catastrophic (A)
Major (B)
Moderate (C)
Minor (D)
Slight (E)
Negligible (F)

Figure 2-1: Impact significance level

2.3.2 Risk Evaluation

In support of ongoing risk management (a key component of Woodside's Process Safety Management Framework – refer to Implementation Strategy (**Section 7**)), Woodside uses the concept of 'current risk' and applies a current risk rating to indicate the current or 'live' level of risk, considering the controls that are currently in place and regularly effective. Current risk rating is effective in articulating potential divergence from baseline risk, such as if certain controls fail or could potentially be compromised. Current risk ratings aid in the communication and visibility of the risk events, and ensures risk is continually managed to ALARP by identifying risk reduction measures and assessing acceptability.



Consequence

	Health & Safety	Environment	Financial	Reputation & Brand	Legal & Compliance	Social & Cultural
A	> 30 fatalities and / or permanent total disabilities	Catastropic, long-term impact (> 50 years) on highly valued ecosystems, species, habitat or physical or biological attributes	> $5B	Catastrophic, long term impact (> 20 years) to reputation and brand. International concern and / or persistent national concern in significant area of operation. Company operations, major ventures, significant or multiple asset operations severely restricted or terminated, and may extend to company at stake	Loss of licence to operate. Potential jail terms for executives, directors or officers. Prolonged litigation / prosecution. Fines (> $100M) and / or civil liability (> $1B)	Catastrophic, long-term impact (> 20 years) to a community, social infrastructure or highly valued areas / items of international cultural significance
B	Multiple fatalities and / or permanent total disabilities	Major, long-term impact (10-50 years) on highly valued ecosystems, species, habitat or physical or biological attributes	> $500M - $5B	National concern and / or international interest. Medium to long-term impact (5-20 years) to reputation and brand. Venture and / or asset operations restricted	Significant restriction on licence to operate. Prolonged litigation / prosecution. Fines (< $100M) and / or civil liability (< $1B)	Major, long-term impact (5-20 years) to a community, social infrastructure or highly valued areas / items of national cultural significance
C	Single fatality and / or permanent total disability	Moderate, medium-term impact (2-10 years) on ecosystems, species, habitat or physical or biological attributes	> $50M - $500M	National concern. Moderate, medium-term impact (2-5 years) to reputation and brand. Venture and / or asset operations restricted or curtailed	Material breach of legislation, regulation, contract or licence condition. Major litigation / prosecution. Fines (< $15M) and / or civil liability (< $150M)	Moderate, medium-term impact (2-5 years) to a community, social infrastructure or highly valued areas / items of national cultural significance
D	Major injury or occupational illness or permanent partial disability	Minor, short-term impact (1-2 years) on species, habitat (but not affecting ecosystems function), physical or biological attributes	> $5M - $50M	Minor, short-term impact (1-2 years) to reputation and brand. Close scrutiny of asset level operations or future proposals	Breach of legislation, regulation, contract or licence condition with investigation and / or report to authority. Litigation / prosecution. Fines (< $5M) and / or civil liability (< $50M)	Minor, short-term impact (1-2 years) to a community or highly valued areas / items of cultural significance
E	Moderate injury or occupational illness or temporary partial disability	Slight, short-term impact (< 1 year) on species, habitat (but not affecting ecosystems function), physical or biological attributes	> $500K - $5M	Slight, short-term local impact (< 1 year) to reputation and brand. Some impact on asset level non-production activities	Breach of legislation, regulation, contract or licence condition. Regulatory action and / or sanction	Slight, short-term impact (< 1 year) to a community or areas / items of cultural significance
F	Minor injury or occupational illness	No lasting effect (< 1 month). Localised impact not significant to environmental receptors	≤ $500K	No lasting effect (< 1 month). Isolated and short-term local concern	Breach of internal standard	No lasting effect (< 1 month). Localised impact not significant to areas / items of cultural significance

Likelihood

	Remote	Highly Unlikely	Unlikely	Possible	Likely	Highly Likely
Experience	Unheard of in the industry	Has occurred once or twice in the industry	Has occurred many times in the industry but not at Woodside	Has occurred once or twice in Woodside or may possibly occur	Has occurred frequently at Woodside or is likely to occur	Has occurred frequently at the location or is expected to occur
Frequency	1 in 100,000 - 1,000,000 years	1 in 10,000 - 100,000 years	1 in 1,000 - 10,000 years	1 in 100 - 1,000 years	1 in 10 - 100 years	> 1 in 10 years
Modelled distribution %* (Probability of event occurrence)	< 1%	1% - 5%	6% - 20%	21% – 50%	51% - 80%	> 80%
LEVEL	0	1	2	3	4	5

** Not to be used for operational Health & Safety or Environment risk assessments.*

LEVEL	0	1	2	3	4	5
A	A0	A1	A2	A3	A4	A5
B	B0	B1	B2	B3	B4	B5
C	C0	C1	C2	C3	C4	C5
D	D0	D1	D2	D3	D4	D5
E	E0	E1	E2	E3	E4	E5
F	F0	F1	F2	F3	F4	F5

Risk endorsement table

Current Risk

SEVERE	Risk at this level requires **immediate (no more than 12 hours)** communication to the **CEO & divisional EVP / SVP** via VP Risk & Compliance
VERY HIGH	Risk at this level requires **immediate (no more than 12 hours)** communication to **divisional EVP / SVP** with concurrent communication to VP Risk & Compliance
HIGH	Risk at this level requires timely communication to **SVP / VP of business unit or function**
MODERATE	Risk at this level requires timely communication to **line manager** (i.e. relevant Asset or Project Manager)
LOW	Risk at this level requires timely communication to the relevant **line manager**

Note: All currency stated in $US. The consequence and likelihood categories are not necessarily equal to each other. For example, the financial column is not equal to the remediation costs or consequences described in other columns.

Figure 2-2: Environmental risk levels

2.3.3 Decision Support Framework

To support the risk assessment process Woodside's HSE risk management procedures include the use of a decision support framework based on principles set out in the Guidance on Risk Related Decision Making (Oil and Gas UK, 2014). This concept has been applied during the ENVID or equivalent preceding processes during historical design decisions to determine the level of supporting evidence that may be required to draw sound conclusions regarding risk level and whether the risk is ALARP and acceptable. This is to confirm:

- activities do not pose an unacceptable environmental risk
- appropriate focus is placed on activities where the risk is anticipated to be acceptable and demonstrated to be ALARP
- appropriate effort is applied to the management of risks based on the uncertainty of the risk, the complexity and risk rating (i.e. potential higher order environmental impacts are subject to further evaluation assessment).

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

This framework enables Woodside to appropriately understand a risk, determine if the risk is acceptable and can be demonstrated to be ALARP.

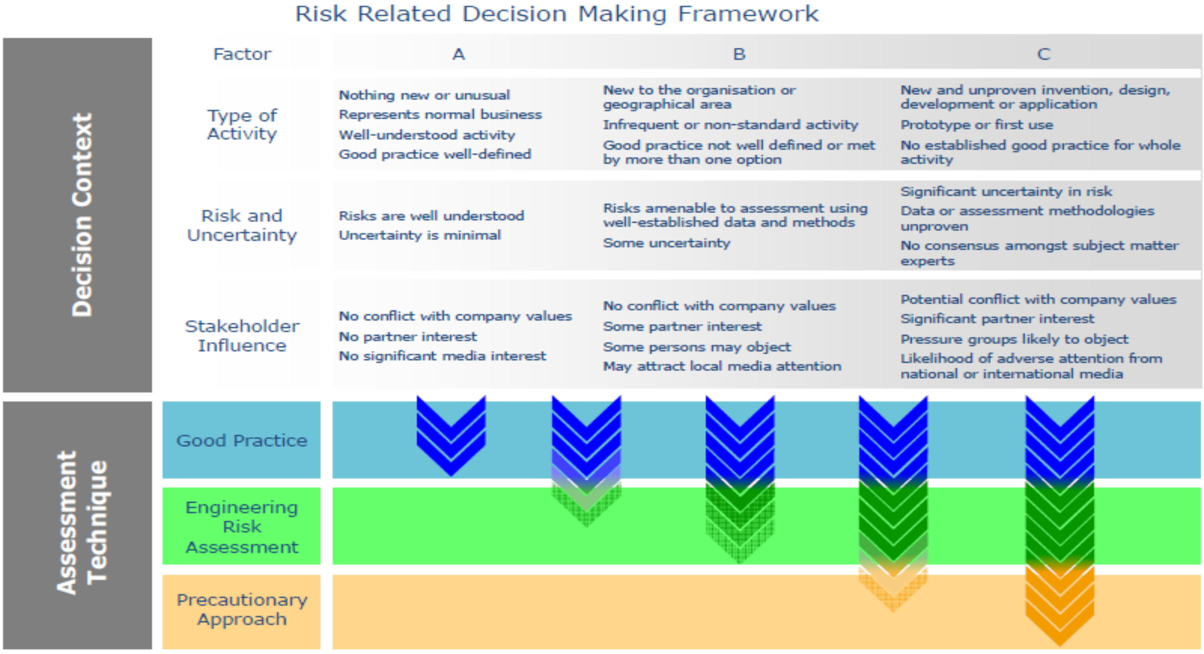


Figure 2-3: Risk related decision-making framework (Oil and Gas UK, 2014)

<u>Decision Type A</u>

Risks classified as a Decision Type A are well understood and established practice, they generally consider recognised good industry practice which is often embodied in legislation, codes and standards and use professional judgement.

<u>Decision Type B</u>

Risks classified as Decision Type B typically involve greater uncertainty and complexity (and can include potential higher order impacts/risks). These risks may deviate from established practice or have some lifecycle implications, and therefore require further engineering risk assessment to support the decision and ensure the risk is ALARP. Engineering risk assessment tools may include:

- risk-based tools such as cost based analysis or modelling
- consequence modelling
- reliability analysis
- company values.

Decision Type C

Risks classified as a Decision Type C typically have significant risks related to environmental performance. Such risks typically involve greater complexity and uncertainty; therefore, requiring adoption of the precautionary approach. The risks may result in significant environmental impact; significant project risk/exposure or may elicit negative stakeholder concerns. For these risks, in addition to Decision Type A and B tools, company and societal values need to be considered by undertaking broader internal and external stakeholder consultation as part of the risk assessment process.

2.3.4 Demonstration of ALARP

Descriptions have been provided below (**Table 2-1**) to articulate how Woodside demonstrates different risks, impacts and Decision Types identified within the EP are ALARP.

Table 2-1: Summary of Woodside's criteria for ALARP demonstration

Risk	Impact	Decision Type
Low and Moderate	***Negligible, Slight, or Minor (D, E or F)***	***A***
Woodside demonstrates these Risks, Impacts and Decision Types are reduced to ALARP if: • controls identified meet legislative requirements, industry codes and standards, applicable company requirements and industry guidelines • further effort towards impact/risk reduction (beyond employing opportunistic measures) is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.		
High, Very High or Severe	***Moderate and above (A, B or C)***	***B and C***
Woodside demonstrates these higher order Risks, Impacts and Decision Types are reduced to ALARP (where it can be demonstrated using good industry practice and risk-based analysis) that: • legislative requirements, applicable company requirements and industry codes and standards are met • societal concerns are accounted for • the alternative control measures are grossly disproportionate to the benefit gained.		

2.3.5 Demonstration of Acceptability

Acceptability of the Scarborough Project, including the Petroleum Activities Program described in this EP, was demonstrated in the Scarborough OPP (SA0006AF0000002, Rev 5) as required by Environment Regulation 5D (6). The EPOs set in the OPP demonstrate that the environment impacts and risks of the project will be managed to an acceptable level.

The impacts and risks of Scarborough were determined to be acceptable in the OPP through consideration of the following evaluation criteria (Scarborough OPP (SA0006AF0000002, Rev 5); Section 6.4.4)

- Principles of Ecologically Sustainable Development (ESD) as defined under the EPBC Act
- internal context – the proposed impacts and risk levels are consistent with Woodside policies, procedures and standards

- external context – consideration of the environment consequence and stakeholder acceptability
- other requirements – the proposed controls and impact and risk levels are consistent with national and international standards, laws, policies and Woodside Standards (including applicable plans for management and conservation advices, and significant impact guidelines for MNES)

In this EP Woodside has demonstrated that the level of acceptability determined in the OPP has been met through the following criteria:

- Adoption of relevant OPP EPOs and controls
- Adoption of EP specific controls where required
- Impact Significance Level / Risk Consequence levels for receptors are equal to or less than the significant impact level defined in the Scarborough OPP (SA0006AF0000002, Rev 5; Section 6.5; Table 6-3) and are therefore consistent with the EPOs and managed to an acceptable level of impact or risk, and
- Consideration of internal/external context and other requirements specific to this EP Petroleum Activities Program (including issues raised during EP Stakeholder Consultation).

A summary of the process as adopted is shown in **Table 2-2**.

Table 2-2: Summary of Woodside's criteria for Acceptability for Scarborough EPs

Risk	Impact	Decision Type
Low and Moderate	***Negligible, Slight, or Minor (D, E or F***	***A***
Woodside demonstrates these Risks, Impacts and Decision Types are 'Broadly Acceptable' if they meet the EP criteria listed above in **Section 2.4.4**. Further effort towards risk reduction (beyond employing opportunistic measures) is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.		
High, Very High or Severe	***Moderate and above (A, B or C)***	***B and C***
Woodside demonstrates these higher order Risks, Impacts and Decision Types are 'Acceptable if ALARP' if they meet the EP criteria listed above in **Section 2.4.4**. In addition, these higher order risks, impacts and decision types are 'Acceptable if ALARP' if it can be demonstrated that the predicted levels of impact and/or residual risk, are managed to ALARP (as described in **Section 2.7.1**). For potential C or above consequence/impact levels where significant uncertainty exists in analysis of the risk or impact (such as, for predicted or potential high risk of significant environmental impacts, significant project risk/exposure, novel activities, lack of consensus on standards, and significant stakeholder concerns. (E.g. Decision Type C), defined acceptable levels and assessment of acceptability may be required to be conducted separately for key receptors.		

2.4 Recovery Plan and Threat Abatement Plan Assessment

To support the demonstration of acceptability, a separate assessment is undertaken to demonstrate that the EP is not inconsistent with any relevant recovery plans or threat abatement plans (refer **Section 1.10.2.2**). The steps in this process are:

- identify relevant listed threatened species and ecological communities (**Section 4.6**; **Appendix I**);
- identify relevant recovery plans and threat abatement plans (**Appendix I**);
- list all objectives and (where relevant) the action areas of these plans, and assess whether these objectives/action areas apply to government, the Titleholder, and the Petroleum Activities Program (**Section 6.8**); and
- for those objectives/action areas applicable to the Petroleum Activities Program, identify the relevant actions of each plan, and evaluate whether impacts and risks resulting from the activity are clearly not inconsistent with that action (**Section 6.8**).

2.5 Environmental Performance Objectives/Outcomes, Standards and Measurement Criteria

The OPGGS Environment Regulations define EPOs to mean: "*a measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level*". As such, the process of defining an appropriate EPO, has relied on the required levels of performance set either in legislation (such as the OPGGS Act), regulator guidance notes such as the Matters of National Environmental Significance–Significant Impact Guidelines (DotE, 2013) or may be the result of specific agreements or expectations with other relevant stakeholders (e.g. fishers or other marine users).

EPOs for the Scarborough Project have been set within the Scarborough OPP (SA0006AF0000002, Rev 5) and assessed as meeting the requirements of the Regulations to be appropriate, consistent with the principles of ecologically sustainable development and to demonstrate that the environmental impacts and risks of the project will be managed to an acceptable level.

Environment Plans for petroleum activities submitted subsequent to the OPP process are required to contain EPOs that are appropriate by being consistent with those set out in the OPP. The EPOs presented in a subsequent EP are not required to be exactly the same however should achieve the same environmental outcome (or better) as that described in the OPP. Activity specific EPs will also be required to contain measurement criteria and performance monitoring, auditing and reporting processes relating to the EPOs.

Table 6-1 shows a comparison between EPOs in the Scarborough OPP (SA0006AF0000002, Rev 5) and this EP.

3. DESCRIPTION OF THE ACTIVITY

3.1 Overview

This section has been prepared in accordance with Regulation 13(1) of the Environment Regulations and describes the activities to be undertaken as part of the Petroleum Activities Program under this EP. It includes the location of the activities, operational details and additional information relevant to considering environmental risks and impacts.

3.2 Project Overview

Woodside proposes to develop and produce hydrocarbons from the Scarborough field Permit Area WA-61-L.

The Petroleum Activities Program will involve drilling and installation of up to ten Scarborough development wells (eight planned wells and two contingency wells) and installation of a subsea xmas tree upon each well.

If required, Woodside may also need to intervene, workover or re-drill the proposed development wells within Permit Area WA-61-L to monitor and maintain their integrity and mechanically alter them as required.

An overview of the Petroleum Activities Program is provided in **Table 3-1**.

Table 3-1: Petroleum Activities Program Overview

Item	Description
Permit Titles	WA-61-L
Location	North West Shelf
Water depth	Approx. 900 m to 955 m
Number of wells	Scarborough development wells drilling and completions including: • eight development wells and the potential for two additional development wells (contingency).
Subsea infrastructure	Subsea xmas tree at each well
MODU	Dynamic Positioned (DP) MODU with contingency for moored MODU, depending on availability and suitability for the development well locations
Vessels	• Installation vessel for installing the subsea infrastructure. • Light well intervention vessel as an option for well intervention, subsea hardware installation or contingent activities. • Support vessels including anchor handling vessel(s) and general supply/support vessels.
Key activities	• Top hole section drilling. • Installation of blow-out preventer (and marine riser). • Bottom hole section drilling. • Completion and well unload activities. • Installation of subsea xmas trees. • Formation evaluation while drilling. • Temporary suspension or permanent abandonment of well (planned or if necessary, for unforeseen circumstances). • Contingent activities including pre-lay anchors by anchor handling vessel, anchor hold testing and mooring (in case of moored MODU); intervention, workover, well re-drill, wireline logging and installation of up to two additional development wells.

3.3 Concordance with the Scarborough OPP

The OPP describes the scope of the Scarborough project and its component activities, at a level comprehensive enough to facilitate thorough evaluation of environmental impacts and risks and appropriate setting of EPOs. However, in accordance with NOPSEMA guidance, it is acknowledged that an OPP is prepared at an early stage in project development, before detailed planning of component activities has occurred. More detailed descriptions of the component activities are therefore expected in subsequent EPs.

Refinement or modifications to methods or timing for individual project activities may occur after an OPP acceptance and before the submission of EPs. These refinements or modifications to the accepted project cannot be new activities and cannot significantly change the overall environmental impacts and risks of the project as described in the accepted OPP. Table 3-2 shows which scopes from the OPP may have progressed in level of definition from the time the OPP was authored.

Section 4 of the Scarborough OPP (SA0006AF0000002, Rev 5) provides a detailed description of the Scarborough project.

Table 3-2: Concordance of activities described in the Scarborough OPP with those included in this EP

Scarborough OPP Section	Scope or overview of the Activity	Relevance to this EP	Refinement or modification to methods	Refinement or modification to timing	Is this a new activity	Significance of change
4.4.3 Drilling Activities	Drilling of 7 Phase 1 Development wells	It is now proposed that 8 development wells be drilled as part of Phase 1, with potential for two additional contingent wells. This is within the scope of the total well count assessed by the OPP (30 wells) however is slightly more than the original estimate for the first drilling phase provided in Table 4-8 of the description of Drilling Activities.	No	Yes	No	No. Minor change in project execution phasing which does not affect impact or risk profile as it was assessed in the OPP.
Table 7-63 Well cuttings and fluid volumes discharged	Table 7-63 in the OPP estimates cuttings and fluid volumes that might be discharged for an example Scarborough well. The volumes quoted in Table 7-63 are described as “estimates only, for the purpose of undertaking an assessment of the environmental impacts. Detailed design will be undertaken further and the assessment updated in relevant activity EPs”.	This EP provides an update on previous estimates of cuttings and fluid discharges during drilling activities, which were used in OPP risk assessment. The more recent estimation of cuttings and fluids are higher than original estimates due to refinement in well design - particularly some interval lengths have increased i.e. the 26” surface hole goes deeper into the Muderong, which will generate more cuttings, being a longer section of a larger hole.	Yes	No	No	No. Refer to Section 6.6.7 which shows overall environmental impact significance level is consistent with OPP assessment.
4.4.3.4 Bottom Hole Section Drilling	The OPP does not detail Formation Evaluation, which is carried out once well total depth is reached, to determine the presence and quantity of hydrocarbons in a reservoir. In Table 3-1 in the OPP which lists relevant legislation, it is noted that radioactive tracers may be used during formation evaluation. Well logging as an activity is included in the description of Well Intervention; with wireline listed as a specific example.	In this EP, Formation Evaluation While Drilling (FEWD) is proposed to be carried out, and may include extracting small cores, wireline logging, full diameter cores and other down-hole technologies, as required. Some FEWD tools contain radioactive sources, however, no radioactive material will be released to the environment and radiation fields are not generally detectable outside the tool when the tool is not energised, therefore, they do not present an environmental risk.	Yes	No	No	No. Because Formation evaluation is the interpretation of a combination of measurements taken inside a wellbore once total depth is reached, there are no specific environmental impacts from this activity.

3.4 Location

The Petroleum Activities Program is located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-north-west of Dampier. The closest landfall to the Petroleum Activities Program is the North West Cape, about 226 km south-south-east at its nearest point (**Figure 3-1**). Approximate location details for the Petroleum Activities Program are provided in **Table 3-3**.

Table 3-3: Approximate location details for the proposed Scarborough development wells

Activity	Water depth (approx. m LAT)	Latitude (WGS84)	Longitude (WGS84)	Petroleum title(s)
New Development Wells				
Well 1	910	19° 53’ 30.499” S	113° 08’ 43.568” E	WA-61-L
Well 2	912	19° 53’ 48.471” S	113° 06’ 55.261” E	WA-61-L
Well 3	912	19° 53’ 18.551” S	113° 10’ 03.300” E	WA-61-L
Well 4	918	19° 52” 30.359” S	113° 06’ 41.412” E	WA-61-L
Well 5	918	19° 52’ 38.718” S	113° 13’ 24.437” E	WA-61-L
Well 6	902	19° 49’ 27.763” S	113° 13’ 08.300” E	WA-61-L
Well 7	907	19° 45’ 52.900” S	113° 14’ 27.449” E	WA-61-L
Well 8	909	19° 53’ 27.254” S	113° 08’ 43.647”E	WA-61-L
Contingent wells	Within permit area WA-61-L			

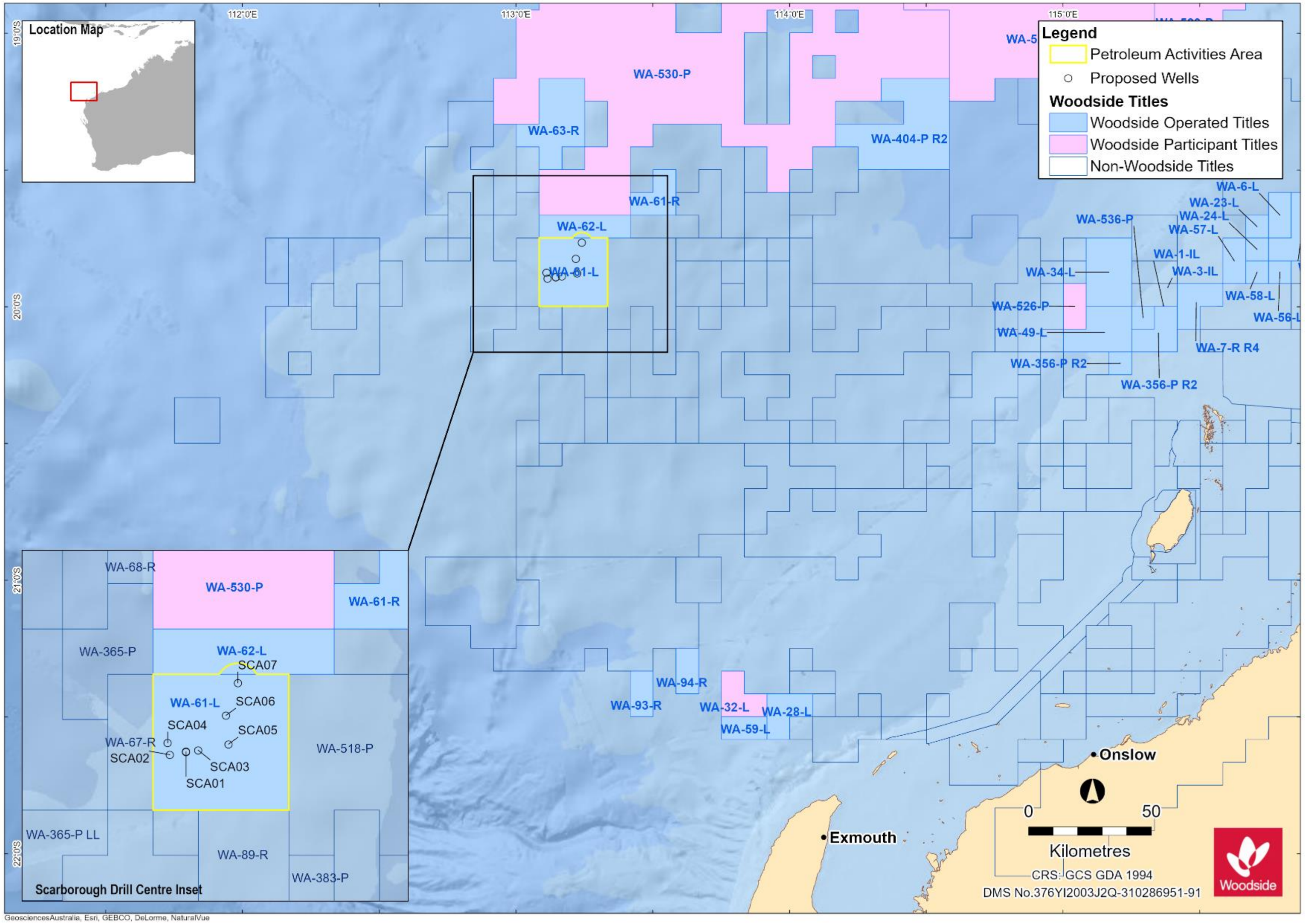


Figure 3-1: Location of the Petroleum Activities Program

3.5 Operational Areas

The spatial boundary of the Petroleum Activities Program has been described and assessed using two 'areas', the Operational Area and the Permit Area[1]. The combination of the Operational Area and Permit Area defines the spatial boundary of the Petroleum Activities Program, as described and risk assessed by this EP, including vessel related petroleum activities. For the purposes of this EP, the following Operational Areas will apply:

- For a dynamically positioned (DP) MODU, the Operational Area encompasses a radius of 500 metre (m) from each well centre, in which drilling related petroleum activities will take place and will be managed under this EP.
- For a moored MODU, the Operational Area encompasses a radius of 4000 m from each well centre, in which drilling related petroleum activities will take place and will be managed under this EP. This increased Operational Area allows for temporary installation of moorings. Noting that the Operational Area will be limited to the western boundary of Permit Area WA-61-L.
- For the installation activities, the Operational Area encompasses a radius of 1500 m around subsea locations, in which subsea installation activities will take place and will be managed under this EP. The 1500 m (radius) Operational Area around subsea installation allows for the movement and positioning of large vessels.

The Operational Area for drilling activities includes a 500 m petroleum safety zone around the MODU to manage vessel movements. The 500 m petroleum safety zone is under the control of the MODU Person in Charge.

The Operational Area and Permit Area are collectively referred to as the Petroleum Activity Area (PAA) in this EP, with specific Operational Areas referred to where relevant. Vessel-related activities within the Operational Areas will comply with this EP. Vessels supporting the Petroleum Activities Program when outside the Operational Area must adhere to applicable maritime regulations and other requirements.

3.6 Timing

The Petroleum Activities Program is planned to commence within a five-year window, with potential commencement date of H2 2022. Drilling may occur at any time within the five-year period between 2022 and 2027, for which this EP will be active. Wells may not be drilled consecutively (i.e. one well may be drilled and then the program stopped for 12 or more months before recommencing with further wells). Drilling operations for the development wells is expected to take approximately 60 days per well to complete, including mobilisation, demobilisation and contingency. Subsea xmas trees are expected to be installed after completing the relevant sections of the well while the MODU is still in the field. Installation of subsea xmas trees is expected to have a cumulative duration of about 14 days (including mobilisation, demobilisation, and contingency).

When underway activities will be 24 hours per day, seven days per week. Simultaneous Operations (SIMOPS) activities may occur (e.g. drilling and xmas tree installation, with MODU and vessel separated by at least 1 km). Timing and duration of all activities is subject to change due to project schedule requirements, MODU/vessel availability, unforeseen circumstances and weather.

The EP has risk-assessed drilling activities, installation of subsea infrastructure, IMR, support operations and contingency activities such as intervention, workover, or re-drilling activities

[1] For the purposes of this EP the Permit Area comprises WA-61-L plus a buffer to incorporate the portion of the Operational Area that extends beyond the north boundary of the Permit Area (Figure 3-2). The existing environment of the entire Permit Area plus the defined buffer is considered to provide context for the risk assessment. This approach facilitates assessing environmental risks and impacts for the entire scope, including development drilling of the contingency wells with a moored MODU.

throughout the year (all seasons) to provide operational flexibility for requirements and schedule changes and MODU/vessel availability.

3.7 Drilling Activities

Well construction activities are conducted in a number of stages, as described below. Detailed well designs will be submitted to the Well Integrity Department of NOPSEMA as part of the approval to drill and the accepted Well Operation Management Plan (WOMP), as required under the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011.

3.7.1 Drilling Operations

3.7.1.1 Cement Unit Test

The MODU may be required to perform a cement unit test, or ‘dummy cement job’ to test the functionality of the cement unit and the MODU’s bulk cement delivery system prior to performing an actual cement job. This operation is usually performed after a MODU has been out of operation for an amount of time (warm-stack), if maintenance on the cement unit has been carried out, or if it is the first time a MODU is being used in-country and commissioning of the cement unit system is required.

A ‘dummy cement job’ involves mixing a sacrificial cement slurry at surface and, once functionality of the cement unit and delivery system has been confirmed, the slurry is discharged through the usual cement unit discharge line (which may be up to 10 m above the sea level) or through drill pipe below sea level. The slurry is usually a mix of cement and water, however, may sometimes contain stabilisers or chemical additives.

3.7.1.2 Top-Hole Section Drilling

Petroleum Activities Program drilling commences with the top-hole section as follows:

1. The MODU arrives and establishes position over the well site.
2. Top-hole sections are drilled riserless using seawater with pre-hydrated bentonite/guar gum or similar sweeps or drilling fluids to circulate drilled cuttings from the wellbore (discharge to seabed during riserless drilling). As a contingency Pump and Dump (PAD) water-based mud may be used if required based on shallow hazards.
3. Once the top-hole sections of the well have been drilled, steel tubulars (called conductor or casing) are inserted into the wellbore and secured in place by pumping cement into the annular space back to about 300 m above the casing shoe or to surface (seabed), which will involve a discharge of excess cement at the seabed.

At some well locations, top-hole section drilling may be batched. Batch drilling is where the same section of each well is drilled one after another, before going back and drilling the next section of each well.

3.7.1.3 Blowout Preventer and Marine Riser Installation

After setting the surface casing, a blowout preventor (BOP) and marine riser is installed on the wellhead. The BOP provides a means for sealing, controlling and monitoring the well during drilling activities. The BOP components are operated using open hydraulic systems (utilising water-based BOP control fluids). Each time a pressure and function test schedule is undertaken approximately 3620 L of water-based fluid is released to the marine environment, of this approximately 4% is control fluid additive. BOP operation includes function and pressure testing approximately every 21 days, and a function test (approx. 2665 L) approximately every seven days, excluding the week a pressure test is conducted.

The marine riser provides a physical connection between the well and MODU. This enables a closed circulation system to be maintained, where weighted water-based muds (WBM) and cuttings can be circulated from the wellbore back to the MODU via the riser.

3.7.1.4 Bottom Hole Section Drilling

A closed system (riser in place), is used for drilling bottom hole sections to the planned wellbore total depth. The plan is for bottom hole sections to be drilled using WBM drilling fluids; however, non water-based mud (NWBM) may also be used.

Protective steel tubulars (casings and liners) are inserted as required. The size, grade, weight, length and inclination of the casing/liner sections within the wellbore is determined by factors such as the geology/subterranean pressures likely to be encountered in the area and any specific information or resource development requirements.

After a string of casing/liner has been installed into the wellbore, it is cemented into place. The casing/liner is then pressure tested. Once the pressure testing is passed, drilling of the next section can resume with the riser in place to circulate drill cuttings and drilling fluids back to the MODU.

Cementing operations are also undertaken to:

- provide annular isolation between hole sections and structural support of the casing/liner as required
- set a plug in an existing well to side-track
- plug a well so it can be suspended/abandoned.

Cement, barite and bentonite is transported as dry bulk to the MODU by the support vessels. Cement is mixed as required by the cementing unit on the MODU and pumped by high pressure pumps to the surface cementing head then directed down the well.

Excess cement, barite and bentonite (dry bulk) after well operations are completed, will either be held onboard and used for subsequent wells; provided to the next operator at the end of the program or discharged to the marine environment. Excess cement, barite and bentonite that does not meet technical requirements during the Petroleum Activities Program may also be bulk discharged to the environment. Bulk discharges of cement, barite and bentonite may occur as a slurry through the usual cement discharge line or blown as dry bulk and discharged.

Cuttings in drilling fluids circulated back to the MODU are separated from the drilling fluids by the solids control equipment (SCE). The SCE comprises shale shakers to remove coarse cuttings from the drilling fluid. After processing by the shale shakers, the recovered fluids from the cuttings may be directed to centrifuges, which are used to remove the finer solids (4.5 to 6 µm). Water-based drill cuttings are usually discharged below the water line and the fluids are recirculated into the fluid system.

3.7.1.5 Drilling Fluids

In addition to the base fluid, drilling muds contain a variety of chemicals, incorporated into the selected drilling fluid system to meet specific technical requirements (e.g. mud weight required to manage pressure, or for borehole stability). All chemicals selected for use have been assessed under Woodside's internal guidelines to ensure potential impacts are acceptable, ALARP and meet Woodside's expectation for environmental performance.

3.7.1.6 Water-Based (WBM) System

The Petroleum Activities Program will use a water-based drilling fluid system as the planned option. WBM is mainly comprised of water (salt or fresh). Some basic additives such as bentonite/guar gum may be added to the water.

The WBM drilling fluid will either be mixed on the MODU or received pre-mixed, then stored and maintained in a series of pits aboard the MODU. The top-hole sections will be drilled riserless with seawater containing pre-hydrated gel sweeps, and cuttings and drilling fluids returned to the seabed. The bottom hole sections may be drilled using WBM in a closed circulation system which enables re-use of the WBM drilling fluids.

WBM drilling fluids that cannot be reused (e.g. due to bacterial deterioration or do not meet required drilling fluid properties), or are mixed in excess of required volumes, may be operationally discharged to the ocean under the MODU’s Permit to Work (PTW) system. Opportunities to reuse the WBM drilling fluids at the end of the Petroleum Activities Program are reviewed across current Woodside drilling activities.

WBM may not be able to be reused between drilling sections due to the drilling sequence, technical requirements of the mud (i.e. no tolerance for deterioration of mud during storage) and maintenance of productivity/injectivity.

A number of factors unique to each drilling program will determine the quantities of WBM drilling fluids required and subsequent discharge volumes if no suitable reuse option is available.

3.7.1.7 Non Water-Based Mud System (Contingency only)

The decision to use non water-based muds (NWBM) drilling fluids for the bottom hole sections of a particular well is based on various technical factors relevant to wellbore conditions, such as: well temperature, well shape and depth, reactivity of the formation to water and well friction. The technical justification to use NWBM includes but is not limited to consideration of environment, health, safety and waste management.

The use of NWBM drilling fluids is subject to a formal written commercial and/or technical justification approved in accordance with the Best Practice – Overburden Drilling Fluids Environmental Requirements. The main ingredient of NWBM is base oil and, similar to a WBM system, a range of standard solid and liquid additives may be added in the pits to alter specific mud properties for each section of the well. This depends on the conditions encountered while drilling. Where NWBM is used, the base oil will be a Group III synthetic oil (e.g. Saraline 185V), for all development wells.

The NWBM drilling fluid will be primarily mixed onshore (new or re-use existing stock) and transferred to the MODU by a support vessel, where it is stored and maintained in the mud pits. During drilling operations, the NWBM drilling fluid, like the WBM, is pumped by high pressure pumps down the drill string and out through the drill bit, returning via the annulus between the drill string and the casing back to the MODU via the riser.

The used NWBM pumped back to the MODU contains drill cuttings and is pumped to the Solids Control Equipment (SCE), where the drill cuttings are removed before being pumped back to the pits ready for re-use. The technical properties of the NWBM drilling fluids are maintained/altered (e.g. to increase weight) using additives as required when in the mud pits.

The NWBM drilling fluids that cannot be re-used (i.e. do not meet required drilling fluid properties or are mixed in excess of required volumes) are recovered from the mud pits and returned to the shore base for onshore processing, recycling and/or disposal. The mud pits and associated equipment/infrastructure are cleaned when NWBM is no longer required, with wash water treated onboard through SCE prior to discharge with mud pit washings or returned to shore for disposal if discharge criteria cannot be achieved (refer to mud pits below).

3.7.1.8 Mud Pits

There are typically a number of mud pits (tanks) on the MODU that provide a capacity to mix, maintain and store fluids required for drilling activities. The mud pits form part of the drilling fluid circulating system. The mud pits and associated equipment/infrastructure are cleaned out at the completion of drilling and completions operations. Mud pit wash residue is operationally discharged with less than 1% oil contamination by volume. Mud pit residue over 1% oil by volume is sent to shore for disposal.

3.7.1.9 Drill Cuttings

Drill cuttings generated from the well are expected to range from very fine to very coarse (less than 1 cm) particle/sediment sizes. Cuttings generated during drilling of the top hole sections are discharged at the seabed. Estimated volumes of drill cuttings that may be discharged during the Petroleum Activities Program are presented in **Table 6-7.**

The bottom hole sections will be drilled with a marine riser that enables cuttings and drilling fluid to be circulated back to the MODU, where the cuttings are separated from the drilling fluids by the SCE. The SCE comprises but is not limited to shale shakers, cuttings dryers and centrifuges. The SCE uses shale shakers to remove coarse cuttings from the drilling mud. After being processed by the shale shakers, the recovered mud from the cuttings may be directed to centrifuges, which are used to remove fine solids (4.5 to 6 µm). The cuttings are usually discharged below the water line and the mud is recirculated into the fluid system.

If NWBM is needed to drill a well section, the cuttings which are separated from the NWBM via the shakers will also pass through a cuttings dryer and associated SCE, to reduce the average oil on cuttings (only sections using NWBM) to 6.9% wt/wt or less on wet cuttings, prior to discharge.

3.7.2 Formation Evaluation

Formation evaluation is the interpretation of a combination of measurements taken inside a wellbore to detect and quantify hydrocarbon presence in the rock adjacent to the well once total depth is reached. Formation Evaluation While Drilling (FEWD) is the process by which the presence and quantity of hydrocarbon in a reservoir is measured according to its response to radioactive and electrical input. It may include extracting small cores, wireline logging, full diameter cores and other down-hole technologies, as required. FEWD tools will be incorporated into the drillstring during development drilling and may include gamma ray, directional deep resistivity, callipers, density-neutron, sonic and tools which can measure formation pressures. Some FEWD tools contain radioactive sources, however, no radioactive material will be released to the environment and radiation fields are not generally detectable outside the tool when the tool is not energised, therefore, they do not present an environmental risk.

3.7.3 Well Clean-out

Prior to installing the lower completion, wells will be displaced from one drilling fluid system to another, or from the drilling fluid system to completion brine. A chemical cleanout pill or fluids train will be circulated between the two fluids, then seawater or brine circulated until operational cleanliness specifications are met. Brine is typically a filtered brine with <70 NTU or <0.05% total suspended solids (TSS). This results in a brine and seawater discharge after this operation. Cleanout fluids and completion brine will be captured and stored on the MODU and discharged if oil concentration is less than 1% by volume or returned to shore if discharge requirements cannot be met.

3.7.4 Completion

Once a well has been drilled, well completion activities will be undertaken including installation of the lower completion, intermediate completion, upper completion / production tubing, and subsea tree. The well is then pressure tested for integrity prior to well unloading and suspension. Lower completion will be an open hole gravel pack with a viscous water-based fluid.

The wells will be completed with a big bore upper completion. Following unloading, wells will be suspended with a gas column and two crown plugs installed in the tubing hanger. Crown plugs will be individually pressure tested to verify as suspension barriers prior to the BOP being removed.

3.7.5 Well Flowback

3.7.5.1 General Description

Upon successfully drilling the development wells, all completion and reservoir fluids will be flared or discharged to the environment via the temporary production system. The types of tasks associated with well testing and flowback may include:

- reservoir gas flaring
- reservoir gas venting.

During well flowback activities, all completion and reservoir fluids will be flared or discharged to the environment via the temporary production system. Base oil will be used to underbalance the well. The base oil column, completion fluids, hydrocarbons and produced/condensed water will be treated for overboard discharge if it meets discharge requirements or flared/burned through the temporary production system on the MODU.

3.7.5.2 Produced / Reservoir Water Disposal

The temporary production system water filtration treatment package will be used to treat produced/reservoir water before discharge. Prior to discharging, the fluids are cycled through an oilbond filtration system and gauge tank. Water filtration is standard practice for well unloading operations. Fluids that cannot be treated or flared will be sent onshore in tanks for disposal.

3.7.6 Air Emissions

During well unloading it is expected that gas, condensate, base oil and methanol in the wellbore will be flared and efficiently burned. The flare may be extinguished due to water ingress, lack of pilot (propane), weather impact or equipment failure resulting in cold venting of gas from the flare for several minutes, before the flare can be restarted or venting stopped. After the objectives of the well testing and flowback are achieved, the flow is stopped and the well may be cleaned using a brine that can include several chemicals, such as biocide and surfactant.

3.7.7 Subsea Equipment Preservation Chemicals

Following well completion activities, the wells may be left with subsea equipment (such as xmas trees) installed, awaiting pre-commissioning and connection to the Floating Production Unit (FPU). All subsea equipment will contain preservation fluids to prevent corrosion and any other deterioration of the equipment before production.

3.7.8 Well Suspension

During drilling activities, wells will be temporarily suspended due to batch drilling. Suspension involves establishing suitable barriers, removing the riser and disconnecting the MODU from the well. The BOP may sometimes be left in place to act as a barrier. Suspension may be short term (e.g. in the case of a cyclone) or longer term (more than one year) following well unloading. On return to a well following suspension, the MODU reconnects to the well via the riser, and with BOP in place, barriers are removed and drilling and completions activity resumes.

3.7.9 Underwater Acoustic Positioning

An array of long base line (LBL) transponders may be installed on the seabed as required to support drilling activities. The LBL array provides accurate positioning by measuring ranges to three or more transponders deployed at known locations on the seabed and structures.

An array of transponders is proposed within a radius of 500 m from the proposed location of the wells and will be in place for a period of about three months per well. Transmissions are not continuous but consist of short ‘chirps’ with a duration that ranges from 3 to 40 milliseconds. Transponders will not emit any sound when on standby and are planned to only actively emit sound for about six hours per well. When required for general positioning, they will emit one chirp every five seconds (estimated to be required for four hours at a time). When required for precise positioning, they will emit one chirp every second (estimated to be required for two hours at a time).

During xmas tree installation activities ultra-short baseline transponders (USBL) may be installed on the seabed or mounted to the wellhead as required by the sub-sea installation activities. Transmissions from USBL transponders are similar to LBL transponders.

Transponders may be moored to the seabed either by a clump weight or mounted on a seabed frame. The standard clump weights used, made of cement or steel, will likely weigh about 80 kilogram (kg). A typical seabed frame is 1.5 m × 1.5 m × 1.5 m in dimension and weighs about 40 kg. On completion of the positioning operation, the array transponders moored by clump weight are recovered by means of a hydrostatic release, which leaves the clump weight on the seabed. The transponders mounted on seabed frames will be removed by ROV.

3.7.10 Installation of Subsea Infrastructure

The subsea installation scope of work comprises the installation of subsea xmas trees. The dimensions of the xmas trees will be approximately 5 x 5 x 5 m (Length x Width x Height).

Prior to the upper completion being installed into the wells, the xmas trees will be installed from an installation vessel in SIMOPS with the MODU, or directly from the MODU. Due to the subsea well layout, if installation was to occur from the installation vessel, the MODU will be required to kedge off or reposition away from the drill centre to allow the installation vessel to install the xmas trees. The xmas trees will be suspended vertically approximately 10 m off the sea floor. Once the xmas trees have been installed, they will be pressure tested to confirm integrity before the MODU BOP is reconnected to continue with drilling and completions activities.

The xmas trees will be installed with a preservation mixture in the production and annulus bores. There will be a small discharge of preservation fluid associated with testing and connection the subsea system (estimated 100 to 150 L per well).

3.8 Project Fluids

3.8.1 Assessment of Project Fluids

All chemicals that may be operationally released or discharged to the marine environment by the Petroleum Activities Program are evaluated using a defined framework and set of tools to ensure the potential impacts are acceptable, ALARP and meet Woodside’s expectation for environmental performance.

All approved drilling and completion chemicals are included on the Drilling and Completions – Master Chemical List which is periodically reviewed to drive continuous environmental improvement.

The chemical assessment process follows the principles outlined in the Offshore Chemical Notification Scheme (OCNS) which manages chemical use and discharge in the United Kingdom (UK) and the Netherlands. It applies the requirements of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention). The OSPAR Convention is widely accepted as best practice for chemical management.

All chemical substances listed on the OCNS ranked list of registered products have an assigned ranking based on toxicity and other relevant parameters, such as biodegradation and bioaccumulation, in accordance with one of two schemes (as shown in **Figure 3-2**):

- Hazard Quotient (HQ) Colour Band: Gold, Silver, White, Blue, Orange and Purple (listed in order of increasing environmental hazard), or
- OCNS Grouping: E, D, C, B or A (listed in order of increasing environmental hazard). Used for inorganic substances, hydraulic fluids and pipeline chemicals only.

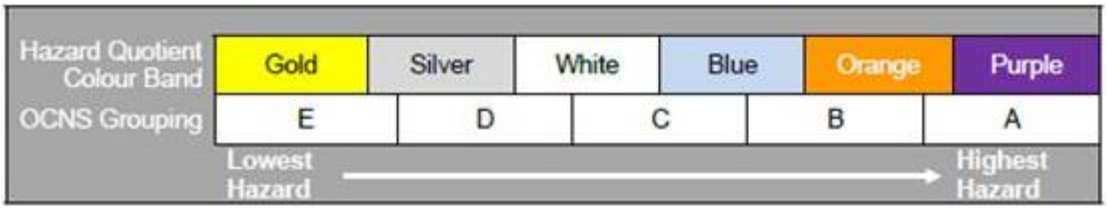


Figure 3-2: OCNS ranking scheme

Chemicals fall into the following assessment types:

- No further assessment: Chemicals with an HQ band of Gold or Silver or an OCNS ranking of E or D with no substitution or product warnings do not require further assessment. Such chemicals do not represent a significant impact on the environment under standard use scenarios and are, therefore, considered ALARP and acceptable.
- Further assessment/ALARP justification required: The following types of chemicals require further assessment to understand the environmental impacts of discharge into the marine environment:
    - chemicals with no OCNS ranking
    - chemicals with an HQ band of White, Blue, Orange, Purple or an OCNS ranking of A, B or C
    - chemicals with an OCNS product or substitution warning.

3.8.1.1 Further Assessment/ALARP Justification

This includes assessing the ecotoxicity, biodegradation and bioaccumulation of the chemicals in the marine environment in accordance with the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) Hazard assessment and the Department of Mine and Petroleum (DMP) Chemical Assessment Guide: *Environmental Risk Assessment of Chemicals used in WA Petroleum Activities Guideline.*

3.8.1.2 Ecotoxicity

Chemical ecotoxicity is assessed using the criteria used by CEFAS to group chemicals based on ecotoxicity results (**Table 3-6**). If a chemical has an aquatic or sediment toxicity within the criteria for the OCNS grouping of D or E this is considered acceptable in terms of ecotoxicity.

Table 3-4: CEFAS OCNS grouping based on ecotoxicity results

Initial grouping	A	B	C	D	E
Results for aquatic-toxicity data (ppm)	<1	>1-10	>10-100	>100-1000	>1000
Result for sediment toxicity data (ppm)	<10	>10-100	>100-1000	>1000-10,000	>10,000

Note: Aquatic toxicity refers to the Skeletonema constatum EC50, Acartia tonsa lethal concentration 50% (LC_{50}) and Scophthalmus maximus (juvenile turbot) LC_{50} toxicity tests; sediment toxicity refers to Corophium volutator LC_{50} test

Biodegradation

The biodegradation of chemicals is assessed using the CEFAS biodegradation criteria, which align with the categorisation outlined in the DMP Chemical Assessment Guide: *Environmental Risk Assessment of Chemicals used in WA Petroleum Activities Guideline*.

CEFAS categorises biodegradation into the following groups:

- Readily biodegradable: results of >60% biodegradation in 28 days to an OSPAR harmonised offshore chemical notification format (HOCNF) accepted ready biodegradation protocol.
- Inherently biodegradable: results >20% and <60% to an OSPAR HOCNF accepted ready biodegradation protocol or result of >20% by OSPAR accepted inherent biodegradation study.
- Not biodegradable: results from OSPAR HOCNF accepted biodegradation protocol or inherent biodegradation protocol are <20%, or half-life values derived from aquatic simulation test indicate persistence.

Bioaccumulation

The bioaccumulation of chemicals is assessed using the CEFAS bioaccumulation criteria, which align with the categorisation outlined in the DMP Chemical Assessment Guide*: Environmental Risk Assessment of Chemicals used in WA Petroleum Activities Guideline.*

The following guidance is used by CEFAS:

- Non-bioaccumulative: LogPow <3, or BCF ≤100 and molecular weight is ≥700.
- Bioaccumulative: LogPow ≥3 or BC >100 and molecular weight is <700.

If a product has no specific ecotoxicity, biodegradation or bioaccumulation data available, the following options are considered:

- Environmental data for analogous products can be referred to where chemical ingredients and composition are largely identical. OR
- Environmental data may be referenced for each separate chemical ingredient (if known) within the product.

Alternatives

If no environmental data is available for a chemical or if the environmental data does not meet the acceptability criteria outlined above, potential alternatives for the chemical will be investigated, with preference for options with an HQ band of Gold or Silver, or OCNS Group E or D with no substitution or product warnings.

If no more environmentally suitable alternatives are available, further risk reduction measures (e.g. controls related to use and discharge) will be considered for the specific context and implemented where relevant to ensure the risk is ALARP and acceptable.

Decision

Once the further assessment/ALARP justification has been completed, the relevant environment adviser must concur that the environmental risk as a result of chemical use is ALARP and acceptable.

3.9 Subsea Inspection, Maintenance, Monitoring and Repair Activities

Subsea infrastructure is designed not to require any significant degree of intervention. However, the infrastructure is inspected and maintained to ensure its integrity and identify any issues before they present a risk of loss of containment. Intervention may be required to repair identified issues. Subsea activities are typically performed from a relevant support vessel via an ROV or divers.

Interventions often require deployment frames/baskets, which are temporarily placed on the seabed. Typically, these have a perforated base with a seabed footprint of about 15 m^2. They are recovered to the vessel at the end of the activity. Subsea activities are broadly categorised into inspection, monitoring, maintenance and repair; typical IMMR activities are described in the next sections.

3.9.1 Inspection

Subsea infrastructure inspections physically verify and assess components to detect changes to the as-installed location and condition by comparing them to previous inspections. The scope and frequency of subsea inspections are determined using risk-based inspection (RBI) methodology, resulting in detailed RBI plans. **Table 3-5** lists typical relevant subsea infrastructure inspections/surveys.

Table 3-5: Typical inspections/surveys

Type of Inspection/Survey	Purpose
General visual inspections	Check general infrastructure integrity
Close visual inspections	Investigate certain subsea infrastructure components
Cathodic protection	Check for corrosion
Wall thickness surveys	Monitor the condition of subsea infrastructure. (i.e. ultrasonic testing)
Non-destructive testing	Evaluate the properties of material/items using electromagnetic, radio graphic, acoustic resonance technology, ultrasonic, or magnetic equipment
Anode sampling	Take samples of anode materials for testing
Marine growth sampling	Take samples of marine growth for testing
Laser surveys	Conduct dimensional checks on trees etc. and measure proximity

Inspection methods will not directly result in environmental aspects which could lead to impacts on the environment and are therefore not discussed further. Potential impacts from vessel and ROV operations associated with inspections are described in **Section 3.10.4**.

3.9.2 Monitoring

Subsea infrastructure monitoring surveys the physical and chemical environment that a subsea system or component is exposed to, to determine if and when damage may occur, and (where relevant) predict the rate or extent of that damage.

Monitoring activities may include corrosion probes, corrosion mitigation checks, metocean and seismic monitoring, and cathodic protection testing.

Monitoring will not directly result in environmental aspects which could lead to impacts on the environment and are therefore not discussed further. Potential impacts from vessel and ROV operations associated with monitoring are described in **Section 3.10.4**.

3.9.3 Maintenance and Repair

Maintenance activities on subsea infrastructure are required at regular or planned intervals to prevent deterioration or integrity failure. Maintenance activities may include cycling and actuating valves, flushing chemical/hydraulic fluid lines, and leak and pressure testing.

Repair activities are required when a subsea system or component is degraded, damaged, or has deteriorated to a level outside acceptance limits. Damage sustained may not necessarily pose an immediate threat to continued system integrity, but presents an elevated level of risk to safety, environment, or production. Typical subsea repair activities include:

- xmas tree or component/cap repair and/or replacement
- corrosion protection.

Some environmental discharges are expected during subsea maintenance and repair activities. **Table 3-6** lists typical discharge volumes during different maintenance and repair activities.

Table 3-6: Typical discharge volume during maintenance and repair activities

Activity	Typical Discharge
Pressure/leak testing	Chemical dye >10 L
Valve functioning	0.5 L to 5 L per valve actuation
Flushing	Residual hydrocarbon or chemical releases volume depends on injection port size, component geometry, and pumping rates
Hot stab changeout	Hydrocarbons or control fluid <10 L.
Xmas tree repair, replacement, and recovery	Typical release of hydrocarbon or other chemicals depends on equipment configuration and flushing ability. This will be subject to an ALARP determination for the activity, as per normal practice.

Excess marine growth may need to be removed before undertaking subsea IMR activities and/or following return to wells after a period of suspended drilling. An ROV is used for this activity; **Table 3-7** lists the different techniques used.

Table 3-7: Marine growth removal

Activity/Equipment	Description
Water jetting	Uses high-pressure water to remove marine growth
Brush systems	Uses brushes attached to an ROV to physically remove marine growth
Acid	Chemically dissolves calcium deposits

If sediment builds up around subsea infrastructure, an ROV-mounted suction pump/dredging unit may be used to move small amounts of sediment in the immediate vicinity of the subsea infrastructure (i.e. within the existing footprint) to allow inspection/intervention works to be undertaken. Sediment relocation typically results in minor seabed disturbance and some localised turbidity.

3.10 Project Vessels and Support Activities

3.10.1 MODU Operations

The Petroleum Activities Program will be drilled by a MODU. This is planned to be a DP MODU, with risks assessed in this EP for a moored MODU as a contingency. Typical specifications for these MODU types are provided in **Table 3-7** and **Table 3-8** respectively. These are collectively referred to as the MODU for the remainder of the document, unless specific risks for different MODU types have been identified. Due to variabilities, such as contractual and operational matters, the MODU used may be subject to change.

Table 3-8: Typical DP MODU specifications (Valaris DPS-1)

Component	Specification Range
Rig type / Design / Class	Ultra deepwater semi-submersible MODU
Accommodation	200 persons
Station keeping	Dynamically positioned
Bulk mud and cement storage capacity	1000 m^3
Liquid mud storage capacity	2663 m^3
Fuel oil storage capacity	3640 m^3
Drill water storage capacity	3482 m^3

Table 3-9: Typical moored MODU specification ranges (Ocean Apex)

Component	Specification Range
Rig type/design/class	Semi-submersible MODU
Accommodation	120 to 200 personnel (maximum persons on board)
Station keeping	Minimum eight-point mooring system
Bulk mud and cement storage capacity	283 to 770 m^3
Liquid mud storage capacity	576 to 2500 m^3
Fuel oil storage capacity	966 to 1400 m^3
Drill water storage capacity	3500 m^3

3.10.2 Vessel Operations

Vessels used during the Petroleum Activities Program include a installation vessel and subsea support vessels, with other vessels likely to be used to support MODU and vessel operations including general support vessel(s) and anchor handling vessel(s).

Vessels may mobilise from the nearest Australian port or directly from international waters to the Petroleum Activity Area (PAA), in accordance with biosecurity and marine assurance requirements.

All project vessels are subject to the Marine Offshore Vessel Assurance procedure which is detailed in Implementation **Section 7.5.2.3**.

3.10.2.1 Installation Vessel

The Petroleum Activities Program subsea installation scopes of work may require an installation vessel with enough capacity to accommodate hardware and equipment including the xmas trees.

A typical installation vessel would be a DP vessel (usually DP2 Class) equipped with a primary differential global surface positioning system (DGPS) and an independent secondary DGPS backup system. The specification of a typical subsea installation vessel is provided in **Table 3-10**.

Installation vessels are typically equipped with a variety of material handling equipment, which includes cranes, winches, ROVs and ROV Launch and Recovery Systems (LARS), Vertical Lay System (VLS) with either vertical reel drive or horizontal drive (carrousel) and pre-commissioning spread.

Lifting operations may involve loading and unloading of equipment from support and supply vessels onto the installation vessel and subsequently onto the seabed. Cranes are typically equipped with active heave compensation and auto tension modes and have lifting capacities in excess of expected lifting loads to be encountered during operations.

Table 3-10: Typical DP 2 Class subsea installation vessel specifications for MMA Pinnacle

Component	Specification Range
Vessel Type	DP 2 Class as minimum
Crane Capacity	150 T HMC
Deck Space	About 1000 m^2
Deck Strength	About 10 T/m^2
Accommodation	About 100 people
Fuel Oil	About 868 m^3
Potable Water	About 586 m^3

3.10.2.2 Subsea Support Vessel

During the Petroleum Activities Program, a subsea support vessel for light well intervention (LWI) operations may be used as an option for contingent well intervention, subsea installation, subsea inspection maintenance and repair and other activities. Vessels supporting offshore activities may vary depending on requirements, vessel schedules, capability and availability.

Typical support vessels use a DP system to allow manoeuvrability and avoid anchoring when undertaking works. However, vessels are equipped with anchors which may be deployed in an emergency.

An example of this vessel type is the *Sapura Constructor*, which is a 117 m long subsea support vessel equipped with a saturation dive system, two work class remotely operated vehicles (ROV), well intervention equipment, a helideck, moon pool and accommodation for 120 personnel. The final vessel selection, if required, will be subject to commercial and operational considerations.

3.10.2.3 Support and Other Vessels

Support vessels are used to transport equipment and materials between the MODU/installation vessel and port (e.g. Dampier, Onslow, Exmouth). If required, one of the vessels may be present at the MODU to perform standby duties, and others will make regular trips between the PAA to port for routine, non-routine and emergency operations.

Anchor Handling Vessels (AHVs) may be required to set anchors and support the MODU and the installation vessel, during operations.

A variety of materials are routinely bulk transferred from support vessels to the MODU including drilling fluids (e.g. muds), base fluids, cements, and drill water. Cement, barite and bentonite are transported as dry bulk to the MODU by support vessels and pneumatically blown to the MODU storage tanks using compressed air. A range of dedicated bulk transfer stations and equipment are in place to accommodate the bulk transfer of each type of material. There is also a capacity to bulk transfer waste oil from the MODU to the support vessel, for back loading and disposal on shore.

The loading and back-loading of equipment, materials and wastes is one of the most common supporting activities conducted during drilling programs. Loading and back-loading is undertaken using cranes on the MODU to lift materials in appropriate offshore rated containers (e.g. ISO tanks, skip bins, containers) between the MODU and support vessel.

For power generation, vessels may use diesel-powered generators and/or LNG. All vessels will display navigational lighting and external lighting, as required for safe operations. Lighting levels will be determined primarily by operational safety and navigational requirements under relevant legislation, specifically the Navigation Act 2012. The MODU and support vessels will be lit to maintain operational safety on a 24-hour basis.

Standby duties may include but are not limited to periods of helicopter operations and working over the side activities while in the field.

Seawater is pumped on board and used as a heat exchange medium for the cooling of machinery engines and high temperature drilling fluid on the MODU. It is subsequently discharged from the MODU at the sea surface at potentially a higher temperature. Alternately, MODUs may use closed loop cooling systems.

Potable water, primarily for accommodation and associated domestic areas, may be generated on vessels using a reverse osmosis (RO) plant. This process will produce brine, which is diluted and discharged at the sea surface.

The MODU and support vessels will also discharge deck drainage from open drainage areas, bilge water from closed drainage areas, putrescible waste and treated sewage and grey water. Solid hazardous and non-hazardous wastes generated during the Petroleum Activities Program are disposed of onshore by support vessels, or may be incinerated where permissible.

Support vessels do not anchor within the PAA during the activities due to water depth; therefore, vessels will utilise DP.

The support vessels are also available to assist in implementation of the WA-61-L Scarborough Drilling and Completions Oil Pollution First Strike Plan (FSP), should an environmental incident occur (e.g. spills).

3.10.2.4 Holding Station: Mooring Installation and Anchor Hold Testing/Soil Analysis

Mooring uses a system of chains/wires and anchors, which may be pre-laid before the MODU arrives at the location, to maintain position when drilling. A mooring analysis will be undertaken to determine the appropriate mooring system for the Petroleum Activities Program. The mooring analysis will identify whether the mooring system will be pre-laid or set by the MODU, define proof tension values, and evaluate whether synthetic fibre mooring ropes are required. A pre-laid system can generally withstand higher sea states compared to a system that only uses the MODUs mooring chain/equipment and can also save the time in establishing anchors.

Installation and proof tensioning of anchors involves some disturbance to the seabed. Anchor handling vessels (AHV) are used in the deployment and recovery of the mooring system.

As part of mooring preparations, anchor hold testing may be conducted at the development well locations. Anchor hold testing would be undertaken if Woodside determines that further assurance is required to ensure a robust mooring design.

Anchor hold testing may consist of an AHV or similar vessel dropping an anchor at a potential mooring location. The AHV would then tension the anchor to determine its ability to hold, embed and not drag at location. This may have to be repeated several times at each location. A ROV may also be utilised to judge how deep the anchor has embedded and independently verify the seabed condition. Anchor hold testing activities would occur prior to the MODU arriving on location.

Soil analysis may also be necessary to provide data on composition and rock/substrate strength as input into the mooring design and verify seabed conditions for anchor holding. Soil analysis could include taking a physical sample of the seabed using ROV or other tools or using measuring devices such as a cone penetrometer. These tests would be carried out up to several months prior to MODU arriving on location and may occur from a support vessel or anchor handling vessel.

Suction piling may be required as a contingent activity and will be reviewed with the MODU contractor.

3.10.2.5 Holding Station: Dynamic Positioning (DP MODU and DP Vessels Only)

DP uses satellite navigation and radio transponders in conjunction with thrusters to maintain the position of the MODU or vessel at the required location. Information relating to the position of the MODU or vessel is provided via seabed transponders, which emit signals that are detected by receivers on the MODU or vessel and used to calculate position. The transponders are typically deployed in a pentagon array on the seabed, using steel clump weights, for the duration of the drilling at each development well. They are recovered at the end, generally by remotely operated vehicle (ROV). Clump weights are recovered if practicable to do so or may be left in situ.

3.10.2.6 Refuelling

The MODU will be refuelled via support vessels approximately once a month or as required. Refuelling will take place within the PAA of the well being drilled at the time and has been included in the risk assessment for this EP. Other fuel transfers that may occur on board the MODU may include refuelling of cranes, helicopters or other equipment as required.

3.10.3 Helicopter Operations

During the Petroleum Activities Program, crew changes will be undertaken using helicopters as required. Helicopters are the primary means of transporting passengers and/or urgent freight to/from the activity. They are also the preferred means of evacuating personnel in an emergency.

Helicopter operations within the PAA are limited to helicopter take-off and landing on the helideck. Helicopters may be refuelled on the helideck.

3.10.4 ROV Operations

The MODU, installation vessel and support vessels may be equipped with a ROV system that is maintained and operated by a specialised contractor aboard the vessel. ROVs may be used during drilling operations and subsea installation, for activities such as:

- anchor holding testing
- pre-drill seabed and hazard survey
- transponder deployment
- blowout preventer (BOP) land-out and recovery
- BOP well control contingency
- visual observations at seabed during riserless drilling operation
- pre and post installation survey
- installation and testing of subsea infrastructure
- xmas tree operations.

An ROV can be fitted with various tools and camera systems that can be used to capture permanent records (both still images and video) of the operations and immediate surrounding environment. Specifically, during installation, the ROV will be fitted with hydraulically driven tools to facilitate flowline tie-in.

An ROV may also be used in the event of an incident for the deployment of the Subsea First Response Toolkit. This is discussed further in **Appendix D**.

3.11 Contingent Activities

The next sections present contingencies that may be required, if operational or technical issues occur during the Petroleum Activities Program. These contingencies have been considered within the relevant impact assessment sections and do not represent significant additional risks or impacts but may generate additional volumes of drilling fluids and cuttings being operationally discharged.

3.11.1 Contingency Development Wells

Two additional development wells may be installed under this EP. The wells would be installed as described in **Section 3.7** (Drilling Activities) and have not yet been located within WA-61-L.

3.11.2 Respud

A respud may be required for a number of reasons, such as if the conductor or well head slumps or fails installation criteria (typically during top hole drilling). Respudding involves moving the MODU to a suitably close location (e.g. about 25m - 50 m from the original location) to recommence drilling. A respud activity would result in repeating top-hole drilling (**Section 3.7.1.2**).

The environmental aspects of respudding are the same as those for drilling and are considered to be adequately addressed by this EP, with no significant changes to existing environmental risks or any additional environmental risks likely. The net environmental effect will be limited to an increase in the volume of cuttings generated (**Table 6-7**) and discharged at the seabed, from the repeat drilling of the top-hole section, plus an increase in the quantity of cement discharged at seabed from cementing the conductor and surface casing strings.

3.11.3 Workover

The proposed development wells may be worked over to monitor and maintain well integrity as required. A workover may be completed using either a MODU or LWI vessel. The environmental aspects of a workover operation are the same as those for undertaking well completion activities and are considered to be adequately addressed by this EP (**Section 6**), with no significant changes to existing environmental risks or any additional environmental risks likely.

3.11.4 Wireline Logging

Wireline contingencies that may be in place for development drilling include but are not limited to, Gamma Ray (GR) and Casing Collar Locator (CCL) for depth correlation, Ultrasonic Imaging Tool (USIT) and CBL to measure cement integrity, formation pressures (XPT), Density, Neutron and Resistivity and punch perforators/tubing cutters suitable for all tubing sizes. Wireline contingency work will be carried out with appropriate isolation barriers in place, i.e. an overbalanced fluid column. If wireline work is required to take place in a live well, or where there is a risk of barrier failure, then the operation will be carried out with full pressure control equipment at the surface.

Some logging tools may contain low activity radiation sources. Radiation fields are not generally detectable outside the tool when the tool is not energised, therefore they do not present an environmental risk.

3.11.5 Sidetrack

A sidetrack may be required instead of a respud if operational issues are encountered. The environmental aspects of a sidetrack well are the same as those for routine drilling activities, which are considered to be adequately addressed by this EP (**Section 6**), with no significant changes to existing environmental risks or any additional environmental risks likely. The net environmental effect will be limited to an increase in the volume of cuttings generated (**Table 6-7**), potential increase in the use of drilling fluids, and the additional emissions (atmospheric and waste) associated with an extended drilling program.

3.11.6 Well Intervention

An intervention may be carried out on any of the Petroleum Activities Program wells. Interventions may be carried out due to down-hole equipment failure or to address underperformance of a well.

Well intervention generally occurs within the wellbore and includes activities such as:

- slickline/wireline/coil-tubing operations
- well testing and flowback
- well workovers (mechanical or hydraulic).

Potential environmental impacts from intervention activities have been included in this EP, including discharge of suspension fluids and brines and small volume gas releases subsea due to removal of a tree cap which may be in place if the well was previously suspended.

During intervention activities, local control of the xmas tree may be required. Valve actuation of the trees may be required, which will result in small releases of subsea control fluids to be released to the environment. Intervention activities also include removing marine fouling by mechanical or acid soaking, resulting in the release of marine-fouling debris and small amounts of acid to the environment (refer to **Table 3-7**). When retrieving intervention tooling, small volumes of wellbore fluids may be displaced back into the well.

3.11.7 Well Abandonment

The Petroleum Activities Program covers the drilling of development wells, which are not envisaged to be abandoned until the end of the production field life. For technical reasons, it may be required to abandon the lower section of a well, prior to sidetracking, or in the event that a respud is required.

Well abandonment activities are conducted in accordance with Woodside's internal standards. Base oil may be used for inflow testing prior to abandonment, to verify barrier integrity (base oil is also used for well cleanup/well test activities and as such has been risk assessed in this EP). Base oil would be pumped down the drill string and reverse circulated back to the rig, with fluids collected for disposal onshore. If stored in a mud pit, the base oil and other fluids associated with the test may result in pit wash water contaminated with hydrocarbons. If this is the case, mud pit wash water would be discharged in accordance with requirements in this EP; with a hydrocarbon content <1% by volume.

If required, wells will be abandoned with abandonment cement plugs, including verification of the uppermost cement plug by tagging and/or pressure testing through a prescribed program. A lower section of a well may also be abandoned prior to sidetracking.

Following abandonment activity, the marine riser and BOP will be removed and every reasonable attempt for retrieval of the wellhead will be made. Wellheads are typically removed by deploying a cutting device on drill pipe which then cuts through the conductor, allowing the wellhead to be retrieved to the surface. Another technique may use an ROV to activate the cutter. The conductor cutting equipment is usually reliable with a high success rate of cutting wellheads. Typically wellhead removal is successful after two attempts therefore this is considered reasonable. If these recognised removal techniques are ineffective after two attempts or technically the cut is deemed unfeasible after the first attempt (e.g. wellhead rotating, cutting BHA misalignment), the wellhead may be left in-situ (refer to **Section 3.11.8**).

3.11.8 Wellhead Assembly Left In-situ

If a well is abandoned due to the requirement to respud, the wellhead assembly may be left in-situ if recognised removal techniques are ineffective. Well abandonment activities would be undertaken as outlined in **Section 3.11.7**, but the wellhead assembly would remain. The integrity of the wellbore is not affected by the wellhead assembly remaining in-situ. The environmental aspects of the wellhead assembly remaining in-situ are considered to be adequately addressed by this EP (**Section 6**), with no significant changes to existing environmental risks or any additional environmental risks likely.

Final decommissioning of the development wellhead assembly and other subsea infrastructure at the end of field life will be subject to a separate EP.

3.11.9 Sediment Mobilisation and Relocation

If required, an ROV-mounted suction pump/dredging unit may be used to relocate sediment/cuttings around the wellhead or other infrastructure, to keep the area clear and safe for operations and equipment. This activity has the potential to generate plumes of suspended sediment during pumping and disturb benthic fauna in the immediate area.

3.11.10 Venting

During drilling of the well, a kick may occur. A kick is an undesirable influx of formation fluid into the wellbore. To maintain well integrity in this situation, a small volume of greenhouse gases is released to the atmosphere via the degasser, in a well control operation known as ‘venting’.

3.11.11 Emergency Disconnect Sequence

An Emergency Disconnect Sequence (EDS) may be implemented if the MODU is required to rapidly disengage from the well. The EDS closes the BOP (i.e. shutting in the well) and disconnects the riser to break the conduit between the wellhead/BOP and MODU. Common examples of when this system may be initiated include the movement of the MODU outside of its operating circle (e.g. due to a failure of one or more of the moorings or dynamic positioning system) or the movement of the MODU to avoid a vessel collision (e.g. third-party vessel on collision course with the MODU). EDS aims to leave the wellhead and BOP in a secure condition but will result in the loss of the drilling fluids/cuttings in the riser following disconnection.

4. DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 Overview

In accordance with Regulations 13(2) and 13(3) of the Environment Regulations, this section describes the existing environment that may be affected by the activity (planned and unplanned, as described in **Section 3**), including details of the particular relevant values and sensitivities of the environment, which were used for the risk assessment.

The Environment that May Be Affected (EMBA) is the largest spatial extent where unplanned events could have an environmental consequence on the surrounding environment. For this EP, the EMBA is the potential spatial extent of surface and in-water hydrocarbons at concentrations above ecological impact thresholds, in the event of the worst-case credible spill. The ecological impact thresholds used to delineate the EMBA are defined in **Section 6.7.1.3**. The worst-case credible spill scenario for this EP is loss of marine diesel during a vessel collision.

Woodside recognises that hydrocarbons may be visible beyond the EMBA at lower concentrations than the ecological impact thresholds defined in **Section 6.7.1.3**. These visible hydrocarbons are not expected to cause ecological impacts. In respect of this, an additional socio-cultural EMBA is defined, as the potential spatial extent within which social-cultural impacts may occur from changes to the visual amenity of the marine environment. Receptors relevant to the socio-cultural EMBA include Commonwealth and State marine protected areas (MPAs), National and Commonwealth Heritage Listed places, areas of tourism and recreation, and commercial and traditional fisheries. For this EP, the socio-cultural EMBA for surface hydrocarbons encompasses an area fully within the boundaries of the EMBA for ecological impacts. The EMBA and socio-economic EMBA are shown in **Figure 4-1** and described in **Table 4-1**.

The EMBA presented does not represent the predicted coverage of any one hydrocarbon spill or a depiction of a slick or plume at any particular point in time. Rather, the areas are a composite of a large number of theoretical paths, integrated over the full duration of the simulations under various metocean conditions.

Table 4-1: Hydrocarbon spill thresholds used to define EMBA for surface and in-water hydrocarbons

<table>
<tr><th>Hydrocarbon Type</th><th>EMBA[1]</th><th>Socio-cultural EMBA[1]</th><th>Planning Area for Scientific Monitoring</th></tr>
<tr><td>Surface</td><td>10 g/m^2
This represents the minimum oil thickness (0.01 mm) at which ecological impacts (e.g. to birds and marine mammals) are expected to occur.</td><td>1 g/m^2
This represents a wider area where a visible sheen may be present on the surface and, therefore, the concentration at which socio-cultural impacts to the visual amenity of the marine environment may occur. However, it is below concentrations at which ecological impacts are expected to occur.</td><td>NA</td></tr>
<tr><td>Dissolved</td><td colspan="2">50 ppb
This represents potential toxic effects, particularly sublethal effects to highly sensitive species (NOPSEMA guidance note: A652993, April 2019). As dissolved hydrocarbons are within the water column and not visible, impacts to socio-cultural receptors are associated with ecological impacts. Therefore, dissolved hydrocarbons at this threshold also represent the level at which socio-cultural impacts may occur.</td><td rowspan="2">10 ppb
This low exposure value establishes the planning area for scientific monitoring (based on potential for exceedance of water quality triggers) (NOPSEMA guidance note: A652993, April 2019). This area is described further in Appendix D: Figure 5-1.</td></tr>
<tr><td>Entrained</td><td colspan="2">100 ppb</td></tr>
</table>

Hydrocarbon Type	EMBA[1]	Socio-cultural EMBA[1]	Planning Area for Scientific Monitoring
	This represents potential toxic effects, particularly sublethal effects to highly sensitive species (NOPSEMA guidance note: A652993, April 2019). As entrained hydrocarbons are within the water column and not visible, impacts to socio-cultural receptors are associated with ecological impacts. Therefore, entrained hydrocarbons at this threshold also represent the level at which socio-cultural impacts may occur.		In the event of a spill, DNP will be notified of AMPs which may be contacted by hydrocarbons at this threshold **Table 5-3**.
Shoreline	100 g/m^2 This represents the threshold that could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat.	10 g/m^2 This represents the volume where hydrocarbons may be visible on the shoreline but is below concentrations at which ecological impacts are expected to occur.	N/A

[1] *Further details including the source of the thresholds used to define the EMBA in this table are provided in* ***Section 6.7.1.3***

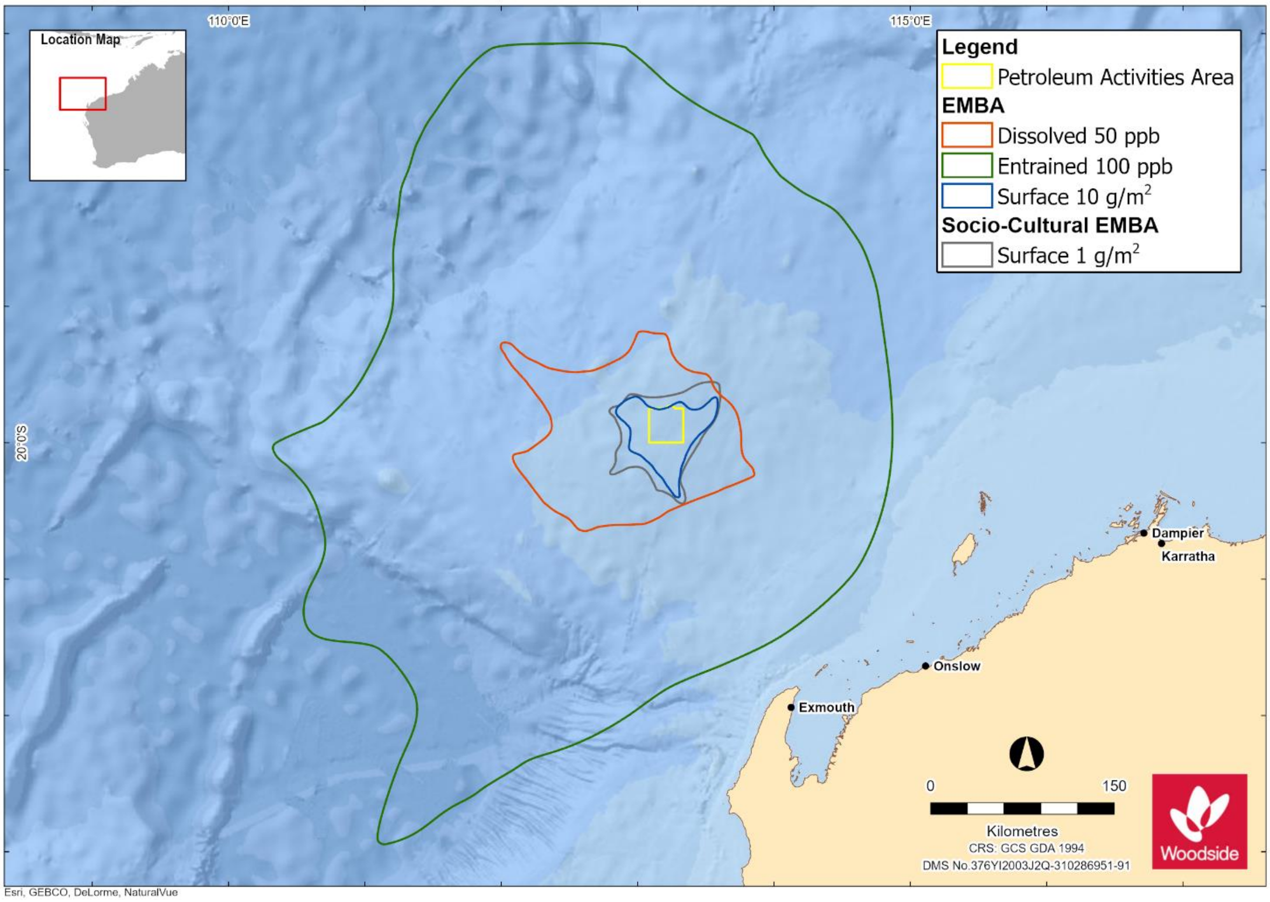


Figure 4-1: Environment that May Be Affected by the Petroleum Activities Program

4.2 Regional Context

The PAA occurs in Commonwealth waters off the north-west coast of Western Australia (WA), located in the North-west Marine Bioregion (NWMR) (IMCRA 4.0). Within the NWMR, the PAA lies within the Northern Carnarvon Basin on the Exmouth Plateau, about 374 km offshore from Dampier. The PAA overlaps with the Northwest Province and the EMBA partially overlaps with the Central Western Transition (**Figure 4-2**). Woodside's Description of Existing Environment (**Appendix I**) summarises the characteristics for the relevant marine bioregions.

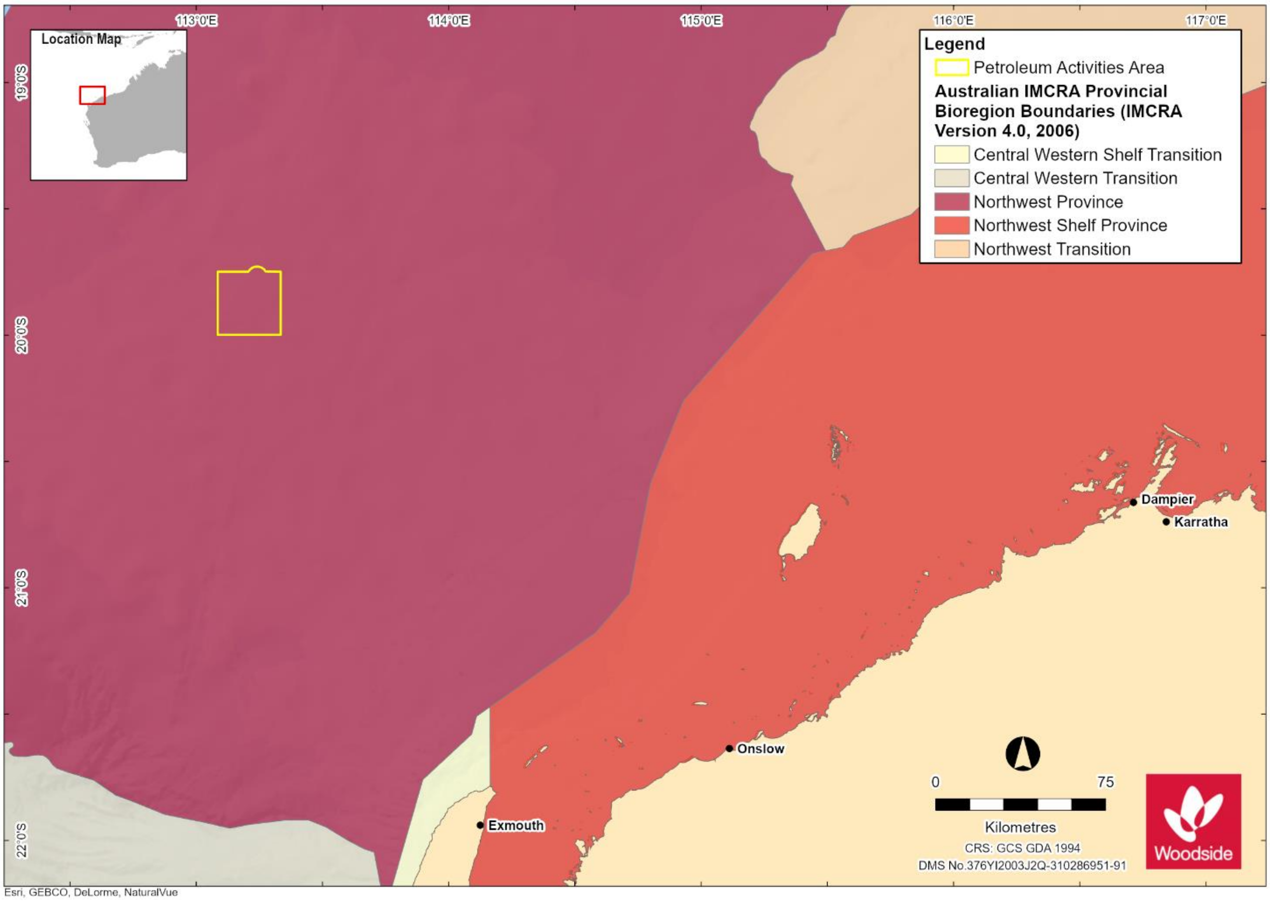


Figure 4-2: Location of the PAA and relevant marine bioregions

4.3 Matters of National Environmental Significance (EPBC ACT)

Table 4-2 and **Table 4-3** summarise the matters of national environmental significance (MNES) overlapping the PAA and EMBA, respectively, according to Protected Matters Search Tool (PMST) results (**Appendix C**). It should be noted that the EPBC Act PMST is a general database that conservatively identifies areas in which protected species have the potential to occur.

Additional information on these MNES are provided in subsequent sections of this chapter and described in detail in **Appendix I**.

Table 4-2: Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the PAA

MNES	Number	Relevant Section
World Heritage Properties	0	**Section 4.9.1**
National Heritage Places	0	**Section 4.9.1**

MNES	Number	Relevant Section
Wetlands of International Importance (Ramsar)	0	**Section 4.9.1**
Commonwealth Marine Area	1	**Section 4.2**
Listed Threatened Ecological Communities	0	**Section 4.5**
Listed Threatened Species	23	**Section 4.6**
Listed Migratory Species	23	**Section 4.6**

Table 4-3: Summary of MNES identified by the EPBC Act PMST as potentially occurring within the EMBA

MNES	Number	Relevant Section
World Heritage Properties	0	**Section 4.9.1**
National Heritage Places	0	**Section 4.9.1**
Wetlands of International Importance (Ramsar)	0	**Section 4.9.1**
Commonwealth Marine Area	2	**Section 4.2**
Listed Threatened Ecological Communities	0	**Section 4.5**
Listed Threatened Species	26	**Section 4.6**
Listed Migratory Species	25	**Section 4.6**

4.4 Physical Environment

Water depths of the PAA range from 900 m to 955 m. The shallowest waters are approximately in the centre of the PAA, with a gradual increase in depth to the north/north-west and also to the south/south-east (**Figure 4-3**). To the centre and west of the PAA, craters (up to 400 m across and 10 m deep) and similar pockmarks (metres to tens of metres across) have been identified through geophysical surveys (Fugro, 2010). The seafloor exhibits gradients less than 1^{o} but extends to about 15^{o} on the edge of craters (Fugro, 2010). These crater and pockmark formations may be associated with hydrocarbon seeps and associated authigenic carbonate formations (Fugro, 2010).

Marine sediment quality surveys within the Scarborough (WA-61-L[2]) title were undertaken during the 2012/2013 wet and dry seasons (ERM, 2013). The ERM marine investigation included sampling at a number of sampling sites, to:

- provide a broad characterisation of the habitats within WA-61-L
- achieve spatial coverage across WA-61-L
- provide a representative selection of the various topographic features and corresponding benthic habitats (i.e. crater/pockmark versus non-crater areas).

Key results included:

All the sediment samples collected were predominantly (≥97% w/w) composed of clay and silt; and only small amounts (1–3% w/w) of sand and shell were detected.
Generally, low concentrations of metals and nutrients were detected. With the exception of nickel, metal concentrations were below the sediment default guideline values (DGVs) (Simpson, 2013) for analytes with defined DGVs (arsenic, cadmium, chromium, copper, mercury, nickel, lead and zinc). Nickel concentrations were below the high GV.
No hydrocarbons were detected.

[2] Note that the WA-1-R title expired on 1/11/2020, and was replaced by WA-61-L.

Although crater and pockmark formations have been identified in the EMBA, which have been associated with hydrocarbon seeps and authigenic carbonate formations (Fugro, 2010), the absence of hydrocarbons in sediment samples indicates the lack of recent hydrocarbon seep activity in the locations sampled (ERM, 2013).

Water quality in the PAA is typical of an tropical offshore environment. Much of the surface water in this area is nutrient poor, transported from the Indonesian Throughflow (ITF) and has low primary productivity.

The marine water quality of the offshore environment of the Exmouth Plateau was measured by collecting triplicate water samples at three stations per 15 sampling sites (across two seasons) (ERM, 2013a). Water profiling and water quality sampling was undertaken in the 2012/2013 wet and dry seasons. The main findings include:

- The deeper waters had significantly lower dissolved oxygen concentrations (about 23%) compared to the oxygen-saturated (≥100%) surface waters.
- Generally low concentrations of metals, nutrients and chlorophyll-a were detected. With the exception of cobalt, copper and zinc, mean metal concentrations throughout WA-61-L during both the wet and dry season studies were below the ANZECC guidelines trigger value for 95% species protection (ANZECC and ARMCANZ 2000).
- Total suspended solid mean concentrations were higher during the wet season (22,450 µg/L) than the dry season study (4000 µg/L) and showed variability across sites and throughout the water column.
- No hydrocarbons were detected.

Results from the studies indicated that the water quality within the WA-61-L title is generally typical of the NWMR's tropical deep-water environment (ERM, 2013a).

Appendix I provides a summary of the physical characteristics of the environment within the EMBA.

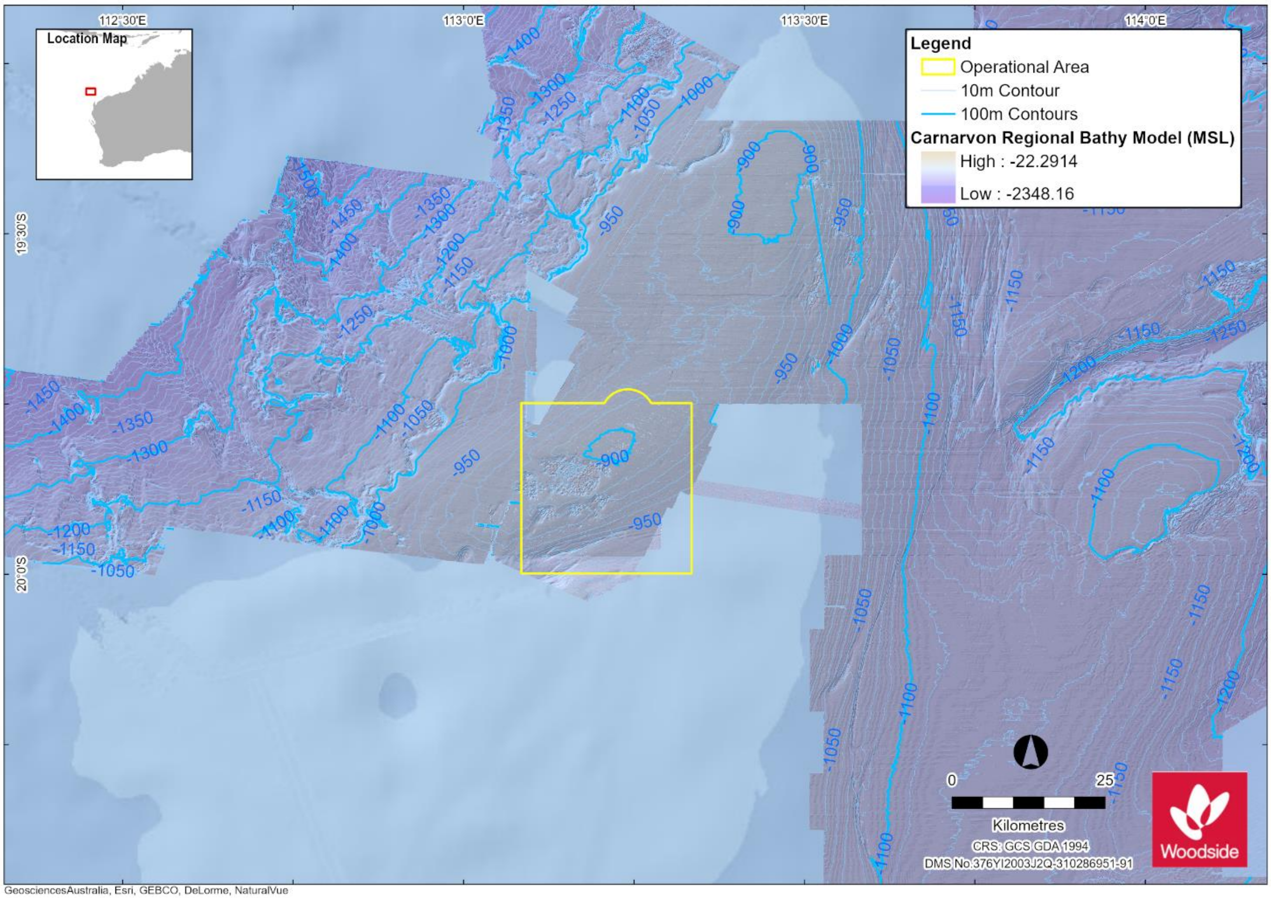


Figure 4-3: Bathymetry of the PAA

4.5 Habitats and Biological Communities

The seafloor in the PAA is characterised by sparse marine life dominated by motile organisms (ERM, 2013). This soft bottom habitat also supports patchy distributions of mobile epibenthos, such as sea cucumbers, ophiuroids, echinoderms, polychaetes and sea-pens (DEWHA, 2008). Bivalve shell debris and bacterial mats (both with low percent cover) were the only identified features that may be indicative of historic hydrocarbon seep activity. A benthic infauna analysis reported by ERM in 2013 provided no evidence of the presence of unique hydrocarbon seep chemosynthetic benthic communities, which are typically characterised by species from the family Dorvilleidae (ERM, 2013; Thornhill et al., 2012).

Seabed habitat is characterised by sparse marine life dominated by mobile benthic biota (ERM, 2013). The benthic biota are predominately deposit feeders such as epifauna (living on the seabed): shrimp (crustaceans) and sea cucumbers (echinoderms), and infauna (living within the surface sediments) small, burrowing worms (polychaetes) and crustaceans (ERM, 2013). Bioturbation traces (seabed surface sediment animals trails, mounds and burrows) are characteristic of such deepwater benthic habitats and were recorded during baseline survey work (ERM, 2013) and are thought to be common within the PAA and EMBA. The seabed bioturbation indicates the presence of benthic biota (epifauna and infauna) including echinoderms, crustaceans and echiurans (spoon worms) and annelids (polychaetes) (ERM, 2013).

Sampling within the Permit Area returned low phytoplankton densities (ERM, 2013). Seasonal variation was observed in the samples with total recorded taxa, species richness and species diversity (Shannon-Weiner) being significantly greater in the dry season than in the wet season

(ERM, 2013). Dinoflagellates were the most abundant group within wet season study, and diatoms were generally the most abundant group in dry season study (ERM, 2013).

Similarly, greater species abundance and diversity was recorded in zooplankton samples during the dry season compared to the wet season (ERM, 2013). Copepods were the most dominant taxonomic group during both studies in terms of abundance and concentrations, with other zooplankton including ostracods, molluscs (pteropods), euphausiids (krill) and larvaceans also being identified in relatively abundant amounts (ERM, 2013).

Concentrations of fish larvae were similar in both wet and dry season samples. For both seasons ichthyoplankton communities largely comprised the larvae of meso-pelagic fishes (Myctophidae [lantern fishes] and Gonostomatidae [bristlemouths]) (ERM, 2013).

It is noted that these survey findings do not reflect the productivity trends reported in scientific literature for the region (DEWHA, 2008; Brewer et al., 2007), whereby productivity is typically greater during the wet season when the weakening of surface currents allows for increased upwelling. However, the findings do indicate that productivity remains low across the seasons and that while seasonal variations in plankton species composition potentially occurs, overall variations in abundance are likely to be minor (ERM, 2013).

Key habitats and ecological communities within the EMBA are identified in **Table 4-4** and described in **Appendix I**.

Table 4-4: Habitats and communities within the EMBA

Habitat/community	Key locations within the EMBA
Marine primary producers	
Coral	No hard coral habitats likely to occur within the EMBA.
Seagrass beds and macroalgae	No seagrass beds or macroalgae habitats occur within the EMBA.
Mangroves	No mangrove habitats occur within the EMBA.
Other communities and habitats	
Plankton	Plankton communities within the EMBA are expected to reflect the distribution and abundance of the NWMR.
Pelagic and demersal fish populations	Fish populations within the EMBA are expected to reflect the distribution and abundance of the NWMR.
Epifauna and infauna	Epifauna and infauna within the EMBA are expected to reflect the distribution and abundance of the NWMR.

4.6 Protected Species

A total of 26 EPBC Act listed species considered to be MNES were identified as potentially occurring within the EMBA, of which a subset of 23 species were identified as potentially occurring within the PAA. The full list of marine species identified from the PMST reports is provided in **Appendix C**, including several MNES that are not considered to be credibly impacted (e.g. terrestrial species within the EMBA). Two conservation dependent species have also been identified with a potential to occur within the PAA and / or EMBA. One of those species, southern bluefin tuna, has a spawning area within the South of Java Island Ecologically or Biologically Significant Marine Areas (EBSA) directly to the north of the PAA (**Figure 4-4**).

Species identified as potentially occurring within the PAA and EMBA and Biologically Important Areas (BIAs) or Habitat Critical to their Survival (Habitat Critical) that overlap the PAA and EMBA are listed in **Table 4-5** to **Table 4-10**, and a description of species is included in **Appendix I**. **Figure 4-5** and **Figure 4-7** show the spatial overlap with relevant BIAs and Habitat Critical areas and the PAA.

4.6.1 Fish, Sharks and Rays

Table 4-5: Threatened and Migratory fish, shark and ray species predicted to occur within the PAA and EMBA

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				PAA	***EMBA***
Carcharodon carcharias	White shark, great white shark	Vulnerable	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Pristis zijsron	Green sawfish	Vulnerable	Migratory	NA	Species or species habitat known to occur within area
Carcharhinus longimanus	Oceanic whitetip shark	NA	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Isurus oxyrinchus	Shortfin mako, mako shark	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Isurus paucus	Longfin mako shark	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Manta birostris (recently revised taxonomy *Mobula birostris* [White et al., 2017])	Giant manta ray, chevron manta ray, Pacific manta ray, pelagic manta ray, oceanic manta ray	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Manta alfredi	Reef manta ray	N/A	Migratory	N/A	Species or species habitat likely to occur within area
Anoxypristis cuspidata	Narrow Sawfish	N/A	Migratory	N/A	Species or species habitat may occur within area
Lamna nasus	Porbeagle Shark	NA	Migratory	NA	Species or species habitat may occur within area

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				PAA	***EMBA***
Thunnus maccoyii	Southern bluefin tuna	Conservation Dependent	N/A	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Sphyrna lewini	Scalloped hammerhead shark	Conservation Dependent	N/A	N/A	Species or species habitat likely to occur within area

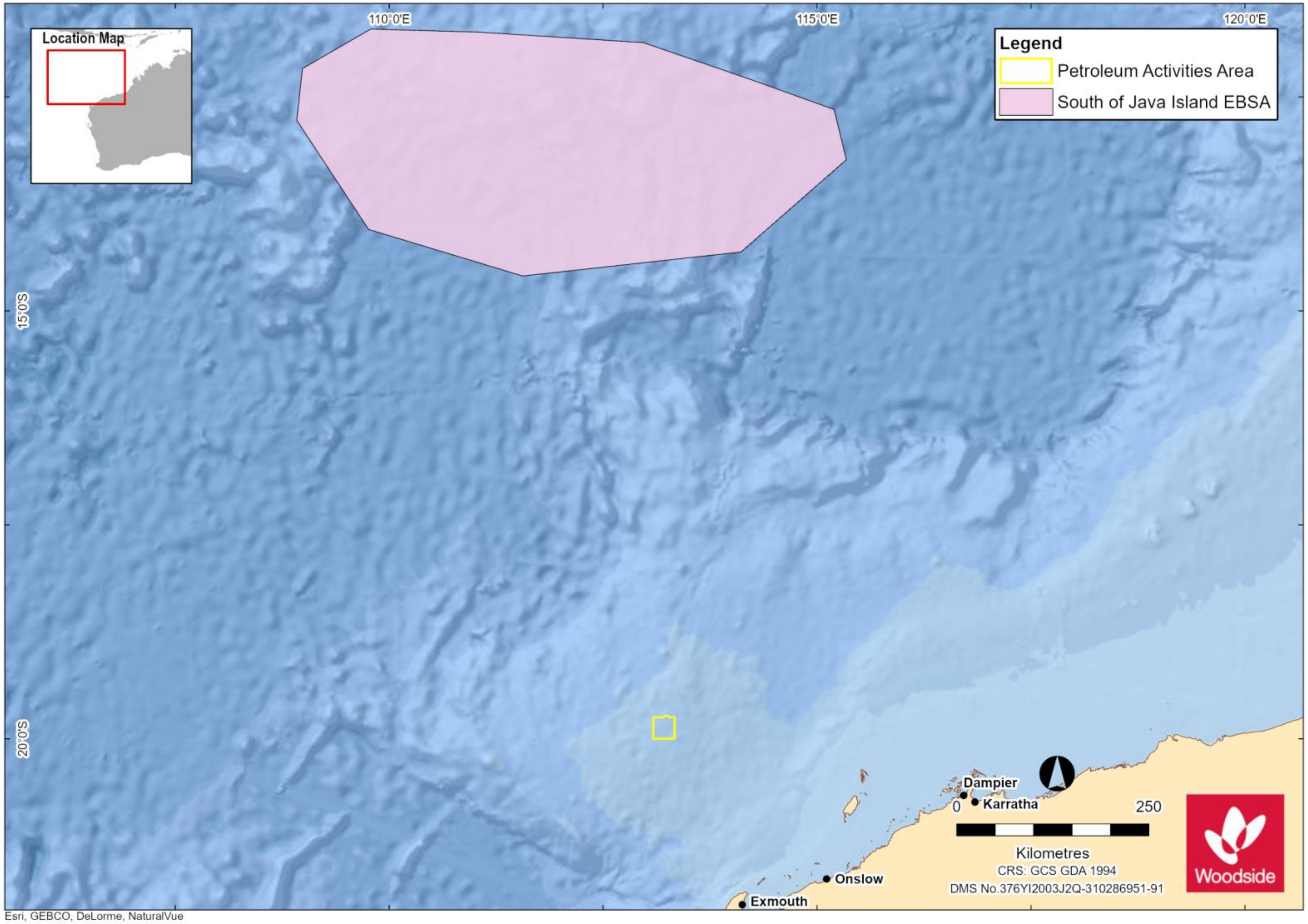


Figure 4-4: Southern bluefin tuna spawning area – South of Java Island EBSA[1]

[1] EBSA – Ecologically or Biologically Significant Marine Areas; https://www.cbd.int/ebsa/

4.6.2 Marine Reptiles

Table 4-6: Threatened and Migratory marine reptile species predicted to occur within the PAA and EMBA

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				PAA	***EMBA***
Caretta caretta	Loggerhead turtle	Endangered	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Dermochelys coriacea	Leatherback turtle, leathery turtle, luth	Endangered	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Chelonia mydas	Green turtle	Vulnerable	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Natator depressus	Flatback turtle	Vulnerable	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area

4.6.3 Marine Mammals

Table 4-7: Threatened and Migratory marine mammal species predicted to occur within the PAA and EMBA

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				PAA	***EMBA***
Balaenoptera musculus	Blue whale (true/Antarctic)	Endangered	Migratory	Species or species habitat likely to occur within area	Migration route known to occur within area
*Balaenoptera musculus brevicauda**	Pygmy blue whale	Endangered	Migratory	Species or species habitat likely to occur within area	Migration route known to occur within area
Balaenoptera borealis	Sei whale	Vulnerable	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Balaenoptera physalus	Fin whale	Vulnerable	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Megaptera novaeangliae	Humpback whale	Vulnerable	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Balaenoptera edeni	Bryde's whale	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Physeter macrocephalus	Sperm whale	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Balaenoptera bonaerensis	Antarctic minke whale, Dark-shoulder minke whale	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Balaenoptera acutorostrata unnamed *subsp**	Dwarf minke whale	N/A	Migratory	Species or species habitat may occur within area	Species or species habitat may occur within area

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				PAA	***EMBA***
Orcinus orca	Killer whale, orca	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Eubalaena australis	Southern right whale	Endangered	Migratory	N/A	Species or species habitat likely to occur within area
Tursiops aduncus	Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	N/A	Migratory	N/A	Species or species habitat likely to occur within area

*Species not detected in PMST search but reported to occur in the area (McCauley, 2011b).
Note: Dolphins of unconfirmed species (potentially Risso's or spinner dolphins) also present in the area (McCauley, 2011b)

Table 4-8: Marine mammal BIAs within the EMBA

Species	BIA type	Approximate distance (km) and direction from PAA
Balaenoptera musculus brevicauda (Pygmy blue whale)	Migration pathway extending from Perth Canyon to Indonesia	37 km south-east

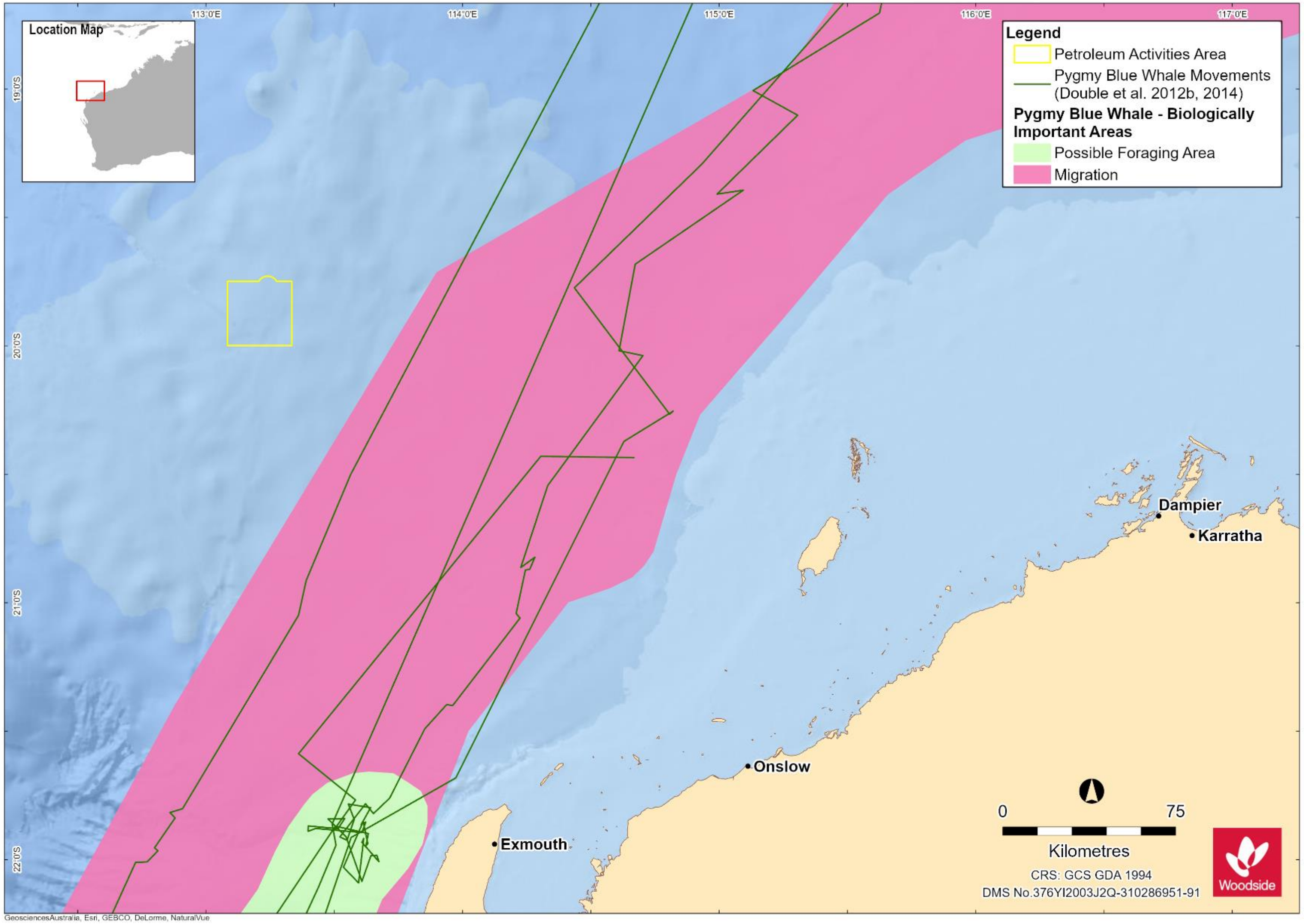


Figure 4-5: Pygmy blue whale BIAs and satellite tracks of whales tagged between 2009 and 2011 (Double et al., 2012, 2014)

4.6.4 Seabirds and Migratory Shorebirds

Table 4-9: Threatened and Migratory seabird and shorebird species predicted to occur within the PAA and EMBA

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				PAA	***EMBA***
Calidris canutus	Red knot, knot	Endangered	Migratory	Species or species habitat likely to occur within area	Species or species habitat may to occur within area
Actitis hypoleucos	Common sandpiper	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Anous stolidus	Common noddy	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat may occur within area
Calidris acuminata	Sharp-tailed sandpiper	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Calidris ferruginea	Curlew sandpiper	Critically Endangered		N/A	Species or species habitat may occur within area
Calidris melanotos	Pectoral sandpiper	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat likely to occur within area
Fregata ariel	Lesser frigatebird, least frigatebird	N/A	Migratory	Species or species habitat likely to occur within area	Species or species habitat may occur within area
Fregata minor	Great frigatebird, greater frigatebird	N/A	Migratory	N/A	Species or species habitat may occur within area
Macronectes giganteus	Southern giant-petrel, southern giant petrel	Endangered	Migratory	Species or species habitat may occur within area	Species or species habitat may occur within area

Species name	Common name	Threatened status	Migratory status	Potential for interaction	
				PAA	***EMBA***
Numenius madagascariensis	Eastern curlew	Critically Endangered		N/A	Species or species habitat may occur within area
Pterodroma mollis	Soft-plumaged petrel	Vulnerable	N/A	N/A	Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica	Wedge-tailed shearwater	NA	Migratory	NA	Foraging, feeding or related behaviour likely to occur within area
Ardenna carneipes	Flesh-footed Shearwater	NA	Migratory	NA	Species or species habitat may occur within area
Calonectris leucomelas	Streaked Shearwater	NA	Migratory	NA	Species or species habitat likely to occur within area
Thalassarche impavida	Campbell Albatross,	Vulnerable	Migratory	NA	Species or species habitat may occur within area
Charadrius leschenaultii	Greater Sand Plover	Vulnerable	Migratory	NA	Species or species habitat known to occur within area
Phaethon lepturus fulvus	Christmas Island White-tailed Tropicbird	Endangered	NA	NA	Species or species habitat may occur within area

Table 4-10: Seabird BIAs within the EMBA

Species	BIA type	Approximate distance (km) and direction from PAA
Ardenna pacifica (Wedge-tailed shearwater)	Breeding and foraging (Pilbara coast)	115 km south-east

4.6.5 Seasonal Sensitivities for Protected Species

Seasonal sensitivities for protected migratory species identified as potentially occurring within the PAA are identified in **Table 4-11**. Movement patterns of all protected species identified in **Section 4.6** are described in **Appendix I**.

As shown in **Figure 4-5**, the Operational Area is located 35 km from the migratory corridor and 187 km from the possible foraging area off North-west Cape / Ningaloo Coast.

In September 2021, DAWE and NOPSEMA released guidance on key terms within the Conservation Management Plan for the Blue Whale (the CMP)[3]. This guidance recognises the potential for whale foraging and feeding to occur in areas of high primary productivity outside of designated foraging areas. Migrating pygmy blue whales are not necessarily confined to the designated migratory corridor, and there is the potential for individuals to undertake opportunistic foraging within and adjacent to the Operational Area, particularly during the northbound migration.

[3] https://www.environment.gov.au/epbc/publications/guidance-key-terms-blue-whale-conservation-management-plan

Table 4-11: Key seasonal sensitivities for protected migratory species identified as occurring within the PAA.

Species	January	February	March	April	May	June	July	August	September	October	November	December
Fish, sharks and rays												
Manta rays – presence/ aggregation/breeding (Ningaloo)[1]												
Marine reptiles												
Green turtle – various nesting/feeding/hatchlings/ mating areas within wider region*[2]												
Flatback turtle – various nesting/feeding/hatchlings/ mating areas within wider region*[2]												
Loggerhead turtle – various nesting areas within wider region*[2]												
Hawksbill turtles – various nesting/hatchlings/mating areas within wider region*[3]												
Mammals												
Blue whale – northern migration (North West Cape, Montebello, Scott Reef)[4]												
Blue whale – southern migration (North West Cape, Montebello, Scott Reef)[5]												
Humpback whale – northern migration (Jurien Bay to Montebello)[6]												
Humpback whale – southern migration (Montebello to Jurien Bay)[7]												
Seabirds												
Wedge-tailed shearwater aggregation/breeding[8]												
	Species may be present in the PAA											
	Peak period. Presence of animals is reliable and predictable each year											

[1] (CALM, 2005; DSEWPaC, 2012a; Environment Australia, 2002; Sleeman et al., 2010)
[2] (Chevron Australia Pty Ltd, 2015; CALM, 2005; DSEWPaC, 2012a)
[3] (Chevron Australia Pty Ltd, 2015; DSEWPaC, 2012a)
[4] (DSEWPaC, 2012a, b; McCauley and Jenner, 2010; McCauley, 2011a)
[5] (DSEWPaC, 2012a, b; McCauley and Jenner, 2010)
[6] (CALM, 2005; Environment Australia, 2002; Jenner et al., 2001a; McCauley and Jenner, 2001)
[7] (McCauley and Jenner 2001)
[8] (CALM, 2005; Department of Environmental Protection, 2001; DSEWPaC, 2012b; Environment Australia, 2002)

4.7 Key Ecological Features (KEFs)

The PAA is situated on the Exmouth Plateau and lies entirely within the Exmouth Plateau Key Ecological Feature (KEF). The Exmouth Plateau KEF starts approximately 110 km offshore and extends to 370 km from the shore. The KEF occupies an area of 49,310 km^2 within water depths of 800 – 4000 m (Exon and Wilcox, 1980, cited in Falkner et al., 2009; Heap and Harris, 2008).

KEFs within the EMBA are identified in **Table 4-12** and described in **Appendix I**. **Figure 4-6** shows the spatial overlap with KEFs and the PAA.

Table 4-12: KEFs within the PAA and EMBA

Key Ecological Feature	Distance (km) and direction from PAA to KEF
Exmouth Plateau	Overlaps PAA
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	116 km south-east
Continental Slope Demersal Fish Communities	132 km south

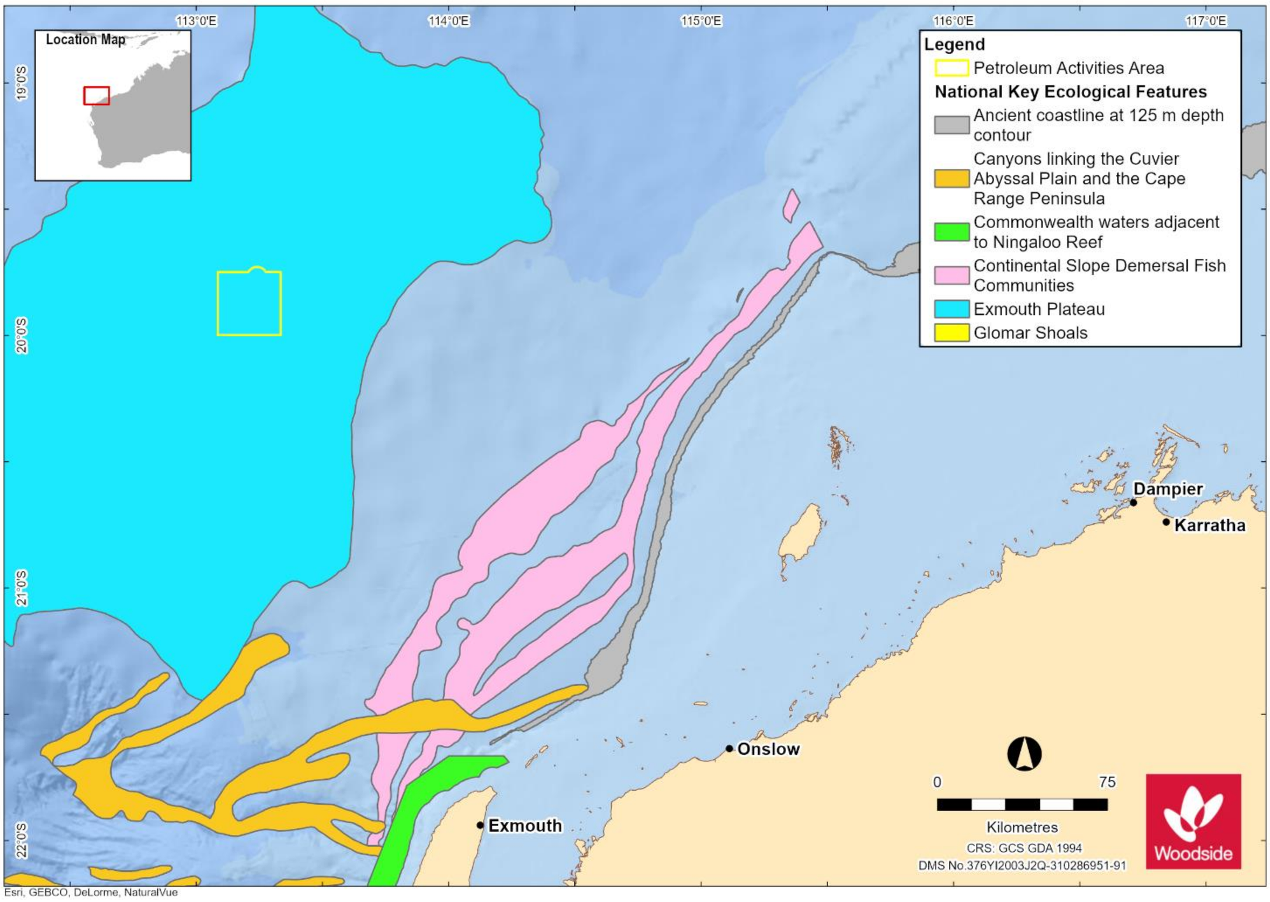


Figure 4-6: KEFs overlapping the PAA

4.8 Protected Places

No protected places overlap the PAA. Protected places within the EMBA are identified in **Table 4-10** and presented in **Figure 4-7**. **Appendix I** outlines the values and sensitivities of protected places and other sensitive areas in the EMBA.

Table 4-13: Established protected places and other sensitive areas overlapping the EMBA

	Distance (km) and direction from PAA to protected place or sensitive area	IUCN category* or relevant park zone overlapping the PAA and/or EMBA
Australian Marine Parks (AMPs)		
Gascoyne AMP	77 km south	IUCN VI
	205 km south-west	IUCN II
	207 km south-west	IUCN IV
State Marine Parks and Nature Reserves		
Marine Parks		
None		
Marine Management Areas		
None		
Nature Reserves		
None		
Other protected areas		
Fish Habitat Protection Areas		
None		

**Conservation objectives for IUCN categories include:*
Ia: Strict Nature Reserve
Ib: Wilderness Area
II: National Park
III: Natural Monument or Feature
IV: Habitat/Species Management Area
V: Protected Landscape
VI: Protected area with sustainable use of natural resources – allow human use but prohibits large scale development.
IUCN categories for the marine park are provided and, in brackets, the IUCN categories for specific zones within each Marine Park as assigned under the North-west Marine Parks Network Management Plan 2018 and South-west Marine Parks Network Management Plan 2018.

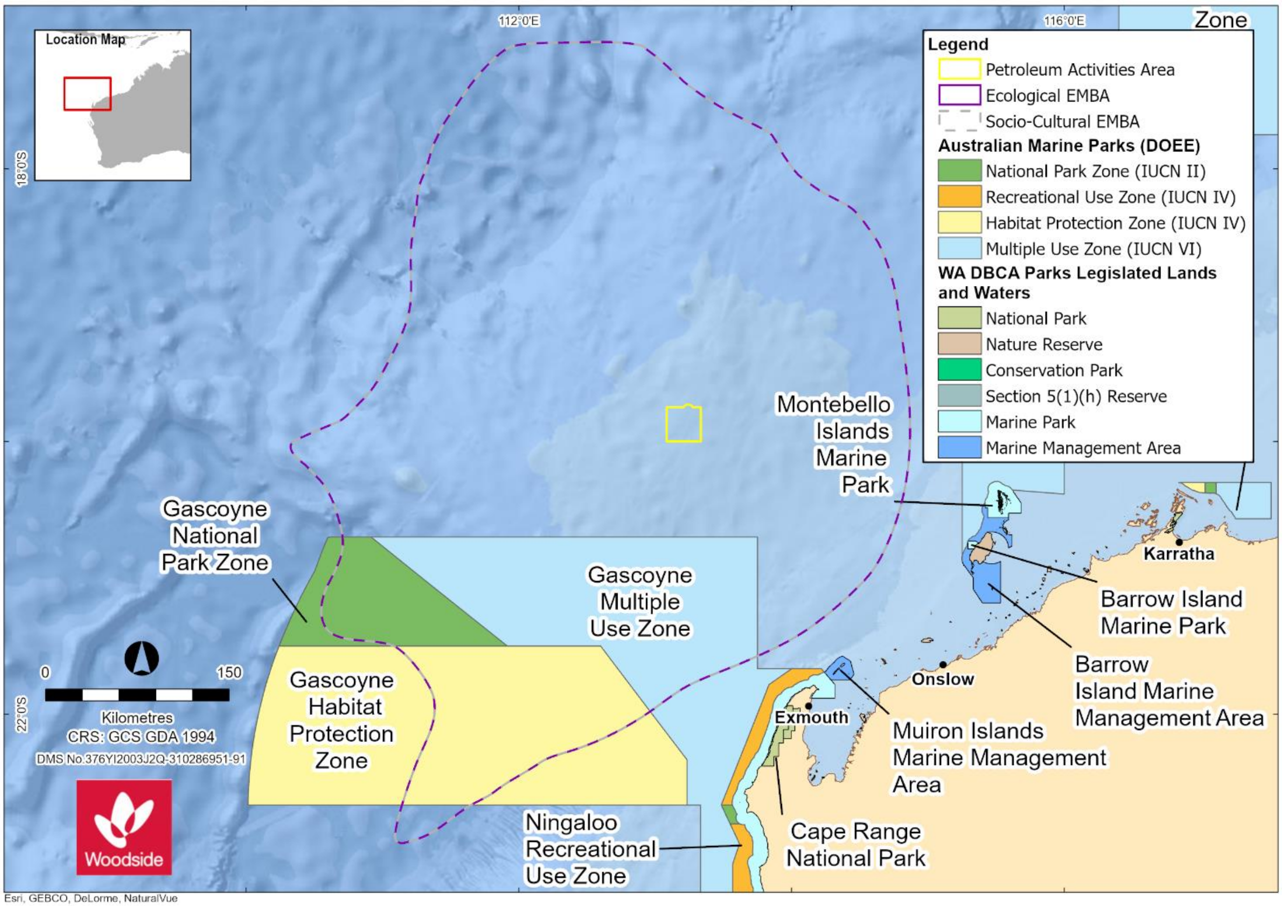


Figure 4-7: Protected areas overlapping the EMBA

4.9 Socio-economic Environment

4.9.1 Cultural Heritage

4.9.1.1 European Sites of Significance

There are no known sites of European cultural heritage significance within the PAA. **Appendix I** describes cultural heritage sites within the EMBA.

4.9.1.2 Indigenous Sites of Significance

The Department of Aboriginal Affairs (DAA) Heritage Inquiry System was searched for the EMBA, which indicated no registered Indigenous heritage places (**Appendix G**). **Appendix I** describes cultural heritage sites within the EMBA.

4.9.1.3 Underwater Heritage

A search of the Australian National Shipwreck Database, which records all known Maritime Cultural Heritage (shipwrecks, aircraft, relics and other underwater cultural heritage) in Australian waters indicated that there are no underwater heritage sites or shipwrecks within the PAA or EMBA.

4.9.1.4 World, National and Commonwealth Heritage Listed Places

No listed world, national or commonwealth heritage places overlap the PAA or EMBA.

4.9.2 Commercial Fisheries

A number of Commonwealth and State fishery management areas are located within the PAA and EMBA. FishCube data were requested to analyse the potential for interaction of fisheries with the PAA, which was used to determine consultation with State Fisheries who may be impacted by proposed petroleum activities (Department of Primary Industries and Regional Development [DPIRD], 2021). **Table 4-14** provides an assessment of the potential interaction and **Appendix I** provides further detail on the fisheries that have been identified through desk-based assessment and consultation (**Section 5**). No fisheries were identified as having a potential interaction with the Petroleum Activities Program.

Table 4-14: Commonwealth and State commercial fisheries overlapping the PAA and EMBA

Fishery	Overlap with PAA	Overlap with EMBA	Potential for interaction within PAA	
Commonwealth Managed Fisheries				
Western Deepwater Trawl Fishery	✓	✓	×	While there is an overlap with the fishery management area and the PAA, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given the current distribution of fishing effort occurs south of the PAA on the western side of the 200 m isobath between Shark Bay and Ningaloo.
Southern Bluefin Tuna Fishery	✓	✓	×	While there is an overlap with the fishery management area and the PAA, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given the current distribution of fishing effort is focused in the Great Australian Bight.
Western Skipjack Tuna Fishery	✓	✓	×	While there is an overlap with the fishery management area and the PAA, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given there have been no active vessels in this fishery since 2009.
Western Tuna and Billfish Fishery	✓	✓	×	While there is an overlap with the fishery management area and the PAA, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given the current distribution of fishing effort is concentrated south of Carnarvon.
State Managed Fisheries				
West Coast Deep Sea Crustacean Managed Fishery	✓	✓	×	The West Coast Deep Sea Crustacean Managed Fishery can fish in waters deeper than the 150 m isobath and therefore overlaps the PAA. However, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program given that current effort is concentrated between Carnarvon and Fremantle.
Pilbara Line Fishery	✓	✓	×	The PAA is located within a 60 nm CAES block (19130), which has not reported any fishing effort between 2009 and 2019. Therefore, while there is an overlap with the fishery management area and the PAA, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Mackerel Managed Fishery (Area 3)	✓	✓	×	The PAA is located across four 10 nm CAES blocks (194130, 194131, 195130 and 195131), which have not reported any fishing effort between 2009 and 2019. Therefore, while there is an overlap with the fishery management area and the PAA, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.

Fishery	Overlap with PAA	Overlap with EMBA	Potential for interaction within PAA	
Marine Aquarium Managed Fishery	✓	✓	×	This fishery generally collects fish for display in water depths less than 30 m. Therefore, no effort occurs within the PAA and Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
South West Coast Salmon Managed Fishery	✓	✓	×	No fishing occurs north of the Perth Metropolitan Area. Therefore, no effort occurs within the PAA and Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Beche-de-mer Fishery	✓	✓	×	The target species typically inhabit nearshore waters and no effort occurs within the PAA. Therefore, while there is an overlap with the fishery management area and the PAA, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.
Pilbara Crab Managed Fishery	✓	✓	×	All waters of the fishery north of 23° 34’ S and west of 115° 06.50’ E (inclusive of the PAA) have been closed to fishing since the formation of the fishery. Fishing activity within the PAA is currently not permitted and accordingly, Woodside considers there to be no potential for interaction with this fishery and the Petroleum Activities Program.

4.9.3 Traditional Fisheries

There are no identified traditional or customary fisheries within the offshore waters of the PAA and EMBA, as these are typically restricted to shallow coastal waters and/or areas with structure such as reef.

4.9.4 Tourism and Recreation

From a regional perspective, recreation and tourism activities within the NWMR are of high social value. The majority of tourism and recreation activities occur on land and within State waters. Recreational and tourism activities include: charter fishing, other recreational fishing, diving, snorkelling, whale, whale shark, marine turtle and dolphin watching, cruise ship stop-overs and yachting.

The PAA is 215 km from Exmouth and 216 km from the Muiron Islands, while these locations are the closest areas with regular tourism and recreation activities, they are both located outside of the EMBA. Tourism and recreation activity within the PAA, socio-cultural EMBA and EMBA is therefore not expected.

4.9.5 Commercial Shipping

The Australian Maritime Safety Authority (AMSA) has introduced a network of marine fairways across the NWMR off WA to reduce the risk of vessel collisions with offshore infrastructure. It is noted that none of these fairways intersect with the PAA; the nearest fairway is approximately 38 km east of the PAA (**Figure 4-8**). Vessel tracking data suggest the majority of shipping is concentrated to the east of the PAA, which is likely associated with ports.

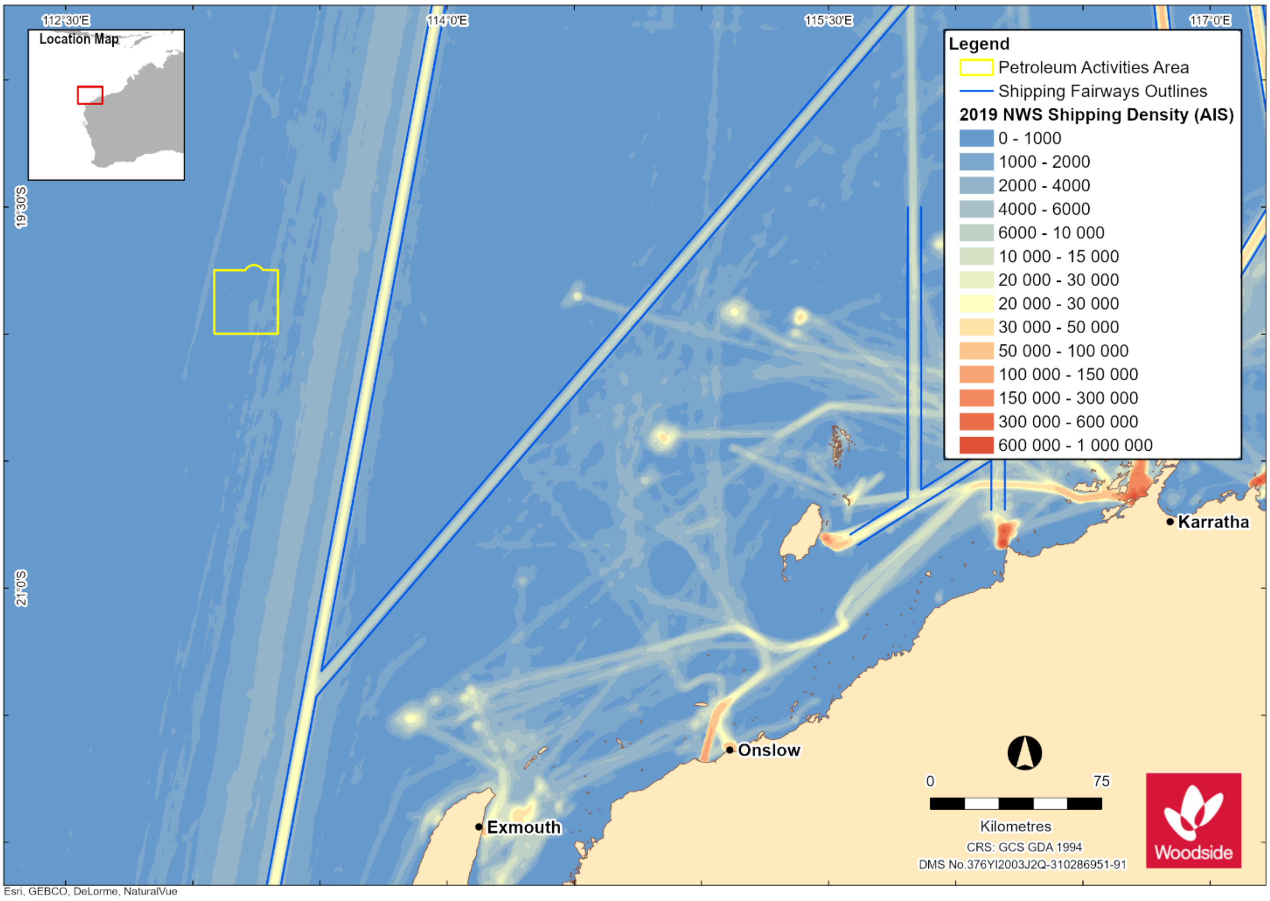


Figure 4-8: Vessel density map for the PAA, derived from AMSA satellite tracking system data (vessels include cargo, LNG tanker, passenger vessels, support vessels, and others/unnamed vessels)

4.9.6 Oil and Gas

The PAA is located in the Exmouth Plateau area of the Northern Carnarvon Basin. No subsea infrastructure is present in the PAA or WA-61-L permit (there are no wellheads above the seabed).

There are a number of petroleum titles held by various titles within the vicinity of the Petroleum Activities Program, but currently no oil and gas facilities. The proposed Equus Development Project is located about 70 km east of the PAA, within the EMBA. The closest facilities, the Pluto and Wheatstone platforms, are located outside the EMBA.

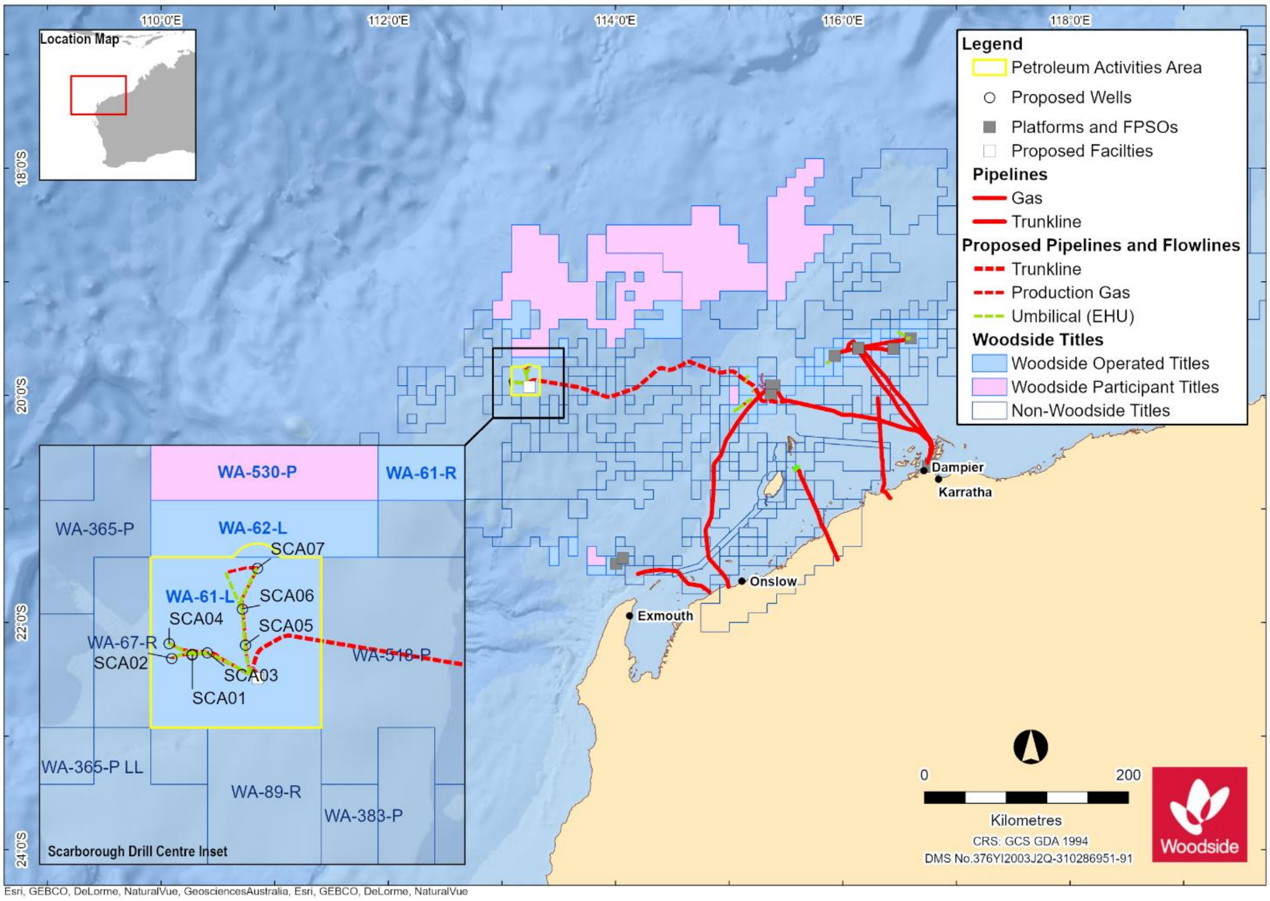


Figure 4-9: Oil and gas titles and infrastructure within the region

4.9.7 Defence

There are designated Department of Defence practice areas in the offshore marine waters off Ningaloo Reef and the North West Cape, associated with the Royal Australian Air Force base located at Learmonth, of which a military flying training area partially overlaps the PAA **Figure 4-10.**

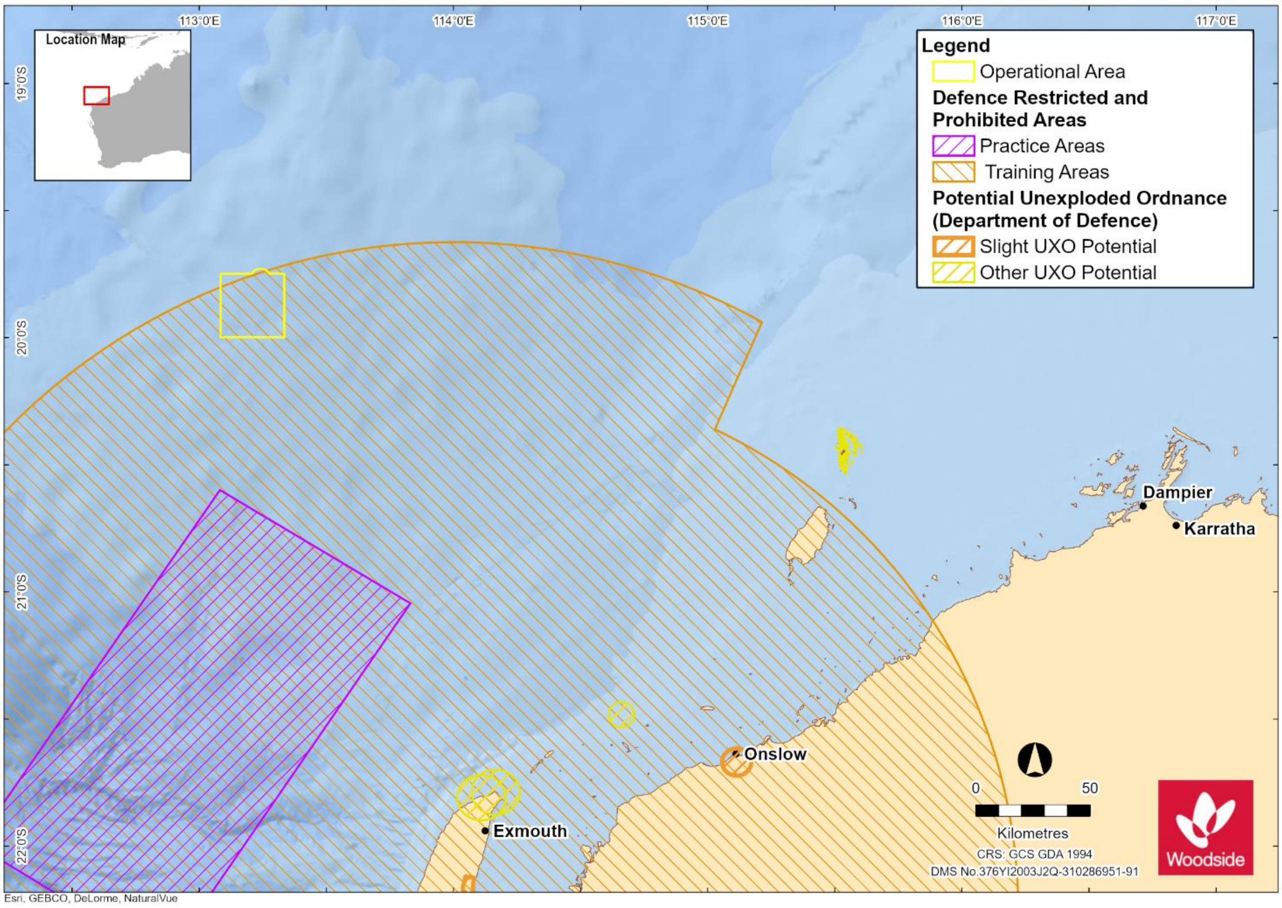


Figure 4-10: Defence training areas relative to the PAA

5. STAKEHOLDER CONSULTATION

5.1 Summary

Woodside is committed to consulting relevant stakeholders to ensure stakeholder feedback informs its decision making and planning for proposed petroleum activities and builds upon Woodside's extensive and ongoing stakeholder consultation for its offshore petroleum activities in the region.

This includes consultation undertaken with regards to the Scarborough development through the OPP process.

5.2 Stakeholder Consultation Guidance

Woodside has followed the requirements of Subregulation 11A(1) of the Environment Regulations to identify relevant stakeholders, these being:

- each Department or agency of the Commonwealth Government to which the activities to be performed under the EP, or the revision of the EP, may be relevant
- each Department or agency of a State or the Northern Territory Government to which the activities to be performed under the EP, or the revision of the EP, may be relevant
- the Department of the responsible State Minister, or the responsible Northern Territory Minister
- a person or organisation whose functions, interests or activities may be affected by the activities to be performed under the EP, or the revision of the EP
- any other person or organisation that the Titleholder considers relevant.

Woodside has assessed stakeholders as being relevant based on feedback required to support each phase of decision making and planning for activities. Woodside's assessment of stakeholders relevant to activities covered under this EP are outlined in **Table 5-1.**

5.3 Stakeholder Consultation Objectives

Woodside's objectives for stakeholder consultation are to:

- improve stakeholder awareness and understanding of the development of Scarborough
- provide stakeholders with opportunities to obtain information about Scarborough including the physical, ecological and socio-economic and cultural environment that may be affected, the potential impacts that may occur, and the prevention and mitigation measures proposed to avoid or minimise those impacts
- gain feedback from stakeholders on their concerns about the development of Scarborough and where possible, address stakeholder concerns through further activities, or by implementing additional mitigation measures.

Preliminary consultation for the Scarborough Offshore Project Proposal commenced with interested and affected stakeholders in February 2018 as part of a planned, integrated and consistent approach to stakeholder engagement for Woodside's proposed Burrup Hub opportunities (including the Browse to North West Shelf (NWS) Project, Scarborough, Pluto Train 2, NWS Project Extension and Pluto-NWS Interconnector). Consultation aims to be inclusive, transparent, voluntary, respectful and two-way. Consultation was completed by email, letter, phone call or meeting.

Consultation activities will continue to complement an overarching approach to stakeholder consultation for Woodside's Burrup Hub opportunities and will be phased throughout project planning and execution. Woodside is employing a participatory approach, consulting stakeholders and gaining input into the identification and assessment of these impacts and opportunities.

5.4 Stakeholder Expectations for Consultation

Stakeholder consultation for this activity has also been guided by stakeholder organisation expectations for consultation on planned activities. This guidance includes:

NOPSEMA:

- *GL1721 - Environment plan decision making - June 2021*
- *GN1847 - Responding to public comment on environment plans - Rev 0 - April 2019*
- *GN1344 - Environment plan content requirements - Rev 4 - April 2019*
- *GN1488 - Oil pollution risk management - Rev 2 - February 2018*
- *GL1887 - Consultation with Commonwealth agencies with responsibilities in the marine area – Rev 0 – December 2019*

Commonwealth Government:

- *Offshore Petroleum and Greenhouse Gas Activities: Consultation with Australian Government agencies with responsibilities in the Commonwealth Marine Area*

Australian Fisheries Management Authority:

- *Petroleum industry consultation with the commercial fishing industry*

Commonwealth Department of Agriculture, Water and the Environment:

- *Fisheries and the Environment – Offshore Petroleum and Greenhouse Gas Act 2006*
- *Offshore Installations Biosecurity Guide*

WA Department of Primary Industries and Regional Development:

- *Guidance statement for oil and gas industry consultation with the Department of Fisheries*

WA Department of Transport

- *Offshore Petroleum Industry Guidance Note*

Woodside acknowledges that additional relevant stakeholders may be identified prior to or during the proposed activity. These stakeholders will be contacted, provided relevant information to their interests and invited to provide feedback about the proposed activity. Woodside will assess their feedback, respond to the stakeholder and incorporate feedback into the management of the proposed activity where practicable.

Woodside consultation arrangements typically provide stakeholders up to 30 days (unless otherwise agreed) to review and respond to proposed activities where stakeholders are potentially affected. Woodside considers this consultation period an adequate timeframe in which stakeholders can assess potential impacts of the proposed activity and provide feedback.

5.5 Stakeholder Identification

The process for stakeholder consultation as undertaken by Woodside as the Operator of Scarborough included the identification of stakeholders and their relevance to the project. **Table 5-1** presents a summary of stakeholders and stakeholder groups that are interested in, or likely to be affected by the development of Scarborough activities under the scope of this EP.

Stakeholders identified include stakeholders known as a result of Woodside's ongoing activities in Western Australia, as well as those identified through engagements with regulators, government agencies, desktop research and regional contacts.

Table 5-1: Assessment of relevant stakeholders for the proposed activity

Stakeholder	Relevant to activity	Reasoning
Commonwealth Government department or agency		
Australian Border Force (ABF)	Yes	Responsible for coordinating maritime security.
Australian Fisheries Management Authority (AFMA)	Yes	Responsible for managing Commonwealth fisheries.
Australian Hydrographic Office (AHO)	Yes	Response for maritime safety and Notices to Mariners.
Australian Maritime Safety Authority (AMSA) – Shipping	Yes	Statutory agency for vessel safety and navigation and legislated responsibility for oil pollution response in Commonwealth waters.
Australian Maritime Safety Authority (AMSA) – Oil Spill	Yes	Legislated responsibility for oil pollution response in Commonwealth waters.
Department of Agriculture, Water and the Environment (DoAWE)	Yes	Responsible for implementing Commonwealth policies and programs to support agriculture, water resources, the environment and our heritage.
Department of Defence (DoD)	Yes	Responsible for defending Australia and its national interests.
Department of Industry, Science, Energy and Resources (DISER)	Yes	Department of relevant Commonwealth Minister and is required to be consulted under the Regulations.
Director of National Parks (DNP)	Yes	Responsible for the management of Commonwealth parks and conservation zones.
WA Government department or agency		
Department of Biodiversity, Conservation and Attractions (DBCA)	Yes	Responsible for managing WA's parks, forests and reserves.
Department of Mines, Industry Regulation and Safety (DMIRS)	Yes	Department of relevant State Minister and is required to be consulted under the Regulations.
Department of Primary Industries and Regional Development (DPIRD)	Yes	Responsible for managing State fisheries.
Department of Transport (DoT)	Yes	Legislated responsibility for oil pollution response in State waters.
Commonwealth fisheries*		
Southern Bluefin Tuna Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. Fishing will not occur in the Operational Area. Australia has a 35% share of total global allowable catch of Southern Bluefin Tuna, which is value-added through tuna ranching near Port Lincoln (South Australia), or fishing effort in New South Wales (Australian Southern Bluefin Tuna Industry Association).

Stakeholder	Relevant to activity	Reasoning
Western Deepwater Trawl Fishery	Yes	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. Woodside has chosen to consult Western Deepwater Trawl Fishery should there be future fishing in the area and based on fishing methods and water depth.
Western Tuna and Billfish Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years.
Western Skipjack Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years.
State fisheries*		
Mackerel Managed Fishery – Pilbara (Area 3)	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. Fishers are not active at water depths greater than 70 m (previous WAFIC advice).
South West Coast Salmon Managed Fishery	No	Fishers are active south of Perth and from the beach (previous WAFIC advice).
West Coast Deep Sea Crustacean Managed Fishery	No	Although the fishery overlaps the Operational Area, it has not been active in the Operational Area within the last five years. In recent years fishing has only been undertaken along the continental shelf edge and in waters south of Exmouth (West Coast Deep Sea Crustacean Managed Fishery; DPIRD, 2005).
Pilbara Crab Managed Fishery	No	Target species (blue swimmer crab) are only found in waters up to 50 m deep.
Marine Aquarium Fishery	No	This is a dive and wade fishery with activities generally restricted to waters less than 30 m deep (previous WAFIC advice).
Specimen Shell Fishery	No	This is a dive and wade fishery with activities generally restricted to waters less than 30 m deep (previous WAFIC advice).
Abalone Managed Fishery	No	This is a dive and wade fishery with activities generally restricted to waters less than 30 m deep (previous WAFIC advice).
Onslow Prawn	No	Prawn trawling takes place in water depths of approximately 30 metres and less (WAFIC advice).
Pilbara Demersal Scalefish Fishery	No	The fishery does not overlap the Operational Area.
• Pilbara Trawl Fishery	No	The fishery does not overlap the Operational Area.
• Pilbara Trap Fishery • Pilbara Line Fishery	No	The fishery does not overlap the Operational Area
Industry		
Chevron	Yes	Adjacent Titleholder.
Western Gas	Yes	Adjacent Titleholder.
ExxonMobil	Yes	Adjacent Titleholder.
Shell	Yes	Adjacent Titleholder.
Industry representative organisations		
Australian Petroleum Production and	Yes	Represents the interests of oil and gas explorers and producers in Australia.

Stakeholder	Relevant to activity	Reasoning
Exploration Association (APPEA)		
Commonwealth Fisheries Association (CFA)	Yes	Represents the interests of commercial fishers with licences in Commonwealth waters.
Pearl Producers Association (PPA)	Yes	Although interactions with licence holders in the Pearl Oyster Managed Fishery are unlikely, PPA has requested to be informed of Woodside's planned activities.
Recfishwest	No	Represents the interests of recreational fishers in WA. Activities do not have the potential to impact recreational fishers.
Marine Tourism WA	No	Represents the interests of recreational fishers in WA. Activities do not have the potential to impact recreational fishers.
WA Game Fishing Association	No	Represents the interests of charter owners and operators in WA. Activities do not have the potential to impact game fishers.
Western Australian Fishing Industry Council (WAFIC)	Yes	Represents the interests of commercial fishers with licences in State Waters.
Other Stakeholders		
Conservation Council of WA (CCWA)	No	CCWA have identified themselves as interested in activities relating to the Scarborough Development.

5.6 Stakeholder Consultation Approach

Woodside, as Operator of Scarborough has carried out a phased program of consultation:

- **Phase 1:** Preliminary consultation undertaken during the impact assessment process and preparation of the OPP.
- **Phase 2**: Formal consultation under the public review process of the draft OPP by NOPSEMA.
- **Phase 3**: Ongoing consultation during project planning and execution and development of activity specific Environment Plans.

Phase 1 (Preliminary Consultation) carried out as part of the OPP consultation process, commenced in early 2018 and was built on the broader consultation and engagement processes that Woodside has in place for the region. It was undertaken up until the point of formal consultation under the OPP process. It included tasks such as developing a dedicated project website, making available a Scarborough development fact sheet, hosting community forums and group meetings and providing information to key stakeholders such as approval submissions and progress against key milestones.

Phase 2 (Formal OPP Consultation) ran from 5 July 2019 until 30 August 2019. It was determined by NOPSEMA that an 8-week formal consultation period would apply for the Scarborough OPP and all public comments were provided to NOPSEMA, who provided a copy of the comments received to Woodside. Following the public comment period, Woodside prepared a consultation report and final OPP for assessment by NOPSEMA.

More details on Phase 1 and Phase 2 Scarborough development stakeholder consultation processes can be found in the Scarborough OPP (SA0006AF0000002, rev 5).

Stakeholder consultation carried out for this and other Scarborough development Environment Plans represent Phase 3 (Ongoing Consultation) of the consultation approach.

5.7 Stakeholder Consultation

Consultation activities conducted for the proposed activity are outlined in **Table 5-5-2**.

The Consultation Information Sheet (App F, ref 1.2) is published on the Woodside website and includes a toll free 1800 phone number.

Table 5-5-2: Stakeholder consultation plan activities

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
Australian Government department or agency				
ABF	On 2 July 2021, Woodside emailed ABF advising of the proposed activity (Appendix F, reference 1.2) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has addressed maritime security-related issues in **Section 6** of this EP based on previous offshore activities. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
AFMA	On 2 July 2021, Woodside emailed AFMA advising of the proposed activity (Appendix F, reference 1.13) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.12).	On 5 July 2021, AFMA responded, noting that it cannot comment on individual proposals.	No response required.	Woodside has assessed the relevancy of Commonwealth fisheries issues in **Section 4.9.2** of this EP. Woodside has consulted with the Western Deepwater Trawl Licence Holders. Woodside has consulted with CFA, DAWE and WAFIC. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
AHO	On 2 July 2021, Woodside emailed AHO advising of the proposed activity (Appendix F, reference 1.3) and provided a Consultation Information Sheet and shipping lanes map (Appendix F, reference 1.4).	No feedback received.	No response required.	Woodside will notify the AHO no less than four working weeks before operations commence, as referenced at **Control 4.3** in this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
AMSA (marine safety)	On 2 July 2021, Woodside emailed AMSA advising of the proposed activity (Appendix F, reference 1.5) and provided a Consultation Information Sheet and shipping lanes map (Appendix F, reference 1.4).	On 5 July 2021, AMSA emailed Woodside requesting: • The AHO be contacted no less than four working weeks before operations commence for the promulgation of related notices to mariners. • AMSA's Joint Rescue Coordination Centre (JRCC) be notified at least 24–48 hours before operations commence • Provide updates to the AHO and JRCC should there be changes to the activity. • Vessels exhibit appropriate lights and shapes to reflect the nature of operations and comply with the International Rules of Preventing Collisions at Sea. AMSA provided advice on obtaining vessel traffic plots, including digital datasets and maps.	On 22 July 2021, Woodside responded and confirmed it will contact/notify: • The AHO no less than 4 weeks before operations commence • AMSA's JRCC at least 24-48 hours before operations commence • Provide updates to both the AHO and AMSA on any changes. Woodside also confirmed vessels will exhibit appropriate lights and shapes to reflect the nature of operations and the obligation to comply with the International Rules for Preventing Collisions at Sea.	Woodside has addressed AMSA's requests: Woodside will notify AMSA's JRCC at least 24–48 hours before operations commence for each survey, as referenced as **Control 4.5** in this EP. Woodside will notify the AHO no less than four working weeks before operations commence, as referenced as a **Control 4.3** in this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
AMSA (marine pollution)	On 2 July 2021, Woodside emailed AMSA advising of the proposed activity (Appendix F, reference 1.5) and provided a Consultation Information Sheet and shipping lanes map (Appendix F, reference 1.4). On 13 July 2021, Woodside emailed AMSA and noted it had sent the previous consultation to the wrong email address. Woodside asked if AMSA needed additional time to review.	No feedback received.	No response required.	Woodside has addressed oil pollution planning and response at **Appendix D**. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
	On 6 October 2021, Woodside emailed AMSA and provided a copy of the Oil Pollution First Strike Plan (Appendix F, reference 1.21).	No feedback received.	No response required.	

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
DAWE	On 2 July 2021, Woodside emailed DAWE advising of the proposed activity (Appendix F, reference 1.16) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.12).	No feedback received.	No response required.	No feedback provided. Woodside has consulted CFA, AFMA and WAFIC. Woodside has assessed the relevancy of Commonwealth fisheries issues in **Section 4.9.2** of this EP. Woodside will provide notifications to the Western Deepwater Trawl Licence Holders prior to the commencement and at the end of the activity **PS 4.4.** Woodside has addressed maritime biosecurity issues in **Section 6** of this EP based on previous offshore activities. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DoD	On 2 July 2021, Woodside emailed DoD advising of the proposed activity (Appendix F, reference 1.8) and provided a Consultation Information Sheet and defence map (Appendix F, reference 1.9).	On 2 August 2021, DoD responded advising that a proportion of the survey area is within the North West Exercise Area (NWXA). DoD further advised that unexploded ordinance (UXO) may be present on and in the sea floor within the NWXA. DoD noted that it requires a minimum of five weeks notification prior to the commencement of activities. DoD also noted that Woodside should continue to liaise with the Australian Hydrographic Service.	On 4 August 2021, Woodside responded, requesting shape files or further specific detail in relation to the mentioned UXO so that Woodside can map it against the proposed activity. Woodside also noted the notifications outlined by DoD.	Woodside reviewed the proposed activity and the location of the NXWA and UXOs to understand the potential for UXOs to be within the Operational Area. The Learmonth Air Weapons Range (AWR) practice area is approximately 20 km south of the operational area and the location of any UXOs (known to occur) are near Bessieres Island which is located 190 km from the Operational Area.- Based on the locations of the proposed activity and potential UXOs it was determined that there is no credible risk from UXOs for the proposed activity.

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
		On 4 August 2021, DoD responded and provided a link to its mapping system which identifies UXO locations within the NXWA.	No response required.	Woodside has addressed DoDs expectations on notifications – Defence and AHO (**PS 4.8** and **P 4.3**). AHO have been engaged for the activity and are included in Woodside's activity notification protocols. AHO will be notified four weeks prior to the start of activities. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DISER	On 2 July 2021, Woodside emailed DISER advising of the proposed activity (Appendix F, reference 1.2) and provided a Consultation Information Sheet.	No response received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DNP	On 2 July 2021, Woodside emailed DNP advising of the proposed activity (Appendix F, reference 1.10) and provided a Consultation Information Sheet.	On 11 August 2021, DNP responded and noted that there are no authorisation requirements from the DNP. The DNP confirmed it does not require further notification of progress made in relation to the activity unless details regarding the activity change and result in an overlap with new impact to a marine park, or for emergency response.	No response required.	This EP demonstrates how Woodside will identify and manage impacts and risks on Australian marine park values (including ecosystem values) to an ALARP and acceptable level and that the activity is not inconsistent with the management plan **(Section 6).** Woodside will ensure DNP is made aware of any incidences within a marine park for the activity, as per the commitment in the Oil Pollution First Strike Plan. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
Western Australian Government department or agency or advisory body				
DBCA	On 2 July 2021, Woodside emailed DBCA advising of the proposed activity (Appendix F, reference 1.2) and provided a Consultation Information Sheet.	On 20 July 2021, DBCA responded, noting that DBCA has no comments on the proposed activities. DBCA noted that Woodside should continue to provide future notifications to the department.	No response required.	Woodside notes DBCA has no comments to provide based on its responsibilities. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DMIRS	On 2 July 2021, Woodside emailed DMIRS advising of the proposed activity (Appendix F, reference 1.2) and provided a Consultation Information Sheet.	On 7 July 2021, DMIRS responded to Woodside and noted that the email had been reviewed and no further information was required. DMIRS requested commencement and cessation notification for the activities.	No response required.	Woodside will provide notifications to DMIRS prior to the commencement and at the end of the activity. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DPIRD	On 2 July 2021, Woodside emailed DPIRD advising of the proposed activity (Appendix F, reference 1.15) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.12).	No feedback received.	No response required.	Woodside has consulted DPIRD, WAFIC, and individual relevant Licence holders. Woodside has assessed the relevancy of State fisheries in **Section 4.9.2** of this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
DoT	On 2 July 2021, Woodside emailed DoT advising of the proposed activity (Appendix F, reference 1.2) and provided a Consultation Information Sheet.	On 16 July 2021, DoT responded, advising that if there is a risk of a spill impacting State water from the proposed activities, DoT should be consulted.	No response required.	Woodside has addressed oil pollution planning and response at **Appendix D**. Woodside will contact DoT if there is a risk of a spill impacting State waters. Woodside will submit of copy of the OPEP to DoT once accepted. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
	On 6 October 2021, Woodside emailed DoT and provided a copy of the Oil Pollution First Strike Plan (Appendix F, reference 1.22).	On 12 October 2021, DoT responded, noting that as there is a low risk to State waters, a full review has not been deemed necessary at this time. DoT requested a copy of the accepted version of the OPEP once finalised.	On 12 October 2021, Woodside responded, thanking DoT for the feedback and confirmed Woodside will submit a copy of the OPEP to DoT once accepted.	

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
Commonwealth fisheries				
Western Deepwater Trawl Fishery Licence Holders	On 2 July 2021, Woodside emailed Western Deepwater Trawl Licence Holders advising of the proposed activity (Appendix F, reference 1.18) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.12).	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside has consulted with CFA, WAFIC and AFMA. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
Industry				
Chevron	On 2 July 2021, Woodside emailed Chevron advising of the proposed activity (Appendix F, reference 1.6) and provided a Consultation Information Sheet and titleholders map (Appendix F, reference 1.7).	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
Western Gas	On 2 July 2021, Woodside emailed Western Gas advising of the proposed activity (Appendix F, reference 1.6) and provided a Consultation Information Sheet and titleholder maps (Appendix F, reference 1.7).	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
ExxonMobil	On 2 July 2021, Woodside emailed ExxonMobil advising of the proposed activity (Appendix F, reference 1.6) and provided a Consultation Information Sheet and titleholders map (Appendix F, reference 1.7).	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
Shell	On 2 July 2021, Woodside emailed Shell advising of the proposed activity (Appendix F, reference 1.6)	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond.

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
	and provided a Consultation Information Sheet and titleholders map (Appendix F, reference 1.7).			Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
Industry representative organisations				
APPEA	On 2 July 2021, Woodside emailed APPEA advising of the proposed activity (Appendix F, reference 1.2) and provided a Consultation Information Sheet.	No feedback received.	No response required.	Woodside has provided sufficient information and opportunity to respond. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
CFA	On 2 July 2021, Woodside emailed CFA advising of the proposed activity (Appendix F, reference 1.14) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.12).	No feedback received.	No response required.	Woodside has consulted relevant Commonwealth fishery stakeholders including AFMA, DAWE and WAFIC. Woodside has assessed the relevance of Commonwealth fisheries in **Section 4.9.2** of this EP. Woodside has consulted with the Western Deepwater Trawl Licence Holders. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
PPA	On 2 July 2021, Woodside emailed PPA advising of the proposed activity (Appendix F, reference 1.17) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.12).	No feedback received.	No response required.	Woodside has consulted relevant State fishery stakeholders including WAFIC, and DPIRD. Woodside has assessed the relevancy of State fisheries issues in **Section 4.9.2** of this EP. Woodside considers this adequately addresses stakeholder interests and no further consultation is required.

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
WAFIC	On 2 July 2021, Woodside emailed WAFIC advising of the proposed activity (Appendix F, reference 1.11) and provided a Consultation Information Sheet and fisheries map (Appendix F, reference 1.12).	On 2 August 2021, WAFIC responded. WAFIC asked for clarification of how cautionary / operational zones are determined. WAFIC also asked for confirmation that Woodside has considered data, communications, support, process and commitments regarding unplanned activities. WAFIC also confirmed that a no fishing from support / commercial vessels policy should in included in the EP.	On 10 September 2021, Woodside responded to WAFIC's queries, providing information on how operational zones are determined, and Woodside's consideration of data, communications, support, process and commitments regarding unplanned activities. Woodside also confirmed that no recreational fishing from vessels will be included as a commitment in the EP.	Woodside has consulted relevant State fishery stakeholders including WAFIC and DPIRD. Woodside has assessed the relevancy of State fisheries issues in **Section 4.9.2** of this EP. Woodside has included no recreational fishing from vessels as a commitment in this EP (**Section 7.4.2**). Woodside considers this adequately addresses stakeholder interests and no further consultation is required.
		On 19 October 2021, WAFIC responded, thanking Woodside for the responses provided and noted that WAFIC has no additional comments at this stage.	No response required.	
Other stakeholders				
CCWA	In response to CCWA's request to be consulted on Scarborough EPs (12 August 2021), Woodside emailed CCWA (20 August 2021) advising of the proposed activity (Appendix F, reference 1.20) and provided a Consultation Information Sheet.	On 14 September 2021, CCWA emailed requesting: 1) An additional 2 weeks timeframe for comment to be received 2) Provision of draft the EP for comment noting "the consultation documents attached and linked on your website are highly summarized and not really	On 17 September 2021, Woodside responded to CCWA with the following: 1) Please provide your consultation responses by 20 September 2021 as this period is consistent with other stakeholder response times, and general Environment Plan drafting timeframes and no additional time will be allocated.	The Consultation Information Sheet for this EP has been available on the Woodside website since 2 July 2021. Woodside provided CCWA with 30 days for consultation relating to this EP, consistent with other stakeholder response times. CCWA commented on the Scarborough Offshore Project

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
		adequate to assess the EP's and provide meaningful comment. We request copies of the draft EP's and other application documents including studies that will be submitted to the regulator in support of the EP's. This will enable a reasonable comment to be made."	The factsheet has been available on our website for public comment since 2 July 2021. An additional 30 day comment period has already been granted to CCWA, following its request, which allows a reasonable opportunity for consultation. 2) During Woodside's consultation period, stakeholders are provided with a factsheet containing information relevant to the Environment Plan, for the purposes of the consultation. Consistent with the process in the legislation, consultation occurs while the draft Environment Plan is being developed. Given the EPs are in development, copies of those drafts are not provided to stakeholders during the consultation phase.	Proposal (OPP), accepted by NOPSEMA on 30 March 2020. The OPP provides a significant amount of information in relation to all activities associated with the proposed Scarborough Project, including issues raised in CCWA's letter dated 20 September. Woodside provided additional detailed information to CCWA as requested (15 October 2021) and a further 14 days in which to respond. Three weeks following receipt of additional information no response has been received from CCWA. Woodside considers it has provided sufficient information and opportunity to respond and considers this adequately addresses stakeholder interests.
		On 20 September 2021, CCWA sent a letter to Woodside with the following key points: 1. CCWA is a "relevant person" 2. Form of consultation required under cl.11A of the Environment Regulations 3. The information sheet is not "sufficient information" 4. Information required by CCWA (12 technical queries) 5. "Reasonable period" for the consultation 6. Further submissions	On 7 October 2021, Woodside advised CCWA that it is aiming to provide further information in the following week. On 15 October 2021, Woodside responded to CCWA, noting that CCWA provided comments on the OPP during the eight-week public comment period, and recommended that CCWA consider this in addition to information provided in the consultation information sheet. CCWA had technical queries on the worst-case oil spill, greenhouse gas emissions, cumulative impacts, geotechnical information, cultural	

Stakeholder	Information provided	Stakeholder response	Woodside response	Woodside assessment and outcome
			heritage, demonstration of ALARP, acceptability and environmental performance outcomes, standards and measurement criteria. Each of these points was addressed. This included providing a worst-case loss of containment modelling outcome figure, and a list of aspects considered in the D&C EP with reference to where this is addressed in the Scarborough OPP. Woodside requested any further comments about the proposed Drilling and Completions activities by 29 October 2021.	

5.8 Ongoing Stakeholder Consultation

Woodside is committed to the engagements listed in **Table 5-3** based on stakeholder feedback.

Table 5-3: Ongoing stakeholder consultation

Stakeholder	Activity
AHO	Woodside will notify the AHO no less than four weeks before operations commence and provide updates to AHO on any changes to planned activities.
AMSA	Woodside will notify AMSA's JRCC at least 24-48 hours before operations commence.
DMIRS	Woodside will send DMIRS commencement and cessation notifications.
DNP	Woodside will contact the DNP in the event of an emergency response.
DoD	Woodside will notify DoD five weeks before operations.
DoT	Woodside will consult DoT if there is a spill impacting State water from the proposed activity.
Western Deepwater Trawl licence holders	Woodside will send licence holders commencement and cessation notifications.

6. ENVIRONMENTAL RISK ASSESSMENT, PERFORMANCE OUTCOMES, STANDARDS AND MEASUREMENT CRITERIA

6.1 Overview

This section presents the impact and risk analysis, evaluation and Environment Performance Outcomes (EPOs), Environmental Performance Standards (EPS) and Measurement Criteria (MC) for the Petroleum Activities Program, using the methodology described in **Section 2** of this EP.

6.2 Impact and Risk Analysis and Evaluation

As required by Regulations 13(5) and 13(6) of the Environment Regulations, the following analysis and evaluation demonstrates that the identified impacts and risks associated with the Petroleum Activities Program are reduced to ALARP, are of an acceptable level and consider all operations of the activity, including potential emergency conditions. The impact assessment for planned activities has been based on the size of the PAA.

The impacts and risks identified during the ENVID workshops (including decision type, current risk level, acceptability of impacts and risks, and tools used to demonstrate acceptability and ALARP) have been divided into two broad categories:

- Planned activities (routine and non-routine) that have the potential for inherent environmental impacts; and
- Unplanned events (accidents, incidents or emergency situations) with an environmental consequence, termed risks.

Within these categories, impact and risk assessment groupings are based on environmental aspects such as emissions and physical presence. In all cases, the worst-case risk was assumed.

The ENVID (performed in accordance with the methodology described in **Section 2**) identified 16 sources of environmental impacts and risks. A summary of the ENVID is provided in **Table 6-2**.

The Scarborough Drilling and Completions specific ENVID workshop was conducted on 18 May 2021. Attendees included: Superintendent (Drilling and Completions), Environmental Advisers, Environmental Scientists, Environmental Engineers, Lead Drilling Engineer, Hydrocarbon Spill Adviser, and Environmental Consultants.

The impact and risk analysis and evaluation for the Petroleum Activities Program indicates that all current environmental risks and impacts associated with the individual activities are reduced to ALARP and are of an acceptable level, as discussed further in **Sections 6.6** and **6.7.**

6.2.1 Cumulative Impacts

The Scarborough OPP (SA0006AF0000002, Rev 5; Section 8) assesses the potential cumulative impact of the Scarborough Project and other activities / developments. In addition, Woodside has assessed the cumulative impacts of the Petroleum Activities Program in relation to other relevant petroleum activities, including other Scarborough activities, that could realistically result in overlapping temporal and spatial extents.

Other facilities located in proximity to the PAA were identified within **Section 4.9.6**. Given the distance between the location of the PAA and other nearby petroleum facilities and activities, no cumulative risks or impacts will credibly occur.

Woodside has also identified and assessed the following proposed activities for WA-61-L that may overlap temporally and/or spatially:

- Scarborough 4D B1 marine seismic survey may be undertaken over WA-61-L however there will be no temporal overlap (activities will not occur concurrently) and therefore no cumulative impacts are predicted with this activity.

- Scarborough trunkline installation may result in cumulative impacts due to both a spatial and temporal overlap, however any potential impacts will be described, assessed and managed under the Scarborough Seabed Intervention and Trunkline Installation EP (under development).
- Fibre optic cable installation in WA-61-L may be undertaken during the timing of the Petroleum Activities Program. However given that the distance between activities in this EP and fibre optic cable installation activities would be at least 10 km, no cumulative risks or impacts will credibly occur.

Where relevant the cumulative impacts of activities associated with undertaking multiple concurrent or parallel activities of this Petroleum Activities Program have been assessed in **Sections 6.6** and **6.7.**

6.3 Environmental Performance Outcomes, Standards and Measurement Criteria

Regulation 13(7) of the Environment Regulations requires that an EP includes Environmental Performance Outcomes (EPOs), Environmental Performance Standards (EPSs) and Measurement Criteria (MC) that address legislative and other controls to manage the environmental risks of the activity to ALARP and acceptable levels.

The EPOs, EPSs and MC specified are consistent with legislative requirements and Woodside's standards and procedures. They have been developed based on the Codes and Standards, Good Industry Practices and Professional Judgement outlined in **Sections 2.3.2 and 2.3.3** as part of the acceptability and ALARP justification process.

The EPOs, EPSs and MC are presented throughout this section and in **Appendix D** (Oil Spill Preparedness and Response). A breach of these EPOs or standards constitutes a 'Recordable Incident' under the Environment Regulations (refer to **Section 7.8.4**).

The Scarborough OPP identified the impacts and risks associated with the proposed development and defined suitable high-level EPOs. The OPP EPOs have been cascaded to the relevant project activities under this EP and the relationship between OPP EPOs and those developed in this EP is summarised in **Table 6-1**.

For the physical and biological receptors within the EMBA, Woodside has set EPOs that are consistent with the *Matters of National Environmental Significance – Significant impact guidelines 1.1* (DoE, 2013). For social receptors, including fishing and other commercial activities, the EPOs that have been set reflect the requirements in the OPGGS Act Section 280(2), in that the activities undertaken as a part of the development of Scarborough should not interfere with other marine users, to a greater extent than is necessary for the exercise of right conferred by the titles granted.

The EPOs for all environmental impacts/risks are identified and summarised in **Table 6-1**.

Table 6-1: Comparison of EP EPOs to the relevant OPP EPOs

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
Planned Activities			
Section 6.6.1 Routine Light Emissions: External Lighting on MODU and Project Vessels	**EPO 1** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2:**	The EPOs adopted in the EP for routine light emissions are consistent with the EPOs in the OPP.
	EPO 2 Undertake the Petroleum Activities Program in a manner that will not have a substantial adverse effect on a population of seabirds or shorebirds, or the spatial distribution of the population.	**EPO 1.2; EPO 15.3**	
	EPO 3 Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**EPO 1.4; EPO 4.3; EPO 10.6; EPO 15.9; EPO 18.5**	
	EPO 4 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fishes, marine mammals, marine reptiles, or the spatial distribution of a population.	**EPO 4.2; EPO 15.7; EPO 18.4**	
Section 6.6.2 Routine Atmospheric and Greenhouse Gas Emissions	**EPO 5** Undertake the Petroleum Activities Program in a manner that will not result in a substantial change in air quality which may adversely impact on biodiversity, ecological integrity social amenity or human health.	**EPO 2.1**	**New EPO –** EPO 6 relating to Atmospheric and GHG emissions to be inclusive of all emissions relevant to this PAP.
	EPO 6 Optimise efficiencies in air emissions and reduce GHG emissions to ALARP and Acceptable Levels	**New EPO**	

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
Section 6.6.3 Routine Acoustic Emissions – Generation of Noise from MODU, Project Vessels and Positioning Equipment	**EPO 3** Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**EPO 1.4; EPO 4.3; EPO 10.6; EPO 15.9; EPO 18.5**	The EPOs adopted in the EP for routine noise emissions are consistent with the EPOs in the OPP.
	EPO 4 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fishes, marine mammals, marine reptiles, or the spatial distribution of a population.	**EPO 4.2; EPO 15.7; EPO 18.4:**	
	EPO 8 Undertake the Petroleum Activities Program in a manner that will not substantially modify, destroy or isolate an area of important habitat for a migratory species.	**EPO 1.3; EPO 10.5; EPO 15.8**	
Section 6.6.4 Physical Presence – Interaction with Other Marine Users	**EPO 9** Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on the sustainability of commercial fishing.	**EPO 5.1**	The EPOs adopted in the EP for interaction with other marine users are consistent with the EPOs in the OPP.
	EPO 10 Undertake the Petroleum Activities Program in a manner that does not interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted.	**EPO 5.2**	
Section 6.6.5 Physical Presence – Disturbance to Benthic Habitat from MODU Anchoring, Drilling Operations,	**EPO 1** Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2:**	The EPOs adopted in the EP for the disturbance to benthic habitat are consistent with the EPOs in the OPP.

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
Subsea Installation and ROV Operations	**EPO 11** Undertake the Petroleum Activities Program in a manner that prevents a substantial change to water quality that may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1; EPO 8.1; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 15.2**	
Section 6.6.6 Routine and Non-Routine Discharges: MODU and Project Vessels	**EPO 11** Undertake the Petroleum Activities Program activities in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health	**EPO 6.1; EPO 7.1 ; EPO 8.1 ; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2**	The EPOs adopted in the EP for MODU and project vessel discharges are consistent with the EPOs in the OPP.
	EPO 12 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of plankton including its life cycle and spatial distribution.	**EPO 10.2; EPO 11.3; EPO 12.3; EPO 13.3**	
	EPO 13 Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity an area defined as a Key Ecological Feature.	**EPO 10.8; EPO 11.6; EPO 12.5; EPO 13.6; EPO 16.3**	
Section 6.6.7 Routine and Non-Routine Discharges: Drill cuttings and drilling fluids	**EPO 1** Undertake Petroleum Activities Program in a manner that does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results.	**EPO 1.1; EPO 4.1; EPO 6.4; EPO 6.8; EPO 11.5, EPO 12.4; EPO 13.4; EPO 15.6; EPO 16.2; EPO 17.2; EPO 18.2**	The EPOs adopted in the EP for the drilling discharges are consistent with the EPOs in the OPP.
	EPO 11 Undertake Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1 ; EPO 8.1 ; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2**	

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
	EPO 12 Undertake Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of plankton including its life cycle and spatial distribution.	**EPO 10.2; EPO 11.3; EPO 12.3; EPO 13.3**	
	EPO 13 Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity an area defined as a Key Ecological Feature.	**EPO 10.8; EPO 11.6; EPO 12.5; EPO 13.6; EPO 16.3**	
	EPO 14 Undertake Petroleum Activities Program in a manner that prevents substantial change in sediment quality, which may adversely impact biodiversity, ecological integrity, social amenity or human.	**EPO 13.2**	
	EPO 15 Undertake Petroleum Activities Program in a manner that prevents significant impacts on the values of the Exmouth Plateau KEF.	**EPO 10.3; EPO 11.4; EPO 13.5**	
Section 6.6.8 Routine and Non-Routine Discharges: Cement, Cementing Fluids, Subsea Well Fluids, Produced Water and Unused Bulk Product	Same as **Section 6.6.7** above		
Unplanned Activities			
Section 6.7.2 Unplanned Hydrocarbon Release: Vessel Collision	**EPO 16** No release of hydrocarbons to the marine environment due to a vessel collision associated with the Petroleum Activities Program.	**EPO 19.1**	The EPOs adopted in the EP for an unplanned hydrocarbon release from a vessel collision are consistent with the EPOs in the OPP.

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
Section 6.7.3 Unplanned Hydrocarbon Release: Loss of Well Control	**EPO 17** No loss of well control resulting in loss of hydrocarbons to the marine environment during the Petroleum Activities Program	**New EPO**	This EPO is new to this EP, and is consistent with both the wording of previous Woodside Environment Plans and the intent of EPO 19.1 in the OPP.
Section 6.7.4 Unplanned Discharge: Chemicals and Hydrocarbons	**EPO 18** Undertake the Petroleum Activities Program in a manner that will prevent an unplanned release of chemicals or non-process hydrocarbons to the marine environment resulting in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 14.1**	The EPOs adopted in the EP for an unplanned hydrocarbon release from bunkering are consistent with the EPOs in the OPP.
Section 6.7.5 Unplanned Hydrocarbon Release: Bunkering	Same as **Section 6.6.7** above		
Section 6.7.6 Unplanned Discharge: Hazardous and Non – Hazardous Solid Waste	**EPO 2** Undertake Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of seabirds or shorebirds, or the spatial distribution of the population	**EPO 1.2; EPO 15.3**	The EPOs adopted in the EP for an unplanned discharge of hazardous and non-hazardous solid wastes are consistent with the EPOs in the OPP.
	EPO 3 Undertake Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.	**EPO 1.4; EPO 4.3; EPO 10.6; EPO 15.9; EPO 18.5**	
	EPO 4 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fishes, marine mammals, marine reptiles, or the spatial distribution of a population.	**EPO 4.2; EPO 15.7; EPO 18.4**	

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
	EPO 8 Undertake Petroleum Activities Program in a manner that will not substantially modify, destroy or isolate an area of important habitat for a migratory species.	**EPO 1.3; EPO 10.5; EPO 15.8**	
	EPO 11 Undertake Petroleum Activities Program in a manner that will prevent a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**EPO 6.1; EPO 7.1; EPO 8.1; EPO 9.1; EPO 10.1; EPO12.1; EPO 13.1; EPO 14.1; EPO 15.2**	
	EPO 19 Undertake Petroleum Activities Program in a manner that will prevent an unplanned release of solid waste to the marine environment resulting in a significant impact	**EPO 15.1**	
	EPO 20 Undertake Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of fish, or the spatial distribution of the population.	**EPO 10.4; EPO 15.4**	
	EPO 21 Undertake Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of marine mammals or the spatial distribution of the population.	**EPO 10.7; EPO 15.5; EPO 18.3**	
Section 6.7.7 Physical Presence (Unplanned): Seabed Disturbance	**EPO 13** Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in an area defined as a Key Ecological Feature.	**EPO 10.8; EPO 11.6; EPO 12.5; EPO 13.6; EPO 16.3**	The EPOs adopted in the EP for unplanned seabed disturbance are consistent with the EPOs in the OPP.
	EPO 22 Undertake the Petroleum Activities Program in a manner which prevents unplanned seabed disturbance.	**EPO 16.1**	

Aspect	EPOs in this EP	Relevant EPOs from the Scarborough OPP	Comparison
Section 6.7.8 Physical Presence (Unplanned): Invasive Marine Species	**EPO 13** ***Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in an area defined as a Key Ecological Feature.***	**EPO 10.8; EPO 11.6; EPO 12.5; EPO 13.6; EPO 16.3**	OPP EPO's 17.1, 17.3 and 17.4 have been combined to form one EPO which encompasses the intent and outcome of all three.
	EPO 23 Undertake the Petroleum Activities Program in a manner which prevents a known or potential pest species (IMS) becoming established.	**EPO 17.1, EPO 17.3, EPO 17.4**	
Section 6.7.9 Physical Presence (Unplanned): Collision with Marine Fauna	**EPO 26** Undertake the Petroleum Activities Program in a manner which prevents a vessel strike with protected marine fauna during project activities.	**EPO 18.1**	The EPOs adopted in the EP for the unplanned collision with marine fauna are consistent with the EPOs in the OPP.

6.4 Presentation

The environmental impact and risk analysis and evaluation (ALARP and acceptability), EPOs, standards and MC are presented in the following tabular form throughout this section. Italicised text in the following example denotes the purpose of each part of the table with reference to the relevant sections of the Environment Regulations and/or this EP.

Scarborough OPP – Relevant Impact Assessment Section		
<Reference to section number in the Scarborough Project OPP>		
Context <Description of the context for the impact/risk. Regulation 13(1, 13(2) and 13(3)>		
Relevant Activities Source of Aspect – **Section reference** *Description of the Activity – Regulation 13(1)*	**Existing Environment** Relevant environment – **Section reference** *Description of the Environment – Regulations 13(2)(3)*	**Stakeholder consultation** Consultation – **Section reference** *Consultation – Regulation 11A*

Impact/Risk Evaluation Summary														
	Environmental Value Potentially Impacted Regulations 13(2)(3)							***Evaluation***						
Source of Impact/Risk Regulation 13(1)	**Soil and Groundwater**	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Summary of source of risk/impact														

Description of Source of Impact/Risk
Description of the identified impact/risk including sources or threats that may lead to the risk or identified event. Regulation 13(1).
Detailed Impact Assessment
Assessment of Potential Impacts
Receptor <u>Impact / risk</u> Assessment of potential impact *Discussion and assessment of the potential impacts to the identified environment value(s). Regulations 13(5)(6).* *Potential impacts to environmental values have been assigned and discussed based on Woodside's Environmental Consequence Definitions for Use in Environmental Risk Assessments (**Figure 2-1**).*
Cumulative Impacts
Description of any cumulative impacts specific to the PAA (cumulative impact assessment of Scarborough project as a whole is covered in the OPP)
Summary of Assessment Outcomes

Receptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level / Risk Consequence**

Overall Impact Significance Level/ Risk consequence: *Roll up to Impact/consequence rating (in impact/risk evaluation summary at top of this table) but need to look at individual receptors as being equal to or less than level of acceptability in the OPP.*

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
ALARP Tool Used – Section 2.3.4				
Summary of control considered to ensure the impacts and risks are continuously reduced to ALARP. *Regulation 13(5)(c).*	*Technical/logistical feasibility of the control.* *Cost/sacrifice required to implement the control (qualitative measure).*	*Quantum of impact/risk that could be averted (measured in terms of reduction of likelihood, consequence and current risk rating) if the cost/sacrifice is made and the control is adopted.*	*Proportionality of cost/sacrifice vs environmental benefit. If proportionate (benefits outweigh costs) the control will be adopted. If disproportionate (costs outweigh benefits) the control will not be adopted.*	*If control is adopted: Reference to Control # provided.*

ALARP Statement:

*Made on the basis of the environmental risk assessment outcomes, use of the relevant tools appropriate to the decision type (**Section 2.3.3** and **Figure 2-3**) and a proportionality assessment. Regulation 10A(b).*

Demonstration of Acceptability
Acceptability Criteria and Assessment
Impact Significance Level / Risk Consequence levels for receptors are within acceptable bounds of the OPP: ***Adoption of relevant OPP EPOs and controls:*** ***Internal/external context and other requirements specific to this EP Petroleum Activities Program***:
Acceptability Statement: *Outcomes of the impact assessment in comparison to OPP and ALARP demonstration.*

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO# S: *Specific performance which addresses the legislative and other controls that manage the activity and against which performance by Woodside in protecting the environment will be measured.* M: *Performance against the outcome will be measured by measuring implementation of the controls via the measurement criteria.*	**C#** *Identified control adopted to ensure the impacts and risks are continuously reduced to ALARP.* ***Regulation 13(5)(c).***	***PS#*** *Statement of the performance required of a control measure. Regulation 13(7)(a)*	***MC#*** *Measurement criteria for determining whether the outcomes and standards have been met. Regulation 13(7)(c)*

A: *Achievability/feasibility of the outcome demonstrated via discussion of feasibility of controls in ALARP demonstration. Controls are directly linked to the outcome.* R: *The outcome will be relevant to the source of risk and the potentially impacted environmental value.* T: *The outcome will state the timeframe during which the outcome will apply or by which it will be achieved.*			

6.5 Potential Environment Risks Not Included Within the Scope of this Environment Plan

The ENVID identified environmental risks that were assessed as not being applicable within or outside the PAA as a result of the Petroleum Activities Program and, therefore, were determined to not form part of this EP. These are described in the next sections for information only.

6.5.1 Shallow/Near-shore Activities

The Petroleum Activities Program is located in water depths greater than 100 m and at a significant distance from nearest landfall (Montebello Islands). Consequently, risks associated with shallow/ near-shore activities such as vessel anchoring, and risks of grounding were assessed as not credible.

6.5.2 Generation of Noise from Flaring and Helicopters

Impacts of noise from flaring and helicopter transfers to marine fauna is not considered credible as the PAA is more than 215 km from mainland Australia and there are no identified BIAs or other biologically sensitive areas within the PAA.

Table 6-2: Environmental Risk analysis and summary

Aspect	EP Section	Risk Rating				Acceptability
		Impact/ Consequence	Potential Impact/Consequence Level	Likelihood	Current Risk Rating	
Planned Activities (Routine and Non-routine)						
Routine Light Emissions: External Lighting on MODU and Project Vessels	**6.6.1**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Routine Atmospheric and Greenhouse Gas Emissions	**6.6.2**	F	Environment – No lasting effect (less than one month); localised impact not significant to environmental receptors.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Routine Acoustic Emissions – Generation of Noise from MODU, Project Vessels and Positioning Equipment	**6.6.3**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence – Interaction with other marine users	**6.6.4**	E	Slight, short-term impact (<1 year) to a community or area/item of cultural significance.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence – Disturbance to Benthic Habitat from MODU Anchoring, Drilling Operations, Subsea Installation and ROV Operations	**6.6.5**	D	Environment – Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Routine and Non-Routine Discharges: MODU and Project Vessels	**6.6.6**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**

Aspect	EP Section	Risk Rating				Acceptability
		Impact/ Consequence	Potential Impact/Consequence Level	Likelihood	Current Risk Rating	
Routine and Non-Routine Discharges: Drill Cuttings and Drill Fluids	**6.6.7**	D	Environment – Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Routine and Non Routine Discharges: Cement, Cementing Fluids, Subsea Well Fluids, Produced Water and Unused Bulk Product	**6.6.8**	D	Environment – Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	-	-	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Unplanned Activities (Accidents, Incidents, Emergency Situations)						
Unplanned Hydrocarbon Release: Vessel Collision	**6.7.2**	D	Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	1	M	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Unplanned Hydrocarbon Release: Loss of Well Integrity	**6.7.3**	D	Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	1	M	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Unplanned Discharge: Chemicals and Hydrocarbons	**6.7.4**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	1	L	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Unplanned Hydrocarbon Release: Bunkering	**6.7.5**	D	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	1	M	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Unplanned Discharge: Hazardous and Non – Hazardous Solid Waste	**6.7.6**	D	Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	0	L	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**

Aspect	EP Section	Risk Rating				Acceptability
		Impact/ Consequence	Potential Impact/Consequence Level	Likelihood	Current Risk Rating	
Physical Presence (Unplanned): Seabed Disturbance	**6.7.7**	D	Minor, short-term impact (1–2 years) on species, habitat (but not affecting ecosystem function), physical or biological attribute.	1	M	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence (Unplanned): Invasive Marine Species	**6.7.8**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	0	L	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**
Physical Presence (Unplanned): Collision with Marine Fauna	**6.7.9**	E	Environment – Slight, short-term impact (less than one year) on species, habitat (but not affecting ecosystems function), physical or biological attributes.	1	L	Broadly Acceptable Has been shown to meet requirements listed in **Section 2.3.5**

6.6 Planned Activities (Routine and Non-Routine)

6.6.1 Routine Light Emissions: External Lighting on MODU and Project Vessels

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.1 – Routine Light Emissions		
Context		
Relevant Activities Well Flowback – **Section 3.7.5** Vessel Operations – **Section 3.10.2** MODU Operations – **Section 3.10.1** Contingency Activities – **Section 3.11**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Protected Species – **Section 4.6**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
External light emissions on board MODU and vessels						✓		A	E	-	-	GP	Broadly Acceptable	EPO 1, 2, 3, 4

Description of Source of Impact/Risk

Vessel and MODU Operations

Vessels and the MODU will have external lighting to support safe navigation and safe operations at night. This lighting typically consists of bright white (i.e. metal halide, halogen, fluorescent) lights, and is not dissimilar to lighting used for other offshore activities, including fishing and shipping.

Lighting is required for the safe operation of the MODU and vessels and cannot reasonably be eliminated.

The extent of this potential impact for the Petroleum Activities Program is restricted to the line of sight for each activity emitting light (**Table 6-3**), which based on previous work undertaken by Woodside is about 30 km from the MODU during drilling activities and 30 km from vessels. For well flowback, specifically flaring, the distance at which the flare will be visible is expected to be less than 50 km from the source, and potentially around 10 km further during emergency flaring (Woodside, 2011, 2014).

Table 6-3: Extent of potential impact from light sources associated with Scarborough

Activity	Estimated visual line of sight	Reference
Vessel operations	30 km	Woodside, 2014
MODU operations	30 km	Woodside, 2014
Well flowback (flaring)	50 km (+ 10 km during emergency flaring)	Woodside, 2011

While the line of sight may extend tens of kilometres from the source, the light density (measured in Lux – which represents the intensity of light that arrives at or leaves a surface, as perceived by the human eye) rapidly decreases as distance increases from the source of the light. Monitoring undertaken as a part of Woodside's 2014 study indicated that light density (from navigational lighting) attenuated to below 1.00 Lux and 0.03 Lux at distances of 300 m and 1.4 km, respectively, from the source (a MODU). Light densities of 1.00 and 0.03 Lux are comparable to natural light densities experienced during deep twilight and during a quarter moon. Navigational lighting from vessels is less than lighting on a MODU. Therefore, light emissions from the MODU and vessels are expected to be below 1.00 Lux within 300 m from the source.

Note that flaring, which is a relatively bright light source, may occur during well unloading.

Detailed Impact Assessment

Assessment of Potential Impacts

Ambient Light

The introduction of light emissions from activities associated with the Petroleum Activity Program can result in a temporary change to ambient light.

The area of operation is at a significant distance from coastal sources of light emissions. However, there are existing activities in the region which also generate light including offshore facilities and supporting activities, as well as shipping traffic.

The contribution of light emissions from the Petroleum Activities Program will be comparable with existing vessels and facilities on the North West Shelf and will not result in a notable increase.

Given the distance from shore, low sensitivity of receptors offshore (i.e. no presence of nesting turtles and low likelihood of hatchling turtles in the offshore environment), and the negligible contribution of light emissions to the environment from the Petroleum Activities Program, the habitat or ecosystem function or integrity of the marine area will not be impacted. Potential impacts of changes to ambient light are included in a number of recovery plans and conservation advice, including the Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia, 2017) and the Wildlife Conservation for Migratory Shorebirds (Commonwealth of Australia, 2015b).

The National Light Pollution Guidelines for Wildlife (NLPG) addresses potential impacts to marine turtles, seabirds and migratory shorebirds from artificial light (Commonwealth of Australia, 2020). The guidelines recommend a specific artificial light impact assessment process where there is important habitat for listed species that are known to be affected by artificial light within 20 km of a project. The 20 km threshold provides a precautionary limit based on observed effects of sky glow on marine turtle hatchlings demonstrated to occur at 15-18 km (Kamrowski, et al., 2014; Hodge et al., 2007) and fledgling seabirds grounded in response to artificial light 15 km away (Rodríguez et al., 2014). The PAA is about 215 km offshore and outside known BIAs for turtles and seabirds/migratory shorebirds, therefore a specific assessment of potential impacts of artificial lighting is not required under the NLPG.

Seabirds

High levels of marine lighting can attract and disorient seabird species resulting in species behavioural changes (e.g. circling light sources or disrupted foraging), injury or mortality near the light source (e.g. Longcore and Rich, 2004; Gaston et al., 2014; Rich and Longcore, 2006). As the PAA is offshore and away from islands or other emergent features, any presence of seabirds or shorebirds is considered likely to be of a transient nature only. The nearest BIA for birds within the EMBA is a breeding and foraging BIA for the wedge-tailed shearwater, located 115 km to the south-east of the PAA. Impacts to shearwaters within the BIA are therefore not expected.

Behavioural disturbance to birds from light is expected to be localised to within the vicinity of the MODU and vessels within the permit areas. The light source from the MODU and vessels within the PAA will be temporary and only when operations are occurring. Interactions with seabirds are therefore expected to be unlikely. Any impacts are predicted to be at an individual level and not a population level. The temporary behavioural disturbance of birds will be localised around the light sources, and not result in a substantial adverse effect on a population of species or its lifecycle. Additionally, light emissions will not seriously disrupt the lifecycle of an ecologically significant proportion of any migratory birds.

Based on the detailed evaluation, the magnitude of impacts to birds from light emissions during activities associated with the Petroleum Activities Program is expected to have no lasting effect.

Marine Reptiles

Exposure of marine turtles to artificial light can result in changes to their natural behaviour. Witherington and Martin (2003) state that light pollution on nesting beaches is detrimental to marine turtles because it alters critical nocturnal behaviours, namely, how turtles choose nesting sites, how they return to the sea after nesting, and how hatchlings find the sea after emerging from their nests. However, there are no sensitive marine turtle habitats near the PAA. The closest known turtle nesting beaches are at the North West Cape and Montebello Islands, located about 215 km and 225 from the PAA respectively. Marine turtles generally have a pelagic life stage as juveniles, before returning to nearshore coastal habitats as adults to forage and breed. At the PAA, marine turtles are unlikely to occur due to the deep waters (>900 m) however, they may occur offshore in small numbers. Leatherback turtles are an oceanic, pelagic species known to regularly forage within continental shelf waters. While leatherback turtles may occur in the PAA in small numbers, their distribution is widespread in Australia and their presence is unlikely. No turtles were observed during the winter or summer offshore marine surveys in the PAA (ERM, 2013).

While artificial lighting may be visible up to tens of kilometres away from the MODU/vessels, the light intensity will be low beyond several hundred metres from the light sources as described above. Although individuals undertaking behaviours such as migration or foraging (adults and pelagic juveniles) may occur within the PAA, marine turtles do not use light cues to guide these behaviours. Furthermore, there is no evidence, published or anecdotal, to suggest that foraging or migrating turtles are impacted by light from offshore vessels. As such, light emissions from the project vessels/MODU are unlikely to result in displacement of, or behavioural changes to individuals in these life stages

Any hatchlings within the PAA, due to the distance offshore the density of any hatchlings is expected to be very low and limited to individuals, may temporarily alter their normal behaviour if attracted to the light spill from vessel and MODU operations. For any isolated individuals potentially attracted to light spill from project vessels/MODU, following sunrise, any effect of these light sources on hatchlings will be eliminated allowing dispersal behaviour to resume.

As described above, behavioural disturbance to turtles from light in the PAA is expected to be localised to within the vicinity of the MODU and vessels within the Permit Area. The light source from the MODU and vessels within the PAA will be temporary and interaction with turtles is expected to be low. Therefore, any impacts are predicted to be at an individual level and not a population level. Impacts will not occur to significant proportions of the populations of the species, nor result in a decrease of the quality of the habitat such that the extent of these species is likely to decline.

Based on the detailed evaluation, the magnitude of impacts to marine turtles from light emissions during activities associated with the Petroleum Activities Program is evaluated to have no lasting effect.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level
Ambient Light	Change in ambient light	Low value (open water)	Slight	Negligible (F)
Seabirds and migratory shorebirds	Change in fauna behaviour	High value species (e.g. wedge-tailed shearwater)	No lasting effect	Slight (E)
Marine reptiles		High value species (e.g. flatback turtle)	No lasting effect	Slight (E)

Overall Impact Significance Level: The overall impact significance level for routine light emissions is E based on no lasting effect to the high value receptors (seabirds, migratory shorebirds and marine turtles). The impact significance levels for individual receptors are consistent with the level in the OPP.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Lighting will be limited to the minimum required for navigational and safety requirements, with the exception of emergency events.	F: Yes. Lighting is typically appropriate for navigation and safety.	Given the potential impacts to turtles during this activity is insignificant, implementation of this control would not result in a reduction in consequence.	While the control does not result in significant reduction of impacts, it is good practice and not at significant cost.	**C 1.1**
Professional Judgement – Eliminate				
Substitute external lighting with ''turtle friendly'' light sources (reduced emissions in turtle visible spectrum).	F: Yes. Replacement of external lighting with turtle friendly lighting is technically feasible, although is not considered to be practicable.	Given the potential impacts to turtles during this activity is insignificant, implementation of this control would not result in a reduction in consequence.	Grossly disproportionate. Implementation of the control requires considerable cost sacrifice and provides minimal environmental benefit.	No

	CS: Significant cost sacrifice. The retrofitting of external lighting on the MODU and vessels, etc., would result in considerable cost and time expenditure. Considerable logistical effort to source sufficient inventory of the range of light types onboard the MODU.		The costs/sacrifices outweigh the benefit gained.	
Variation of the timing of the Petroleum Activities Program to avoid peak turtle internesting periods (December to January).	F: Not feasible due to total length of drilling campaign, planned batch drilling sequence and successive activities dependent upon completion timing of D&C campaign execution CS: Significant cost and schedule impacts due to delays in securing vessels/MODU for specific timeframes.	Not considered – control not feasible.	Not considered, control not feasible.	No
Do not flare.	F: No. Flaring is the only feasible way to manage the reservoir fluids and achieve well objectives. CS: Not considered – control not feasible	Not considered – control not feasible.	No considered – control not feasible.	No
Well unloading acceptance criteria that define the well objectives will be established.	F: Yes CS: Standard practice	Eliminates unnecessary flared volumes and corresponding emissions (light and GHG)	Benefits outweigh cost/sacrifice	Yes C 1.2
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement: On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the potential impacts from routine light emissions from the MODU and vessels to be ALARP. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.				

Demonstration of Acceptability
Acceptability Criteria and Assessment
Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.1.1.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the EP acceptability criteria (**Section 2.3.5**): • Overall impact significance levels for individual receptors are less than the significant impact level defined in the OPP. • EPOs and controls in the OPP that are relevant to routine light emissions have been adopted. • There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that, given the adopted controls, routine light emissions from external lighting on the MODU and project vessels is unlikely to result in an impact significance level greater than slight. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. Regard has been given to relevant conservation advice and wildlife conservation plans during the assessment of potential impacts and the NLPG were taken into consideration during the impact evaluation. The Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice (**Section 6.8**). The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of light emissions to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 1 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 2** Undertake the Petroleum Activities Program in a manner that will not have a substantial adverse effect on a population of seabirds or shorebirds, or the spatial distribution of the population. **EPO 3** Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. **EPO 4** Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of	**C 1.1** Lighting will be limited to the minimum required for navigational and safety requirements, with the exception of emergency events.	**EPS 1.1** Lighting will be limited to that required for safe work/navigation.	**MC 1.1.1** Inspection verifies no excessive light being used beyond that required for safe work/ navigation.
	C 1.2 Well unloading acceptance criteria that defines well objectives will be established.	**PS 1.2** Flaring restricted to a duration necessary to achieve the well objectives	**MC 1.2.1** Records demonstrate flaring was restricted to a duration necessary to achieve well objectives.

marine reptiles or the spatial distribution of the population.			

6.6.2 Routine Atmospheric and Greenhouse Gas Emissions

Scarborough OPP – Relevant Impact Assessment Section

Section 7.1.2: Routine Atmospheric and Greenhouse Gas Emissions

Context

Relevant Activities	Existing Environment	Stakeholder consultation
Well Flowback – **Section 3.7.5** Vessel Operations – **Section 3.10.2** MODU Operations – **Section 3.10.1** Contingency Activities – **Section 3.11**	Marine Regional Characteristics – **Section 4.2** Protected Species – **Section 4.6**	Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Internal combustion engines and incinerators on MODU and vessels				✓				A	F	-	-	LCS GP PJ	Broadly Acceptable	EPO 5, 6
Well flowback (flaring) inc. base oil				✓										
Contingent venting of gas during drilling (i.e. well kick)				✓										

Description of Source of Impact

Atmospheric emissions assessed in this EP have been classified into two categories:

- Atmospheric pollutants (non-greenhouse gas emissions) are gases and particulates from an activity, or piece of machinery, which have a recognised adverse effect on human health and/or flora and fauna. The main emissions responsible for these effects include carbon monoxide (CO), oxides of nitrogen (NOx), sulphur dioxide (SO2), particulate matter less than 10 microns (PM10), non-methane volatile organic compounds (VOCs), BTEX (benzene, toluene, ethylbenzene and xylenes), which are specific VOCs of interest
- Greenhouse gas (GHG) emissions are those gasses within the atmosphere that absorb long-wave radiation, and thus trap heat reflected from the Earth's surface. The main gases responsible for this effect include carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Other greenhouse gases include perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF6)

MODU, Vessel and Helicopter Operations

Atmospheric emissions are generated by project vessels from internal combustion engines (including all equipment and generators) and incineration activities (including onboard incinerators for standard operations, excluding drilling waste).

Atmospheric emissions generated during these operations will include SOx, NOx, particulates and VOCs. SOx and particulate matter emissions are heavily influenced by the fuel used and its relative sulphur content, MGO usually having a lower sulphite content than marine diesel oil (MDO) or heavy fuel oil (HFO).

NO_2 emissions from routine MODU power generation for an offshore project were modelled previously by another operator (BP, 2013). NO_2 is the focus of the modelling, on account of the larger predicted emission volumes compared to the other atmospheric emissions, and the potential for NO_2 to impact on human health (as a proxy for environmental receptors). The model demonstrated that atmospheric emissions generated by MODU operations may increase ambient NO_2 concentrations by 1 µg/m³ (0.001 ppm) within 10 km of the source and 0.1 µg/m³ (0.0001 ppm) within 40 km of the source. This represents an increase of 2% over typical background concentrations within 40 km, with air quality remaining well below the WHO air quality guideline for NO_2 of 40 µg/m³ annual mean. As NO_2 is the main emission that poses a threat to receptor health, it is considered conservative to use the above studies to justify potential impacts to receptors. As such, studies into the attenuation of other gasses emitted are not evaluated.

Based on fuel consumption information from the DPS-1 MODU on previous Woodside drilling campaigns (approximately 45 m^3/d) and the expected activity duration, it is estimated that the MODU will consume approximately 27,000 m^3 of diesel fuel. Applying the appropriate diesel emission factor from the National Greenhouse and Energy Reporting Scheme (NGERS), it is estimated that this fuel combustion will generate approximately 75,000 tCO_2e of greenhouse gas emissions.

Vessels will operate within the PAA, although emissions produced will be substantially less than that of the MODU. Using an estimated fuel use of 5 t/d for support vessels (Energy Institute 2000) and diesel emission factor from NGERS, approximately 30,000 tCO_2e of greenhouse gas will be emitted by vessels.

Using an estimated fuel use of 600 L/r (Energy Institute 2000), and applying aviation fuel emissions factor from NGER, approximately 2500 tCO2e will be generated by helicopters.

Well Flowback (Flaring) and Contingency Activities (venting)

Well flowback will occur following running and testing the upper completion and will result in flaring and/or venting of hydrocarbons. During well flowback, initial unloading of the well displaces the well fluids (i.e. suspension/completion brine). These unloaded completion fluids are treated and discharged overboard. Once the brines are unloaded, the gas stream is sent to flare via the production separator. If flow rate is not sufficient to sustain a flare for MODU operations, venting will occur. Depending on the process selected (flaring or venting), the emissions may vary from methane to carbon dioxide, NOx, etc.

The volumes of hydrocarbons flared during well flowback are typically no more than 100 Mscf per well. Up to 300 bbl of base oil may also be flared per well as part of flowback operations. Applying NGER emission factors for flaring during oil and gas exploration, the total estimated greenhouse emissions generated by flaring during flowback for 10 wells is approximately 60,000 tCO2e.

The global warming potential of un-combusted methane, which is the greatest component of Scarborough reservoir gas, is significantly greater than that of burnt methane. Therefore, greenhouse gas emissions would be greater during contingency venting activity. However, as described above, venting will only occur in cases where flare rate is not sufficient to maintain a flame, which is not credible for flowback of an entire well. The estimate of 60,000 tCO2e generated by flowback flaring for ten wells is still considered a conservative estimate as it assumes the longest likely flowback duration for every well.

During drilling of the well, a kick may occur. A kick is an undesirable influx of formation fluid into the wellbore. The resultant effect would be a release of a small volume of greenhouse gases via the degasser to the atmosphere during well control operations, known as 'venting'. Venting is required to ensure well integrity is maintained in the event of a kick thereby avoiding an emergency condition.

During the study undertaken by BP (2013), NO_2 emissions from flaring were modelled for clean-up flaring on MODUs at a rate of 250 MMscfd for up to two days. This model showed that short term concentrations of NO_2 from MODU flaring increased by up to about 60 µg/m³ (0.06 ppm) within 10 km of the source and increase of up to 20 µg/m³ (0.02 ppm) at about 40 km from the source. These levels are intermittent and temporary and do not result in exceedances above the WHO air quality guideline for NO_2 of 40 µg/m³ annual mean.

Planned flaring during wellbore clean-up and flowback will be below the volumes modelled in the study undertaken by BP (2013), therefore the outcomes are assumed to be an appropriately conservative indicator of attenuation of flaring emissions. As stated above, studies into the attenuation of other gasses is not discussed due to the nature of potential impacts of NO_2 to receptors being considered an appropriate proxy.

Detailed Impact Assessment

Assessment of Potential Impacts

Air Quality (atmospheric pollutants)

Atmospheric emissions may result in a decline in local air quality, within the immediate vicinity of the emissions source. As described above, produced emissions throughout the project will include SO_2, NOx, ozone depleting substances, CO_2, particulates and VOCs. Emissions from engines, generators and deck equipment may be toxic, odoriferous or aesthetically unpleasing, and will result in a reduction in air quality.

Given the offshore location of the PAA, and the low volumes of atmospheric emission which will be generated, biodiversity, ecological integrity, social amenities and human health will not be impacted and any potential impact to air quality is slight.

Marine Fauna

Atmospheric emissions can cause direct impacts to fauna, if they are present in the immediate vicinity of significant releases. Birds, for example, have been shown to suffer respiratory distress and illness when subjected to extended duration exposure to air pollutants (Sanderfoot and Holloway, 2017). Given that fauna numbers will be low at the point of discharge, injury or mortality to fauna a result of atmospheric discharges is negligible.

Aesthetic Value

Atmospheric emissions have the potential to introduce odour and visual amenity issues which can result in changes to the aesthetic value of an area.

Given the distance from shore of the PAA (215 km), the potential for a change in air quality from atmospheric emissions resulting in a change to aesthetic value for tourism/recreation or settlements is not considered to be credible. As the PAA is not directly visible from the nearest landfall, the flare and potential smoke resulting from emissions will not impact visual amenity, and no impacts to visual amenity for settlements are expected. Therefore, a change in aesthetic value from atmospheric emissions associated with Petroleum Activities Program is negligible.

GHG Emissions

GHG emissions attributed to the MODU, vessels and helicopters contribute to global concentrations of GHG emissions. It is important to acknowledge that climate change impacts cannot be directly attributed to any one activity, as they are instead the result of global GHG, minus global GHG sinks, that have accumulated in the atmosphere since the industrial revolution. The assessment of the Scarborough Project, including the contribution to global GHG emissions and the potential impacts of climate change on sensitive receptors, within Australian jurisdictions is described in Section 7.1.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program GHG emissions, combined with other Scarborough Project construction, installation and decommissioning related GHG emissions, were estimated to be less than 1% of total project lifecycle emissions, as described in the Scarborough OPP Section 7.1.3.2 (SA0006AF0000002, rev 5). Other construction, installation and decommissioning GHG emissions will be addressed in relevant EP for those activities.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level
Air quality	Change in air quality	Low value (open water)	Slight	Negligible (F)

Overall Impact Significance Level: The overall impact significance level for routine atmospheric and GHG emissions is F based on a slight effect to air quality of the regional airshed and a low value receptor. The impact significance levels for individual receptors are consistent with the level in the OPP.

Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*	*Benefit in Impact/Risk Reduction*	*Proportionality*	*Control Adopted*
Legislation, Codes and Standards				
Marine Order 97 (Marine pollution prevention – Air pollution).	F: Yes. CS: Minimal cost. Standard practice	Legislative requirements to be followed may slightly reduce the likelihood of air pollution.	Control based on legislative requirements – must be adopted.	Yes **C 2.1**
Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011: Accepted Well Operations Management Plan (WOMP) and application to drill.	F: Yes. CS: Minimal cost. Standard practice.	The accepted WOMP will manage the risk of well kicks, reducing the likelihood of occurrence. No reduction in consequence will occur.	Control based on legislative requirements – must be adopted	Yes **C 2.2**
As-built checks that shall be completed during well operations to establish a	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of occurrence. No	Benefits outweigh cost/sacrifice.	Yes **C 2.3**

minimum acceptable standard of well integrity is achieved.		reduction in consequence will occur.		
Burning and flaring during well unloading activities will be conducted using Woodside and Vendor approved TPS (Temporary Production System) Package.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of atmospheric emissions impacting air quality. Consequence remains unchanged.	Benefits outweigh cost/sacrifice.	Yes **C 2.4**
Oil burner will operate efficiently to maximise combustion.	F: Yes. CS: Minimal cost. Standard practice.	This control results in a reduction on likelihood of atmospheric emissions impacting air quality, consequence remains unchanged.	Benefits outweigh cost/sacrifice.	Yes **C 2.5**
Subsea BOP installed and tested during drilling operations.	F: Yes. CS: Standard practice. Required by Woodside standards.	BOP testing reduces the volume of gas vented in the event of a well kick.	Benefits outweigh cost/sacrifice.	Yes **C 2.6**
Process conducted to calculate, update and monitor kick tolerance for use in well design and while drilling.	F: Yes. CS: Minimal cost. Standard practice for Woodside activities.	Processes will reduce the volume of gas vented in the event of a well kick.	Benefits outweigh cost/sacrifice.	Yes **C 2.7**
Well control bridging document for alignment of Woodside and the MODU Contractor in order to manage the equipment and procedures for preventing and handling a well kick.	F: Yes. CS: Minimal cost. Standard practice for Woodside activities.	Implementing equipment and procedures in the well control bridging document will reduce the volume of gas vented in the event of a well kick.	Benefits outweigh cost/sacrifice.	Yes **C 2.8**
Reporting of GHG emissions as required by regulatory requirements	F: Yes. CS: Minimal cost. Standard practice for Woodside activities.	Tracking and reporting of emissions gives visibility to performance and enables improvement opportunities to be identified. Reporting increases transparency and accountability which can also drive performance improvements.	Control based on legislative requirements – must be adopted	Yes **C 2.9**
Professional Judgement – Eliminate				
Do not combust fuel.	F: No. There are no MODUs or vessels that do not use internal combustion engines. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Do not vent during well kick.	F: No. Venting is a critical safety activity required in the event of	Not considered – control not feasible.	Not considered – control not feasible.	No

	a kick to reduce pressure build up. CS: Not considered – control not feasible.			
Well unloading acceptance criteria that define the well objectives will be established.	F: Yes CS: Standard practice	Eliminates unnecessary flared volumes and corresponding emissions (light and GHG)	Benefits outweigh cost/sacrifice	Yes **C 1.2**
Professional Judgement - Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
Manage vessel speed to reduce fuel combustion	F: Yes CS: Standard practice	Reducing fuel combustion reduces atmospheric emissions.	Benefits outweigh cost/sacrifice	Yes **C 2.10**

ALARP Statement:

On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls good oil-field practice, and appropriate to manage the impacts of fuel combustion, flaring, incineration and venting. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of the aspect and associated impacts assessed in this section are provided in Section 7.1.3.9 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:**

- Overall impact significance levels for individual receptors are less than the significant impact level defined in the OPP.
- EPOs and controls in the OPP that are relevant to GHG emissions have been adopted.
- There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, routine atmospheric emissions from fuel combustion, flaring, incineration, and venting are unlikely to result in an impact significance greater than negligible. The adopted controls are considered consistent with industry legislation, codes and standards, and professional judgement and meet the requirements of Australian Marine Orders.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of atmospheric emissions to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria

EPO	*Adopted Control(s)*	*EPS*	*MC*
EPO 5 Undertake the Petroleum Activities Program in a manner that will not result in a substantial change in	**C 2.1** Marine Order 97 (Marine Pollution Prevention – Air Pollution) which detail requirements for:	**PS 2.1** MODU and project vessels compliant with Marine Order 97 (Marine Pollution Prevention – Air Pollution) to restrict emissions to those	**MC 2.1.1** Marine Assurance inspection records demonstrate compliance with Marine Order 97.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
air quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 6** Optimise efficiencies in air emissions and reduce GHG emissions to ALARP and Acceptable Levels.	• International Air Pollution Prevention (IAPP) Certificate, required by vessel class • use of low sulphur fuel when available • Ship Energy Efficiency Management Plan (SEEMP), where required by vessel class • onboard incinerator complies with Marine Order 97.	necessary to perform the activity. Vessel marine assurance process conducted prior to contracting vessels, to ensure suitability and compliance with vessel combustion certification/marine order requirements.	
	C 2.2 Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011: accepted Well Operations Management Plan (WOMP), which describes the well design and barriers to be used to prevent a loss of well integrity, specifically: • all permeable zones penetrated by the well bore, containing hydrocarbons or over-pressured water, shall be isolated from the surface environment by a minimum of two barriers (primary and secondary) (a single fluid barrier may be implemented during the initial stages of well construction if appropriateness is confirmed by a shallow hazard study) • discrete hydrocarbon zones shall be isolated from each other (to prevent cross flow) by a minimum of one barrier where deemed required • all normally pressured permeable water-bearing formations shall be isolated from the surface by a minimum of one barrier. The barriers shall:	**PS 2.2.1** Wells drilled in compliance with the accepted WOMP, including implementation of barriers to prevent a loss of well integrity.	**MC 2.2.1** Acceptance letter from NOPSEMA demonstrates the WOMP and application to drill were accepted by NOPSEMA prior to the drilling activity commencing. **MC 2.2.2** Records demonstrate minimum of two verified barriers (a single fluid barrier may be implemented during the initial stages of well construction if appropriateness is confirmed by a shallow hazard study) were in place for all permeable zones penetrated by the wellbore. **MC 2.2.3** Records demonstrate composition and weight of drilling fluids were applicable to down hole conditions.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	• be effective over the lifetime of well construction • (fluid barriers) remain monitored and provide sufficient pressure to counter pore pressure during well construction • (cementing barriers, including conductor, casing and liners) conform to the relevant minimum standards set out in the Woodside Engineering Standard – Well Cementation. Verification: effectiveness of primary and secondary barriers shall be verified (physical evidence of the correct placement and performance) during the drilling of the well.		
	C 2.3 As-built checks shall be completed during well operations.	**PS 2.3.1** Achieve a minimum acceptable standard of well integrity.	**MC 2.3.1** Records show Well Acceptance criteria are developed for each well.
			MC 2.3.2 Records demonstrate Well Acceptance Criteria have been met.
	C 2.4 Burning and flaring during well unloading activities will be conducted using Woodside and Vendor approved TPS Package.	**PS 2.4.1** Maintain gas flare, air supply and oil burner to maximise efficiency of combustion and minimise venting.	**MC 2.4.1** Records demonstrate that a Woodside approved TPS package is in use during well unloading/ testing.
	C 2.5 Oil burner will operate efficiently to maximise combustion.	**PS 2.5.1** Oil burner will have combustion efficiency greater than 99%.	**MC 2.5.1** Records demonstrate that oil burner is greater than 99% efficient.
	C 2.6 Subsea BOP installed and tested during drilling operations. The BOP shall include: • one annular preventer • two pipe rams (excluding the test rams) • a minimum of two sets of shear rams, one of which must be capable of sealing	**PS 2.6.1** Subsea BOP specification, installation and testing compliant with internal Woodside Standards and international requirements (API Standard 53 5th Edition) as agreed by Woodside and MODU contractor.	**MC 2.6.1** Records demonstrate that BOP and BOP control system specifications and testing were in accordance with minimum standards for the expected drilling conditions as agreed by Woodside and MODU contractor.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	• deadman functionality • the capability of ROV intervention • independent power systems.		
	C 2.7 Process conducted to calculate, update and monitor kick tolerance for use in well design and while drilling, including: The BOP shall be closed upon detecting a positive well influx. The shut in procedure shall be according the rig contractor procedures or as the well conditions dictate. Kick tolerance calculations will be made for drilling all hole sections based on the weakest known point in the well. Kick detection techniques will be adjusted based on the level of kick tolerance through a management of change (MOC). The manual also includes requirements for kick tolerance management in the event of down-hole losses.	**PS 2.7.1** Kick tolerance is calculated, managed, monitored and updated while drilling.	**MC 2.7.1** Records demonstrates well kick tolerance is calculated, managed, monitored and updated while drilling. **MC 2.7.2** Records demonstrate shut-in procedures followed in the event of a potential well kick.
	C 2.8 Well control bridging document for alignment of Woodside and the MODU Contractor in order to manage the equipment and procedures for preventing and handling a well kick.	**PS 2.8.1** Well is drilled in accordance with the contractor WCBD to reduce the likelihood of emissions to air from a well kick during drilling operations.	**MC 2.8.1** Records demonstrate well drilled in accordance with WCBD.
	C 2.9 Reporting of GHG emissions as required by regulatory requirements	**PS 2.9.1** GHG emission regulatory reporting undertaken as required	**MC 2.9.1** Records demonstrate required regulatory GHG emission reported
	C 2.10 Manage vessel speed to reduce fuel combustion	**PS 2.10.1** Vessel speed will be managed to reduce fuel consumption where practicable.	**MC 2.10.1** Records demonstrate speed of support vessels managed
	C 1.2 Refer to **Section 6.6.1**	**PS 1.2.1** Refer to **Section 6.6.1**	**MC 1.2.1** Refer to **Section 6.6.1**

6.6.3 Routine Acoustic Emissions – Generation of Noise from MODU, Project Vessels and Positioning Equipment

Scarborough OPP – Relevant Impact Assessment Section
Section 7.1.4 (Routine Acoustic Emissions)

Context

Relevant Activities	Existing Environment	Stakeholder consultation
Vessel Operations – **Section 3.10.2** MODU Operations – **Section 3.10.1** Contingency Activities – **Section 3.11**	Marine Regional Characteristics – **Section 4.2** Marine Fauna of Conservation Significance – **Section 4.6**	Consultation – **Section 4.9**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Generation of acoustic signals from MODU, drilling and support vessels during normal operations						✓		A	E	-	-	PJ	Broadly Acceptable	EPO 3, 4, 8
Generation of acoustic signals from DP systems on MODU and support vessels						✓								
Generation of acoustic signals from positioning equipment (transponders)						✓								

Description of Source of Impact/Risk

The MODU and project vessels will generate noise both in the air and underwater, due to the operation of thrusters, engines, propeller cavitation, drilling operations etc. Vessels, including the MODU, may use Dynamic Positioning (DP) where propellers and thrusters are used to hold position, rather than anchoring. These noises will contribute to and have the potential to exceed ambient noise levels which range from around 90 dB re 1 µPa (root square mean sound pressure level [rms SPL]) under very calm, low wind conditions, to 120 dB re 1µPa (rms SPL) under windy conditions (McCauley, 2005).

MODU Operations (Excluding DP)

During drilling operations, the MODU will produce low-intensity continuous sound. Sound produced from an active MODU is predominantly below 2 kHz, with peak frequencies below 500 Hz. Measured frequencies for the West Aquarius MODU, which is expected to be similar to the MODU that will be contracted for the Scarborough drilling activity, recorded a peak frequency at 190 Hz (Martin et al.,2019). A range of broadband values, 59 to 185 dB re 1 µPa at 1 m (SPL), have been quoted for various MODUs (Simmonds et al., 2004). McCauley (1998) recorded source noise levels for moored MODUs from 149-154 dB re 1 µPa at 1 m while actively drilling (with support vessel on anchor) and Greene (1987) recorded source levels of two moored drillships from 145-158 dB re 1 µPa at 1 m during drilling (with support vessels idling nearby). An acoustic monitoring program commissioned by Santos was conducted during an exploratory drilling program in 2003, which indicated that the drilling operation was not audible from between 8 - 28 km from the MODU (or beyond) (McCauley, 2004).

Project Vessels and Operation of DP

Vessels produce low frequency sound (i.e. below 1 kHz) from the operation of machinery, hydrodynamic flow sound around the hull and from propeller cavitation, which is typically the dominant source of sound (Ross, 1987, 1993). Vessels in the 50-100 m size class (e.g. supply ships, crew boats, research vessels) produce broadband source levels in the 165–180 dB re 1 µPa SPL range (Gotz et al., 2009). In comparison, underwater sound levels generated by large ships can produce levels exceeding 190 dB re 1 µPa (Gotz et al., 2009), and small vessels up to the 20 m size class typically produce sound at source levels of 151 to 156 dB re 1µPa (Richardson et al., 1995).

McCauley (1998) measured underwater broadband noise equivalent to about 182 dB re 1 µPa at 1 m (RMS SPL) from a support vessel holding station in the Timor Sea; it is expected that similar noise levels will be generated by support vessels used for this Petroleum Activities Program.

DP MODU underwater noise measurements were taken for the West Aquarius MODU by JASCO on the Scotian Shelf in Canada, which is expected to have a similar thruster configuration to the MODU that will be contracted for the Scarborough drilling activity. The 90th percentile of the broadband radiated sound levels was 186.3 dB re 1 µPa (Martin et al., 2019). This is similar to measurements taken for the Maersk Discoverer drill rig on the North West Shelf (Woodside, 2011), where the system emitted tonal signals between 200 Hz to 1.2 kHz, at a source level between 176 and 185 dB re 1 µPa SPL @ 1 m.

Project vessels and the MODU are conservatively expected to have an overall combined source level of 192 dB re 1 µPa (rms SPL), which represents a doubling of sound pressure from the single loudest source (i.e. 186 dB + 6 dB). Cumulative noise from the MODU and/or multiple project vessels operating in the PAA may result in elevated noise levels, and will be assessed in subsequent EPs (i.e. for activities such as trunkline installation and the SURF scope).

Generation of Underwater Noise from Positioning Equipment

An array of long baseline (LBL) and/or ultra-short baseline (USBL) transponders may be installed on the seabed for metrology and positioning. An array of transponders is proposed within a radius of 500 m from the proposed location of the wells and will be in place for a period of about three months per well.

Transponders typically emit pulses (impulsive noise) of medium frequency sound, generally within the range 21 to 31 kHz. The estimated SPL would be 180 to 206 dB re 1 µPa at 1 m (Jiménez-Arranz et al., 2017). LBL will be used for rig activities, however the xmas tree deployment vessel will use USBL. Transmissions are not continuous but consist of short ‘chirps’ with a duration that ranges from 3 to 40 milliseconds. Transponders will not emit any sound when on standby and are planned to only actively emit sound for about six hours per well. When required for general positioning they will emit one chirp every five seconds (estimated to be required for four hours at a time). When required for precise positioning they will emit one chirp every second (estimated to be required for two hours at a time). For moored drilling transponders are expected to be only active at the commencement of the drilling where positioning is required. For DP MODU positioning an array of transponders will be active whilst the drill rig is on location.

Contingency Activities (Additional Development Well, Respud, Sidetrack)

Contingency activities which involve drilling, such as an additional development well, respud and sidetrack, will involve the use of a MODU and vessels, plus drilling operations. Any acoustic emissions generated will be the same as those expected from the planned activities described above.

Detailed Impact Assessment

Assessment of Potential Impacts

Receptors

The PAA is located in water depths of approximately 900-955 m (refer to **Section 3.4**). The fauna associated with this area will be predominantly pelagic species of fish, with migratory species such as cetaceans and marine turtles potentially occurring in the area seasonally (**Section 4.6**). Noise interference is a key threat to a number of migratory and threatened cetaceans and marine turtles identified as potentially occurring within the PAA, including the pygmy blue whale. Relevant actions included in recovery plans for these species are outlined in **Section 6.8.**

A pygmy blue whale migration BIA is located about 35 km east of the PAA (**Section 4.6.3**). Individual pygmy blue whales may occasionally transit the PAA during April to July and October to January during their seasonal migrations. A humpback whale migration BIA is located about 155 km south-east of the PAA, and migrating whales may be present between about May and November. Occasional individuals may transit through the PAA.

The nearest marine turtle internesting buffer BIA for the flatback turtle is located about 165 km east of the PAA at the Montebello Islands. Given the water depths and distance from shore, the PAA does not represent suitable foraging or internesting habitat and therefore, marine turtle presence within the PAA is expected to be infrequent.

<u>Potential Impact of Noise</u>

Elevated underwater noise can affect marine fauna, including cetaceans, marine turtles, fish, sharks and rays, in three main ways (Richardson et al., 1995; Simmonds et al., 2004):

- by causing direct physical effects on hearing or other organs. Hearing loss may be temporary (temporary threshold shift [TTS]; referred to as auditory fatigue), or permanent threshold shift (PTS; injury);
- by masking or interfering with other biologically important sounds (including vocal communication, echolocation, signals and sounds produced by predators or prey); and
- through disturbance leading to behavioural changes or displacement from important areas (e.g. BIAs). The occurrence and intensity of disturbance is highly variable and depends on a range of factors relating to the animal and situation.

Sound Propagation

Increasing the distance from the noise source results in the level of noise reducing, due primarily to the spreading of the sound energy with distance. The way that the noise spreads (geometrical divergence) will depend upon several factors such as water column depth, pressure, temperature gradients, and salinity, as well as surface and bottom conditions.

Cetaceans

Species Sensitivity and Thresholds

Marine mammals and especially cetaceans rely on sound for important life functions including individual recognition, socialising, detecting predators and prey, navigation and reproduction (Weilgart, 2007; Erbe et al., 2015; Erbe et al., 2018). Underwater noise can affect marine mammals in various ways including interfering with communication (masking), behavioural changes, a shift in the hearing threshold (PTS and TTS), physical damage and stress (Erbe, 2012; Rolland et al., 2012).

The thresholds that could result in a behavioural response, temporary threshold shift (TTS) and permanent threshold shift (PTS) for cetaceans as a result of continuous noise sources are presented in Table 6-4 . These thresholds have been adopted by the United States National Oceanic and Atmospheric Administration (NOAA) (National Marine Fisheries Service [NMFS], 2014, 2018; Southall et al., 2019; NOAA, 2019).

Table 6-4: Thresholds for PTS, TTS and behavioural response onset for low-frequency (LF) and high-frequency (HF) cetaceans for continuous noise

Hearing group and generalised hearing range	PTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)	TTS onset thresholds: SEL_{24h} (dB re 1 µPa².s)	Behavioural response (dB re 1 µPa)
LF cetaceans	199	179	120
HF cetaceans	198	178	120

Source: NMFS (2014, 2018; Southall, 2019; NOAA, 2019).

Impact Assessment

JASCO modelled underwater noise levels during the proposed construction and operation of the Scarborough Development, including noise from a support vessel (the Setouchi Surveyor), which operates on 4600 HP while producing a broadband source level of 186.1 dB re 1 re 1 µPa^{2}m^2 (McPherson et al. 2019). Maximum-over-depth horizontal distances to PTS thresholds for LF cetaceans as a result of the modelled support vessel was about 10 m from the source. TTS thresholds could be reached at up to 230 m from the source for the support vessel. PTS and TTS thresholds would therefore not be exceeded in the pygmy blue whale BIA. The predicted distances for PTS and TTS criteria exceedance are based upon exposure for 24-hours by a stationary receptor, which is not a realistic scenario. PTS and TTS thresholds are therefore not expected to be exceeded for cetaceans transiting through the PAA.

As described above, the MODU is expected to have a similar thruster configuration to the West Aquarius, which has been measured to have a source level of 186.3 dB 1 µPa. Based on an intermediate spreading equation to estimate sound propagation loss (15Log(R), which is considered conservative for the water depths of the PAA), noise levels would drop below 120 dB re 1 µPa (behavioural response threshold; refer **Table 6-4**) within about 26 km. Modelling of propagation loss for the West Aquarius, conducted by JASCO in a water depth of 1137 m off the coast of Canada, predicted that noise levels would drop below 120 dB re 1 µPa within about 47 km (Matthews et al., 2017). While the sound speed profile of the water column and bathymetry may be different, the modelling provides a broad comparison to support that the estimated propagation loss is within the right order of magnitude. The modelling also predicted that underwater noise from the West Aquarius would drop below PTS thresholds within 230 m and a similar distance may be expected for the Petroleum Activities Program.

For an operating MODU with support vessel on standby with a combined source level of about 192 dB re 1 µPa (rms SPL), noise levels would drop below 120 dB re 1 µPa within about 64 km using the same intermediate spreading equation.

Given the sound propagation loss estimated above for an operating MODU and project vessels, there is no potential for injury (PTS or TTS) to pygmy blue whales migrating within the BIA (about 35 km from the PAA). Injury to other cetacean species is also not considered credible as individuals are not expected to spend long durations in close proximity to operations and are more likely to be transiting through the area.

It is reasonable to expect that cetaceans may demonstrate avoidance or attraction behaviour to the noise generated by the Petroleum Activities Program. For example, when transiting through the area, pygmy blue whales may deviate slightly from their migration route, but continue on their migration pathway. Considering proximity of the pygmy blue whale migration BIA to the PAA (about 35 km), it is likely that individuals may transit in and around the PAA during migratory periods; however, only transient individuals or small groups are expected. Further, the PAA is surrounded by open water, with no restrictions (e.g. shallow waters, embayments) to an animal's ability to avoid the activities.

Transponders used for positioning have the potential to cause some temporary behavioural disturbance to marine fauna; however, noise levels will be well below injury thresholds. Based on empirical spreading loss estimates measured by Warner and McCrodan (2011), received levels from USBL transponders are expected to exceed the cetacean behavioural response threshold for impulsive sources out to about 42 m. Given the short-duration chirps and the mid frequencies used by positioning equipment, the acoustic noise from a single transponder is unlikely to have any substantial effect on the behavioural patterns of marine fauna. Therefore, potential impacts from transponder noise are likely to be restricted to temporary and localised avoidance behaviour of individuals transiting through the PAA, and therefore are considered localised with no lasting effect.

Potential impacts from predicted noise levels from project vessels (including MODU and support vessels) and transponders are not considered to be ecologically significant at a population level.

Marine Turtles

Species Sensitivity and Thresholds

There is a paucity of data regarding responses of marine turtles to underwater noise. However, turtles have been shown to respond to low frequency sound, with indications that they have the highest hearing sensitivity in the frequency range 100–700 Hz (Bartol and Musick, 2003). Lenhardt (1994) observed marine turtles avoiding low-frequency sound.

A Popper et al. (2014) review assessed thresholds for marine turtles and found qualitative results that TTS was only moderate for near field exposure, and low for both intermediate and far field exposure (Popper et al., 2014). McCauley et al. (2000) noted that sea turtles exhibit increased swimming activity at 166 dB re 1 µPa. No numerical thresholds have been developed for impacts of continuous sources (e.g. vessel noise) on marine turtles.

The thresholds listed in **Table 6-5** are considered appropriate for the assessment of impacts from continuous acoustic discharges to marine turtles from the Petroleum Activities Program.

Table 6-5: Impact thresholds to marine turtles for continuous noise

Receptor	Mortality and potential mortal injury	PTS	TTS	Masking	Behaviour
Marine turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low

Note: The sound units provided in the table above include: relative risk (high, medium and low) is given for marine turtles at three distances from the source defined in relative terms as near (N – tens of metres), intermediate (I – hundreds of metres) and far (F – thousands of metres) (after Popper et al. 2014).

Impact Assessment

The Recovery Plan for Marine Turtles (Commonwealth of Australia, 2017) notes there is limited information available on the impact of noise on marine turtles and that the impact of noise on turtle stocks may vary depending on whether exposure is short (acute) or long-term (chronic). However, given the thresholds outlined in **Table 6-5**, it is reasonable to expect that marine turtles may demonstrate avoidance or attraction behaviour to the noise generated by the Petroleum Activities Program.

There are no marine turtle BIAs or Habitat critical within 165 km of the PAA, and given the water depths and distance from shore, the PAA does not represent suitable foraging or internesting habitat. Marine turtle presence is expected to be infrequent, and potential impacts from predicted noise levels from the project vessels (including MODU and support vessels) are not considered to be ecologically significant at a population level.

Fish, Sharks and Rays

Species Sensitivity and Thresholds

Fish perceive sound through the ears and the lateral line, which are sensitive to vibration. Some species of teleost or bony fish (e.g. herring) have a structure linking the gas-filled swim bladder and ear, and these species usually have increased hearing sensitivity. These species are considered to be more sensitive to anthropogenic underwater noise sources than species such as cod (Gadus sp.), which do not possess a structure linking the swim bladder and inner ear. Fish species that either do not have a swim bladder (e.g. elasmobranchs (sharks and rays) and scombrid fish (mackerel and tunas)) or have a much-reduced swim bladder (e.g. flat fish) tend to have a relatively low auditory sensitivity.

Considering these differences in fish physiology, Popper et al. (2014) developed sound exposure guidelines for fish; these are presented in Table 6-6 and are considered appropriate to assess continuous acoustic discharges to fish from the PAP.

Table 6-6: Impact thresholds to fish, sharks and rays for continuous noise

Receptor	Mortality and potential mortal injury	PTS	TTS	Masking	Behaviour
Fish: no swim bladder	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder involving hearing	(N) Low (I) Low (F) Low	170 dB rms SPL for 48-hours	158 dB rms SPL for 12-hours	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low

Note: The sound units provided in the table above include:

- *rms SPL: root mean square of time-series pressure level, useful for quantifying continuous noise sources.*
- *Relative risk (high, medium and low) is given for fish (all types) at three distances from the source defined in relative terms as near (N – tens of metres), intermediate (I – hundreds of metres) and far (F – thousands of metres) (after Popper et al. 2014).*

Source: Popper et al. (2014).

Impact Assessment

Maximum-over-depth horizontal distances to PTS and TTS thresholds for fish with a swim bladder involved in hearing as a result of underwater noise from a support vessel are approximately 10 m or less from the source based on modelling from JASCO for the Scarborough field (McPherson et al., 2019). For fish with a swim bladder not involved in hearing, and fish without a swim bladder (including whale sharks) the likelihood of PTS or TTS is low. Based on an intermediate spreading equation to estimate sound propagation loss from the MODU (15Log(R)), noise levels would drop below PTS and TTS thresholds for fish with a swim bladder involved in hearing within <15 m and 78 m respectively.

Given the thresholds outlined in Table 6-6, it is reasonable to expect that fish, sharks and rays may demonstrate avoidance or attraction behaviour to the noise generated by the Petroleum Activities Program. However, potential impacts from predicted noise levels from the project vessels (including MODU and support vessels) are not considered to be ecologically significant at a population level.

Cumulative Impacts

Cumulative impacts have been assessed above.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level
Marine mammals	Change in fauna behaviour Injury / mortality to fauna	High value species (i.e. pygmy blue whale)	No lasting effect	Slight (E)
Marine reptiles	Change in fauna behaviour Injury / mortality to fauna	High value species (i.e. flatback, green, hawksbill or loggerhead turtles)	No lasting effect	Slight (E)
Fish	Change in fauna behaviour Injury / mortality to fauna	High value species	No lasting effect	Slight (E)

Overall Impact Significance Level: The overall impact significance level for routine acoustic emissions is E based on no lasting effect to the high value receptors (marine mammals, reptiles and fish). The impact significance levels for individual receptors are consistent with the level in the OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation Codes and Standards				
EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans, including the following measures[4]: • Project vessels will not travel greater than 6 knots within 300 m of a cetacean or turtle (caution zone) and not approach closer than 100 m from a whale. • Project vessels will not approach closer than 50 m for a dolphin or turtle and/or 100 m for a whale (with the exception of animals bow riding). • If the cetacean or turtle shows signs of being disturbed, project vessels will immediately withdraw from the caution zone at a constant speed of less than 6 knots. • Vessels will not travel greater than 8 knots within 250 m of a whale shark and not allow the vessel to approach closer than 30 m of a whale shark.	F: Yes. CS: Minimal cost. Standard practice.	Implementation of controls for reduced vessel speed around cetaceans can potentially reduce the underwater noise footprint of a vessel and lower the likelihood of interaction above significant thresholds	Controls based on legislative requirements – must be adopted.	Yes **C 3.1**
Good Practice				
Implement adaptive management procedure prior to and during MODU /installation vessel moves to the next well location, during daylight hours. Adaptive management procedure to include: • Use of trained crew (both MODU and installation vessel)	F: Yes CS: Time / Cost associated with person used for observations. Schedule delays associated with waiting on Pygmy Blue Whale activity to cease / move on.	Detecting pygmy blue whale foraging activity in the area before MODU / installation vessel moves allows distance to be maintained and reduces the likelihood of impact or influence on pygmy blue whale activity.	Benefits outweigh cost/sacrifice.	Yes **C 3.2**

[4] For safety reasons, the distance requirements below are not applied for a vessel holding station or with limited manoeuvrability e.g. anchor handling, loading, back-loading, bunkering, close standby cover for overside working and emergency situations.

• Monitoring 30 minutes prior to move and during the transit to the new well location • MODU / installation vessel will not approach within 500 m of any foraging pygmy blue whales • Where pygmy blue whale foraging presence has been observed the area will not be approached, within 500m, until there has been a period of 30 minutes with no recorded foraging pygmy blue whale(s)				
Collect data on opportunistic sightings of pygmy blue whales to gauge presence and behaviour	F: Yes CS: Time / Cost associated with person used for observations and in data collection	Collecting data on pygmy blue whale presence and behaviour may assist in increasing understanding of their activity in the PAA to inform future activities.	Benefits outweigh cost/sacrifice.	Yes **C 3.3**
Use of aircraft to carry out visual observations for pygmy blue whale foraging activity (Aerial Survey).	F: Yes CS: Time / cost associated with chartering aircraft and use of dedicated MFO's Due to WA-61-L distance offshore actual observation times are limited by fuel availability - larger fuel capacity associated with larger aircraft increases cost of the exercise	Aerial Surveys could assist in identifying pygmy blue whale foraging activity over a larger monitoring zone.	Cost/sacrifice outweighs benefit. Due to distance of PAA from pygmy blue whale migration and foraging BIA's, presence of PBW's carrying out opportunistic foraging activities in the area is expected to be low. Adequate observations are able to be made from the MODU Bridge due to height and surveillance by trained crew. It is not expected that an aircraft would add significantly more value than this, to warrant deployment.	No.
Professional Judgement – Eliminate				
Remove support vessel on standby at the Petroleum Activities Program location.	F: No. Activity support vessel required as per MODU Safety Case, particularly for maintaining the 500 m petroleum safety zone around the MODU/ installation vessel.	Not considered – control not feasible.	Not considered – control not feasible.	No

	CS: Introduces unacceptable safety risk.			
Only use Moored MODU (no DP thruster noise).	F: Yes, it would be feasible to use a Moored MODU. CS: Costs and schedule implications of waiting for a Moored MODU to be available, rather than selecting a DP MODU.	Eliminates DP thruster noise from the MODU	Cost/sacrifice outweighs benefit. Woodside plans to use a DP MODU for technical capability, efficiency, and cost reasons. Cost and schedule implications of using a Moored MODU are grossly disproportionate to potential environmental gains given distance to Migratory BIA for PBW and low likelihood of presence of opportunistic foraging in PAA.	No
Eliminate generation of noise from the MODU, installation vessel, support vessels or survey positioning equipment.	F: No. The generation of noise from these sources cannot be eliminated due to operating requirements. Note that vessels operating on DP may be a safety critical requirement. CS: Inability to conduct the Petroleum Activities Program. Loss of project.	Not considered – control not feasible.	Not considered – control not feasible.	No
Move support vessel(s) away from MODU (>2km) if foraging pygmy blue whale(s) observed within 500 m – when support vessel is not being used to perform functionality as required by Safety Case	F: Yes CS: Time / Cost associated with vessel moving and delay to activities which cannot be carried out without support vessel present and at required standby distance	Can reduce cumulative noise and potential reduction in likelihood of impact to foraging Pygmy Blue Whales	Benefits outweigh cost/sacrifice	Yes **C 3.4**
		Professional Judgement – Substitute		
Management of vessel noise by varying the timing of the Petroleum Activities Program to avoid migration periods.	F: Not feasible due to total length of drilling campaign, planned batch drilling sequence and successive activities dependent upon completion timing of D&C campaign execution CS: Significant cost and schedule impacts deeming the project unviable if activities avoid specific timeframes.	Not considered – control not feasible.	Not considered – control not feasible.	No

Professional Judgement – Engineered Solution				
Drone surveys to identify cetacean activities prior to well moves (during batch drilling) or initial entry into the Project Activity Area	F: Yes CS: Cost of drone, pilot and other equipment required. Standby time for MODU or Installation vessel if cetaceans present.	Can reduce likelihood of encountering PBWs at a distance that may cause injury/impact or behavioural response. Could give more reliability on whales and whether they are foraging	Cost/sacrifice outweighs benefit. Due to distance of PAA from PBW migration and foraging BIA's, presence of PBW's carrying out opportunistic foraging activities in the area is low. Adequate observations are able to be made from the MODU Bridge due to height and surveillance by a trained MFO. It is not expected that a drone would add significantly more value than this, to warrant deployment.	No
Passive Acoustic Monitoring (PAM)	F: No. PAM has limited ability to detect calls from baleen whales such as the Pygmy Blue Whale, particularly with added background noise from drilling/ installation vessel activities and known reliability and practicality limitations of the technology. CS: Costs associated with PAM technology acquisition and implementation.	Not considered – control not feasible.	Not considered – control not feasible.	No.
Use of thermal imaging equipment at night or periods of low visibility to identify cetacean presence.	F: Yes. Feasible to install on support vessel CS: Costs associated with infrared technology acquisition and implementation.	Can increase likelihood of identifying cetacean presence however limitations on detection distance/depth, interpretation of data (identification of cetacean type for example) and practicality.	Cost/sacrifice outweighs benefit. Lack of proven application in detection of cetaceans in deep water environment and limitations of the technology reduce potential benefit gained when compared with low likelihood of expected cetacean activity and low likelihood of MODU/ installation vessel movement at night.	No
Use of Autonomous Underwater Vehicle (AUV) to monitor for presence of pygmy blue whales using detection of their vocalisations.	F: Yes. Could be deployed from support vessel CS: Costs associated with obtaining and	Limited benefit as the technology relies on Pygmy Blue Whale vocalisation, which is currently not well understood,	Cost/sacrifice outweighs benefit. Due to distance of PAA from PBW migration and	No.

	operating the technology. Schedule delays while data is collected and interpreted (not real time monitoring)	particularly during foraging activities. Technology and applications still under development and not widely tested in field. Application limited due to lack of real time capability.	foraging BIA's, presence of PBW's carrying out opportunistic foraging activities in the area is expected to be low. Adequate observations are able to be made from the MODU Bridge due to height and surveillance by a trained crew. It is not expected that an AUV would add significantly more value than this, to warrant deployment.	

ALARP Statement:

As identified in the DAWE and NOPSEMA guidance on key terms within the CMP, where it can be reasonably predicted that blue whale foraging is probable, known or whale presence is detected, adaptive management (**C3.2**) should be used during industry activities to prevent unacceptable impacts (i.e. no injury or biologically significant behavioural disturbance) to blue whales from underwater anthropogenic noise.

On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the potential impacts from noise emissions. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in **Section 7.1.4.3** of the Scarborough OPP (SA0006AF0000002, Rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:**

- Overall impact significance levels for individual receptors are less than the significant impact level defined in the OPP.
- EPOs and controls in the OPP that are relevant to routine acoustic emissions have been adopted.
- Additional guidance on key terms within the Conservation Management Plan for the Blue Whale (the CMP) was issued in September 2021 and these were considered in the assessment against relevant actions in the CMP. The Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.
- There are no additional changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that the generation of noise from project vessels, MODU, and positioning equipment is unlikely to result in an impact significance level greater than slight. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice (**Section 6.8**).

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of acoustic emissions to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 3 Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. **EPO 4** Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of fishes, marine mammals, marine reptiles, or the spatial distribution of a population. **EPO 8** Undertake the Petroleum Activities Program in a manner that will not substantially modify, destroy or isolate an area of important habitat for a migratory species.	**C 3.1** EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans, including the following measures[5]: • Project vessels will not travel greater than 6 knots within 300 m of a cetacean or turtle (caution zone) and not approach closer than 100 m from a whale. • Project vessels will not approach closer than 50 m for a dolphin or turtle and/or 100 m for a whale (with the exception of animals bow riding). • If the cetacean or turtle shows signs of being disturbed, project vessels will immediately withdraw from the caution zone at a constant speed of less than 6 knots. • Vessels will not travel greater than 8 knots within 250 m of a whale shark and not allow the vessel to approach closer than 30 m of a whale shark.	**PS 3.1.1** Compliance with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05 and 8.06) Interacting with cetaceans	**MC 3.1.1** Records demonstrate no breaches with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.
	C 3.2 Implement adaptive management procedure prior to and during MODU /installation vessel moves to the next well location, during daylight hours. Adaptive management procedure to include: • Use of trained crew (both MODU and installation vessel) • Monitoring 30 minutes prior to move and during the transit to the new well location • MODU / installation vessel will not approach within 500 m of any	**PS 3.2.1** During moves to the next well location MODU or installation vessel will not approach within 500 m of • foraging pygmy blue whales or • an area where foraging pygmy blue whales were observed within the previous 30 minutes.	**MC 3.2.1** Records demonstrate trained MODU/vessel crew on watch prior to moving to next well location **MC 3.2.2** Records demonstrate when foraging PBW presence detected the MODU or installation vessel did not

[5] For safety reasons, the distance requirements below are not applied for a vessel holding station or with limited manoeuvrability e.g. anchor handling, loading, back-loading, bunkering, close standby cover for overside working and emergency situations.

	foraging pygmy blue whales • Where pygmy blue whale foraging presence has been observed the area will not be approached, within 500m, until there has been a period of 30 minutes with no recorded foraging pygmy blue whale(s)		approach within 500 m.
	C 3.3 Collect data on opportunistic sightings of Pygmy Blue Whales to gauge presence and behaviour	**PS 3.3.1** Process developed for collecting PBW sighting data PBW sighting data sent to relevant organisations as required (i.e. Australian Marine Mammal Centre (AMMC)	**MC 3.3.1** Records demonstrate process developed and communicated to crew for collection of Pygmy Blue Whale siting data
	C 3.4 Move support vessel(s) away from MODU (>2km) if foraging Pygmy Blue Whale(s) observed within 500 m – when support vessel is not being used to perform functionality as required by Safety Case	**PS 3.4.1** Support vessels relocate, where safety allows, from vicinity of the MODU when foraging Pygmy Blue Whales are observed within 500 m of the MODU.	**MC 3.4.1** Records demonstrate support vessels relocated from MODU vicinity when cetacean activity identified.

6.6.4 Physical Presence – Interaction with Other marine Users

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.4 (Physical Presence – Displacement of Other Users)		
Context		
Relevant Activities Installation of Subsea Infrastructure – **Section 3.7.10** Vessel Operations – **Section 3.10.2** MODU Operations – **Section 3.10.1** Helicopter Operations – **Section 3.10.3** Wellhead Assembly Left In-situ – **Section 3.11.8**	**Existing Environment** Socio-economic Values – **Section 4.9**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Interaction with other marine users – proximity of MODU and project vessels interfering with or displacing third party vessels (commercial fishing and commercial shipping)							✓	A	E	-	-	LCS GP PJ	Broadly Acceptable	EPO .9, 10
Presence of subsea infrastructure interfering with or displacing third party vessels (commercial fishing)							✓							

Description of Source of Impact/Risk

MODU and Vessel Operations

The movement of vessels within the PAA, and the physical presence of the MODU and vessels, have the potential to displace other marine users.

The MODU will have a 500 m safety exclusion zone within the PAA for the duration of the Petroleum Activities Program. Woodside proposes to drill up to ten new development wells (two of which are contingency). Inspection, monitoring, maintenance and repair activities may also be conducted on any of the proposed new development wells within Permit Area WA-61-L. While wells may be batch drilled, only one well will be drilled at any given time. Drilling operations for the development wells is expected to take approximately 60 days per well to complete, including mobilisation, demobilisation and contingency. This is equivalent to 480 days for the eight planned wells (with an additional 120 days as required for the two contingent wells).

Subsea xmas trees are expected to be installed after completing the relevant sections of the well while the MODU is still in the field. Installation of subsea xmas trees is expected to have a cumulative duration of about 14 days (including mobilisation, demobilisation, and contingency).

The eight planned wells are currently scheduled to be drilled in a consecutive batch-drill sequence as described in **Section 3**. However, to allow flexibility in the execution of the Petroleum Activities Program, it has been assumed for the purposes of assessment that the MODU, subsea installation vessel and other vessels may be present at any time during the five-year approval period of the EP, for a combined period as described above.

Other vessels may also be required during the activities, including subsea support vessel for light well intervention (LWI) and other support vessels. Some vessels will need to transit in and out of the PAA to port for emergency and routine operations.

Physical presence of subsea infrastructure

The subsea xmas trees and wellheads will be located within the PAA. The physical presence of this infrastructure will remain for the duration of field life. Wellheads and xmas trees take up a small area on the seabed and will rise several metres above the seabed.

As described in **Section 3.11.2** wells may need to be abandoned if a respud is required. This is considered a contingent activity and if a well is abandoned due to respud, a reasonable attempt to remove the wellhead(s) will be made. Wellhead assemblies may be left in-situ if these reasonable attempts are unsuccessful. If a wellhead is left in-situ, it could potentially interfere with third-party activities (commercial fishing).

Detailed Impact Assessment

Assessment of Potential Impacts

Interaction with other marine users due to the physical presence of in the Petroleum Activities Program may result in the following impact:

- Localised changes to the functions, interests or activities of other users.

The duration of change will be for the period of the Petroleum Activities Program.

Commonwealth and State Managed Fisheries

Four Commonwealth managed fisheries and six State managed fisheries overlap the PAA. Potential impacts to commercial fishers depend on the use of the area by fishers, in addition to the temporal and spatial extent of the presence of vessels and facilities/infrastructure.

Potential impacts to commercial fisheries include damage to fishing and loss of commercial catch due to displacement from fishing grounds. Damage to trawl nets could occur if they catch or snag on subsea infrastructure or wellhead assemblies. However, such infrastructure occupies a small area within the PAA only. One trawl fishery, the Western Deepwater Fishery overlaps the PAA. Trawl frequency assessment has shown that fishing activity occurs further south of the PAA, on the western edge of the 200 m isobath between Shark Bay and Ningaloo. Therefore, trawl activity within the PAA is not expected.

The presence of vessels (and MODU) in the PAA will present a surface hazard to fishing vessels and potentially result in a temporary exclusion from a small area as during:

- drilling a 500 m safety exclusion zone will be required around the MODU
- during xmas tree installation a 500 m exclusion zone will also be implemented for the installation vessel.

Given the distance offshore, the PAA is not an area of high commercial fishing activity. Furthermore, the 500 m temporary exclusion zones around the MODU and installation vessel comprises a relatively small area when compared to the extent of the individual fishery boundaries that overlap. As such, any displacement of commercial fisheries due to activities in the PAA are not expected to impact commercial fishing activities or the economic viability of the fisheries.

The magnitude of potential impacts to commercial fisheries from activities associated with the Petroleum Activities Program are assessed as having no lasting effect, as impacts will be temporary.

Tourism and Recreation

Tourism and recreation within the PAA are expected to be limited by the distance offshore and water depths. Stakeholder consultation did not identify any key recreational fishing activity within the PAA. Given the location, and the short-term nature of activities, impacts to tourism and recreational activities are not expected, and have not been evaluated further.

Shipping

Shipping activity in the PAA is low, with no shipping fairways located within the PAA. Vessel traffic data shows that the majority of vessel movements occur to the south-east of the PAA. Given the short-term nature of the activities and the low level of shipping activity within the PAA, impacts to shipping are unlikely.

Industry

The NWS is an area of active oil and gas exploration and production. The closest facility to the PAA is the Woodside Pluto facility (approximately 160 km to the east). Displacement of, or interference with, other oil and gas activities are not expected within the PAA. Impacts to industry are therefore unlikely.

Defence

Defence activities in the vicinity of the PAA may include Naval vessel traffic and Air Force training exercises. Neither of these types of activities are expected to be a consistent presence in the area. The PAA is on the outer extent of the training area associated with the Learmonth Air Force Base. Defence stakeholders were notified, and no known defence activities are planned (**Section 5**). Any potential interaction is expected to be minimal and not significantly different from interaction with other facilities within the northwest region.

Summary of Assessment Outcomes				
Receptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level**
Commonwealth Managed Fisheries	Changes to the function interests or activities of others	High value marine user	No Lasting Effect	Slight (E)
State Managed Fisheries		High value marine user	No Lasting Effect	Slight (E)
Overall Impact Significance Level: The overall impact significance level for Interaction with other marine users is slight based on no lasting effect to the high value receptor (commercial fisheries). The impact significance levels for individual receptors are consistent with the levels in the OPP.				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Vessels to adhere to the navigation safety requirements including the *Navigation Act 2012* and any subsequent Marine Orders.	F: Yes. CS: Minimal cost. Standard practice.	The act regulates ship related activities and invokes certain requirements of MARPOL. Vessels (relevant to class) will adhere to requirements.	Benefits outweigh cost/sacrifice. Control is also Standard Practice	Yes **C 4.1**
Establishment of a 500 m petroleum safety zone around MODU and 500 m exclusion zone around the installation vessel.	F: Yes. CS: Minimal cost. Standard practice.	Establishment of a 500 m petroleum safety zone around MODU and installation vessel reduces the likelihood of interaction with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice	Yes **C 4.2**
Reasonable attempts at removal of wellhead(s) will be made in the event of a respud.	F: Yes. CS: Additional cost.	In accordance with OPGGS Act Section 572	Benefits outweigh cost/sacrifice.	Yes **C 4.6**
Good Practice				
Australian Hydrographic Service (AHS) will be notified of activities and movements no less than four working weeks prior to commencement of the Petroleum Activities Program.	F: Yes. CS: Minimal cost. Standard practice.	Notification of AHS will enable them to update maritime charts thereby reducing the likelihood of interaction with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 4.3**
Notify relevant government departments, fishing industry representative bodies and licence holders of activities prior to commencement and upon completion of activities.	F: Yes. CS: Minimal cost. Standard practice.	Communication of the Petroleum Activities Programme to other marine users ensures they are informed and aware, thereby reducing the likelihood of	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 4.4**

		interference with other marine users.		
Notify AMSA Joint Rescue Coordination Centre (JRCC) of activities and movements 24 to 48 hours before operations commence.	F: Yes. CS: Minimal cost. Standard practice.	Communication of the Petroleum Activities Programme to other marine users ensures they are informed and aware, thereby reducing the likelihood of interference with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 4.5**
Undertake consultation with relevant stakeholders for activities and movements that commence more than a year after EP acceptance	F: Yes CS: Minimal cost. Standard Practice	Communicating the Petroleum Activities Program to other marine users ensures they are informed and aware, thereby reducing the likelihood of interfering with other marine users.	Benefits outweigh cost/sacrifice. Control is also Standard Practice	Yes **C 4.7**
Notify Defence of activities no less than five weeks before the scheduled activity commencement date	F: Yes CS: Minimal cost. Standard Practice	Communicating the Petroleum Activities Program to other marine users ensures they are informed and aware, thereby reducing the likelihood of interfering with other marine users.	Benefits outweigh cost/sacrifice.	Yes **C 4.8**
Professional Judgement – Eliminate				
Limit drilling activities to avoid peak shipping and commercial fishing activities.	F: No. Shipping occurs year-round and cannot be avoided. SIMOPS with fishing seasons cannot be eliminated as exact timings for all activities are not confirmed. CS: Not considered – control not feasible	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
Over-trawl protection on subsea infrastructure.	F: Yes. Over-trawl protection could mitigate against the potential for commercial fishing trawl gear to damage subsea infrastructure and/or result in loss of trawl gear. CS: Significant additional cost.	Reduce the potential for snagging of trawl nets if a wellhead is left in situ following abandonment during drilling. However, given the low level of trawling activity occurring in the PAA, the benefit is low.	Disproportionate. Significant additional costs.	No

ALARP Statement:

On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A; **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of the physical presence of the Petroleum Activities Program on other users.

As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.1.5.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:**

- Overall impact significance levels for individual receptors are less than the significant impact level defined in the OPP.
- EPOs and controls in the OPP that are relevant to the interaction with other users have been adopted.
- There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, the Petroleum Activities Program is unlikely to result in an impact significance level greater than Slight.

The adopted controls are considered consistent with industry good practice and professional judgement and meet the requirements and expectations of Australian Marine Orders, AMSA, DPIRD, DOD and AHS identified during impact assessment and stakeholder consultation. Further opportunities to reduce the impacts have been investigated above.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts from the physical of the Petroleum Activities Program to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria

EPO	*Adopted Control(s)*	*EPS*	*MC*
EPO 9 Undertake the Petroleum Activities Program in a manner that prevents a substantial adverse effect on the sustainability of commercial fishing. **EPO 10** Undertake the Petroleum Activities Program in a manner that does not interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted.	**C 4.1** Vessels to adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.	**PS 4.1** Activity support vessels and MODU compliant with Navigation Act and Marine Order 21 (Safety of navigation and emergency procedures) 2012	**MC 4.1.1** Marine assurance inspection records demonstrate compliance with standard maritime safety procedures
	C 4.2 Establishment of a 500 m petroleum safety zone around MODU and installation vessel and communicated to marine users.	**PS 4.2** No entry of unauthorised vessels within the 500 m safety exclusion zone.	**MC 4.2.1** Records demonstrate breaches by unauthorised vessels within the petroleum safety zone are recorded.
			MC 4.2.2 Consultation records demonstrate that AHS has been notified prior to commencement of the activity to allow generation of navigation warnings (Maritime Safety Information Notifications (MSIN) and Notice to Mariners (NTM) (including AUSCOAST warnings where relevant)), which

			communicate safety exclusion zones to marine users.
	C 4.3 Notify AHO of activities and movements no less than four working weeks prior to commencement of the Petroleum Activities Program.	**PS 4.3** Notification to AHO of activities and movements to allow generation of navigation warnings (Maritime Safety Information Notifications (MSIN) and Notice to Mariners (NTM) (including AUSCOAST warnings where relevant)).	**MC 4.2.2** **See above**
	C 4.4 Notify relevant government departments, fishing industry representative bodies and licence holders of activities prior to commencement and upon completion of activities.	**PS 4.4** DPIRD, WAFIC and Western Deepwater Trawl licence holders notified prior to commencement and upon completion of activities.	**MC 4.4.1** Consultation records demonstrate that DPIRD, WAFIC and Western Deepwater Trawl licence holders have been notified prior to commencement drilling.
	C 4.5 Notify AMSA JRCC of activities and movements 24 to 48 hours before operations commence.	**PS 4.5** Notification to AMSA JRCC to prevent activities interfering with other marine users. AMSA's JRCC will require the MODU's details (including name, callsign and Maritime Mobile Service Identity (MMSI)), satellite communications details (including INMARSAT-C and satellite telephone), area of operation, requested clearance from other vessels and need to be advised when operations start and end.	**MC 4.5.1** Consultation records demonstrate that AMSA JRCC has been notified prior to commencement of the activity within required timeframes.
	C 4.6 Reasonable attempt at removal of wellheads will be undertaken in the event of a respud.	**PS 4.6** Removal of wellheads attempted during the Petroleum Activity Program in the event of a respud.	**MC 4.6.1** Records demonstrate reasonable attempts at wellhead removal were made.
	C 4.7 Notify relevant stakeholders for activities within the Petroleum Activities Program that commence more than a year after EP acceptance.	**PS 4.7** Stakeholders will be notified no less than four working weeks prior to scheduled activity commencement date.	**MC 4.7.1** Records demonstrate relevant stakeholders have been consulted.
	C 4.8 Notify Defence of activities no less than five weeks before the scheduled activity commencement date.	**PS 4.8** Notification to Defence five weeks prior to the scheduled commencement date.	**MC 4.8** Records demonstrate that Defence has been notified prior to commencement of the Petroleum Activities

			Program within the required timeframes.

6.6.5 Physical Presence – Disturbance to Benthic Habitat from MODU Anchoring, Drilling Operations, Subsea Installation and ROV Operations

Scarborough OPP – Relevant Impact Assessment Section
Section 7.1.6

Context		
Relevant Activities Mooring Installation and Anchor Hold Testing – **Section 3.10.2.4** Drilling Operations – **Section 3.7.1** Installation of Subsea Infrastructure – **Section 3.7.10** MODU Operations – **Section 3.10.1** ROV Operations – **Section 3.10.4** Subsea IMMR Activities – **Section 3.8** Contingency Activities – **Section 3.11**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Physical Environment – **Section 4.3** Habitats and Biological Communities – **Section 4.5**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Disturbance to seabed from drilling operations		✓	✓		✓			A	D	-	-	GP PJ	Broadly Acceptable	EPO 1,11
Mooring installation and anchor hold testing (moored MODU only)		✓	✓		✓									
Placement and retrieval of seabed transponders (DP MODU and installation vessel)		✓	✓		✓									
Installation of the subsea infrastructure and subsea IMR activities		✓	✓		✓									
ROV operations near the seabed (including localised sediment relocation)		✓	✓		✓									
Wellhead assembly left in-situ in event of respud		✓	✓		✓									
Removal of marine growth from infrastructure.		✓	✓		✓									

Description of Source of Impact/Risk

Drilling and MODU Operations

The proposed development wells are planned to be drilled using a DP MODU; however, a moored MODU may be used as a contingency.

Dynamic positioning of the MODU uses satellite navigation and long baseline (LBL) transponders in conjunction with thrusters to maintain the position of the MODU at the required location. An array of transponders is proposed within a radius of 500 m from the proposed location of the wells and will be in place for a period of about three months per well. Transponders may be moored to the seabed either by a clump weight or mounted on a seabed frame. A typical seabed frame is 1.5 m × 1.5 m × 1.5 m in dimension. On completion of the positioning operation, the array transponders moored by clump weight will be recovered by means of a hydrostatic release and the clump weights removed from the seabed. The transponders mounted on seabed frames will be removed by ROV.

If a moored MODU is used, seabed disturbance will result from the MODU anchor mooring system and anchor hold testing, including placement of anchors and chain/wire on the seabed, potential dragging during tensioning, and recovery of anchors. Mooring may require an 8 to 12-point pre-laid mooring system at each well location, depending on the time of year. Suction piling may be required for installing the anchors.

Although the exact anchoring configurations are currently unknown, a conservative radius of 4000 m has been assessed, a semi-submersible MODU with an 8 to 12-point anchoring system could disturb up to 0.013 km^2 per well (13,000 m^2), allowing for anchor footprint and disturbance from anchor chains (NERA, 2018). For ten wells, this gives a total footprint of 0.13 km^2.

Drilling activities may result in intermittent or discontinuous direct physical or mechanical disturbance to the seabed up to an approximate 100 m radial distance around each new well location due to the installation of the BOP and conductor.

The generation and discharge of cuttings and drilling fluids are not considered in this section; refer to **Section 6.6.7** for an assessment of drill cuttings and drilling fluids.

The planned anchoring activities will be within the parameters defined in the *Anchoring of Vessels and Floating Facilities Environment Plan Reference Case* (Department of Industry, Innovation and Science, undated) for all anchoring activities undertaken by vessels and floating facilities (excluding FPSOs and FLNGs) while undertaking petroleum activities including:

- locations of water depth greater than 70 m; this boundary is set to exclude areas of sensitive marine primary producer habitats (e.g. corals, seagrass) that occur in shallower waters
- installation of moorings, buoys, equipment or other infrastructure for a period of up to two years
- wet storage on seabed of anchor chains, etc. during activities up to two years.

Installation of the Subsea Infrastructure

When the wells are completed, a subsea xmas tree will be installed onto each wellhead to prepare the wells for production. Xmas trees are planned to be vertically suspended approximately 10 m above the wellheads, and therefore should not contact the seabed. During xmas tree installation activities USBL may be installed on the seabed or mounted to the wellhead as required by the sub-sea installation activities.

IMR Activities

The subsea infrastructure will be inspected and maintained, and intervention may be required to repair identified issues. Subsea activities are typically performed from a relevant support vessel via an ROV or divers, and often require deployment of frames/baskets that are temporarily placed on the seabed. Typically, these have a perforated base with a seabed footprint of about 15 m^2. They are recovered to the vessel at the end of the activity.

Excess marine growth may need to be removed before undertaking subsea IMR activities and/or following return to wells after a period of suspended drilling. Removing marine growth is undertaken via a high-pressure water and/or brushes or acid, by ROV.

ROV Operations

The use of an ROV during activities as described may result in temporary seabed disturbance and suspension of sediment as a result of working close to, or occasionally on, the seabed. ROV use close to or on the seabed is limited to that required for effective and safe subsea activities. The footprint of a typical ROV is about 2.5 m × 1.7 m (4.25 m^2).

Contingency Activities

Woodside may need to intervene, workover or re-drill the proposed development wells within Permit Area WA-61-L. Any seabed disturbance would be the same as those described for Drilling Operations and MODU Operations. In addition, in the event of a respud the base case would be to remove the wellhead infrastructure. However if reasonable attempts at wellhead removal are unsuccessful, a wellhead may remain in situ until the end of field life.

The ROV may be used to relocate sediment material around the well location (known as jetting) to help manage cement or cuttings flow.

Detailed Impact Assessment

Assessment of Potential Impacts

Epifauna and Infauna

Marine life such as deep water benthic communities epifauna and infauna (living on and in the sediment dominated habitat), may be impacted from the permanent placement of infrastructure (i.e. wellheads), or placement of temporary infrastructure (anchors, ROV) on the seabed. Disturbance to the seabed can alter the physical seabed habitat conditions, resulting in epifauna and infauna community changes (Newell et al., 1998). Subsea well installations are permanent for the duration of field life and will result in the displacement and/or permanent loss of epifauna and infauna within the physical footprint.

The seabed of the PAA is characterised by sparse marine life dominated by mobile organisms (ERM, 2013). The benthic biota are predominately deposit feeders such as epifauna (living on the seabed): shrimp (crustaceans) and sea cucumbers (echinoderms), and infauna (living within the surface sediments) small, burrowing worms (polychaetes) and crustaceans (ERM, 2013) (**Section 4.5**).

Habitat modification as a result of seabed disturbance could occur within a radius of up to 100 m from each well (10 wells in total). In proximity to this area benthic communities may be reduced or altered, leading to a highly localised impact to any epifauna and infauna benthic communities present. Potential impacts include; burial or smothering of benthic biota from localised sediment deposition, particularly to sessile epifauna such as sea pens and infauna (polychaetes), and sediment coating resulting from elevated turbidity/TSS potentially causing clogging or damage to the physiological functioning of certain biota (sea pens, polychaetes) reliant on external respiratory and feeding structures. The deep-water environment is not oxygen saturated and oxygen levels in the water column at depth are substantially reduced as compared to the upper surface layers. Deep water benthic biota are adapted to such conditions which also include zero light and reduced temperature. Changes in oxygen levels resulting from the seabed infrastructure installation will be of short duration and temporary, furthermore, sediment quality sampling indicated low organic content (**Section 4.4**) and further depletion of oxygen levels due to organically rich sediment disturbance is not predicted. The seabed sediments of the PAA contain low levels of contaminants such as metals and no hydrocarbons (**Section 4.4**) so no toxicological impacts to benthic biota from disturbed sediments is predicted. The scale and magnitude of potential impacts will be limited to the offshore seabed infrastructure physical footprint area, representing a small proportion of the total area of deep water habitat and associated benthic communities of the PAA, that are known to be present in the wider region.

In the unlikely event that a wellhead cannot be removed following well abandonment (if required due to a respud), over time the cement surrounding the wellhead will likely become buried in sediment as a result of prevailing ocean currents. The steel wellhead structure is expected to accumulate marine growth, whereby a marine life structure may remain above the seafloor. If the wellhead remains in-situ, it is expected to have a localised impact not significant to environment receptors. No further impacts to benthic habitats are likely.

The use of water jetting to remove marine growth on subsea infrastructure will result in temporary suspension of organic matter and localised increase in turbidity. Water jetting will be limited to what is necessary to clean infrastructure for inspection, drilling or other activities to take place. No threatened or migratory species, or ecological communities (as defined under the EPBC Act), were identified in the benthic communities during studies completed in the PAA (ERM, 2013). The epifauna and infauna benthic communities known to exist in the PAA are likely to be well represented elsewhere in the region, with impacts restricted to a highly localised proportion of benthic communities.

The PAA is not located within or adjacent to an AMP.

KEFs

The Exmouth Plateau KEF overlaps the PAA and seabed disturbance may lead to a highly localised change in habitat and water quality, which will be short-term, associated with the temporal extent of drilling and installation activities (approximately 60 days per well). These potential short term impacts are unlikely to impact on the ecological value of the KEF.

The magnitude of potential impacts to epifauna and infauna from seabed disturbance during activities associated with the Petroleum Activities Program is Slight.

Summary of Assessment Outcomes

Receptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level**
Epifauna and Infauna	Injury/mortality to fauna	Low value	Slight	Negligible (F)
KEFs	Change in habitat	High value habitat	Slight	Minor (D)

Overall Impact Significance Level: The overall impact significance level for disturbance to benthic habitat from MODU station keeping, drilling operations, subsea installation, ROV operations and contingency activities is D based on a slight impact to the high value receptor (KEFs). The impact significance levels for individual receptors are consistent with the level in the OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Reasonable attempt(s) at removal of wellheads will be undertaken in the event of a respud.	F: Yes CS: Additional cost. Standard Practice.	In accordance with OPGGS Act Section 572	Benefits outweigh cost/sacrifice.	Yes **C 4.6**
Good Practice				
Subsea infrastructure will be positioned within planned footprint to reduce seabed disturbance.	F: Yes. CS: Standard practice.	Ensures risks appropriately addressed for seabed disturbance.	Benefits outweigh cost/sacrifice.	Yes **C 5.1**
Project-specific Basis of Well Design, which includes an assessment of seabed sensitivity.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of anchoring occurring in areas of high sensitivity. Assessment of seabed topography reduces the likelihood of anchor drag leading to seabed disturbance.	Benefits outweigh cost/sacrifice.	Yes **C 5.2**
Project-specific Mooring Design Analysis.	F: Yes. CS: Additional costs associated with upgraded MODU mooring design.	The mooring design analysis determines the number and spread of anchors required based on sediment type and seabed topography, reducing the likelihood of anchor drag leading to seabed disturbance.	Benefits outweigh cost/sacrifice.	Yes **C 5.3**
Positioning technology used to place seabed infrastructure within the design footprint to reduce seabed disturbance	F: Yes. CS: Minimal cost. Standard practice.	Use of positioning technology to position infrastructure on the seabed with accuracy will reduce seabed disturbance.	Benefits outweigh cost/sacrifice.	Yes **C 5.4**
Environmental monitoring of the seabed prior to, and following the Petroleum Activities Program to assess any impacts to seabed.	F: Yes. CS: Significant. Monitoring of the seabed, particularly the deep waters of the PAA, would have significant additional costs to obtain and analyse data with the spatial resolution to accurately assess changes to the seabed habitat.	Environmental monitoring would not result in any additional information of the seabed above the WLSADS and mooring design analysis. Therefore, no additional reductions in likelihood or consequence would occur.	Control grossly disproportionate. Monitoring will not reduce the consequence or likelihood of any impacts to the seabed, and the cost associated with the level of monitoring required to accurately assess any impacts greatly outweighs the benefits gained.	No
Professional Judgement – Eliminate				

Only use DP MODU (no anchoring required).	F: Yes, it would be feasible to use a DP MODU. CS: Costs and schedule implications of waiting for a DP MODU to be available, rather than selecting a moored MODU.	Eliminates seabed disturbance and associated impacts to benthic communities from anchor placement and movement.	Cost/sacrifice outweigh benefit. Control would eliminate environmental impact from anchoring, however impacts are assessed as having a low consequence. While Woodside plans to use a DP MODU, flexibility is required to meet potential contractual and operational constraints. Costs of implementation are disproportionately higher than the environmental gains	No
Do not use ROV close to, or on, the seabed.	F: No. The use of ROVs (including work close to or occasionally landed on the seabed) is critical as the ROV is the main tool used to guide and manipulate equipment during drilling. ROV usage is already limited to only that required to conduct the work effectively and safely. Due to visibility and operational issues ROV work on or close to the seabed is avoided unless necessary. CS: Not assessed, control not feasible.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement: On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of seabed disturbance from activities associated with the Petroleum Activities Program. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.				

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.1.6.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:**

- Overall impact significance levels for individual receptors are consistent with the levels rated in the OPP.
- EPOs and controls in the OPP that are relevant to disturbance to benthic habitats have been adopted.
- There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, the Petroleum Activities Program is unlikely to result in an impact significance level greater than Minor. Further opportunities to reduce the impacts have been investigated above. The adopted controls are considered consistent with industry good practice and meet the requirements of Woodside relevant systems and procedures.

The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of disturbance to benthic habitat to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria

EPO	Adopted Control(s)	EPS	MC
EPO 1 Undertake the Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 11** Undertake the Petroleum Activities Program in a manner that prevents a substantial change to water quality that may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**C 5.1** Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance.	**PS 5.1** All infrastructure will be placed within the PAA.	**MC 5.1.1** As built surveys verify location installation of equipment within the PAA.
	C 5.2 Project specific Basis of Well Design, which includes an assessment of seabed sensitivity.	**PS 5.2** MODU/installation vessel well site locations consider seabed sensitivities.	**MC 5.2.1** Records that Basis of Well Design includes the assessment of seabed sensitivities.
	C 5.3 Project specific Mooring Design Analysis (for anchored MODU).	**PS 5.3** Seabed disturbance from MODU mooring limited to that required to ensure adequate MODU station holding capacity.	**MC 5.3.1** Records demonstrate Mooring Design Analysis completed and implemented during anchor deployment.
	C 5.4 Positioning technology used to place seabed infrastructure within the design footprint to reduce seabed disturbance.	**PS 5.4.1** Infrastructure will be positioned in the planned location[6] where impacts have been assessed.	**MC 5.4.1** As-built surveys verify installation of equipment within acceptable tolerance[5].
		PS 5.4.2 Transponder equipment, including clump weights/frames, will be removed at the end of the Petroleum Activity Program.	**MC 5.4.2** Records demonstrate removal of transponder equipment.
	C 4.6 Reasonable attempt(s) at removal of wellheads will	**PS 4.6.1** Refer **Section 6.6.4.**	**MC 4.6.1** Refer **Section 6.6.4**.

[6] Acceptable tolerance is considered to be ±150 m, given the homogenous and low sensitivity habitat.

	be undertaken in the event of a respud.		

6.6.6 Routine and Non-Routine Discharges: MODU and Project Vessels

Scarborough OPP – Relevant Impact Assessment Section
Section 7.1.7 (Routine and Non-Routine Discharges: Sewage and Greywater) Section 7.1.8 (Routine and Non-Routine Discharges: Food Waste) Section 7.1.9 (Routine and Non-Routine Discharges: Chemicals and Deck Drainage) Section 7.1.10 (Routine and Non-Routine Discharges: Brine and Cooling Water)

Context		
Relevant Activities Subsea Equipment Preservation – **Section 3.7.7** Maintenance and Repair – **Section 3.9.3** Vessel Operations – **Section 3.10.2** MODU Operations – **Section 3.10.1**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Habitats and Biological Communities – **Section 4.5**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (inc. odour)	Ecosystems / Habitat	Species	Socio-economic	Decision Type	Impact/Consequence	Likelihood	Current Risk Rating	ALARP Tools	Acceptability	Outcome
Routine discharge of sewage, grey water and putrescible wastes to marine environment from MODU and project vessels			✓			✓		A	E	-	-	LCS GP PJ	Broadly Acceptable	EPO 11, 12, 13
Routine discharge of deck and bilge water to marine environment from MODU and project vessels			✓			✓		A	E	-	-			
Routine discharge of brine or cooling water to the marine environment from MODU and project vessels.			✓			✓		A	F	-	-			

Description of Source of Impact/Risk

Vessel and MODU Operations

<u>Sewage, grey water and putrescible wastes</u>

The MODU and project vessels routinely generate/discharge small volumes of treated sewage, putrescible wastes and grey water to the marine environment (impact assessment based on approximate discharge of 15 m^3 per vessel/MODU per day), using an average volume of 75 L/person/day and a maximum of 200 persons on board. However, it is noted that vessels such as support vessels will have considerably less persons on board.

Deck and bilge water

The MODU and project vessels routinely generate/discharge:

- Routine/periodic discharge of relatively small volumes of bilge water. Bilge tanks receive fluids from many parts of the project vessels or MODU. Bilge water can contain water, oil, detergents, solvents, chemicals, particles, biocides and other liquids, solids or chemicals.
- Variable water discharge from MODU/vessel decks directly overboard or via deck drainage systems. Sources could include rainfall events and/or deck activities such as cleaning/wash-down of equipment/decks.

Brine

Reverse osmosis (RO), distillation or desalination plants on board vessels and the MODU use seawater to produce potable and demineralised water; resulting in reject brine (i.e. hypersaline water) that is discharged to the marine environment. The potable water produced is stored in tanks on board.

During the distillation process, relatively small volumes of reject brine is produced and discharged. Reject brine discharge is typically 20 to 50 percent higher in salinity than the intake seawater (depending on the desalination process used) and may contain low concentrations of scale inhibitors and biocides, which are used to avoid fouling of pipework (Woodside, 2014).

Models developed by the US EPA (Frick et al., 2001) for temporary brine discharges from vessels assuming no ocean current (i.e. 0 m/s) found that brine discharges from the surface dilute 40–fold at 4 m from the source. This modelling can be used as an indicator for predicting horizontal attenuation and diffusion of reject brine; and suggests that the salinity concentration drops below environmental impact thresholds within 4 m of the discharge point.

Cooling Water

Seawater is used as a heat exchange medium for cooling machinery engines and other equipment. Seawater is drawn up from the ocean, where it is subsequently de-oxygenated and sterilised by electrolysis (by release of chlorine from the salt solution) and then circulated as coolant for various equipment through the heat exchangers (in the process transferring heat from the machinery), prior to discharge to the ocean. Upon discharge, it will be warmer than the ambient water temperature. Cooling water is often treated with additives including scale inhibitors and biocide to avoid fouling of pipework. Scale inhibitors and biocide are usually used at low dosages, and are usually consumed in the inhibition process, so there is little or no residual chemical concentration remaining upon discharge.

In some instances, fresh water or central cooling systems may be fitted. In these systems, fresh water is used in a closed circuit to cool down the engine room machinery, and then further cooled by sea water in a seawater cooler.

Seawater used for cooling purposes will be routinely discharged at a temperature expected to be less than 70°C and rates ~50 m³/d.

Environmental risks relating to the unplanned disposal/discharges are addressed in **Section 6.7.4** and **0.**

Detailed Impact Assessment

Assessment of Potential Impacts

Water Quality

Sewage, grey water and putrescible wastes

The principal environmental impact associated with ocean disposal of sewage and other organic wastes (i.e. putrescible waste) is eutrophication. Eutrophication occurs when the addition of nutrients, such as nitrates and phosphates, causes adverse changes to the ecosystem, such as oxygen depletion and phytoplankton blooms. Other contaminants of concern occurring in these discharges may include ammonia, E. coli, faecal coliform, volatile and semi-volatile organic compounds, phenol, hydrogen sulphide, metals, surfactants and phthalates.

Woodside conducted monitoring of sewage discharges at its Torosa-4 Appraisal Drilling campaign which demonstrated that a 10 m³ sewage discharge reduced to about 1% of its original concentration within 50 m of the discharge location. In addition to this, monitoring at distances 50 m, 100 m and 200 m downstream of the platform and at five different water depths confirmed that discharges were rapidly diluted; no elevations in water quality monitoring parameters (e.g. total nitrogen, total phosphorous and selected metals) were recorded above background levels at any station (Woodside, 2011). Mixing and dispersion would be further facilitated in deep offshore waters, consistent with the location of the PAA, through regional wind and large scale current patterns resulting in the rapid mixing of surface and near surface waters where sewage discharges may occur. Studies investigating the effects of nutrient enrichment from offshore sewage discharges indicate that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed areas (McIntyre and Johnston, 1975).

Given the offshore location, any routine and non-routine discharges of sewage and greywater and putrescible wastes from activities associated with the Petroleum Activities Program will result in no lasting change to water quality.

Activities associated with the Petroleum Activities Program will occur over a period of five years (2022-2027), however actual project activities are expected to take up to approximately 600 days in total, therefore project vessels and the MODU will not be continuously in the PAA during this time. Vessels will also be moving (i.e. not in a single location for an extended period of time). Rather, these routine discharges are expected to be intermittent in nature for the duration of the Petroleum Activities Program. Therefore, impacts to water quality within the PAA are expected to be localised with no lasting effect.

Deck and bilge water

Deck drainage and treated bilge may contain a range of chemicals, oil, grease and solid material. This particulate matter can cause an increase in the turbidity of the receiving waters close to the point of discharge. The addition of these substances into the marine environment will result in a change ambient water quality; however, these discharges are expected to rapidly dilute in the water column (Shell, 2010). Discharges will disperse and dilute rapidly, with concentrations significantly dropping with distance from the discharge point.

Bilge water and deck drainage discharges, which may include non-organic contaminants, will rapidly dilute. As such, no significant impacts from the planned routine discharges are anticipated, because of the minor quantities involved, the expected localised mixing zone and high level of dilution into the open water marine environment of the PAA. The involved is located more than 12 nm from land, which exceeds the exclusion zones required by Marine Order 96 (Marine pollution prevention – sewage) 2018 and Marine Order 95 (Marine pollution prevention – garbage) 2013.

Based on the detailed evaluation, the magnitude of potential impact of a change in water quality is no lasting effects.

Brine or cooling water

The key physicochemical stressors that are associated with reject brine and cooling water discharge include salinity, pH, temperature and chemical toxicity.

Water quality of the surrounding environment may be altered through the addition of chemicals and an increase in salinity. Scale inhibitors and biocides are commonly used within the systems described above to prevent fouling. Scale inhibitors are typically low molecular weight phosphorous compounds that are water-soluble, and only have acute toxicity to marine organisms about two orders of magnitude higher than typically used in the water phase (Black et al., 1994). The biocides typically used in the industry are highly reactive and degrade rapidly (Black et al., 1994).

The potential impacts on water quality due to cooling water discharge include chlorine toxicity and increased water temperatures.

Reject brine water is typically 20 to 50% higher in salinity to the surrounding water and, based on models developed by the US EPA (Frick et al., 2001), discharges of brine water will sink through the water column where it will be rapidly mixed with receiving waters and dispersed by ocean currents, decreasing in salinity rapidly as distance from source increases.

Generally, reject brine and cooling water containing chemical additives are inherently safe at the low dosages used. They are usually consumed in the inhibition process, so there is little or no residual chemical concentration remaining upon discharge.

Woodside undertook modelling of continuous wastewater discharges (including cooling water) for its Torosa South-1 drilling program in the Scott Reef complex (Woodside, 2014). This study predicted that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being <1 °C above ambient within 100 m (horizontally) of the discharge point, and 10 m vertically (Woodside, 2014).

As such, any potential impacts to water quality are expected to be limited to 100 m of the source of the discharge where concentrations are highest.

Based on the detailed risk evaluation, the magnitude of the potential impact of a change in water quality from routine and non-routine brine and cooling water discharges is assessed as no lasting effect.

Seabirds and Migratory Shorebirds, Fish, Marine Reptiles and Marine Mammals

It is possible that marine fauna transiting the localised area may come into contact with these discharges (e.g. marine turtles, humpback whales, whale sharks; **Section 4.6**) as they traverse the PAA. However, given the localised extent of cumulative impacts from multiple vessel discharges and limited exposure, within the PAA, significant impacts to marine fauna are not expected.

Plankton

Research suggests that zooplankton composition and distribution are not affected in areas associated with sewage dumping grounds (McIntyre and Johnston, 1975). Plankton communities are expected to rapidly recover from any such short term, localised impact, as they are known to have naturally high levels of mortality and a rapid replacement rate.

Discharged brine sinks through the water column where it is rapidly mixed with receiving waters and dispersed by ocean currents. As such, any potential impacts are expected to be limited to the source of the discharge where concentrations are highest. Studies indicate that effects from increased salinity on planktonic communities in areas of high mixing and dispersion are generally limited to the point of discharge only (Azis et al., 2003).

Planktonic productivity in the NWMR is low. No significant impacts from the planned routine discharges are expected, because of the minor quantities involved, the expected localised mixing zone and high level of dilution into the open water marine environment of the PAA. The PAA is located more than 12 nm from land, which exceeds the exclusion zones required by Marine Order 96 (Marine pollution prevention – sewage) 2018 and Marine Order 95 (Marine pollution prevention – garbage) 2013.

Based on the impact assessment, the magnitude of the potential impacts on plankton from routine and non-routine brine and cooling water discharges is assessed as no lasting effect.

Summary of Assessment Outcomes				
Receptor	**Impact**	**Receptor Sensitivity Level**	**Magnitude**	**Impact Significance Level**
Water quality	Change in water quality	Low value (open water)	No lasting effect	Negligible (F)
Migratory Shorebirds and Seabirds	Injury/mortality to fauna	High value species	No lasting effect	Slight (E)
Fish		High value species	No lasting effect	Slight (E)
Marine Mammals		High value species	No lasting effect	Slight (E)
Marine Reptiles		High value species	No lasting effect	Slight (E)
Plankton		Low value (open water)	No lasting effect	Negligible (F)
Overall Impact Significance Level: The overall impact significance level for routine and non-routine discharges is E based on no lasting effect to the high value receptors (marine fauna). The impact significance level for water quality is consistent with the level in the OPP. Potential impacts to migratory shorebirds and seabirds have been additionally assessed in this EP and there is no change in magnitude of impact (no lasting effect).				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 96 – Pollution prevention – Sewage (as appropriate to vessel class) which include the following requirements: • a valid International Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class • an AMSA-approved sewage treatment plant • a sewage comminuting and disinfecting system • a sewage holding tank sized appropriately to contain all generated waste (black and grey water); • discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land	F: Yes. CS: Minimal cost. Standard practice.	No reduction in likelihood or consequence would result.	Controls based on legislative requirements – must be adopted.	Yes **C 6.1**

• discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land • discharge of sewage will occur at a moderate rate while support vessel is proceeding (more than 4 knots), to avoid discharges in environmentally sensitive areas.				
Marine Order 95 – Pollution prevention – Garbage (as appropriate to vessel class) which requires putrescible waste and food scraps are passed through a macerator so that it is capable of passing through a screen with no opening wider than 25 mm.	F: Yes. CS: Minimal cost. Standard practice.	No reduction in likelihood or consequence would result.	Controls based on legislative requirements – must be adopted.	Yes **C 6.2**
Where there is potential for loss of primary containment of oil and chemicals on the MODU, deck drainage must be collected via a closed drainage system. E.g. drill floor.	F: Yes. CS: Minimal cost. Standard practice.	Requirements for deck drainage and management of oily water would reduce the likelihood of contaminated deck drainage water being discharged to the marine environment. No change in consequence would occur.	Benefits outweigh cost/sacrifice.	Yes **C 6.3**
Marine Order 91 – Oil (as relevant to vessel class) requirements, which include mandatory measures for the processing of oily water prior to discharge: • Machinery space bilge/oily water shall have International Maritime Organisation (IMO) approved oil filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 ppm prior to discharge. • IMO approved oil filtering equipment shall also have an alarm and an automatic stopping	F: Yes. CS: Minimal cost. Standard practice.	No reduction in likelihood or consequence would result.	Controls based on legislative requirements – must be adopted.	Yes **C 6.4**

device or be capably of recirculating in the event that OIW concentration exceeds 15 ppm. • A deck drainage system shall be capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. • There shall be a waste oil storage tank available, to restrict oil discharges. • In the event that machinery space bilge discharges cannot meet the oil content standard of <15 ppm without dilution or be treated by an IMO approved oil/water separator, they will be contained on-board and disposed of onshore. • Valid International Oil Pollution Prevention Certificate.				
Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.	F: Yes. CS: Minimal cost. Standard practice.	Environmental assessment of chemicals will reduce the consequence of impacts resulting from discharges to the marine environment by ensuring chemicals have been assessed for environmental acceptability. Planned discharges are required for safely executing activities; therefore, no reduction in likelihood can occur.	Benefits outweigh cost/sacrifice.	Yes **C 6.5**
Good Practice				
No additional controls identified.				
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
Storage, transport and treatment/disposal onshore of sewage, greywater and putrescible waste.	F: Not feasible. Would present additional safety and hygiene hazards resulting from the storage, loading	Not considered – control not feasible.	Not considered – control not feasible.	No

	and transport of the waste material. Distance of activity offshore also makes the implementation of this control not feasible. CS: Not considered – control not feasible.			
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement: On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of planned (routine and non-routine) discharges from MODU/vessels. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts are considered ALARP.				

Demonstration of Acceptability
Acceptability Criteria and Assessment
Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.1.7.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall impact significance levels for individual receptors are less than the significant impact level defined in the OPP. • EPOs and controls in the OPP that are relevant to routine discharges have been adopted. • There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that, given the adopted controls, routine and non-routine discharges from the MODU and project vessels are unlikely to result in an impact significance level greater than slight. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. The adopted controls are considered consistent with industry legislation, codes and standards, and professional judgement and meet the requirements of Australian Marine Orders. The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of these discharges to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 11 Undertake the Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 12** Undertake Scarborough activities in a manner that prevents a substantial adverse effect on a	**C 6.1** Marine Order 96 - pollution prevention – sewage (as appropriate to vessel class) which include the following requirements: • a valid International Sewage Pollution Prevention (ISPP) Certificate, as required by vessel class • an AMSA-approved sewage treatment plant • a sewage comminuting and disinfecting system	**PS 6.1** MODU and project vessels compliant with Marine Order 96 – Pollution prevention – Sewage (as appropriate to vessel class).	**MC 6.1.1** Records demonstrate MODU and project vessels are compliant with Marine Order 96 – Pollution prevention – Sewage (as appropriate to vessel class).

population of plankton including its life cycle and spatial distribution. **EPO 13** Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in an area defined as a Key Ecological Feature.	• a sewage holding tank sized appropriately to contain all generated waste (black and grey water) • discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land • discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land • discharge of sewage will occur at a moderate rate while support vessel is proceeding (more than 4 knots), to avoid discharges in environmentally sensitive areas.		
	C 6.2 Marine Order 95 – Pollution prevention – Garbage (as appropriate to vessel class) which requires putrescible waste and food scraps are passed through a macerator so that it is capable of passing through a screen with no opening wider than 25 mm.	**PS 6.2** MODU and project vessels compliant with Marine Order 95 – Pollution prevention – Garbage.	**MC 6.2.1** Records demonstrate MODU and project vessels are compliant with Marine Order 95 – Pollution prevention (as appropriate to vessel class).
	C 6.3 Where there is potential for loss of primary containment of oil and chemicals on the MODU, deck drainage must be collected via a closed drainage system. E.g. drill floor.	**PS 6.3** Contaminated drainage contained, treated and/or separated prior to discharge.	**MC 6.3.1** Records demonstrate MODU has a functioning bilge/oily water management system.
	C 6.4 Marine Order 91 – oil (as relevant to vessel class) requirements, which include mandatory measures for the processing of oily water prior to discharge: • Machinery space bilge/oily water shall have International Maritime Organisation (IMO) approved oil	**PS 6.4** Discharge of machinery space bilge/oily water will meet oil content standard of <15 ppm without dilution.	**MC 6.4.1** Records demonstrate discharge specification met for MODU and project vessels.

	filtering equipment (oil/water separator) with an on-line monitoring device to measure Oil in Water (OIW) content to be less than 15 ppm prior to discharge. • IMO approved oil filtering equipment shall also have an alarm and an automatic stopping device or be capably of recirculating in the event that OIW concentration exceeds 15 ppm. • A deck drainage system shall be capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. • There shall be a waste oil storage tank available, to restrict oil discharges. • In the event that machinery space bilge discharges cannot meet the oil content standard of less than 15 ppm without dilution or be treated by an IMO approved oil/water separator, they will be contained on-board and disposed of onshore. Valid International Oil Pollution Prevention Certificate.		
	C 6.5 Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints. [check with Heather]	**PS 6.5** Reduces to ALARP the impact potential of all chemicals intended or likely to be discharged into the marine environment	**MC 6.5.1** Records demonstrate chemical selection, assessment and approval process for selected chemicals is followed.

6.6.7 Routine and Non-Routine Discharges: Drill Cuttings and Drilling Fluids

Scarborough OPP – Relevant Impact Assessment Section
Section 7.1.12 (Routine and Non-Routine Discharges: Drilling)

Context		
Relevant Activities Drilling Activities – **Section 3.7** Contingency Activities – **Section 3.11**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Habitats and Biological Communities – **Section 4.5** Protected Species – **Section 4.6**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Routine discharge of WBM drill cuttings to the seabed and the marine environment		✓	✓		✓			A	D	-	-	LCS GP PJ	Broadly Acceptable	EPO 1, 11, 12, 14, 15
Routine discharge of treated NWBM drill cuttings to the marine environment		✓	✓		✓									
Routine discharge of drilling muds (WBM) to the seabed and the marine environment		✓	✓		✓									
Non-routine discharge of wash water from mud pits and vessel tank wash fluids		✓	✓		✓									
Routine discharge of well clean-out fluids		✓	✓		✓									
Non-routine discharge of well annular fluids		✓	✓		✓									

Description of Source of Impact/Risk

Drilling Operations

Up to ten development wells (two of which are a contingency) are planned to be drilled during the Petroleum Activities Program, which will result in the same number of discharge locations. Each well is expected to take approximately 60 days to drill. Drilling activities generate drill cuttings, require cementing of the casing, and require the use of a range of fluids. Throughout the drilling program several different fluids are to be run through the closed circulation system including, but not limited to, drilling fluids (water-based muds and non water-based muds), sea water, and kill-weight brine. It is noted that non water-based muds will be used as a contingency only.

Routine drilling discharges will include:

- drill cuttings
- drilling fluids (direct to seabed (WBMs only), retained on cuttings and bulk discharge of mud pits (WBMs only)

Non-routine drilling discharges may include:

- drill cuttings and fluids generated due to respud or side tracking
- well intervention and use of fluids (subsea control, completions and well annular fluids).

Drill Cuttings and Fluids

The primary discharges used as the basis of the impact assessment for this Petroleum Activities Program are as follows:

- Drill cuttings: drilling generates drill cuttings due to the breakup of solid material from within the borehole. The resultant drill cuttings are basically rock particles of various shapes, with sizes typically ranging from very fine to very coarse.
- Drilling fluids: serve many purposes including maintaining borehole stability and hydrostatic pressure, reducing friction and cleaning/ cooling of the drill bit, in addition to acting as a medium to carry cuttings from the well bore and return them to the surface at seabed or on the MODU. There are two main types of drilling fluids as follows:
  - Water based muds (WBMs) consists mainly of fresh water or seawater with the addition of chemical and mineral additives to aid in its function. Drilling additives typically used may include chlorides (e.g. sodium, potassium), bentonite (clay), cellulose polymers, guar gum, barite or calcium carbonate. These additives are either completely inert in the marine environment, naturally occurring benign materials, or readily biodegradable organic polymers with a very fast rate of biodegradation in the marine environment. Bentonite and guar gum are listed as 'E' category fluids under the OCNS and is included on the Oslo Paris (OSPAR) Commission PLONOR (chemicals that 'pose little or no risk to the environment') list (OSPAR Commission, 2019). WBMs can be discharged to sea as fluids retained on cuttings and as bulk discharge from mud pits.
  - Non-water based muds (NWBMs) refers to drill fluids that are hydrocarbon rather than water based fluid. NWBM may contain a range of synthetic hydrocarbons, such as paraffins and olefins; however, such additives are designed to be low in toxicity and biodegradable, as well as not being readily bioavailable or likely to bioaccumulate, particularly in deeper water areas. No bulk discharge of NWBMs will occur offshore, only NWBMs retained on cuttings can be discharged from the MODU. If a NWBM system is required to drill a well section, the cuttings from the NWBM drilling fluid system will pass through the SCE (centrifuge and dryers) to reduce the average residual oil on cuttings (OOC). An OOC discharge limit of 6.9% wt/wt or less on wet cuttings will be averaged over well sections drilled with NWBM for the well. It is noted that microbial biodegradation can result in oxygen reduction within sediments, however Nedwed et al. (2006) found that depth is an important factor for residual concentrations of NWBF once they reach the seabed, suggesting that loss of base fluid during settling acted to significantly reduce chemical effects from discharges. It is also noted that NWBM cuttings tend to clump and settle to the seabed rapidly adding to the cuttings pile in proximity to the well site.

Drill cuttings and unrecoverable WBMs are discharged at the seabed at each well site for the top-hole sections, which are drilled riserless (i.e. no closed loop with the MODU). This results in a localised area of sediment deposition (known as a cuttings pile) around and in proximity to the well site influenced by prevailing seabed currents.

Once the top-hole sections are complete, installation of the riser and BOP provides a conduit back to the MODU, forming a closed circulating system. The bottom hole sections will be drilled with a marine riser in place that enables cuttings and drilling fluids to be circulated back to the MODU, where the cuttings are separated from the drilling fluids by the solids control equipment (SCE) and typically re-used in the closed loop system between the well bore and the MODU. The cuttings (with adhered residual fluids) are, in typical circumstances, discharged below the water line, with their fate and dispersion determined by cuttings particle size and the density of the unrecoverable fluids. In contrast the fluids are recirculated into the fluid system where there are a number of mud pits (tanks) on the MODU that provide a capacity to mix, maintain and store fluids required for drilling activities. The mud pits form part of the drilling fluid circulating system and may be discharged at the end of specific well sections, where there is a requirement to change the drilling fluid system or the drilling fluid cannot be re-used (due to deterioration/contamination). Bulk discharge of this type is only permitted for WBMs.

For the purposes of this impact assessment, the indicative dimensions, discharge locations and approximate drill cuttings and drilling fluid volumes provided in **Table 6-7** represent the worst case for a single section, taking into account each well to be drilled during the Petroleum Activities Program.

Table 6-7: Indicative drill cuttings and fluid volumes for an example SCA development well

Well Section	Discharge Point	Drilling Fluid Type	Approx. Interval Length (m)	Approx. Cuttings Volume Discharged (m^3)	Approx. Fluid Volume (m^3)
42" Conductor Hole	Seabed	Seawater (SW) / pre-hydrated bentonite sweeps (PHB)	72	65	880

26" Surface Hole	Seabed	SW / PHB / WBM / PAD	744	255	2800**
17-1/2" Hole	Surface (-1 m MSL)	WBM	396	62	1450
12-1/4" Hole	Surface (-1 m MSL)	WBM	573	44	1020
8 ½" x 9 7/8" Open Hole	Surface (-1 m MSL)	WBM	336	17	970
Total per well				**443**	**7120**
Contingency Side Track				*121*	*2000*

** Includes drilling 60 m with PAD
MSL – metres below sea below.
Not all fluid will be discharged after each section – options for reuse during batch drilling will be explored

Subsea – Displacement, Completion and Well-bore Cleanout Fluids

Completion fluids are usually brines (i.e. a mixture of seawater or formation water) with additives that can include:

- chlorides (often sodium, potassium or calcium)
- bromides
- hydrate inhibitor (MEG)
- biocide
- oxygen scavenger.

They are designed to have the proper density and flow characteristics to be compatible with the reservoir formation. Completion fluids are used to run well completions, and during wellbore clean up and flowback during drilling.

Wellbore and casing clean-up are required at various stages of the drilling operations to ensure the contents of the well are free of contaminants before the next stage of drilling. A chemical wellbore cleanout fluid train may be used to remove residual fluids (including NWBM, if used) from the wellbore. The wellbore cleanout fluid is usually brine (similar to completion fluid) that can include several chemicals, such as biocide and surfactant. During the clean-up process, fluids are circulated back to the MODU.

Cleanout fluids and completion brine will be captured and stored on the MODU and discharged if oil concentration is less than 1% by volume or returned to shore if discharge requirements cannot be met. Discharge volume would be ~400 m³.

Contingent Drilling Activities

Respud

It is unlikely that a well would be required to respud. If required, the most likely scenario is that the decision to respud is made during drilling of the top hole section of a well; therefore, the incremental increase in cuttings and fluids discharges is associated with the repeat drilling of the same top hole sections for the respudded well with the same associated discharges. A respud once drilling of the bottom hole sections has commenced is far less likely, given the time and effort already committed to the well. However, if this was to occur, the associated discharges would also be a repeat of the discharges as per **Table 6-7** to re-drill the same sections of the respudded well.

Sidetrack

The option of a sidetrack instead of a respud may be determined, if operational issues are encountered. Should a sidetrack be required, it will result in an increase in the volume of cuttings generated and a potential increase in the use of NWBM. Additional drill cuttings volumes are estimated in **Table 6-7.**

Well Annular Fluids

Well annular fluids refer to the fluids that remain in the wellbore, or annular spaces between the casing. It may consist of weighted drilling fluid and cement-contaminated mud, seawater, barite, cement polymer, and may include small amounts of hydrocarbon.

If a well is underperforming, or surveillance indicates debris is contained within the well, the contents of the wellbore may be flowed to a MODU. This displaces the well fluids (i.e. suspension/completion fluids). These are discharged overboard, as potential gas content makes it too dangerous to personnel to filter or treat them.

In the event a wellhead is removed due to the requirement to respud, small volumes (~1.5 m³) of fluid exchange between the annular spaces and the ocean may occur. The exchange will not be instantaneous as the annular spaces are small and the fluids are typically heavier than seawater. In the unlikely event routine wellhead removal techniques are unsuccessful, this fluid exchange is expected to occur over time following sufficient corrosion of the wellhead.

The small volumes and non-instantaneous nature of the release of the well annular fluids is expected to result in rapid dilution to a no-effect concentration within metres of the release location.

Detailed Impact Assessment

Assessment of Potential Impacts

Routine and non-routine drilling-related discharges may result in the following impacts:

- change in water quality
- change in seabed sediment quality
- change in seabed habitat
- injury/mortality to marine fauna (benthic communities).

Some fluids are discharged at the sea surface (or just below); and some are discharged at the seabed. Due to water depth in the PAA (900 – 955 m), this will determine the exposure pathway, and hence potential impacts and receptors.

Drill Cuttings and Retained Fluids

Water Quality and Planktonic Communities

Drill cuttings and retained drilling fluid discharges are expected to increase turbidity and TSS levels above ambient concentrations above the seabed (top-hole well sections) or in the upper surface layers (bottom-hole well sections with discharge below the water line from the MODU). Drill cuttings discharge will be generally intermittent and of short duration (over a total period of about 60 days per well) during the drilling of a well.

Top-hole well section drill cuttings and drilling fluids (WBM) will be discharged at the seabed. The coarser material (drill cuttings) will deposit on the seabed and the finer sediment material (the WBM) will cause localised elevated TSS in the water column above the seabed surrounding the well. This reduction in water quality will be temporary (limited to the operational discharges during drilling) and subject to rapid dispersion and dilution by prevailing seabed currents.

During bottom-hole well sections, when drill cuttings with retained drilling fluids (WBM or NWBM) are discharged below the water line (from the MODU), the larger particles, representing about 90% of the mass of the solids, form a plume that drops out of suspension in the water column rapidly and, deposits on the seabed. About 10% of the mass of the solids (the fines predominately composed of drilling fluid) form a plume in the upper surface layer (depending on the depth of discharge from the MODU) that will be transported by prevailing currents away from the MODU and is diluted rapidly in the receiving waters (Neff 2005, 2010). There is a large body of knowledge indicating a discharge of cuttings with adhered fluids diluting rapidly. These studies have found that within 100 m of the discharge point, a drilling cuttings and fluid plume released at the surface will have diluted by a factor of at least 10,000. Further to that, Neff (2005) states that in well mixed oceans waters, the plume is diluted by more than 100-fold within 10 m of the discharge site.

Dispersion of the cuttings plume is influenced by a number of factors: particle sized distribution of the cuttings and fluids, operational discharge events and rates and metocean conditions such as ocean current speed. The case studies described in Neff (2005) used WBMs and surface current speeds of 0.15–0.3 m/s. As currents in the PAA are ~0.25 m/s at the surface, and WBMs (bulk discharge) will contribute the largest input to elevated TSS/turbidity during drilling discharges, the dispersion extent as determined by Neff (2005) is considered representative for the Scarborough drilling program.

Using the widely-accepted dilution factor of 10,000 (Neff, 2005), cuttings (and adhered fluids) are expected to reach 100 mg/L TSS within 100 m of the MODU. Using a conservative ocean current speed of 0.1 m/s (which is below average current speeds in the PAA), these discharges are expected to disperse to 100 mg/L within ~16 minutes.

Given the generally low concentration of TSS outside the immediate vicinity of the discharge point, due to rapid dispersion of sediment and the short period of intermittent discharge, the plume is not expected to have more than a very highly localised reduction in water quality and area of potential ecological impact. It is not predicted to impact productivity of the water column.

The combination of low toxicity and rapid dilution of unrecoverable NWBMs discharged in association with drill cuttings are of little risk of direct toxicity to water-column biota (Neff et al., 2000).

Injury/mortality to planktonic species may occur due to a change in water quality following discharges of drill cuttings and fluids. Impacts to these organisms can be as a product of both physical and chemical alterations of water quality, predominantly in the water column.

As outlined above, using the widely-accepted dilution factor of 10,000 (Neff, 2005), cuttings (and adhered fluids) are expected to reach 100 mg/L TSS within 100 m of the MODU over a period of ~16 minutes. Minimal impact to plankton (phytoplankton, zooplankton and meroplankton (larvae of invertebrates and fish) is therefore expected from the discharge of drill cuttings. Neff (2010) explains that the lack of toxicity and low bioaccumulation potential of the drilling muds means that the effects of the discharges are highly localised and are not expected to spread through the food web (of which planktonic species are the basis).

Impacts to zooplankton from turbidity are associated with variations in predator prey dynamics, which favours planktonic feeders over visual feeders (Gophen, 2015), while impacts to phytoplankton occur due to decreases in available light, therefore reducing productivity (Dokulil, 1994). Surveys completed by ERM (2013) during the wet and dry season within the Exmouth Plateau in the vicinity of the PAA found that there is generally very low planktonic productivity in the region, with areas of periodic upwelling that induce greater productivity.

Jenkins and McKinnon (2006) reported that levels of suspended sediments greater than 500 mg/L are likely to produce a measurable impact upon larvae of most fish species, and that levels of 100 mg/L will affect the larvae of some species if exposed for periods greater than 96 hours. Jenkins and McKinnon (2006) also indicated that levels of 100 mg/L may affect the larvae of several marine invertebrate species, and that fish eggs and larvae are more vulnerable to suspended sediments than older life stages. However, dilution estimates (e.g. Hinwood et al., 1994; Neff, 2005) suggest suspended sediment concentrations caused by the discharge of drill cuttings will be well below the levels required to cause an effect on fish or invertebrate larvae (i.e. predicted levels are well below a 96-hour exposure at 100 mg/L, or instantaneous 500 mg/L exposure), beyond the immediate vicinity of the discharge.

Due to the low levels of planktonic productivity in the offshore area, plankton populations on a regional scale are not expected to be affected by drilling operations. In addition, due to the open nature of the marine environment of the PAA and associated environmental conditions (i.e. windy, strong currents, etc.), the content and dispersive nature of drilling muds within the marine environment and the high population replenishment of these organisms, it is expected that impacts to plankton species will be limited to within tens of metres of the discharge point and return to previous conditions within a relatively short period of time. On this basis, the impacts to plankton from routine and non-routine discharges during drilling activities is slight.

Sediment Quality and Benthic Communities

Accumulation of drill cuttings on the seabed causes changes in the physical properties of the seabed sediment such as the particle size distribution (PSD), the introduction of contaminants (metals such as barium) from retained drilling fluids (WBM), introduction of forms of petroleum hydrocarbons (from retained NWBM on cuttings) and associated ecological effects.

The discharge of drill cuttings and unrecoverable fluids at the seabed during riserless top hole drilling results in a localised area of sediment deposition (known as a cuttings pile) surrounding the well site. The cuttings pile distribution may reflect prevailing seabed currents and spread predominately downstream of the well site but overall extent from the well site is typically tens of metres. The dimensions of the cuttings pile depend on several factors, including volume (approximately 320 m^3 of top hole cuttings per well; **Table 6-7**) and composition of cuttings, and oceanographic conditions at the discharge location. The top-hole well section drill cuttings and retained drilling fluids (WBM) to seabed have the greatest impact to sediment quality and modification of the habitat in proximity to the well, as the solids tend to clump and settle rapidly around the discharge point (Neff, 2010).

Indicative components of the WBM system outlined in **Section 3.7.1.6** have a low toxicity. Bentonite and chemicals from the family of XC polymers (Xanthan Gum or similar) are listed as ‘E’ category fluids under the OCNS and considered to ‘pose little or no risk to the environment’. Metals such as barium from these additives will be present in the drilling fluid, primarily as insoluble mineralised salts, and consequently are not released in significant amounts to the pore water of marine sediments and have low bioavailability to those benthic fauna which may come into contact with the discharged barite (Crecelius et al., 2007; Neff, 2008). The XC polymer and bentonite sweeps have very low toxicities and are considered by OSPAR to pose little or no risk to the environment.

As described above, the bottom hole sections are drilled after the riser is fitted. Cuttings and unrecoverable fluids are discharged below the water line at the MODU site, resulting in drill cuttings and retained drilling fluids rapidly dispersing through the water column. The larger cuttings particles will drop out of suspension and deposit in proximity to the well site (tens to hundreds of metres distance) with potential for localised spreading downstream, while the finer fluid particles will remain in suspension and will be transported further away from the well site, rapidly diluting and eventually depositing over a larger area (hundreds of metres to several kilometres) downstream of the well site. Drill cuttings from the bottom-hole sections will be smaller in volume (approximately 122 m^3 per well**; Table 6-7**) and as determined by surface discharge, depth of seabed and time to reach seabed, result in an extended area of deposition, but a much thinner cuttings pile depth (IOGP, 2016). The fines associated with the retained drilling fluids or mud pit bulk discharge of WBM will settle over a greater extended distance as a thin, undetectable veneer on the seabed. Predicted impacts for bottom hole cuttings are generally confined to a maximum of 500 m from the discharge point (IOGP, 2016). However, when discharged in deeper waters (>400 m), WBM/NWBM cuttings may be deposited over a much larger area, to a horizontal distance of 500–1000 m from the discharge site (with concentrations decreasing with increasing distance) (IOGP, 2016). The final deposition of drill cuttings and drilling fluids is largely determined by seabed depth and the time to drop out of suspension within the water column and deposit on the seabed. This leads to the coarser cuttings material being deposited at a location offset but closest to the well site in an area downstream and a distance up to of several hundreds of metres, with associated ecological effects within this area and the fines (predominately drilling fluids) dispersed over a greater distance from the discharge site, typically several kilometres but with no associated ecological effects.

Base fluids for NWBM are assessed in accordance with Woodside’s Chemical Selection and Assessment Environment Guideline. They are designed to be biodegradable in offshore marine sediments. Biodegradation can result in a low oxygen (anoxic) environment resulting in changes in benthic community structure. Species sensitive to anoxic environments are eliminated and replaced by tolerant and opportunistic species, resulting in decreased species diversity, but the number of individuals often increases (Neff et al., 2000). NWBMs are designed to be low in toxicity and are not readily bioavailable to benthic fauna due to their physical/chemical properties. Nedwed et al. (2006) found that depth is an important factor for concentrations of NWBM on cuttings, where cuttings which had a great distance to reach the seabed (950 m) had significantly lower concentrations, suggesting that loss of base fluid during settling acted to significantly reduce chemical effects from discharges. The study concluded that NWBM discharged in deep water posed very limited environmental impacts (from analysis of difference in benthic fauna between pre- and post-drilling samples, Nedwed et al., 2006). This discharge is expected to dilute rapidly, with a potential impact to the environment considered to be a local, temporary decrease in water quality (as discussed above).

Benthic organisms below the cuttings pile will be buried and smothered; however, the cuttings piles are expected to be recolonised over time. Ecological impacts to benthic biota are predicted when sediment deposition is equal to or greater than 6.5 mm in thickness (IOGP, 2016). This amount of sediment deposition from top hole and bottom hole cuttings is expected to be confined to within a few hundred metres around the well location, although this depends on the nature of the cuttings, the water depth and currents of the receiving environment (IOGP, 2016). A conservative radius of 500 m representing a zone of potential ecological impact has been applied to each well location for this impact assessment. Mobile benthic fauna, such as demersal fish, may be temporarily displaced from areas where cuttings discharges accumulate. Furthermore, ecological impacts are not expected for mobile benthic fauna such as crabs and shrimps or pelagic and demersal fish, given their mobility (IOGP, 2016). Balcom et al., (2012) concluded that impacts associated with discharging cuttings and base fluids (including NWBMs) are minimal, with impacts highly localised to the area of the discharge deposition on the seabed. Changes to benthic communities are normally not severe. Organic enrichment can occur, leading to anoxic conditions in the surface sediments and a loss of infauna species that have a low tolerance to low oxygen concentrations, and to a lesser extent chemical toxicity near the well location. These impacts are highly localised with short-term recovery that may include changes in community composition with the replacement of infauna species that are hypoxia-tolerant (IOGP, 2016). Recovery of affected benthic infauna, epifauna and demersal communities is expected to occur, given the short duration of sediment deposition and the widely represented benthic and demersal community composition. The zone of potential ecological impact for each well is conservatively estimated to be 0.8 km^2 and the total area of potential ecological impact for the ten wells (two of which are contingency) is conservatively estimated to be 8 km^2.

It is acknowledged that transport of fines (associated with the drilling fluids) will disperse beyond the zone of potential ecological impact but there are no associated ecological effects expected beyond this zone (500 m distance from the well sites). Low levels of sediment deposition away from the immediate area of the well site would represent a thin layer of settled drill cuttings and drilling fluids, which will likely be naturally reworked into surface sediment layers through bioturbation (US Environmental Protection Agency, 2000). Metals such as barium from the drilling fluid additives are used as a tracer of dispersion and are typically detected beyond the zone of ecological impact but as discussed for sediment quality (above), the insoluble mineralised salts (the source of barium) have low bioavailability to benthic biota.

Impacts associated with routine and non-routine drilling discharges will be largely limited to an area surrounding the well locations, which are in 900 - 955 m water depth, in the offshore, open water environment and >215 km from the nearest shore. The low sensitivity of the benthic communities/habitats within and in the vicinity of the PAA, combined with the low toxicity of WBMs and residual NWBMs, no bulk discharges of NWBM and the highly localised nature and scale of predicted physical impacts to seabed biota, affirm that any predicted impact is considered likely but of a minor environmental consequence.

KEFs

Potential impacts to the Exmouth Plateau KEF, which overlaps the PAA, relate to ecological impacts to the seabed habitat and benthic communities. As described above, the sediment deposition from the discharge of drill cuttings and drilling fluids will be highly localised around each well location. Within the conservatively applied zone of potential ecological impact (500 m radius per well) epifauna and infauna will be buried or smothered, particularly, in close proximity to the wellheads. Mobile epifauna and demersal fish are more likely to be displaced from the zone of potential ecological impact. Recovery of affected benthic infauna, epifauna and demersal fish communities is expected to occur, given the short duration of sediment deposition and the widely represented benthic and demersal community composition. The total percentage area of the Exmouth Plateau seabed habitat and benthic communities affected is conservatively estimated to be 0.01%. The extremely small portion of the overall KEF area predicted to be impacted in combination with the predicted recovery of the affected benthic communities, affirms that any predicted impact is considered likely but of a slight environmental consequence.

Drilling Fluids (Bulk Discharge)

WBM may be bulk discharged at the end of specific well sections, as described above, where there is a requirement to change the drilling fluid system or the drilling fluid cannot be re-used (due to deterioration/contamination). A small quantity of WBM and NWBM residue (<1%) may also be discharged at the sea surface while cleaning the mud pits, typically at the conclusion of drilling activities or when changing between mud types.

Discharge of WBM will result in a buoyant plume of fine materials that will rapidly dilute and decrease in turbidity levels immediately away from the discharge point. WBM samples collected by Jones et al. (2021) from the mud pits just before discharge during the Greater Western Flank-2 drilling campaign were ~90% silt sized (<62.5 µm) with a mean diameter of 12 µm (gel-polymer) and 33 µm (KCl-polymer). Total suspended solid (TSS) levels in the gel-polymer mud and KCl-polymer mud were 257 g/L and 245 g/L respectively. Jones et al. (2021) used an ROV to observe mud pit discharges and reported the discharge to exit the discharge outlet as a jet of material in a distinctive cloud-like plume descending rapidly to the seabed and growing in diameter with increasing depth.

The subsea plume can be expected to disperse over a wide area (up to several kilometres), with no discernible sediment deposition on the seabed and no physical or biological impacts, particularly given the water depth of the PAA (900-955 m). Impacts beyond the 500 m zone of ecological impact for each well as described for drill cuttings and retained fluids discharge is not expected.

Subsea – Displacement, Completion and Well-bore Cleanout Fluids

Discharges such as displacement, completion and wellbore cleanout fluids are typically inert and of low-toxicity. These fluids are mostly brine, with a small proportion of chemical additives such as surfactants, biocide, corrosion inhibitor, oxygen scavenger, MEG and guar gum. The volume of one wellbore and subsequent discharge volume would be ~400 m^3. Any change to water quality is expected to be localised and temporary. As this is an intermittent batch discharge, any change in water quality will be short term as discharges are discrete and of short duration. Rapid dilution due to prevailing ocean currents in the open water environment would lead to any changes in water quality such as low toxicity contaminants being temporary (only for the duration of the discharge) and reducing water quality within a short distance of the discharge location.

Cumulative Impacts

Given the Petroleum Activities Program includes the drilling of up to 10 development wells, there is the potential for cumulative disturbance to marine sediment quality and benthic communities to occur. The cuttings and drilling fluids discharged from each of the wells will accumulate within the receiving environment. Given that the distances between some of the proposed wells are within 100 m, overlap may occur. When considering deposition of sediments from each drilling activity, deposition at a thickness of greater than 6.5 mm is limited to within a distance of a few hundred metres, although this is dependent on the nature of the cuttings, and the water depth and currents of the receiving environment (IOGP, 2016). If the area of drill cuttings and drilling fluids deposition from the wells overlap, impacts are anticipated to be minimal, considering the observed limited benthic biota within the PAA.

No cumulative impacts to water quality are expected to occur since discharged sediments are predicted to settle in between the drilling activities for each well and no concurrent drilling will occur.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level
Sediment Quality	Change in sediment quality	Low value (open water)	Minor	Slight (E)
Water Quality	Change in water quality	Low value (open water)	Slight	Negligible (F)
Plankton	Injury/ mortality to fauna	Low value (open water)	Slight	Negligible (F)
Epifauna and Infauna	Injury/ mortality to fauna	Low value	Minor	Slight (E)
KEFs	Change in habitat	High value habitat	Slight	Minor (D)

Overall Impact Significance Level: The overall impact significance level for routine and non-routine drilling discharges is D based on slight impact to the high value receptors (KEFs). Further review on the potential recovery time of sediment quality and epifauna/Infauna receptors has increased the significance level from the OPP, but the overall impact significance level (D) is consistent with the level in the OPP.

Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*	*Benefit in Impact/Risk Reduction*	*Proportionality*	*Control Adopted*
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Drilling and completions fluids will have an environmental	F: Yes. CS: Minimal cost. Standard practice.	Environmental assessment of chemicals will reduce the consequence of impacts	Benefits outweigh cost/sacrifice.	Yes **C 7.1**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
assessment completed prior to use.		resulting from discharges to the marine environment by ensuring chemicals have been assessed for environmental acceptability. Planned discharges are required for the safe execution of activities and therefore no reduction in likelihood can occur.		
For drilling and completion fluids, periodic chemical reviews are performed.	F: Yes. CS: Minimal cost. Standard practice.	Regular reviews will ensure chemicals selected for drilling and completions fluids remain ALARP.	Benefits outweigh cost/sacrifice.	Yes **C 7.2**
Written NWBM justification process followed.	F: Yes. CS: Minimal cost. Standard practice.	The written justification takes onboard the technical need for NWBM use, receiving environment, cost and additional controls that may be required. By undertaking formal assessment, the potential impacts are well understood allowing for development of control measures to reduce the consequence of NWBM use. This provides an overall environmental benefit.	Benefits outweigh cost/sacrifice.	Yes **C 7.3**
NWBM base oils selected based on expected toxicity.	F: Yes. CS: Minimal cost.	By selecting a base oil with lower toxicity, the consequence of the release on the environment is reduced.	Benefits outweigh cost/sacrifice	Yes **C 7.4**
No overboard disposal of bulk NWBM.	F: Yes. CS: Minimal cost. Standard practice.	By restricting the volume of NWBM for overboard discharge, the consequence of the release on the environment is reduced. Although no change in likelihood is provided, the decrease in consequence results in an environmental benefit.	Benefits outweigh cost/sacrifice.	Yes **C 7.5**
Bulk operational discharges conducted under MODU's Permit to Work (PTW) system (to operate discharge valves/pumps).	F: Yes. CS: Minimal cost. Standard practice.	The MODU's PTW may slightly reduce the volumes of bulk discharges occurring, but it is unlikely to be significant given that bulk discharges are often	Benefits outweigh cost/sacrifice.	Yes **C 7.6**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
		operationally required and cannot be eliminated.		
Displacement, brine, workover or intervention fluids contaminated with hydrocarbons will be treated prior to discharge or contained. If discharge specification not met the fluid will be returned to shore.	F: Yes. CS: Minimal cost. Standard practice.	Ensuring <1% oil content will provide a small reduction in consequence when fluids are discharged to the environment.	Benefits outweigh cost/sacrifice.	Yes **C 7.7**
SCE used to treat NWBM cuttings prior to discharge.	F: Yes. CS: Minimal – more frequent cuttings sampling and testing.	Achieving average oil on cuttings (sections using NWBM only) discharge limit of 6.9% or less oil on wet cuttings will have a small reduction in consequence.	Benefits outweigh cost/sacrifice.	Yes **C 7.9**
In event of SCE failure (including auger) while drilling with NWBM, the initial action will be to cease drilling and determine whether to repair SCE or drill ahead until next practicable opportunity to trip out of the hole. If cuttings are discharged during dryer or auger failure, measurement of OOC to occur more frequently from shakers.	F: Yes. CS: Cost and schedule implications due to cessation of drilling.	Ceasing of drilling in the event of equipment failure will allow for time to assess feasibility of drilling ahead while still meeting residual OOC discharge requirements.	Benefits outweigh cost/sacrifice.	Yes **C 7.10**
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
Mud pit wash residue will be measured for oil content prior to discharge.	F: Yes. CS: Minimal cost. Standard practice.	Ensuring <1% oil content will provide a small reduction in consequence when residue is discharged to the environment.	Benefits outweigh cost/sacrifice.	Yes **C 7.11**
WBM drill cuttings returned to the MODU will be processed using SCE equipment.	F: Yes. CS: Minimal cost. Standard practice.	Limiting the discharge of WBMs through reuse will reduce the consequence of the using WBM.	Benefits outweigh cost/sacrifice.	Yes **C 7.12**
Drill cuttings returned to the MODU will be	F: Yes.	Discharge of drill cuttings below the water line will reduce carriage and	Benefits outweigh cost/sacrifice.	Yes **C 7.13**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
discharged below the water line.	CS: Minimal cost. Standard practice.	dispersion of cuttings thereby reducing the consequence of cuttings discharges during the Petroleum Activities Programme.		
Cuttings reinjection into formation. Cuttings are crushed, slurrified and pumped to a desired geological structure with a suitable seal, below the seabed through an annulus or tubing.	F: No. No concurrent drilling or direct sequential drilling planned which would require cuttings to be stored prior to re-injection. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Riserless Mud Recovery (RMR) system to return top-hole cuttings/mud from the riserless section of the well to the MODU prior to treatment onboard and discharge from the MODU (below the water line) for <u>all wells</u>.	F: Not technically feasible due to water depth. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Riserless Mud Recovery (RMR) system to return top hole cuttings from the riserless section of the well to the MODU prior to transport to an alternative discharge location or back to shore for disposal.	F: Not technically feasible due to water depth. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Return riser-in-place cuttings for disposal at another marine location or onshore for processing and land disposal (skip and ship) for whole well to reduce risk of benthic disturbance. OR Return riser-in-place cuttings for all sections drilled with NWBM for disposal onshore (to reduce potential residual oil on cuttings to environment).	F: Yes. CS: Primary cost/sacrifice of this option is the additional handling required in transporting cuttings to alternative disposal location. Particularly the health and safety risks associated with high frequency of support vessel activity alongside the rig and the amount of crane lifting required if a cuttings skip/drilling waste container system were employed. Other cost/sacrifice elements which are considered include: • Further treatment of cuttings onshore is required to ensure a standard suitable for landfill. Class II disposed locally (e.g. Karratha). Class III	Compared to adopted control, return riser in place cuttings would achieve a reduction in cuttings/mud discharged (although discharge would still occur during riserless drilling on the basis this control is not adopted) at each well location; however, given current impact assessment and controls adopted, this would not result in a significant reduction on consequence.	Disproportionate. Given the adopted controls and low current risk rating, the high cost/sacrifice outweighs the benefit gained over the duration of the Petroleum Activities Program. Impact assessment has determined no sensitive benthic receptors in the vicinity and a low level of impact potential from overall cuttings/mud discharge	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	landfill requires transport to Geraldton or Perth • Increased risk of unplanned vessel collision or loss of cuttings during transfer activities • Environmental impact (suspended sediment/sedimentation) of discharging cuttings at new location and other regulatory approvals may also be required (e.g. sea dumping permit). • Potential halt to drilling activity if transfer operations are delayed due to weather or operational issues • Additional environmental impact incurred (air emissions) from vessel use and onshore trucking for transportation of cuttings. Disposal via landfill and/or treatment does not eliminate an environmental impact. These options have their own impacts and therefore disadvantages if implemented.		therefore benefit to be gained from cuttings/mud recovery is disproportionate to the risks introduced by cuttings relocation (including if an alternative system which doesn't use transport containers was implemented).	
Reduce total drill cuttings by implementing slim well design.	F: No. Slim well design is not considered feasible based on the following factors: • The well design is optimised to minimise the size of hole drilled while still being able to reach the targets and meet development objectives safely. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Water quality and/or sediment monitoring of drill cuttings or drilling fluids to verify impact during activity.	F: Yes. CS: • For in-water sampling utilising ROV - Time and logistics for tool change out from operational tools to specialised scientific sampling tools.	No environmental benefit would be gained by implementation of monitoring during the activity. Monitoring could be used to inform additional control measures in future drilling activities;	Disproportionate Cost/sacrifice outweigh benefit to be gained in the context of existing environment (deep water, open ocean	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	• Additional personnel on board to operate ROV and coordinate sampling program. • Low ROV availability due to operations can limit time to perform environment monitoring. • If additional ROV is required on the MODU, deck space and resources to run/store/service ROV. • Resources for sample processing (space/ equipment/ personnel).	however, there is a considerable body of existing scientific literature on potential impacts of drill cuttings and impacts are generally well understood. Furthermore, it is not guaranteed that additional controls would be feasible, or if they would provide any environmental benefit.	communities with no proximity to sensitive benthic communities or receptors). Although adoption of this control could be used to verify EPOs associated with drilling mud and cutting discharge, alternative controls identified achieve an appropriate outcome.	
Use SCE with secondary treatment for NWBM: Thermomechanical systems (to achieve <1% average oil on cuttings).	F: Yes – with associated infrastructure including vessels for offline storage and delivery to thermomechanical dryer. CS: The primary cost/sacrifice of this option is the monetary outlay for acquisition and implementation which is estimated at $800,000 to mobilise, install and demobilise, along with a running cost of about $32,000/day. Other factors considered include: • It is estimated that it would take a minimum of seven months to mobilise, install and commission the system on to the MODU. • Complex and unfamiliar system to integrate with the rig systems. • Increased health and safety exposure due to: • crew of nine engineers and technicians required to run the plant. • multiple crane lifting operations, during installation, operations and demobilisation. • rotating machinery	A reduction in consequence would be achieved by reducing the average oil on cuttings discharged.	Disproportionate. Cost/sacrifice outweighs benefit to be gained in the context of existing environment and drilling campaign.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	• heat illness • deck congestion due to large footprint of the plant.			
Time restricted discharge of WBM and/or cuttings to align with tide/current or other oceanographic events.	F: Yes. CS: Disruption to drilling operations in having to stop drilling at time when discharge of WBM and/or cuttings might not be permitted. Additional mud storage volume required.	Given the offshore location, oceanographic changes are unlikely to significantly affect the dispersion of cuttings and therefore no environmental benefit would be gained.	Disproportionate. The cost/sacrifice outweighs the benefit gained – No hard coral or other photo-sensitive benthic communities in the vicinity of wells to rationalise phased/ timed discharge.	No

ALARP Statement:

On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of drill cuttings and drilling fluids (WBM and NWBM). As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.1.13.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**):

- Overall impact significance levels for individual receptors are less than the significant impact level defined in the OPP.
- EPOs and controls in the OPP that are relevant to routine drilling discharges have been adopted.
- There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, routine and non-routine drilling discharges are unlikely to result in an impact greater than minor. Further opportunities to reduce the impacts have been investigated above.

The adopted controls are considered good oil-field practice/industry good practice to prevent the generation of significant volumes of drill cuttings and to manage the discharge of drill cuttings and fluids. The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of these discharges to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 1 Undertake Petroleum Activities Program in a manner that does not modify, destroy,	**C 7.1** Drilling and completions fluids will have an environmental assessment completed prior to use.	**PS 7.1** All chemicals intended or likely to be discharged into the marine environment reduced to ALARP using	**MC 7.1.1** Records demonstrate chemical selection, assessment and approval

fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 11** Undertake Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 12** Undertake Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of plankton including its life cycle and spatial distribution. **EPO 13** Undertake Petroleum Activities Program in a manner that will not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in an area defined as a Key Ecological Feature. **EPO 14** Undertake Petroleum Activities Program in a manner that prevents substantial change in sediment quality, which may adversely impact biodiversity, ecological integrity, social amenity or human. **EPO 15** Undertake Petroleum Activities Program in a manner that prevents significant impacts on the values of the Exmouth Plateau KEF.		the chemical assessment process.	process for selected chemicals is followed.
	C 7.2 For drilling and completion fluids, periodic chemical reviews are performed.	**PS 7.2** Acceptability of previously approved chemicals are re-evaluated to ensure ALARP and alternatives are considered.	**MC 7.2.1** Records confirm periodic reviews have taken place, and any actions/changes are being tracked to closure.
	C 7.3 Written NWBM justification process followed.	**PS 7.3** NWBMs only used where written justification process has been followed.	**MC 7.3.1** Records show NWBM justification process has been followed and NWBM only used where technically required.
	C 7.4 NWBM base oils selected based on expected toxicity.	**PS 7.4** Group III base oils used in NWBM.	**MC 7.4.1** Records demonstrate that only Group III base oils used in NWBM.
	C 7.5 No overboard disposal of bulk NWBM.	**PS 7.5** Achieve oil concentration <1% by volume prior to discharge.	**MC 7.5.1** Records demonstrate that discharge criteria was met prior to discharge or was taken onshore.
	C 7.6 Bulk operational discharges conducted under MODU's permit to Work (PTW) system (to operate discharge valves/pumps).	**PS 7.6** Increased level of assurance and verification on bulk operational discharges.	**MC 7.6.1** Records demonstrate that bulk discharges are conducted under the MODU PTW system.
	C 7.7 Displacement, brine, workover or intervention fluids contaminated with hydrocarbons will be treated prior to discharge or contained. If discharge specification not met the fluid will be returned to shore.	**PS 7.5**	**MC 7.5.1**
	C 7.9 SCE used to treat NWBM cuttings prior to discharge.	**PS 7.9** Average OOC (sections using NWBM only) discharge limit of 6.9% or less oil on wet cuttings is achieved.	**MC 7.9.1** Records confirm the average OOC for the entire well (sections using NWBM only) do not exceed limit.
	C 7.10 In event of SCE failure (including auger) while drilling with NWBM, the initial action will be to cease drilling and determine whether to repair SCE or drill ahead until next practicable opportunity to trip out of the hole.	**PS 7.10** The decision whether to repair SCE or drill ahead has considered the estimated time for repairs and the amount of drilling until next planned trip out of hole, to ensure the OOC limit is not exceeded.	**MC 7.10.1** Records demonstrate that in the event of auger or cuttings dryer failure (where no redundancy is available), active drilling is initially stopped as soon as safe to do so. Evidence of assessment to drill ahead

	If cuttings are discharged during dryer or auger failure, measurement of OOC to occur more frequently from shakers		with failed SCE can be produced.
	C 7.11 Mud pit wash residue will be measured for oil content prior to discharge.	**PS 7.11** Achieve less than 1% by volume oil content before discharge	**MC 7.11.1** Records after pit clean out (for pits potentially contaminated with base oil) demonstrate mud pit wash residue was less than 1% by volume oil content before discharge.
	C 7.12 WBM drill cuttings that are returned to the MODU will be processed (using SCE equipment).	**PS 7.12** WBM drill cuttings that are returned to the MODU processed using SCE equipment allowing reuse of mud prior to discharge.	**MC 7.12.1** Records demonstrate that operational SCE is in use.
	C 7.13 Drill cuttings returned to the MODU will be discharged below the water line.	**PS 7.14** Cuttings discharged below the water line	**MC 7.14.1** Records confirm cuttings discharge chute/line below the water line.

6.6.8 Routine and Non-Routine Discharges: Cement, Cementing Fluids, Subsea Well Fluids, Produced Water and Unused Bulk Product

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.1.12 (Routine and Non-Routine Discharges: Drilling)		
Context		
Relevant Activities Drilling Activities – **Section 3.7** Contingency Activities – **Section 3.11**	**Existing Environment** Marine Regional Characteristics – **Section 4.2** Habitats and Biological Communities – **Section 4.5** Protected Species – **Section 4.6**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	Environmental Value Potentially Impacted							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Routine discharge of cement and cementing fluids, to the seabed and the marine environment.		✓	✓		✓			A	D	-	-	LCS GP PJ	Broadly Acceptable	EPO 1, 11, 12, 14, 15
Routine discharge of subsea well fluids (inc. BOP and well construction activity control fluids); completion fluids, produced water and well intervention/ workover fluids.		✓	✓		✓			A	D	-	-			
Non-routine discharge of unused bulk products		✓	✓		✓			A	D	-	-			

Description of Source of Impact/Risk

Cement, Cementing Fluids, Grout, Subsea Well Fluids and Unused Bulk Products

<u>*Cementing Fluids, Cement and Grout*</u>

Cementing fluids, including cementing mix water, may require discharge to the marine environment under various scenarios.

At the commencement of the drilling campaign there may be a requirement to run a cement unit test to ensure the functionality of the cement unit and the cement bulk delivery system prior to performing an actual cement job. This test would result in a small volume of approximately 10 m^3 of cement slurry being discharged at the sea surface. The slurry is usually a mix of cement and water however may contain stabilisers or chemical additives.

When cementing the conductor and surface casings after top hole sections of the well have been drilled, cement must be circulated to the seabed to ensure structural integrity of the well. Excess cement is pumped to ensure structural integrity is achieved. If the hole is completely in-gauge and there are no downhole losses while pumping the cement, a maximum volume of 80 m³ per well is estimated to be circulated to the seabed at the well location, which forms a thin concrete film on the seabed in close proximity to the well.

Wherever possible, the cement line flush volumes are included in the planned cement jobs. After each cement job, leftover cement slurry in the cement pump unit and the surface lines is flushed and discharged to the sea to prevent clogging of the lines and equipment. This is estimated at about 44 m³ per well (based on up to four cement jobs per well x 11 m³ discharged per job). In the unlikely event a respud event is required it would result in additional cement jobs. Also, in the rare event that the cement products become contaminated, the entire volume (~180 m³ per well) may need to be discharged to sea.

Cement spacers can be used as part of the cementing process, within the well casing, to assist with cleaning of the casing sections prior to cement flow through. The spacers may consist of either seawater or a mixture of seawater and dye. The dye is used to provide a pre-indicator of cement overflow to the seabed surface, to ensure adequate cement height.

Excess cement (dry bulk, after well operations are completed) will either be: used for subsequent wells; provided to the next operator at the end of the drilling program (as it remains on the rig); or if these options are not practicable, discharged to the marine environment as dry bulk or as a slurry. The process that will be followed to determine discharge is the last option is presented in **Figure 6-1**.

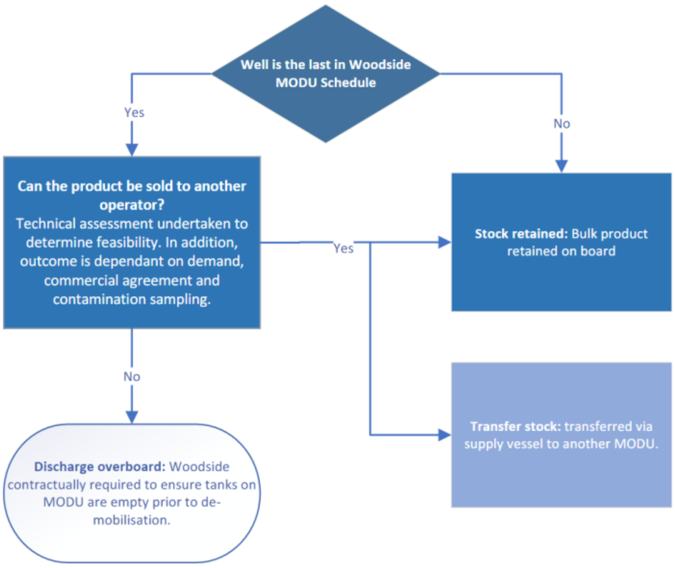


Figure 6-1: Management process for excess bulk product

Subsea Fluids – Blow Out Preventors (BOP) and Well Construction Activity Control Fluids

Subsea fluids are likely to be released during drilling, completions and xmas tree installation, including the release of BOP control fluids. Subsea control fluids are water-based hydraulic control fluids used in control systems on the subsea trees and BOPs. The BOP is required, by legislation, to be regularly function tested when subsea.

Subsea control fluids will be discharged during:

- installation of the subsea trees (~10 L per well)
- function testing of the subsea tree (~30 L per test)
- function testing of the BOP on installation and pressure testing

The BOP is function tested during assembly and maintenance and during operation on the seabed as described in **Section 3.7.1.3**. As part of this testing, small volumes of BOP control fluid (generally consisting of water mixed with a glycol based detergent or equivalent water-based anti-corrosive additive) are released to the marine environment.

Each time a pressure and function test is undertaken approximately 3620 L of water-based fluid is released to the marine environment, of this approximately 4% is control fluid additive. BOP operation includes function and pressure testing approximately every 21 days, and a function test (approx. 2665 L) approximately every seven days, excluding the week a pressure test is conducted.

Functioning and testing of the subsea xmas trees will result in the discharge of small volumes of water and glycol based control fluid.

Subsea Fluids – Well Intervention and Workover Fluids

A workover or intervention may be performed on any wells in the Petroleum Activities Program. If the well has been flowed previously, or if down-hole hydrocarbons remain in the well (e.g. reservoir fluid or if base oil has been left in the well), there is potential that the intervention/workover fluids will be contaminated with hydrocarbons. If hydrocarbon contamination of the intervention/workover fluids has occurred, the fluid will need to be treated on the MODU, to ensure hydrocarbon content prior to discharge, is <1% by volume, or returned to shore if discharge requirements cannot be met.

It may be necessary to remove marine growth from subsea infrastructure using acid (typicallt sulphamic acid) to aid visual inspection and operation of valves and other mechanisms. This will be done using ROV tooling and possibly acid.

Produced Water

During well flowback and completion activities, completion fluids and produced water will be discharged to the marine environment via the well test water filtration treatment package. The well test water filtration treatment package will be used to treat produced water that cannot be flared before discharge. Prior to discharge, the fluids are cycled through a water filtration system consistent with solids and polishing. Approximately 100 bbls (16 m^3) of produced water may be generated per well, which may be discharged via the well test water treatment package.

Other unused bulk products

Additional products such as barite and bentonite may be discharged in bulk during or at the end of the activity if they cannot be reused or taken back to shore (refer to the process that will be followed to determine discharge is the last option is presented in **Figure 6-1**). Use and discharge of all chemicals and products will be conducted in line with Woodside's internal guidelines (**Section 3.8**). Discharge may be in the form of dry bulk or as a slurry; however, discharges will not be contaminated with hydrocarbons. Discharges may be ~75 tonnes of cement, 150 tonnes of barite and 100 tonnes of bentonite. However, these volumes are conservative (50% greater than the minimum required storage volumes) and discharge volumes (if required) are likely to be much smaller.

Other Contingency Activities

Well Intervention

At some point in the life of all oil and gas wells, parts may require maintenance, repair or replacement. Well intervention activities generally occur within the wellbore and may include the following activities, as well as any other drilling activities described in **Section 3.7**:

- well logging activities (slickline, wireline, coil tubing)
- well testing and flowback
- well intervention and workovers.

Relevant discharge types generated from these activities may include the following:

- subsea control fluid (control of subsea tree)
- completions fluids
- well annular fluids.

These discharges are not expected to be different from those described above under the associated headings.

Well annular fluids may also be discharged during well intervention.

Kill-weight brine may also be used during well suspension or well abandonment, which is a brine (e.g. sodium chloride) of adequate density to control formation pressure.

Detailed Impact Assessment

Assessment of Potential Impacts

Benthic habitats and communities in the PAA are considered to be of low sensitivity and reflective of the wider NWMR. No known regionally significant benthic or infauna habitat occur in the area. The Exmouth Plateau KEF overlaps the PAA, (**Section 4.7**), however the impacts to values and sensitivities of this KEF are not expected due to the highly localised and small physical footprint of the discharges, coupled with the low toxicity of cementing fluids used for the PAA. The likelihood of any significant impact to marine biota is subsequently considered to be low.

Cementing Fluids, Cement and Grout

Impacts of cement on the marine environment are predominantly associated with localised burial of benthic biota in the direct physical footprint of deposition. Cement operations during drilling involve routine and non-routine discharges that can result in turbidity in the water column. Reduction in water quality will be temporary (limited to the cement operational discharges during drilling) and subject to rapid dispersion and dilution by prevailing currents. Modelling of cement discharges for another offshore project (BP Azerbaijan, 2013) was used because it provides an appropriate, but conservative, comparison of the potential extent of exposure from this activity. In this study, two hours after the start of discharge, plume concentrations were determined to be between 5 and 50 ppm with the horizontal and vertical extents of the plume ~150 m and 10 m, respectively (BP Azerbaijan, 2013). Five hours after ceasing the discharge, modelling indicates that the plume will have dispersed to concentrations <5 ppm.

Cement is the most common material currently used in artificial reefs around the world and is inert. The potential for toxicity is associated with chemical additives that may be added to cement mixtures. Therefore, the toxicity associated with the discharge of cement is limited to the subsurface release of cement (not discharge of slurrified or dry cement).

Once the cement has hardened, chemical additives are locked into the cement (Terrens et al., 1998) and not expected to pose any toxicological risk to benthic biota from leaching or direct contact. Most cement discharges that will occur during the drilling activities will be at the seabed during cementing of the casing. Once overspill from cementing activities hardens, the physical sediment properties of the area directly adjacent to the well (10–50 m) will be permanently altered (Terrens et.al., 1998). The potential disturbance area is an estimated 0.007 km² per well; giving a total potential disturbance footprint of ~0.21 km² for the proposed wells. Cement discharges at the seabed will overlap with the highest deposition of drill cuttings and drilling fluids. The highly localised physical footprint at the well site is not expected to affect the overall diversity or ecosystem function of the benthic communities of the area.

The potential impacts to benthic communities caused by smothering from a surface release of cement are expected to be significantly less, due to small volumes, intermittent nature of these discharges, and high potential for dispersal by ocean currents. This impact on soft sediment communities is not expected to affect the diversity or ecosystem function in this area and is only considered a localised impact.

Subsea Control Fluids

Subsea control fluids are water-based hydraulic fluids containing ~3% active ingredients. Modelling undertaken for another offshore drilling project indicates that a release of subsea control fluids during function testing is expected to reach a dilution of 3000 times within a maximum displacement of the plume within 98 m distance from the release site (BP Azerbaijan, 2013). Based on this information, concentrations of subsea control fluid are expected to be ~10 ppm within 100 m of the well BOP. Using a conservative ocean current speed of 0.1 m/s, fluids would be expected to travel 100 m (and thus reach concentrations of 10 ppm) in ~16 minutes. Changes in water quality, would comprise the presence of low toxicity contaminants for a short duration and extent in the water column above the seabed.

Given the small volumes associated with this discharge and limited exposure times due to rapid dilution, any potential impact to this aspect is expected to be localised and short term. There is potential for some toxins in the control fluid to accumulate in the sediment, but due to the very small volumes and rapid dispersal, it is considered negligible.

Produced Water

As described above, during well unloading and completion activities about 100 bbls (16 m^3) of produced water will be yielded per well, which may be discharged via the well test water treatment package. Discharge will be instantaneous and of short duration, and will be rapidly dispersed and diluted with negligible impact to water quality.

Subsea – Well Intervention Fluids

Well intervention fluids are typically inert and of low-toxicity. These fluids may include subsea control fluid, completions fluids and well annular fluids. Any change to water quality is expected to be localised and temporary as discharges would be discrete and of short duration. Rapid dilution due to prevailing ocean currents in the open water environment would lead to any changes in water quality such as low toxicity contaminants being temporary (only for the duration of the discharge) and reducing water quality within a short distance of the discharge location.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Magnitude	Impact Significance Level
Sediment Quality	Change in sediment quality	Low value (open water)	Minor	Slight (E)
Water Quality	Change in water quality	Low value (open water)	Slight	Negligible (F)
Plankton	Injury/ mortality to fauna	Low value (open water)	Slight	Negligible (F)
Epifauna and Infauna	Injury/ mortality to fauna	Low value	Minor	Slight (E)
KEFs	Change in habitat	High value habitat	Slight	Minor (D)

Overall Impact Significance Level: The overall impact significance level for routine and non-routine discharges of cement, cementing fluids, subsea well fluids, produced water and unused bulk product is D based on Minor impact to the high value receptors (KEFs). Further review on the potential recovery time of sediment quality and Epifauna/Infauna receptors has increased the significance level from the OPP, but the overall impact significance level (D) is consistent with the level in the OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
Subsea control and cementing fluids and additives will have an environmental assessment completed prior to use.	F: Yes. CS: Minimal cost. Standard practice.	Environmental assessment of chemicals will reduce the consequence of impacts resulting from discharges to the marine environment by ensuring chemicals have been assessed for environmental acceptability. Planned discharges are required for the safe execution of activities and therefore no reduction in likelihood can occur.	Benefits outweigh cost/sacrifice.	Yes **C 8.1**
For drilling and completion fluids, chemical reviews are performed.	F: Yes. CS: Minimal cost. Standard practice.	Regular reviews will ensure chemicals selected for drilling and completions fluids remain ALARP.	Benefits outweigh cost/sacrifice.	Yes **C 7.2**
Bulk operational discharges conducted under MODU's Permit to Work (PTW) system (to operate discharge valves/pumps).	F: Yes. CS: Minimal cost. Standard practice.	The MODU's PTW may slightly reduce the volumes of bulk discharges occurring, but it is unlikely to be significant given that bulk discharges are often operationally required and cannot be eliminated.	Benefits outweigh cost/sacrifice.	Yes **C 7.6**
Displacement, brine, workover or intervention fluids contaminated with hydrocarbons will be treated prior to discharge or contained. If discharge specification not met the fluid will be returned to shore.	F: Yes. CS: Minimal cost. Standard practice.	Ensuring <1% oil content will provide a small reduction in consequence when fluids are discharged to the environment.	Benefits outweigh cost/sacrifice.	Yes **C 7.7**
During well unloading and completion activities, if produced water is not flared, it will be processed through the well test water treatment package prior to discharge to the environment.	F: Yes. CS: Minimal cost. Standard practice.	Reduced toxicity to the marine environment when discharged.	Benefits outweigh cost/sacrifice.	Yes **C 8.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Professional Judgement – Eliminate				
Do not use BOP/Xmas tree control fluids.	F: No. BOP and Xmas tree control fluids are critical to the operation of the BOP and Xmas trees. CS: Not considered, control not feasible.	Not considered, control not feasible.	Not considered, control not feasible.	No
Return bulk cement, barite and bentonite for onshore disposal	F: No. The technical requirements to be able to undertake this safely are unresolved due to: • significant risks with tank high pressure differentials to transfer material onshore • high risk with the vessel to waste truck transfer due to tank corrosion concerns and pressure relief valve issues. CS: Not considered. Control not feasible.	Not considered, control not feasible.	Not considered, control not feasible.	No
Options for use of excess bulk cement, bentonite and barite will be managed as per **Figure 6-1** and only discharged to the marine environment as a last option.	F: Yes. However, the cement may not meet the required technical specifications, and hence not be usable. CS: Minor.	Using excess bulk cement for subsequent wells would eliminate the bulk discharge of cement to the marine environment and eliminate the consequence of impacts from such activities.	Benefits outweigh cost/sacrifice	Yes **C 8.4**
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
ALARP Statement: On the basis of the environmental impact assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the impacts of cement, cementing fluids, subsea well fluids and unused bulk products. As no reasonable additional/alternative controls were identified that would further reduce the impacts without grossly disproportionate sacrifice, the impacts and risks are considered ALARP.				

Demonstration of Acceptability
Acceptability Criteria and Assessment
Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.1.13.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall impact significance levels for individual receptors are less than the significant impact level defined in the OPP. • EPOs and controls in the OPP that are relevant to routine and non-routine discharges of cement, cementing fluids, subsea well fluids, produced water and unused bulk product have been adopted. • There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that, given the adopted controls, cement, cementing fluids, subsea well fluids and unused bulk products discharges are unlikely to result in an impact greater than minor. Further opportunities to reduce the impacts have been investigated above. The adopted controls are considered good practice. The potential impacts are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the impacts of these discharges to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 1 Undertake Petroleum Activities Program in a manner that does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity results. **EPO 11** Undertake Petroleum Activities Program in a manner that does not result in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 12** Undertake Petroleum Activities Program in a manner that prevents a substantial adverse effect on a population of plankton including its life cycle and spatial distribution. **EPO 13** Undertake Petroleum Activities Program in a manner that will not	**C 8.1** Subsea control and cementing fluids and additives will have an environmental assessment completed prior to use.	**PS 7.1** All chemicals intended or likely to be discharge into the marine environment reduced to ALARP using the chemical assessment process.	**MC 7.1.1** Records demonstrate chemical selection, assessment and approval process for selected chemicals is followed.
	C 7.2 **See Section 6.6.7**	**PS 7.2** **See Section 6.6.7**	**MC 7.2.1** **See Section 6.6.7**
	C 7.6 **See Section 6.6.7**	**PS 7.6** **See Section 6.6.7**	**MC 8.2.1** **Section 6.6.7**
	C 7.7 **See Section 6.6.7**.	**PS 7.5** **See Section 6.6.7**	**MC 7.5.1** **See Section 6.6.7**
	C 8.4 During well unloading and completion activities, if produced water is not flared, it will be processed through the well test water filtration treatment package prior to discharge to the environment.	**PS 8.4** Produced water discharged to the marine environment achieves discharge specification of <30 ppm	**MC 8.4.1** Records demonstrate that formation water met discharge specification.
	C 8.5 Options for use of excess bulk cement, bentonite and barite will be managed as per **Figure 6-1** and only discharged to the marine environment as a last option.	**PS 8.5** No bulk cement, bentonite or barite discharged without documented ALARP assessment	**MC 8.5.1** Records demonstrate that, prior to discharge of excess bulk cement, bentonite or barite options for use were assessed.

modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in an area defined as a Key Ecological Feature. **EPO 14** Undertake Petroleum Activities Program in a manner that prevents substantial change in sediment quality, which may adversely impact biodiversity, ecological integrity, social amenity or human. **EPO 15** Undertake Petroleum Activities Program in a manner that prevents significant impacts on the values of the Exmouth Plateau KEF.			

6.7 Unplanned Activities (Accidents, Incidents, Emergency Situations)

6.7.1 Quantitative Spill Risk Assessment Methodology

6.7.1.1 Quantitative Hydrocarbon Spill Modelling

Quantitative hydrocarbon spill modelling was performed by RPS, on behalf of Woodside, using a three-dimensional hydrocarbon spill trajectory and weathering model, SIMAP (Spill Impact Mapping and Analysis Program). The model is designed to simulate the transport, spreading and weathering of specific hydrocarbon types under different environmental conditions (both meteorological and oceanographic). Near-field subsurface discharge modelling was performed using OILMAP, which predicts the droplet sizes that are generated by the turbulence of the discharge as well as the centreline velocity, buoyancy, width and trapping depth (if any) of the rising gas and oil plumes. The OILMAP output parameters were used as input into SIMAP.

The algorithms in the SIMAP model are based on the best available scientific knowledge and are updated when necessary in response to significant advances in knowledge. Recent improvements have been implemented to the entrainment algorithm, which have been adjusted to implement the findings of published data based on field research performed during the Macondo spill event in the Gulf of Mexico (Spaulding et al., 2017; Li et al., 2017; French McCay et al., 2018).

Stochastic modelling was conducted for this study, which compiled data from 200 hypothetical spills under different environmental conditions to determine the widest extent of possible oil dispersion. The environmental conditions for each of the hypothetical spills were selected randomly from an historic time-series of wind and current data representative of the study area. Results of the replicate simulations were then statistically analysed and mapped to define contours of percentage probability of contact at identified thresholds around the hydrocarbon release point. The simulations that show something unusual or unexpected make an important contribution to the overall outcomes and fate of the hydrocarbon.

The model simulates surface releases and uses the unique physical and chemical properties of a representative hydrocarbon type to calculate rates of evaporation and viscosity change, including the tendency to form oil-in-water emulsions. Moreover, the unique transport and dispersion of surface slicks and in-water components (entrained and dissolved) are modelled separately. Thus, the model can be used to understand the wider potential consequences of a spill, including direct contact of hydrocarbons due to surface slicks (floating hydrocarbon) and exposure of organisms to entrained and dissolved aromatic hydrocarbons in the water column. The model also calculates the accumulation of hydrocarbon mass that arrives on each section of shoreline over time, taking into account any mass that is lost to evaporation and/or subsequent removal by current and wind forces.

All hydrocarbons spill modelling assessments performed by RPS undergo initial sensitivity modelling to determine appropriate time to add to the simulation after the cessation of the spill. The amount of time following the spill is based on the time required for the modelled concentrations to practically drop below threshold concentrations anywhere in the model domain in the test cases.

6.7.1.2 Worst-case Scenario

In assessing the potential impacts of an unplanned hydrocarbon release, representative worst-case scenarios (in terms of volume and location) were assessed. A summary of the credible hydrocarbon spill scenarios that could occur during Scarborough drilling are provided in **Table 6-8**.

Table 6-8: Credible hydrocarbon spill scenarios

Scenario	Hydrocarbon type	Maximum credible volume	Location
Vessel collision resulting in rupture of a tank	MDO	250 m³	Within PAA
Loss of well integrity	Dry gas	No or negligible liquid hydrocarbon	Well locations
Loss of containment during bunkering	MDO	50 m³	MODU location

For the Petroleum Activities Program, the worst-case scenario was identified to be an instantaneous surface release of 250 m³ of MDO, representing loss of vessel fuel tank integrity following a collision. As the worst-case scenario, the following assessment of impacts will also address the potential impacts of other credible lesser releases.

6.7.1.3 Environment that May Be Affected and Hydrocarbon Contact Thresholds

The outputs of the quantitative hydrocarbon spill modelling are used to assess the environmental risk, if a credible hydrocarbon spill scenario occurred, by delineating which areas of the marine environment could be exposed to hydrocarbon levels exceeding hydrocarbon threshold concentrations. The summary of all the locations where hydrocarbon thresholds could be exceeded by any of the simulations modelled is defined as the 'environment that may be affected' (EMBA), which is driven by the worst-case credible hydrocarbon spill scenario, which, in this instance, is the loss of 250 m^2 in the event of a vessel collision resulting in a fuel tank rupture.

As the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean mechanism of transportation, the EMBA combines the potential spatial extent of the different fates.

The EMBA covers a larger area than the area that is likely to be affected during any single spill event, as the model was run for a variety of weather and metocean conditions. The EMBA therefore represents the total extent of all the locations where hydrocarbon thresholds could be exceeded from all modelling runs.

Surface and accumulated shoreline hydrocarbon concentrations are expressed as grams per square metre (g/m²), with entrained and dissolved aromatic hydrocarbon concentrations expressed as parts per billion (ppb). A conservative approach adopting accepted contact thresholds that are documented to impact the marine environment are used to define the EMBA. These hydrocarbon thresholds are presented in **Table 6-9** and described in the following subsections.

Woodside recognises that hydrocarbons may be present beyond the ecological impact EMBA at low concentrations that may be visible but are not expected to cause ecological impacts. The threshold for visible surface oil (1 g/m^2) has therefore been used to define an additional boundary within which socio-cultural impacts to the visual amenity of the marine environment may occur. This area is referred to as the socio-cultural EMBA. Any ecological impacts from dissolved and entrained hydrocarbons above prescribed thresholds, as in **Table 6-9**, may also result in socio-cultural impacts. Potential impacts to socio-cultural values assessed within these EMBAs include:

- protected areas
- national and Commonwealth Heritage Listed places
- tourism and recreation
- fisheries.

Table 6-9: Summary of environmental impact thresholds applied to the quantitative hydrocarbon spill risk modelling results

Hydrocarbon Type	EMBA				Socio-cultural EMBA
	Surface Hydrocarbon (g/m^2)	Entrained hydrocarbon (ppb)	Dissolved aromatic hydrocarbon (ppb)	Accumulated hydrocarbons (g/m^2)	Surface Hydrocarbon (g/m^2)
Diesel	10	100	50	100	1

6.7.1.4 Surface Hydrocarbon Threshold Concentrations

The spill modelling outputs defined the EMBA for surface hydrocarbons resulting from a spill (contact on surface waters) using a threshold of ≥10 g/m² for diesel. This threshold is used to define an area within which ecological impacts to the marine environment may occur from surface hydrocarbons. It represents the minimum oil thickness (0.01 mm) at which ecological impacts (e.g. to birds and marine mammals) are expected to occur.

Thresholds for registering biological impacts resulting from contact of surface slicks have been estimated by different researchers at about 10–25 g/m² (French et al., 1999; Koops et al., 2004; National Oceanic and Atmospheric Administration, 1996). Potential impacts of surface slick concentrations in this range for floating hydrocarbons may include harm to seabirds through ingestion from preening of contaminated feathers, or the loss of the thermal protection of their feathers. The 10 g/m² threshold is the reported level of oiling to instigate impacts to seabirds and is also applied to other wildlife, though it is recognised that 'unfurred' animals, where hydrocarbon adherence is less, may be less vulnerable. 'Oiling' at this threshold is taken to be of a magnitude that can cause a response from the most vulnerable wildlife such as seabirds. Due to weathering processes, surface hydrocarbons will have a lower toxicity due to change in their composition over time. Potential impacts to shoreline sensitive receptors may be markedly reduced in instances where there is extended duration until contact.

A surface threshold of 10 g/m² represents a 'dull metallic colour' (Bonn Agreement, 2015) (**Table 6-10**). A lower concentration of 1 g/m^2 is used to define an area within which social-cultural impacts to the visual amenity of the marine environment may occur. The surface threshold of ≥1 g/m² is based on the relationship between film thickness and appearance (Bonn Agreement oil appearance code, 2015), and represents a 'rainbow sheen' appearance. This threshold is considered below levels which would cause ecological impacts, and instead represents potential for visual amenity impacts. This threshold area is referred to as the 'socio-cultural EMBA'.

Table 6-10: The Bonn Agreement oil appearance code

Appearance (following Bonn visibility descriptors)	Mass per area (g/m²)	Thickness (µm)	Volume per area (L/km^2)
Discontinuous true oil colours	50 to 200	50 to 200	50,000 to 200,000
Dull metallic colours	5 to 50	5 to 50	5000 to 50,000
Rainbow sheen	0.30 to 5.00	0.30 to 5.00	300 to 5000
Silver sheen	0.04 to 0.30	0.04 to 0.30	40 to 300

6.7.1.5 Accumulated Hydrocarbon Threshold Concentrations

Owens and Sergy (1994) define accumulated hydrocarbon <100 g/m² to have an appearance of a stain on shorelines. French-McCay (2009) defines accumulated hydrocarbons ≥100 g/m² to be the threshold that could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat. A threshold of ≥100 g/m² has been adopted as the threshold for shoreline accumulation and has been included in the EMBA. Further, any ecological impacts at the shoreline accumulation threshold may also result in socio-cultural impacts.

6.7.1.6 Dissolved Aromatic Hydrocarbon Threshold Concentrations

Dissolved hydrocarbons present a narcotic effect resulting from uptake into the tissues of marine organisms. This effect is additive, increasing with exposure concentration or with time of exposure (French-McCay, 2002; NRC, 2005). The dissolved aromatic threshold of 50 ppb has been selected as a medium level threshold to approximate the potential toxic effects, particularly sublethal effects to sensitive species, as consistent with the NOPSEMA Oil Spill Modelling Guidance Bulletin (NOPSEMA, 2019).

6.7.1.7 Entrained Hydrocarbon Threshold Concentrations

This threshold is used to define an area within which ecological impacts to the marine environment may occur from entrained hydrocarbons. Therefore, it may also be associated with socio-cultural impacts.

Entrained hydrocarbons present a number of possible mechanisms for toxic exposure to marine organisms. The entrained hydrocarbon droplets may contain soluble compounds, hence have the potential for generating elevated concentrations of dissolved aromatic hydrocarbons (e.g. if mixed by breaking waves against a shoreline). Physical and chemical effects of the entrained hydrocarbon droplets have also been demonstrated through direct contact with organisms; for example, through physical coating of gills and body surfaces, and accidental ingestion (National Research Council, 2005).

The entrained threshold has been selected to be consistent with the NOPSEMA Oil Spill Modelling Guidance Bulletin (NOPSEMA, 2019). An entrained threshold of 100 ppb is considered to be appropriate given the oil characteristics for informing potential impacts to receptors.

6.7.1.8 Scientific Monitoring

A planning area for scientific monitoring is also described in Section 5.6 of the Oil Spill Preparedness and Response Mitigation Assessment (**Appendix D**). This planning area has been set with reference to the low exposure entrained value of 10 ppb detailed in NOPSEMA Bulletin #1 Oil Spill Modelling (2019).

A scientific monitoring program would be activated following a Level 2 or 3 unplanned hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. This would consider receptors at risk (ecological and socio-economic) for the entire predicted EMBA and in particular, any identified Pre-emptive Baseline Areas (PBAs) for the worst-case credible spill scenario(s) or other identified unplanned hydrocarbon releases associated with the operational activities.

6.7.2 Unplanned Hydrocarbon Release: Vessel Collision

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.2.6 (Unplanned Hydrocarbon Release)		
Context		
Relevant Activities Vessel Operations – **Section 3.10.2** MODU Operations – **Section 3.10.1**	**Existing Environment** Physical Environment – **Section 4.2** Habitats and Biological Communities – **Section 4.5** Protected Species – **Section 4.6** Protected Places – **Section 4.8** Socio-economic Environment – **Section 4.9**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Loss of hydrocarbons to marine environment due to a vessel collision (e.g. project vessels or other marine users)			X		X	X	X	A	D	1	M	LCS GP PJ	Broadly Acceptable	EPO 16

Description of Source of Impact/Risk

Background

The temporary presence of the MODU and project vessels in the PAA will result in a navigational hazard for commercial shipping within the immediate area (as discussed in **Section 6.6.4**). This navigational hazard could result in a third party vessel colliding with the MODU or a project vessel which could release hydrocarbons.

A MODU will have a total marine diesel capacity of approximately 966 to 1400 m³ (up to 3640 m³ for DP MODU), that is distributed through a number of isolated tanks. MODU fuel tanks are located in the MODU pontoons, typically located on the inner sides of pontoons and can be over 10 m below the waterline.

A typical project vessel (e.g. an installation or subsea support vessel) is likely to have multiple isolated marine diesel tanks distributed throughout the hull of the vessel. The marine diesel storage capacity of a support vessel can be in the order of 1000 m³ (total) that is distributed through multiple isolated tanks typically located mid-ships and can range in typical size from 22 to 105 m³. Subsea installation vessels can have fuel tank sizes ranging from 111m³ – 247m³.

In the unlikely event of a vessel collision involving a project vessel during the Petroleum Activities Program, the vessel will have the capability to pump marine diesel from a ruptured tank to a tank with spare volume in order to reduce the potential volume of fuel released to the environment. A volume of 250 m³ of MDO is considered an appropriate worst-case for a single fuel tank, based on existing facilities.

Industry Experience

Registered vessels or foreign flag vessels in Australian waters are required to report events to the Australian Transport Safety Bureau (ATSB), AMSA or Australian Search and Rescue (AusSAR).

From a review of the ATSB marine safety and investigation reports, one vessel collision occurred in 2011/12 that resulted in a spill of 25–30 L of oil into the marine environment as a result of a collision between a tug and support vessel off Barrow Island. Two other vessel collisions occurred in 2010, one in the port of Dampier, where a support vessel collided with a barge being towed. Minor damage was reported and no significant injury to personnel or pollution occurred. The second 2010 vessel collision involved a vessel under pilot control in port connecting with a vessel alongside a wharf, causing it to sink. No reported pollution resulted from the sunken vessel. These incidents demonstrate the likelihood of only minor volumes of hydrocarbons being released during the highly unlikely event of a vessel collision.

From 2010 to 2011, the ATSB's annual publication defines the individual safety action factors identified in marine accidents and incidents: 42% related to navigation action (2011). Of those, 15% related to poor communication and 42% related to poor monitoring, checking and documentation (ATSB, 2011). The majority of these related to the grounding instances.

Credible Scenario

For a vessel collision to result in the worst-case scenario of a hydrocarbon spill potentially impacting an environmental receptor, several factors must align as follows:

- The identified causes of vessel interaction must result in a collision.
- The collision must have enough force to penetrate the vessel hull.
- The collision must be in the exact location of the fuel tank.
- The fuel tank must be full, or at least of volume which is higher than the point of penetration.

The environmental risk analysis and evaluation identified and assessed a range of potential scenarios that could result in a loss of vessel structural integrity, resulting in damage to fuel storage tank(s) and a loss of marine diesel to the marine environment (**Table 6-11**). The scenarios considered damage to single and multiple fuel storage tanks in a project vessel and MODU due to dropped objects and various combinations of vessel to vessel and vessel to MODU collisions. In summary:

- It is not a credible scenario that the total storage volume of the MODU would be lost, as fuel is stored in more than one tank.
- It is not a credible scenario that a storage tank on the MODU would be damaged due to the location of the tanks within the hull, behind the bilge tanks, below the waterline.
- It is not a credible scenario that a collision between the support vessel and MODU would damage any storage tanks, due to the location of the tanks on both vessel types and secondary containment.
- It is highly unlikely that the full volume of the largest storage tank on a support vessel would be lost.

The last scenario considered was a collision between the support vessel or installation vessel with a third-party vessel (i.e. commercial shipping, other petroleum related vessels and commercial fishing vessels). This was assessed as being credible but highly unlikely, given the standard vessel operations and equipment in place to prevent collision at sea, the standby role of a support vessel (low vessel speed) and its operation in close proximity to the MODU (exclusion areas), and the construction and placement of storage tanks. Potential spill volumes for these scenarios are summarised in the **Table 6-11.**

Given the offshore location of the PAA, vessel grounding is not considered a credible risk.

Table 6-11: Summary of credible hydrocarbon spill scenario as a result of vessel collision

Scenario	Hydrocarbon Volumes	Preventative and Mitigation Controls	Credibility
Breach of MODU fuel tanks due to vessel collision.	MODU has a fuel oil storage capacity of about 966 to 1400 m^3 (up to 3640 m^3 for DP MODU), distributed through multiple tanks.	Fuel tanks are located on the inside of pontoons and protected by location below water line, protection from other tanks, e.g. bilge tanks. The draught of vessel and location of tanks in terms of water line prevent the tanks from being breached.	Not credible Due to location of tanks.
Breach of support vessel fuel tanks due to collision with MODU.	Activity support vessel has multiple marine diesel tanks typically ranging between 22 to 105 m^3 each.	Typically, double wall tanks that are located mid ship (not bow or stern). Slow support vessel speeds when in proximity to MODU.	Not credible Collision with MODU at slow speeds is highly unlikely and, if it did occur, is highly unlikely to result in a breach of support vessel (low energy contact from slow moving vessel).

Breach of installation vessel fuel tanks due to collision with third-party vessel, including commercial shipping and fishing.	Largest volume of a single tank is likely to be <250 m^3.	Tank locations midship (not bow or stern).	Credible Installation vessel – third-party vessel collision could potentially result in the release from a fuel tank.
Breach of project support vessel fuel tanks due to support vessel – other vessel collision including commercial shipping/fisheries.	Activity support vessel has multiple marine diesel tanks typically ranging between 22 to 105 m^3 each.	Typically, double wall tanks that are located midship (not bow or stern). Vessels are not anchored and steam at low speeds when relocating within the PAA or providing stand-by cover. Normal maritime procedures would apply during such vessel movements.	Credible Activity support vessel – other vessel collision could potentially result in the release from a fuel tank.

Quantitative Hydrocarbon Risk Assessment

To inform the impact assessment, quantitative hydrocarbon spill modelling was undertaken for the worst-case hydrocarbon release scenario (RPS, 2019). It is not practicable for spill modelling to be undertaken at every potential spill location within the PAA. The release location was selected by considering locations that would:

- have the greatest potential environmental consequence to the receiving environment (closest to sensitive receptors)
- be considered at greater risk of a spill event.

Accordingly, existing modelling for a spill of MDO within WA-61-L at the approximate location of the proposed FPU (the installation and operation of the FPU is outside the scope of this Activity). The FPU location is considered conservative, as it is located closer to shoreline receptors than the wells. The coordinates of the location are detailed in **Table 6-12**.

Table 6-12: Spill release locations for 250 m^3 MDO spill

Location	Coordinates
Location of the FPU	19° 55'33.60" S 113° 14' 31.20"E

Hydrocarbon Characteristics

MDO is a non-persistent fuel oil and contains a small proportion of heavy components (or low volatile components) that tend to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves but may re-float to the surface if these conditions abate. In the event of a substantial spill, the heavier components can remain entrained or remain on the sea surface for an extended period. The characteristics of the marine diesel are given in **Table 6-13**.

When spilt into the warm tropical and subtropical marine environment expected, MDO spreads rapidly and forms a very thin slick, with most of the volatile components typically evaporating in less than a day. Approximately 41% by mass of this oil is predicted to evaporate over the first couple of days depending on the prevailing wind conditions, with further evaporation slowing over time. The heavier (low volatility) components of the oil tend to entrain into the upper water column due to wind-generated waves, but can subsequently resurface depending on conditions (RPS, 2019).

RPS conducted weathering simulations to illustrate the potential behaviour of MDO when exposed at the water's surface under constant (5 knots) and variable wind conditions (**Figure 6-2** and **Figure 6-3**). Variable wind conditions generate greater entrainment of the hydrocarbon in the water column. Approximately 24 hours after the spill, around 45% of the oil mass is forecast to have entrained and a further 36% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%). The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves (approximately >6 m/s).

Variable wind does result in a higher percentage of biological and photochemical degradation, with an approximate rate of 1.8% per day. Whereas the constant wind scenario shows ~50% of the oil evaporates within 36 hours with negligible entrainment, but with a rate of only ~0.2% degradation per day.

Table 6-13: Characteristics of the marine diesel

Hydrocarbon type	Initial density (g/cm³) at 25 ºC	Viscosity (cP @ 25 ºC)	Component BP (ºC)	Volatiles %<180	Semi volatiles % 180–265	Low volatility (%) 265-380	Residual (%) >380
				Non-Persistent			Persistent
Marine diesel	0.829	4.0	% of total	6	34.6	54.4	5

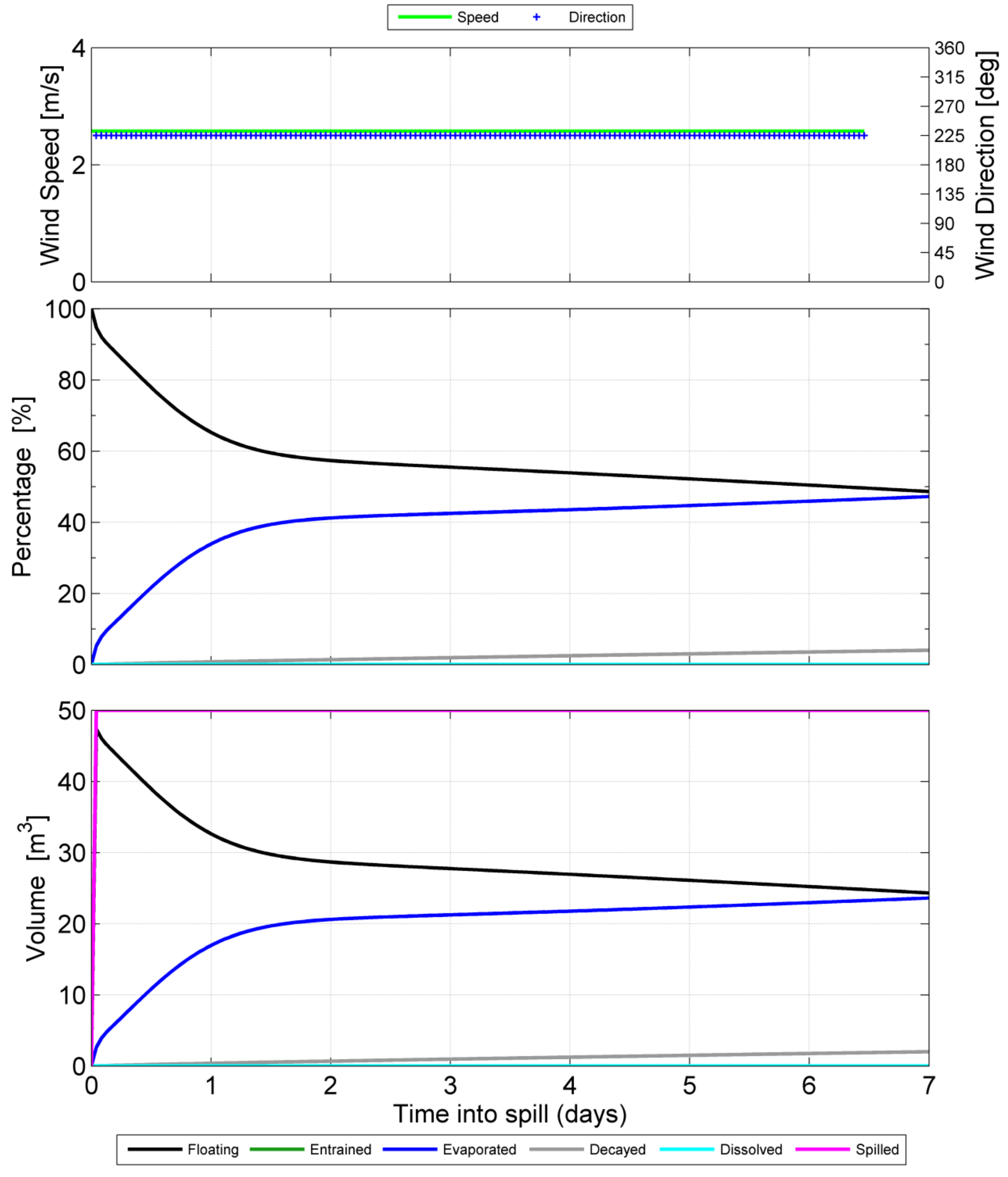


Figure 6-2: Mass balance plot representing, as proportion (middle panel) and volume (bottom panel), the weathering of marine diesel spilled onto the water surface as a one-off release (50 m^3 over one hour) and subject to a constant 5 kn (2.6 m/s) wind at 27 °C water temperature and 25 °C air temperature.

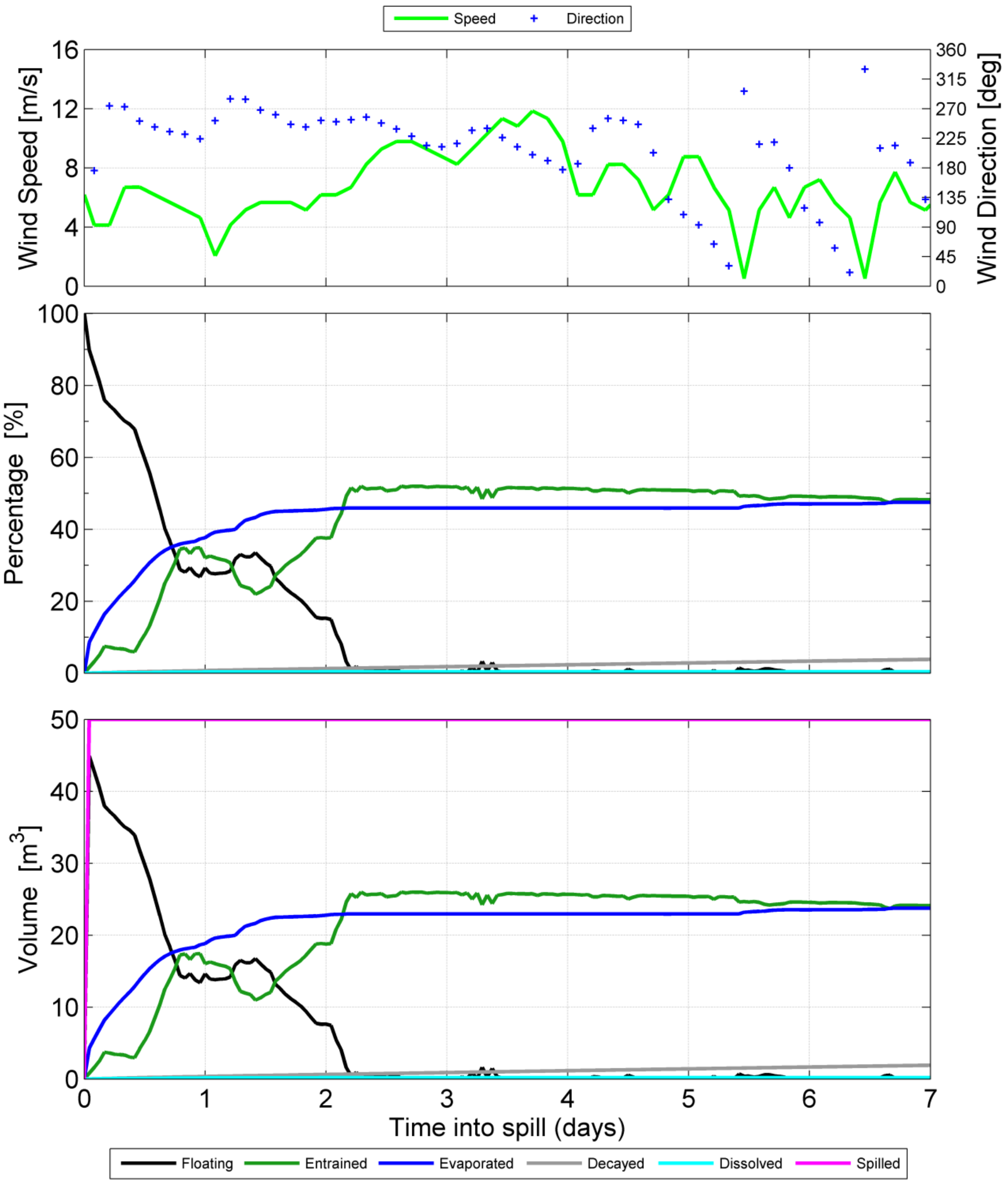


Figure 6-3: Proportional mass balance plot representing weathering of a surface spill of marine diesel as a one-off release (50 m^3 over 1 hour) and subject to variable wind at 27 °C water temperature and 25 °C air temperature (RPS, 2019)

Detailed Impact Assessment

Assessment of Potential Impacts

Environment that May Be Affected

Surface Hydrocarbons: If this scenario occurred, a surface hydrocarbon slick would form down-current of the release location, with the trajectory dependent on prevailing wind and current conditions at the time. The modelling indicates that the EMBA would be confined to open water, with surface hydrocarbons extending up to about 52 km from the release location at or above the 10 g/m² impact threshold. No contact with sensitive receptor locations is predicted.

A socio-cultural EMBA for surface hydrocarbons which includes the threshold for visible surface hydrocarbons of 1 g/m² may extend up to about 58 km from the release site.

Entrained Hydrocarbons: Quantitative hydrocarbon spill modelling results are shown in **Table 6-14**. If this vessel collision scenario occurred, a plume of entrained hydrocarbons would form down-current of the release location, with the trajectory dependent on prevailing current conditions at the time. The modelling indicates that locations exposed to entrained hydrocarbons at or above the threshold concentration of 100 ppb are restricted to offshore areas up to about 236 km from the release site. The only receptor predicted to be contacted by entrained oil concentrations at the 100 ppb threshold was Gascoyne Marine Park (**Table 6-14**). The maximum entrained oil concentration forecast for Gascoyne Marine Park was 998 ppb.

Dissolved Hydrocarbons: Dissolved aromatic hydrocarbons at concentrations equal to or greater than the 50 ppb threshold are predicted to be found up to 145 km from the spill site. No contact with sensitive receptor locations is predicted.

Accumulated Hydrocarbons: Accumulated hydrocarbons above threshold concentrations (≥100 g/m²) were not predicted by the modelling to occur at any location.

Water Quality

The highly-mixed, open water location and characteristics of hydrocarbons released will result in rapid evaporation and dispersion. However, MDO contains a small proportion of heavy components (or low-volatile components) that tend to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves but may resurface if these conditions abate. If a substantial spill occurred, the heavier components could remain entrained or remain on the sea surface for an extended period and travel significant distances from the source, albeit at low concentrations.

The hydrocarbon characteristics of MDO mean that in variable wind conditions, it is expected that approximately 24 hours after the spill, around 45% of the oil mass is forecast to have entrained and a further 36% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%) (RPS, 2019).

Given the control measures in place to prevent unplanned hydrocarbon releases, and the offshore location of Scarborough and hydrocarbon characteristics, the change to water quality resulting from unplanned hydrocarbon releases will be temporary and habitat or ecosystem function or integrity will not be impacted.

Based on the detailed risk evaluation, the magnitude of potential impact of a change in water quality from unplanned release of MDO is assessed as slight. Receptor sensitivity of water quality is low (low value, open ocean), and therefore the consequence of a release of hydrocarbons on water quality is Negligible (F).

Plankton

Injury/mortality to planktonic species may occur due to a change in water quality following an unplanned hydrocarbon release.

Primary production by plankton (supported by sporadic upwelling events in the offshore waters of the NWS) is an important component of the primary marine food web. Planktonic communities are generally mixed, including phytoplankton (cyanobacteria and other microalgae) and secondary consuming zooplankton, such as crustaceans (e.g. copepods), and the eggs and larvae of fish and invertebrates (meroplankton).

Exposure to hydrocarbons in the water column (entrained or dissolved) can change species composition, with declines or increases in one or more species or taxonomic groups (Batten et al., 1998). Phytoplankton may also experience decreased rates of photosynthesis (Tomajka, 1985). For zooplankton, such as fish, coral and invertebrate eggs and larvae, direct effects of contamination may include toxicity, suffocation, changes in behaviour, or environmental changes that make them more susceptible to predation. Impacts on plankton communities are likely to occur in areas where entrained or dissolved aromatic hydrocarbon threshold concentrations are exceeded, but communities are expected to recover relatively quickly (within weeks or months). This is due to high population turnover, with copious production within short generation times that also buffers the potential for long-term (i.e. years) population declines (International Tanker Owners Pollution Federation, 2011a).

When first released, MDO has a higher toxicity due to the presence of the volatile components. Plankton making contact close to the spill source at the time of the spill may be impacted, however, due to low planktonic productivity within the NWMR it is unlikely that large populations of plankton will be affected at the sea surface above thresholds as this is only predicted for the first few days after the spill.

Given hydrocarbon characteristics, expected rapid weathering and then degradation of the entrained component to below impact thresholds, and relatively quick recovery times of plankton, unplanned releases from Scarborough are not expected to have a substantial adverse effect on plankton life cycle and spatial distribution.

There are no Management Plans, Recovery Plans or Conservation Advice related to plankton.

Based on the detailed risk evaluation, the magnitude of potential impact to plankton from unplanned release of MDO is assessed as slight. Receptor sensitivity of plankton is low (low value, open water), and therefore the consequence of a release of hydrocarbons on plankton is Negligible (F).

Fish

Injury/mortality to fish species may occur due to a change in water quality following an unplanned hydrocarbon release. Any surface and subsurface hydrocarbon release could impact fish, as they are widely dispersed throughout the water column.

Impacts to sharks and rays may occur through direct contact with hydrocarbons and contaminate the tissues and internal organs, either through direct contact or via the food chain (consumption of prey). As gill breathing organisms, sharks and rays may be vulnerable to toxic effects of dissolved hydrocarbons (entering the body via the gills) and entrained hydrocarbons (coating of the gills inhibiting gas exchange). In the offshore environment, it is probable that pelagic shark species are able to detect and avoid hydrocarbons by swimming into deeper water or away from the affected areas.

Fish mortalities are rarely observed to occur as a result of hydrocarbon spills (International Tanker Owners Pollution Federation, 2011b). This has generally been attributed to the possibility that pelagic fish are able to detect and avoid surface waters underneath hydrocarbon spills by swimming into deeper water or away from the affected areas. Fish that have been exposed to dissolved aromatic hydrocarbons are capable of eliminating the toxicants once placed in clean water; hence, individuals exposed to a spill are likely to recover (King et al., 1996). Where fish mortalities have been recorded, the spills (resulting from the groundings of the tankers Amoco Cadiz in 1978 and the Florida in 1969) have occurred in sheltered bays.

Laboratory studies have shown that adult fish can detect hydrocarbons in water at very low concentrations, and large numbers of dead fish have rarely been reported after hydrocarbon spills (Hjermann et al., 2007). This suggests that juvenile and adult fish can avoid water contaminated with high concentrations of hydrocarbons.

The effects of exposure to oil on the metabolism of fish appear to vary according to the organs involved, exposure concentrations and route of exposure (waterborne or food intake). Oil reduces the aerobic capacity of fish exposed to aromatics in the water, and to a lesser extent affects fish consuming contaminated food (Cohen et al., 2005). The liver, a major detoxification organ, appears to be where anaerobic activity is most impacted, probably increasing anaerobic activity to help eliminate ingested oil from the fish (Cohen et al., 2005).

Fish are perhaps most susceptible to the effects of spilled oil in their early life stages, particularly during egg and planktonic larval stages, which can become entrained in spilled oil. Contact with oil droplets can mechanically damage feeding and breathing apparatus of embryos and larvae (Fodrie and Heck, 2011). The toxic hydrocarbons in water can result in genetic damage, physical deformities and altered developmental timing for larvae and eggs exposed to even low concentrations over prolonged timeframes (days to weeks) (Fodrie and Heck, 2011). More subtle, chronic effects on the life history of fish because of exposure in early life stages to hydrocarbons include disruption to complex behaviour such as predator avoidance, reproductive and social behaviour (Hjermann et al., 2007). Prolonged exposure of eggs and larvae to weathered concentrations of hydrocarbons in water has also been shown to cause immunosuppression and allows expression of viral diseases (Hjermann et al., 2007).

Adult fish exposed to low hydrocarbon concentrations are likely to metabolise the hydrocarbons and excrete the derivatives, with studies showing that fish can metabolise petroleum hydrocarbons and that accumulated hydrocarbons are released from tissues when the fish is returned to hydrocarbon-free sea water. Several fish communities in these areas are demersal (i.e. living closer to the seabed) where concentrations of entrained hydrocarbons will be lower; any impacts are expected to be highly localised.

Marine fauna with gill-based respiratory systems are expected to have higher sensitivity to exposures of entrained contaminants. Therefore, the receptors most susceptible to dissolved hydrocarbons are fish and whale sharks. Whale sharks are not expected to be present in the EMBA given its offshore location (based on Protected Matters Search results). MDO does not tend to have a high proportion that dissolves – all three release locations predict low probabilities and low concentration to intersect with sensitive receptors.

When first released, MDO has a higher toxicity due to the presence of the volatile components. Individual fish making contact close to the spill source at the time of the spill may be impacted. Fish presence is generally concentrated in waters closer to shore. Although fish presence may occur throughout the entire PAA and defined EMBA, it is unlikely that a large number of fish will be affected at the sea surface above thresholds, as this is only <1-15% remaining on the surface after 7 days. Mobile transient fauna is not expected to remain within entrained hydrocarbon plumes for an extended time. Therefore, no acute impacts or risks associated with entrained exposures from an unplanned MDO release are expected. Any impacts from this exposure are expected to result in localised short-term effects to limited small numbers of juvenile fish and prey species (larvae and planktonic organisms), which are not expected to affect population viability and recruitment of fish. Consequently, diverse fish assemblages are not expected to be significantly impacted.

Although potential impacts could include mortality or sub-lethal injury/illness of pelagic fish, this would be expected to comprise a small proportion of the resident and transitory population. Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds and degradation of entrained fractions, and the mobile transient nature of fish, unplanned releases of MDO are not expected to have a substantial adverse effect on the population or spatial distribution of fish; or substantially modify, destroy or isolate an area of important habitat for migratory species. Additionally, unplanned releases will not seriously disrupt the lifecycle of an ecologically significant proportion of any migratory fish species.

There are specific conservation advices for some fish species which identify habitat degradation/modification as a key threat. While for some species there are specific requirements (e.g. sawfish), no specific requirements have been identified for relevant species (i.e. species identified as having potential to occur in the EMBA).

Based on the detailed risk evaluation, the magnitude of potential impacts to fish from unplanned hydrocarbon releases is assessed as slight. Receptor sensitivity of fish is high (high value fauna), and therefore the consequence of a release of hydrocarbons on fish is Minor (D).

Marine Mammals

A change in marine fauna behaviour or injury/mortality to marine mammals may occur due to a change in water quality after an unplanned hydrocarbon release.

Air-breathing fauna such as marine mammals are most at risk from surface exposures due to the high volatile components. Marine mammals that have direct physical contact with surface, entrained or dissolved aromatic hydrocarbons may suffer surface fouling, ingest hydrocarbons and inhale toxic vapours. This may result in the irritation of sensitive membranes such as the eyes, mouth, digestive and respiratory tracts and organs, impairment of the immune system or neurological damage (Helm et al., 2015). If prey (fish and plankton) are contaminated, this can result in the absorption of toxic components of the hydrocarbons (PAHs).

In a review of cetacean observations in relation to a number of large-scale hydrocarbon spills, Geraci (1988) found little evidence of mortality associated with hydrocarbon spills. However, behavioural disturbance (i.e. avoiding spilled hydrocarbons) was observed in some instances for several species of cetaceans. This suggests that cetaceans are able to detect and avoid surface slicks. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may disrupt behaviours such as migration, or displace individuals from important habitat, such as foraging, resting or breeding.

When first released, MDO has a higher toxicity due to the presence of the volatile components. Individual cetaceans making contact close to the spill source at the time of the spill may be impacted. Cetacean presence is generally more concentrated in waters closer to shore with the exception of false killer whales. Although cetacean presence may occur throughout the PAA and defined EMBA, it is unlikely that a large number of cetaceans will be affected at the sea surface above thresholds, as dependant on wind conditions, weathering predicts that only <1 - 15% of hydrocarbon remains on the surface after about seven days (RPS, 2019d).

Although potential impacts could include mortality or sub-lethal injury/illness of marine mammals, this would be expected to comprise a small proportion of the resident and transitory population. Given hydrocarbon characteristics, expected rapid weathering of surface oil to below impact thresholds, and the mobile transient nature of marine mammals and potential avoidance behaviour, unplanned releases of MDO are not expected to have a substantial adverse effect on the population or spatial distribution of marine mammals; or substantially modify, destroy or isolate an area of important habitat for migratory species. Additionally, unplanned releases will not seriously disrupt the lifecycle of an ecologically significant proportion of any migratory species.

There are specific conservation advices for some species which identify noise interference and vessel disturbance as key threats. While hydrocarbon spills are not explicitly identified as a threat, the sei whale conservation advice does include the management of physical disturbance and development activities. No explicit management actions are identified relevant to hydrocarbon spills.

Potential impacts are unlikely to lead to mortality or sub-lethal injury/illness of an EPBC-listed protected species. Based on the detailed risk evaluation, the magnitude of potential impacts to marine mammals (focused on changes in behaviour) from unplanned MDO releases is assessed as slight. Receptor sensitivity of marine mammals is high (high value fauna), and therefore the consequence of a release of hydrocarbons on marine mammals is Minor (D).

Marine Reptiles

A change in marine fauna behaviour or injury/mortality to marine reptiles may occur due to a change in water or sediment quality following an unplanned hydrocarbon release.

Marine reptiles can be impacted by surface exposure when they surface to breathe, and by shoreline accumulation of hydrocarbons when breeding and nesting.

Hydrocarbons in surface waters may impact turtles when they surface to breathe and inhale toxic vapours. Their breathing pattern, involving large ‘tidal’ volumes and rapid inhalation before diving, results in direct exposure to petroleum vapours which are the most toxic component of the hydrocarbon spill (Milton and Lutz, 2003). This can lead to lung damage and congestion, interstitial emphysema, inhalant pneumonia and neurological impairment (National Oceanic and Atmospheric Administration, 2010). Contact with entrained hydrocarbons can result in hydrocarbon adherence to body surfaces, irritating mucous membranes in the nose, throat and eyes, leading to inflammation and infection (Gagnon and Rawson, 2010).

Adult sea turtles exhibit no avoidance behaviour when they encounter hydrocarbon spills (National Oceanic and Atmospheric Administration, 2010). Oiling can also irritate and injure skin, which is most evident on pliable areas such as the neck and flippers (Lutcavage et al., 1995). A stress response associated with this exposure pathway includes an increase in the production of white blood cells, and even a short exposure to hydrocarbons may affect the functioning of their salt gland (Lutcavage et al., 1995).

When first released, MDO has a higher toxicity due to the presence of the volatile components. Individual turtles making contact close to the spill source at the time of the spill may be impacted. Turtle presence is generally more concentrated in waters closer to shore, with infrequent presence of turtles as far offshore as the PAA. Although turtle presence may occur throughout the PAA and defined EMBA, it is unlikely that a large number of turtles will be affected at the sea surface above thresholds, as weathering predicts that only <1 to 15% of hydrocarbon remains on the surface after about seven days (RPS, 2019d).

With no shoreline exposure, there is negligible potential for impacts to turtle nesting beaches.

Impacts to sea snakes from direct contact with hydrocarbons are likely to result in similar physical effects to those recorded for marine turtles.

Potential impacts are unlikely to lead to mortality or sub-lethal injury/illness of an EPBC-listed protected species. Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds, and the mobile transient nature of individuals, an unplanned release from a vessel collision is not expected to substantially modify, destroy or isolate an area of important habitat for migratory species. It is not expected that unplanned releases will have a substantial adverse effect on the population, or spatial distribution of marine reptiles; or seriously disrupt the lifecycle of an ecologically significant proportion of any migratory species.

Impacts to turtles from unplanned hydrocarbon releases are to be managed in accordance with the Recovery Plan for marine turtles in Australia (Commonwealth of Australia, 2017). The Recovery Plan identifies ensuring spill risk strategies and response programs include management for turtles and their habitats. In addition, there is in place approved Conservation Advice for the short-nosed sea snake (DSEWPaC, 2011), which includes ensuring there is no anthropogenic disturbance in areas where the species occurs, excluding necessary actions to manage the conservation of the species.

Based on the detailed risk evaluation, the magnitude of potential impacts to marine reptiles from unplanned hydrocarbon releases is assessed as no lasting effects (from change in fauna behaviour) and slight (from injury/mortality to fauna). Receptor sensitivity of marine reptiles is high (high value fauna), and therefore the overall consequence of a release of hydrocarbons on marine reptiles is Minor (D).

Seabirds and Migratory Shorebirds

A change in marine fauna behaviour or injury/mortality to seabirds and migratory shorebirds may occur due to a change in water or sediment quality following an unplanned hydrocarbon release.

Seabirds and migratory birds are particularly vulnerable to contact with floating hydrocarbons, which may mat feathers. This may lead to hypothermia from loss of insulation and ingestion of hydrocarbons when preening to remove hydrocarbons. Both impacts may result in mortality (Hassan and Javed, 2011). Pathways of biological exposure that can result in impact may occur through ingesting contaminated fish (nearshore waters) or invertebrates (intertidal foraging grounds such as beaches, mudflats and reefs). Ingestion can also lead to internal injury to sensitive membranes and organs (International Petroleum Industry Environmental Conservation Association, 2004). Whether the toxicity of ingested hydrocarbons is lethal or sub-lethal will depend on the weathering stage and its inherent toxicity. Exposure to hydrocarbons may have longer term effects, with impacts to population numbers due to decline in reproductive performance and malformed eggs and chicks, affecting survivorship and losing adult birds.

When first released, MDO has a higher toxicity due to the presence of the volatile components. Individual birds making contact close to the spill source at the time of the spill may be impacted. Bird presence within the NWMR is more concentrated in waters closer to shore with the potential for individual migratory birds within the PAA. Although bird presence may occur throughout the PAA and defined EMBA, it is unlikely that a large number of birds will be affected at the sea surface above thresholds as this is only predicted for the first five days.

No shoreline contact is predicted, therefore there is negligible likelihood of impact to significant nesting and / or roosting sites.

Although potential impacts could include mortality or sub-lethal injury/illness of birds, this would be expected to comprise a small proportion of the resident and transitory population. Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds, and the mobile transient nature of individuals, an unplanned release from a vessel collision is not is not expected to substantially modify, destroy or isolate an area of important habitat for migratory species.

There are specific conservation advices for some species which identify habitat degradation as the key threat, but generally no explicit management actions are identified relating to hydrocarbon spills.

Based on the detailed risk evaluation, the magnitude of potential impact to seabirds and migratory shorebirds from unplanned hydrocarbon releases is assessed as having no lasting effects (from change in fauna behaviour) and slight (from injury/mortality to fauna). Receptor sensitivity of seabirds and migratory shorebirds is high (high value fauna), and therefore the overall consequence of a release of hydrocarbons on seabirds and migratory shorebirds is Minor (D).

Key Ecological Features

A change in habitat may occur due to a change in water or sediment quality that could impact KEFs.

The PAA intersects with the Exmouth Plateau KEF; and a further two KEFs have the potential to intersect with an unplanned release of hydrocarbons. The values and sensitivities of these KEFs relate to seafloor features, and demersal fish species (i.e. that live close to the seafloor). Therefore, water depth can determine whether any in-water hydrocarbons can potentially interact with these values and sensitivities.

As MDO typically remains in the top ~20 m of the water column and rapidly weathers, there is no potential for in-water hydrocarbons to intersect with the seafloor and demersal values.

- Exmouth Plateau KEF: intersects the PAA. Values and sensitivities are related to seafloor features. Receptors on the seafloor are not expected to be impacted by a surface release of hydrocarbons, given the water depths in the PAA (~930 m). However, these seafloor features may promote enhanced upwelling; potential impacts to plankton and fish are discussed above.
- Continental Slope Demersal Fish Communities KEF: intersects the EMBA (132 km south of the PAA). The KEF represents high levels of endemism of demersal fish species. Considering the minimum water depths of this KEF are 220–500 m and 750–1000 m, impacts to demersal fish are unlikely to occur. However, the values of the KEF may support higher order consumers, such as pelagic fish and shark species, impacts to which are discussed above.
- Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF: intersects the EMBA (116 km south-east of the PAA). The seafloor features of this KEF may promote enhanced upwelling and associated productivity, which is assessed above.

Given the weathering characteristics of MDO, exposure would be restricted to surface (including the upper water column); no interaction with benthic habitats in deep water areas is predicted. As such, there is unlikely to be adverse impact on marine ecosystem functioning or integrity.

Based on the assessment, the magnitude of a potential impact to KEFs associated with a release of hydrocarbons is no lasting effect. Receptor sensitivity of KEFs is high (high value), and therefore the consequence of a release of hydrocarbons on KEFs is slight (E).

AMP's

Spill modelling predicts that the Gascoyne AMP may be contacted by entrained hydrocarbons above the 100 ppb ecological impact threshold with a probability of 4%. The Gascoyne AMP contains marine fauna and biological communities, which are considered to be of important environmental value that the AMP is intended to protect. The values of the AMP have been evaluated in the sections above and it is determined that a spill is unlikely to result in significant impacts based on the nature of the spilled hydrocarbons.

Based on the assessment, the magnitude of a potential impact to the Gascoyne AMP associated with a release of hydrocarbons is slight. Receptor sensitivity of the AMP is high (high value), and therefore the consequence of a release of hydrocarbons on the AMP is Minor (D).

Commonwealth and State Managed Fisheries

A change in marine fauna behaviour or injury or mortality to marine fauna – in particular to commercially targeted species, or their prey species (e.g. plankton) – can impact fisheries.

Fish exposure to hydrocarbon can result in 'tainting' of their tissues. Even very low levels of hydrocarbons can impart a taint or 'off' flavour or smell in seafood. Tainting is reversible through the process of depuration which removes hydrocarbons from tissues by metabolic processes, although it depends on the magnitude of the contamination. Fish have a high capacity to metabolise these hydrocarbons while crustaceans (such as prawns) have a reduced ability (Yender et al., 2002). Seafood safety is a major concern associated with spill incidents. Therefore, actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (Yender et al., 2002).

A major spill could result in the establishment of an exclusion zone around the spill affected area. There would be a temporary prohibition on fishing activities for a period and subsequent potential for economic impacts to affected commercial fishing operators. Additionally, hydrocarbon can foul fishing equipment such as traps and trawl nets, requiring cleaning or replacement.

MDO presence in the water would be restricted to the surface and upper water column only. Dissolved aromatics (i.e. the form that is bioavailable) are in such small concentrations in MDO that their effect in the marine environment is negligible; i.e. tainting from an MDO exposure is not considered likely to occur. Any exclusion zone established would be limited to the immediate vicinity of the release point, and due to the rapid weathering of MDO would only be in place days after release, therefore physical displacement to vessels is unlikely to be a significant impact.

While the PAA and EMBA overlap with a number of fishery management areas for commonwealth and state managed fisheries, Woodside considers there to be no potential for interaction given the current distribution of fishing effort for all fisheries identified is concentrated outside the PAA and EMBA. No significant impact from an MDO spill is therefore predicted.

Although potential impacts could include mortality or sub-lethal injury/illness of pelagic fish (described in the specific receptor evaluation), this would be expected to comprise a small proportion of the resident and transitory population. Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds, and the offshore location of the PAA and lack of fishing effort, an unplanned hydrocarbon spill from the Petroleum Activities Program is not expected to have an adverse effect on the sustainability of commercial fishing; or to interfere with other marine users.

Based on the detailed risk evaluation, the magnitude of potential impacts to Commonwealth and State managed fisheries from an unplanned hydrocarbon releases is assessed as having no lasting effect. Receptor sensitivity of commonwealth and state managed fisheries is high (high value marine user), and therefore the consequence of a release of hydrocarbons on commonwealth and state managed fisheries is Slight (E).

Shipping

In the event of a spill, an exclusion zone may be established around the spill affected area. This could result in exclusion of other users such as shipping vessels or vessels used by the mining and petroleum industries. Any exclusion zone established would be limited to the immediate vicinity of the release point, and due to the rapid weathering of MDO would only be in place for days after release, therefore physical displacement to vessels is unlikely to be a significant impact.

Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds, short duration of displacement, and the offshore location of the PAA, unplanned releases of MDO are not expected to interfere with shipping to a greater extent than necessary.

Based on the assessment, the magnitude of a potential impact to shipping associated with an unplanned release of hydrocarbons is slight. Receptor sensitivity of shipping is medium (medium value user), and therefore the consequence of a release of hydrocarbons on shipping is Slight (E).

Industry

The proposed Equus Development Project is located about 70 km east of the PAA. No other facilities are located within the EMBA. In the event of a major spill, an exclusion zone may be established around the spill affected area. This could result in exclusion of other users such as vessels used by the mining and petroleum industries.

Any exclusion zone established would be limited to the immediate vicinity of the release point, and due to the rapid weathering of MDO would only be in place days after release, therefore physical displacement to vessels is unlikely to be a significant impact.

Given hydrocarbon characteristics, expected rapid weathering to below impact thresholds, and the offshore location of the PAA and distance to relevant industries, unplanned releases from Scarborough are not expected to interfere with other marine users than a greater extent than necessary.

Based on the assessment, the magnitude of a potential impact to industry associated with an unplanned release of hydrocarbons is slight. Receptor sensitivity of industry is medium (medium value user), and therefore the consequence of a release of hydrocarbons on industry is Slight (E).

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Risk Consequence	Likelihood	Risk Rating
Water quality	Change in water quality	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Plankton	Injury/ mortality to fauna	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Fish	Change in fauna behaviour	High value species	Minor (D)	Highly Unlikely	Moderate
	Injury/mortality to fauna	High value species	Minor (D)	Highly Unlikely	Moderate
Marine mammals	Change in fauna behaviour	High value species	Minor (D)	Highly Unlikely	Moderate

	Injury/mortality to fauna	High value species	Minor (D)	Highly Unlikely	Moderate
Marine reptiles	Change in fauna behaviour	High value species	Slight (E)	Highly Unlikely	Low
	Injury/ mortality to fauna	High value species	Minor (D)	Highly Unlikely	Moderate
Seabirds and migratory shorebirds	Change in fauna behaviour	High value species	Slight (E)	Highly Unlikely	Low
	Injury/mortality to fauna	High value species	Minor (D)	Highly Unlikely	Moderate
AMP's	Change in habitat	High value habitat	Minor (D)	Highly Unlikely	Moderate
KEFs	Change in habitat	High value habitat	Slight (E)	Highly Unlikely	Low
Commonwealth and State managed fisheries	Changes to the functions, interests or activities of other users	High value marine user	Slight (E)	Highly Unlikely	Low
Shipping	Changes to the functions, interests or activities of other users	Medium value users	Slight (E)	Highly Unlikely	Low
Industry	Changes to the functions, interests or activities of other users	Medium value	Slight (E)	Highly Unlikely	Low
Overall Risk Consequence/Risk Rating: The overall risk rating for an unplanned hydrocarbon release resulting from a vessel collision is Moderate based on a Minor consequence, to the high value receptors (marine fauna, AMPs and KEFs), and a highly unlikely likelihood. The risk consequence/risk rating for individual receptors are consistent with the levels rated in the OPP.					

Table 6-14: Key receptor locations and sensitivities potentially contacted above impact thresholds by the vessel collision scenario with summary hydrocarbon spill contact (table cell values correspond to probability of contact [%])

Environmental setting	Location / name	Environmental, Social, Cultural, Heritage and Economic Aspects presented as per the Environmental Risk Definitions (Woodside's Risk Management Procedure (WM0000PG10055394))																													Probability of hydrocarbon contact (diesel) (%) Note: the probability is based on stochastic modelling of 200 hypothetical worst-case spills under a variety of weather and metocean conditions					
		Physical		Biological																						Socio-economic and Cultural										
		Water Quality	Sediment Quality	Marine Primary Producers			Other Communities / Habitats								Protected Species									Other Species		Fisheries – commercia	Fisheries – traditional				Socio-cultural EMBA		EMBA			
		Open water – (pristine)	Marine Sediment – (pristine)	Coral reef	Seagrass beds / Macroalgae	Mangroves	Spawning/nursery areas	Open water – Productivity/upwelling	Non biogenic coral reefs	Offshore filter feeders and/or Deepwater benthic communities	Nearshore filter feeders	Sandy shores	Estuaries / tributaries / creeks / lagoons (including mudflats)	Rocky shores	Cetaceans – migratory whales	Cetaceans – dolphins and porpoises	Dugongs	Pinnipeds (sea lions and fur seals)	Marine turtles	Sea snakes	Whale sharks	Sharks and rays	Sea birds and/or migratory shorebirds	Pelagic fish populations	Resident /Demersal Fish			Tourism and Recreation	Protected Areas / Heritage – European and Indigenous / Shipwrecks	Offshore Oil and Gas Infrastructure (topside and subsea)	Surface hydrocarbon (1–10 g/m²)	Accumulated hydrocarbons (10–100 g/m²)	Surface hydrocarbon (≥10 g/m²)	Entrained hydrocarbon (≥100 ppb)	Dissolved aromatic hydrocarbon (≥50 ppb)	Accumulated hydrocarbons (>100 g/m²)
Offshore	Gascoyne AMP	✓	✓												✓	✓			✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	-	-	-	4	-	-

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 30 (Prevention of Collisions) 2016, including: • adherence to steering and sailing rules including maintaining look-outs (e.g. visual, hearing, radar etc.), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar) • adherence to navigation light display requirements, including visibility, light position/shape appropriate to activity • adherence to navigation noise signals as required.	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of interference with other marine users resulting in a collision.	Controls based on legislative requirements – must be adopted.	Yes **C 8.1**
Marine Order 21 (Safety and emergency arrangements) 2016, including: • adherence to minimum safe manning levels	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of interference with other marine users resulting in a collision.	Controls based on legislative requirements – must be adopted.	Yes **C 8.2**
Establishment of a 500 m petroleum safety zone around MODU and installation vessel and communicated to marine users.	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of a collision with a third-party vessel.	Controls based on legislative requirements – must be adopted.	Yes **C 4.2**
Arrangements supporting the activities in the OPEP (per Table 7-4) will be tested to ensure the OPEP can be implemented as planned.	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirement based on vessel class. Unlikely to have a significant reduction in consequence.	Controls based on legislative requirements – must be adopted.	Yes **C 8.3**
Marine Order 27 (safety of navigation and radio equipment) 2016: • maintenance of navigation equipment in efficient working order (compass/radar) • navigational system and equipment required are those specified in Regulation 19 of Chapter V of Safety of Life at Sea	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of interference with other marine users resulting in a collision.	Controls based on legislative requirements – must be adopted.	Yes **C 8.4**

• Automatic Identification System that provides other users with information about the vessel's identity, type, position, course, speed, navigational status and other safety-related data.				
Good Practice				
Support vessel on standby as required during drilling activities to assist in third-party vessel interactions. When a support vessel is designated for standby it will undertake actions to prevent unplanned interactions, such as: • maintain a 24-hour radio watch on designated radio channel(s) • undertake continuous surveillance and warn the MODU/ installation vessel of any approaching vessels reaching 500 m petroleum safety zone. Surveillance shall be conducted by a combination of: – visual lookout – radar watch – other electronic systems available including Automatic Identification System (AIS) – monitoring any additional/ agreed radio communications channels – all other means available. • While complying with the International Regulations for Preventing Collisions at Sea (COLREGS), approach any vessel attempting to transit through the 500 m zone and contact vessel by all available means. • Monitor and advise the MODU if:	F: Yes. CS: Minimal cost – support vessels available routinely in PAA during Petroleum Activities Program. Standard practice.	Given the legislative controls in place, use of a support vessel, as defined in the One Marine Charterers Instructions, will provide a small reduction in likelihood of a collision with a third-party vessel.	Benefits outweigh cost/sacrifice.	Yes **C 8.5**

– MODU navigation signals are defective. – visibility becomes restricted. • Any buoys in the area are not holding position or are not working as expected.				
Notify Australian Hydrographic Service (AHS) of activities and movements will be notified no less than four working weeks prior to scheduled activity commencement date.	F: Yes. CS: Minimal cost. Standard practice.	Notification of AHS will enable them to update maritime charts thereby reducing the likelihood of a collision with a third-party vessel.	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 4.2**
Notify AMSA JRCC of activities and movements of the activity 24 to 48 hours before operations commence.	F: Yes. CS: Minimal cost. Standard practice.	Communication of the Petroleum Activities Program to other marine users ensures they are informed and aware, thereby reducing the likelihood of a collision with a third-party vessel occurring	Benefits outweigh cost/sacrifice. Control is also Standard Practice.	Yes **C 4.5**
Mitigation: Oil spill response	Refer to **Appendix D.**			
Professional Judgement – Eliminate				
Eliminate use of vessels.	F: No. The use of vessels is required to conduct the Petroleum Activities Program. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
No additional controls identified.				
Risk Based Analysis				
A quantitative spill risk assessment was undertaken (see detail above).				
ALARP Statement: On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of an unplanned loss of hydrocarbon as a result of a vessel collision. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.				

Demonstration of Acceptability
Acceptability Criteria and Assessment
Demonstration of acceptability for the sources of risk and associated impacts assessed in this section are provided in Section 7.2.6.4 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall risk consequence/risk ratings for individual receptors are less than the significant impact level defined in the OPP. • EPOs and controls in the OPP that are relevant to an unplanned hydrocarbon release from a vessel collision have been adopted. • There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that an accidental hydrocarbon release as a result of a vessel collision represents a moderate current risk rating and is unlikely to result in a risk consequence greater than Minor. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice. The adopted controls are considered consistent with industry legislation, codes and standards, good practice and professional judgement and meet the requirements and expectations of Australian Marine Orders, AMSA and AHS identified during impact assessment and stakeholder consultation. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks and consequences of a loss of vessel structural integrity to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 16 No release of hydrocarbons to the marine environment due to a vessel collision associated with the Petroleum Activities Program.	**C 8.1** Marine Order 30 – Prevention of collisions – 2016, including: • adherence to steering and sailing rules including maintaining look-outs (e.g. visual, hearing, radar, etc), proceeding at safe speeds, assessing risk of collision and taking action to avoid collision (monitoring radar) • adherence to navigation light display requirements, including visibility, light position/shape appropriate to activity • adherence to navigation noise signals as required.	**PS 8.1** Support vessels, installation vessel and MODU compliant with Marine Orders 30 (Prevention of Collisions) 2016 (which requires vessels to be visible at all times) to prevent unplanned interaction with marine users.	**MC 8.1.1** Marine Assurance inspection records demonstrate compliance with standard maritime safety procedures (Marine Orders 21 and 30).
	C 8.2 Marine Orders 21 (Safety and emergency arrangements) 2016, including:	**PS 8.2** Support vessels, installation vessel and MODU compliant with Marine Orders Marine Orders 21 (Safety and emergency	

	• adherence to minimum safe manning levels	arrangements) 2016 to prevent unplanned interaction with marine users.	
	C 4.2 **See Section** 6.6.4	**PS 4.2** **See Section 6.6.4**	**MC 4.2.1** See Section **6.6.4**
			MC 4.2.2 **See Section 6.6.4**
	C 8.3 Arrangements supporting the activities in the OPEP (per **Table 7-4**) will be tested to ensure the OPEP can be implemented as planned.	**PS 8.3.1** Exercises/tests will be conducted in alignment with the frequency identified in Table 7-7.	**MC 8.3.1** Testing of arrangement records confirm that emergency response capability has been maintained.
		PS 8.3.2 Testing of arrangement records confirm that emergency response capability has been maintained.	**MC 8.3.2** Emergency Management dashboard confirms that minimum level of personnel trained for core OPEP roles are available.
	C 8.4 Marine Order 27 (safety of navigation and radio equipment) 2016: • maintenance of navigation equipment in efficient working order (compass/radar) • navigational system and equipment required are those specified in Regulation 19 of Chapter V of Safety of Life at Sea Automatic Identification System that provides other users with information about the vessel's identity, type, position, course, speed, navigational status and other safety-related data.	**PS 8.4.1** Support vessels, installation vessel and MODU compliant with Marine Orders Marine Orders 27 (Safety of navigation and radio equipment) 2016 to prevent unplanned interaction with marine users.	**MC 8.4.2** Marine Assurance inspection records demonstrate compliance with standard maritime safety procedures (Marine Orders 27).
	C 8.5 Support vessel on standby as required during drilling activities to assist in third-party vessel interactions. When a support vessel is designated for standby it will undertake actions to prevent unplanned interactions, such as: • Maintain a 24-hour radio watch on designated radio channel(s)	**PS 8.5** Define role of support vessels in maintaining petroleum safety zone, preventing unplanned third-party vessel interactions, monitoring the effectiveness of navigation controls (e.g. signals), and warning third-party vessels of navigation hazards.	**MC 8.5.1** Records of non-conformance against controls maintained.

	• Perform continuous surveillance and warn the MODU/ installation vessel of any approaching vessels reaching 500 m petroleum safety zone. Surveillance shall be conducted by a combination of: – visual lookout – radar watch – other electronic systems available including Automatic Identification System (AIS) – monitoring any additional/agreed radio communications channels – all other means available. • While complying with the International Regulations for Preventing Collisions at Sea (COLREGS), approach any vessel attempting to transit through the 500 m zone and contact vessel by all available means. • Monitor and advise the MODU if: – MODU navigation signals are defective – visibility becomes restricted. • Advise if any buoys in the area are not holding position or are not working as expected.		
	C 4.3 **See Section 6.6.4**	**PS 4.3** **See Section 6.6.4**	**MC 4.3.1** **See Section 6.6.4**
	C 4.5 **See Section 6.6.4**	**PS 4.5** **See Section**	**MC 4.5.1** **See Section 6.6.4**
	Detailed preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are presented in **Appendix D**.		

6.7.3 Unplanned Hydrocarbon Release: Loss of Well Control

Scarborough OPP – Relevant Impact Assessment Section		
Section 7.2.6 (Unplanned Hydrocarbon Release)		
Context		
Relevant Activities Drilling Activities – **Section 3.7** Contingency Activities – **Section 3.11**	**Existing Environment** Physical Environment – **Section 4.2** Habitats and Biological Communities – **Section 4.5** Protected Species – **Section 4.6** Protected Places – **Section 4.8** Socio-economic Environment – **Section 4.9**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Unplanned loss of hydrocarbons during drilling operations			X					A	F	1	L	LCS GP PJ	Broadly acceptable	EPO 17

Description of Source of Impact/Risk

Loss of hydrocarbons to marine environment during drilling

A blowout is an incident where hydrocarbons from the formation flow out of the well or between formation layers after all the predefined technical well barriers (e.g. the BOP) or activation of the same have failed.

Shallow hazards

Shallow hazards (small pockets of subsurface gas not contained in the reservoir) may be present around well locations. Current well locations have been planned to avoid any potential shallow hazard zones, however there is a risk that the as-drilled geology is different to that which is expected. In the unlikely event that shallow hazards are unintentionally intersected whilst drilling, gas may evolve to the seabed. This could manifest as bubbles in the water column however would be unlikely to reach the sea surface given water depth, and would not reach the rig, having no conduit.

Likelihood Assessment

Woodside has a good history of implementing industry standard practice in well design and construction. In the Company's 60-year history, it has not experienced any well integrity events that have resulted in significant releases or significant environmental impacts.

The spill likelihood was evaluated using Blowout and Well release Frequencies based on SINTEF offshore blowout database 2012 (Scandpower, 2013). This uses data from 1991-2010 to determine likelihood for well blowouts and releases. For a gas well, the SINTEF calculated probability of blowout during drilling and completion is 2.93 X 10^{-4}.

Operation	Frequency, average well	Frequency, Gas well	Frequency Oil well
Development drilling, deep (normal wells)	2.24 E-05	1.33E-05	3.34 E-05
Completion	1.85 E-04	2.83 E-04	8.72E-05
Total Per well	2.07 E-04	2.93 E-04	1.26 E-04

The SINTEF data supports a likelihood of 'Highly Unlikely' for a well blowout with potential to result in a spill as the dataset does not account for Woodside and Industry Process Safety Improvements post the Gulf of Mexico Macondo event and is therefore likely to be conservative. The SINTEF data set is January 1991 – December 2010, whilst the Macondo blowout occurred in April 2010. Significant strengthening of barriers is now in place post the data set period, including, but not limited to:

- Revised and more stringent API 53 Subsea BOP requirements in force.
- Competency assessments of offshore personnel is now more stringent for both Woodside and drilling contractors, for example through implementation of improvements to well control training as recommended by IOGP and requirements for Woodside personnel in safety critical roles to complete the Process Safety Management training requirements.
- Revision to Woodside barrier installation and verification process, including acceptance criteria and change control management.

The Scarborough Field is well appraised with a comprehensive set of measured reservoir pressure data from exploration and appraisal wells. The likelihood of encountering significant overpressure in the overburden section is minimised through in-field drilling experiences and pre-drill geohazard evaluations including seismic surveys and multiple in-field well data. This is believed another area of conservatism in the SINTEF likelihood data when applied to Scarborough.

When considering likelihood from an 'Experience' perspective a ranking of 'Has occurred many times in the industry' is considered too high when assessing the worst credible event of blowout with no pipe in hole, and no significant bridging or flow restriction through the BOP or other means. This is supported by SINTEF data, showing that none of the 17 blowouts analysed were open hole with no pipe in hole, whilst 28% had an annulus 'full flow' but the flow area is unknown (though it is unlikely to be as large as the open hole, no pipe in hole case).

Drilling Timeframe

Drilling is scheduled to occur throughout the year (all seasons) to provide operational flexibility for requirements and schedule changes and vessel/MODU availability.

Credible Scenario – Loss of Well Control

The Petroleum Activities Program consists of the drilling of up to ten development wells (two of which are contingency). A loss of well control could result in a loss of containment at any of these wells. A key difference between Scarborough and many other offshore developments is that the reservoirs contain no or only trace liquid hydrocarbons. Given that hydrocarbons of the Scarborough reservoir contain no measurable liquid fraction, in the event of a loss of containment there is expected to be no or negligible liquid component. This means there is no credible hydrocarbon spill scenario in the event of well blowout and as such, quantitative spill modelling has not been undertaken.

A loss of well control may escalate to major accident events. An ignited gas release could cause large scale fire and explosions topsides with significant equipment damage. This equipment damage may cause unplanned release of topsides chemical and hydrocarbon inventory, and potentially escalate to impact floating stability. In an extreme case, the MODU may founder, capsize and sink.

Detailed Impact Assessment

Assessment of Potential Impacts

Change in Water Quality

A loss of well control may temporarily decrease the water quality in the immediate vicinity of the release.

The Scarborough reservoir properties are dry gas, primarily methane (approximately 95%) and nitrogen (approximately 4%), with some ethane, CO_2 content and limited heavier hydrocarbon components. Understanding of the Scarborough gas composition was supported by information collected from reservoir samples and well tests obtained from the Scarborough-4 and Scarborough-5 appraisal wells, and compositional analysis undertaken in 2018 and 2019. Analysis of worst case (“heaviest”) reservoir composition indicates that no liquid hydrocarbons will exist at any pressure or temperature conditions that will be experienced in the environment. Liquid hydrocarbons are only expected at sub-zero temperatures which are not present in the marine environment at the location.

In the event of a loss of well control, the well will release gas at a worst-case discharge rate of 1.666 BSCFD/day of dry gas over 67 days. Hydrocarbons will be released from the well until one of the following interventions can be made:

- BOP intervention using ROV and hot stab;
- Capping stack; or
- a relief well is drilled with successful well kill.

In the event of a release of gaseous hydrocarbons from a loss of well control, the pressurised discharge will emit a jet of small gas bubbles with high momentum into the water column. The initial momentum of the jet would rapidly dissipate, and following the initial jet phase as the bubbles expand due to pressure reduction their buoyancy becomes the driving force for an upward plume of gas bubbles and entrained water.

As the gas travels upwards through the water column, dissolution will occur. Methane is moderately soluble in seawater, more so under higher pressure and colder temperature. Because of the deep water location, the majority of methane potentially released at seabed is expected to dissolve in the water column rather than reaching the surface.

The dissolved methane would biodegrade into non hydrocarbon products. Any gaseous methane would continue to rise to the sea surface and be transported away by surface winds.

Given the control measures in place to prevent a loss of well control event, and the offshore location of Scarborough and gas characteristics, the change to water quality resulting from unplanned hydrocarbon releases will be temporary and there is no pathway for impacts to habitat or ecosystem function or integrity.

Based on the risk evaluation, the magnitude of potential impact of a change in water quality from a loss of well control is assessed as slight. Receptor sensitivity of water quality is low (low value, open ocean), and therefore the consequence of a release of hydrocarbons on water quality is Negligible (F).

Benthic communities and Sediment Quality

Seabed disturbance would result in the event of the MODU sinking. The potential area that would be affected can conservatively be defined as MODU footprint plus 100 m in all directions, approximately 0.037 km^2. The benthic habitats and communities in the PAA are considered to be of low sensitivity and reflective of the wider NWMR. The physical disturbance to the seabed resulting from sinking of the MODU would be localised.

The MODU could act as a source of environmental contaminants due to material onboard the MODU (e.g. chemical / hydrocarbon inventories, corrosion of structural materials, debris etc.). The potential for contamination would diminish over time as the structure degrades. Depending on the nature of the loss of structural integrity, complete or partial salvage of the MODU may not be feasible. Any structures not able to be recovered would be left on the seabed indefinitely.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity Level	Risk Consequence	Likelihood	Risk Rating
Water quality	Change in water quality	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Sediment Quality	Change in sediment quality	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Epifauna and Infauna	Injury/ mortality to fauna	Low value	Negligible (F)	Highly Unlikely	Low
KEFs	Change in habitat	High value habitat	Minor (D)	Highly Unlikely	Moderate

Overall Risk Consequence: The risk rating for an unplanned discharge from a loss of well control is Moderate based on a minor consequence to a high value receptor (KEF) and a highly unlikely likelihood. The risk consequence/risk rating for individual receptors are consistent with the levels rated in the OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011: accepted WOMP, which describes the well design and barriers to be used to prevent a loss of well control.	F: Yes. CS: Minimal cost. Standard practice.	Compliance with an accepted WOMP will ensure a number of barriers are in place and verified, reducing the likelihood of loss of well control occurring. Although the consequence of a blowout would not be reduced, the reduction in likelihood reduces the overall risk.	Benefits outweigh cost/sacrifice.	Yes **C 9.1**
As-built checks that shall be completed during well operations to establish a minimum acceptable standard of well integrity is achieved.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of occurrence. No reduction in consequence will occur.	Benefits outweigh cost/sacrifice.	Yes **C 2.3**
Implement requirements for permanent well abandonment: • well barrier as per the internal Woodside Standard and Procedure • placement, length, material and verification of a permanent barrier.	F: Yes. CS: Minimal cost. Standard practice.	This procedure will reduce the likelihood of a spill occurring from a suspended well. Although changes in consequence would occur, the reduction in likelihood results in a reduction in overall risk.	Benefits outweigh cost/sacrifice.	Yes **C 9.2**
An approved Source Control Emergency Response Plan (SCERP) shall exist prior to drilling each well, including feasibility and any specific considerations for relief well kill.	F: Yes. CS: Minimal cost. Standard practice.	The SCERP will describe the responses to a loss of well control including ROV intervention on BOP, use of capping stack to contain well, and the relief well. All of these responses are aimed at reducing the duration of the gas release, resulting in a reduction in consequence and overall risk.	Benefits outweigh cost/sacrifice.	Yes **C 9.3**
Good Practice				
Subsea BOP installed and tested	F: Yes	Testing of the BOP will reduce the likelihood of a blowout	Benefits outweigh cost/sacrifice	Yes **C 9.4**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
during drilling operations.	CS: Standard practice. Required by Woodside standards.	resulting in release of hydrocarbons to the marine environment. In the event of a blowout, this control would not reduce the consequence, although the likelihood reduction reduces the overall risk ranking.		
Project-specific mooring design analysis.	F: Yes. CS: Standard practice. Required by Woodside standards.	Ensure adequate MODU station holding capacity to prevent loss of station. This will reduce the likelihood of a blowout resulting in release of hydrocarbons to the marine environment.	Benefits outweigh cost/sacrifice.	Yes **C 5.3**
Professional Judgement – Eliminate				
Do not drill well.	F: No. CS: Inability to produce hydrocarbons. Loss of the project.	All risk would be eliminated.	Disproportionate. Given the extremely low likelihood of a loss of well control due to the systematic implementation of Woodside's policies, standards, procedures and processes relating to drilling activities, the cost/sacrifice outweighs the benefit gained.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
Implement slimmer well design to reduce blowout volumes.	F: No. Slim well design is not considered feasible based on the following factors: • The well design is optimised to minimise the size of hole drilled while still being able to reach the targets and meet development objectives safely.	Not considered – control not feasible.	Not considered – control not feasible.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	CS: Not considered – control not feasible.			

ALARP Statement:

On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of an unlikely unplanned hydrocarbon release as a result of a loss of well control.

Woodside has completed further analysis of options for other activities with loss of well control events. The cost of applying this analysis to this Petroleum Activities Program is seen as grossly disproportionate because the event is risk rated as highly unlikley likelihood and moderate consequence.

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in **Section 7.2.6.4** of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (Section 2.3.5):

- Overall risk consequence/risk ratings for individual receptors are less than the significant impact level defined in the OPP.
- EPOs and controls in the OPP that are relevant to a loss of well control have been adopted.
- There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that an accidental hydrocarbon release resulting from a loss of well control represents a moderate current risk rating and is unlikely to result in a risk consequence greater than minor. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice. The adopted controls are considered consistent with industry legislation, codes and standards, and industry good practice. Further opportunities to reduce the impacts have been investigated above.

The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks and consequences of a loss of well control to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
EPO 17 No loss of well control resulting in loss of hydrocarbons to the marine environment during Petroleum Activities Program	**C 9.1** Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011: accepted Well Operations Management Plan (WOMP), which describes the well design and barriers to be used to	**PS 9.1** Wells drilled in compliance with the accepted WOMP, including implementation of barriers to prevent a loss of well control.	**MC 9.1.1** Acceptance letter from NOPSEMA demonstrates the WOMP and application to drill were accepted by NOPSEMA prior to the drilling activity commencing.
			MC 9.1.2 Records demonstrate minimum of two verified barriers (a single fluid

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	prevent a loss of well control, which include: • Blowout preventer (BOP) installation during drilling operations • Regular testing of BOP		barrier may be implemented during the initial stages of well construction if appropriateness is confirmed by a shallow hazard study) were in place for all permeable zones penetrated by the wellbore.
			MC 2.3.3 Records demonstrate composition and weight of drilling fluids were applicable to down hole conditions.
	C 2.3 **See Section 6.6.2**	**PS 2.3.1** **See Section 6.6.2**	**MC 2.3.1** **See Section 6.6.2**
			MC 2.3.2 **See Section 6.6.2**
	C 9.2 Implement requirements for permanent well abandonment: • well barrier as per the internal Woodside Standard and Procedure • placement, length, material and verification of a permanent barrier	**PS 9.2** Woodside abandons the wells according to internal Woodside Procedure.	**MC 9.2.1** Records demonstrate Well Acceptance Criteria have been met
	C 9.3 An approved SCERP shall exist prior to drilling each well, including feasibility and any specific considerations for relief well kill.	**PS 9.3** SCERP is in place to ensure feasibility of responding to a source control incident.	**MC 9.3** An approved Source Control Emergency Response Plan

Environmental Performance Outcomes, Standards and Measurement Criteria			
Outcomes	***Controls***	***Standards***	***Measurement Criteria***
	C 9.4 Subsea BOP installed and tested during drilling operations. The BOP shall include: • one annular preventer • two pipe rams (excluding the test rams) • a minimum of two sets of shear rams, one of which must be capable of sealing • deadman functionality • the capability of ROV intervention • independent power systems.	**PS 9.4** Subsea BOP specification, installation and testing compliant with internal Woodside Standards and international requirements (API Standard 53 5th Edition) as agreed by Woodside and MODU contractor.	**MC 9.4.1** Records demonstrate that BOP and BOP control system specifications and testing were in accordance with minimum standards for the expected drilling conditions as agreed by Woodside and MODU contractor.
	C 5.3 **See Section 6.6.5**	**PS 5.3** **See Section 6.6.5**	**MC 5.3.1** **See Section 6.6.5**

6.7.4 Unplanned Discharge: Chemicals and Hydrocarbons

Scarborough OPP – Relevant Impact Assessment Section		
OPP Section 7.2.1 Unplanned Discharge: Chemicals		
Context		
Relevant Activities Drilling Activities – **Section 3.7** Vessel Operations – **Section 3.10.2** MODU Operations – **Section 3.10.1** ROV Operations – **Section 3.10.4** Contingency Activities – **Section 3.11**	**Existing Environment** Marine Regional Characteristics – **Section 4.2**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Accidental discharge of hydrocarbons/ chemicals from MODU and project vessels deck activities and equipment, from subsea ROV hydraulic leaks			✓			✓		A	E	1	L	LCS GP PJ	Broadly Acceptable	EPO 18
Accidental discharge of drilling fluids (WBM/ NWBM/ base oil) and cement to marine environment due to failure of slip joint packers, bulk transfer hose/fitting, emergency disconnect system or from routine MODU operations			✓			✓								

Description of Source of Impact/Risk

Vessel, MODU and ROV Operations

Deck spills can result from spills from stored hydrocarbons/chemicals or equipment. Project vessels typically store hydrocarbon/chemicals in various volumes (20 L, 205 L; up to approximately 4000–6000 L). Storage areas are typically set up with effective primary and secondary bunding to contain any deck spills. Releases from equipment are predominantly from the failure of hydraulic hoses, which can either be located within bunded areas or outside of bunded or deck areas (e.g. over water on cranes). Helicopter refuelling may also take place within the PAA, on the helipad of the MODU and project vessels.

Chemicals that will be used and may be accidentally released include:

- non process chemicals (maintenance and cleaning chemicals)
- non process hydrocarbons - i.e. hydraulic fluids used in machinery (including cranes, winches, ROVs), small volumes of fuel
- drilling and well fluids.

Non-Process Chemicals

Non-process chemicals, such as wash chemicals, cleaning chemicals, maintenance and solvents, are generally held onboard in low quantities (typically <50 L containers) and are located within chemical cabinets or bunded storage areas on the vessels and MODU. Non-process chemical spills may result from human error or damage to a chemical container during handling. Spills are generally captured by the drain system and routed to a holding tank for treatment or disposal onshore. In the event that a spill is not contained on deck or within a bunded area, there would be a release to the marine environment of up to 50 L.

Non-Process Hydrocarbons

Woodside's operational experience demonstrates that spills are most likely to originate from hydraulic hoses and have been less than 100 L, with an average volume <10 L.

Non-process hydrocarbons (hydraulic fluids) are used in hydraulic-powered machinery, such as winches, cranes and ROVs, and are hydrocarbon-based with added chemical component additives. Unplanned discharges are predominantly due to failure of hydraulic hoses or minor leaks from process components, or spills during periodic refuelling of hydraulic hoses. Spills or leaks from hydraulic hoses are usually very small volumes (~1 L) and are typically contained within a bunded or drained area under the equipment mounted on deck. These small on-deck spills are unlikely to reach the marine environment. A burst hydraulic hose on an extended crane could potentially result in hydraulic fluid being sprayed in a fine jet out over the water. However, this would only result in a small volume (~25 L) being released, due to the small capacity of hydraulic hoses.

Subsea spills can result from a loss of containment of fluids from subsea equipment including the BOP or ROVs. A review of these spills to the marine environment in the past 12 months showed subsea spills did not exceed approximately 26 L in Woodside's Drilling function.

The ROV hydraulic fluid is supplied through hoses containing approximately 20 L of fluid. Hydraulic lines to the ROV arms and other tooling may become caught resulting in minor leaks to the marine environment. Small volume hydraulic leaks may occur from equipment operating via hydraulic controls subsea (subsea control fluid).

Hydraulic fluids are medium oils of light to moderate viscosity. They have a relatively rapid spreading rate and will dissipate quickly, particularly in high sea states. Lubricating oils may also be held onboard, typically stored with the non process chemicals and held in low quantities. These hydrocarbons are more viscous, so in the event of an unplanned discharge, the spreading rate of a slick of these oils would be slightly slower.

Drilling Fluids - Transfers

A project vessel will undertake bulk transfer of mud or base oil to the MODU, if and when required. Failure of a transfer hose or fittings during a transfer or backload, as a result of an integrity or fatigue issue, could result in a spill of mud or base oil to either the bunded deck or into the marine environment.

The most likely spill volume of mud is likely to be less than 0.2 m^3 based on the volume of the transfer hose and the immediate shutoff of the pumps by personnel involved in the bulk transfer process. However, the worst-case credible spill scenario could result in up to 8 m^3 of mud being discharged. This scenario represents a complete failure of the bulk transfer hose combined with a failure to follow procedures requiring transfer activities to be monitored, coupled with a failure to immediately shut off pumps (e.g. mud pumped through a failed transfer hose for a period of about five minutes).

Drilling Fluids - Slip Joint Packer Failure

The slip joint packer enables compensation for the dynamic movement of the MODU (heave) in relation to the static location of the BOP. A partial or total failure of the slip joint packer could result in a loss of mud to the marine environment. The likely causes of this failure include a loss of pressure in the pneumatic (primary) system combined with loss of pressure in the back up (hydraulic) system.

Catastrophic sequential failure of both slip joint packers (pneumatic and hydraulic) would trigger the alarm and result in a loss of the volume of fluid above the slip joint (conservatively 1.5 m^3) plus the volume of fluid lost in the one minute (maximum) taken to shut down the pumps. At a flow rate of 1000 gallons per minute this volume would equate to an additional 3.8 m^3. In total, it is expected that this catastrophic failure would result in a loss of 5.3 m^3.

Failure of either of the slip joint packers at a rate not large enough to trigger the alarms could result in an undetected loss of 20 bbl (3 m^3) maximum assuming a loss rate of 10 bbl/hr and that MODU personnel would likely walk past the moon pool at least every two hours.

Loss of a drilling chemical container or drum during transfer from the supply vessel to the MODU may occur due to crane operator error or machinery failure. The maximum container that could be lost is an intermediate Bulk Container (IBC) which can hold 1 m^3 of chemicals. In the event that an IBC or drum is lost to the marine environment and cannot be recovered the contents will discharge, either immediately or over a period depending on the damage to the drum or container.

NWBM Drilling Fluid System

The selection of a NWBM drilling fluid system (if required) will be based on Woodside processes; however, for the purposes of this risk assessment, an example base oil (Saraline 185V) has been used. Saraline 185V is a mixture of volatile to low volatility hydrocarbons. Predicted weathering of base oil, based on typical conditions in the region, indicates that about 50% by mass is predicted to evaporate over the first day or two (refer to **Table 6-15**). At this time, most of the remainder could be entrained into the water column. In calm conditions, entrained hydrocarbons are likely to resurface with up to 100% able to evaporate over time.

Table 6-15: Characteristics of the non water-based mud base oil

Oil type	Initial density (kg/m³)	Viscosity (cP @ 20 °C)	Volatiles (%) <180	Semi volatiles (%) 180–265	Low volatility (%) 265–380	Residual (%) >380	Aromatic (%) of whole oil <380 °C BP
			Non-Persistent		***Persistent***		
Base oil (Saraline 185V)	0.7760	2.0 @ 40 °C	8.5	41.1	50.4	0	0

All chemicals that may be released or discharged to the marine environment during the Petroleum Activities Program are assessed as per Woodside Chemical Selection and Assessment. This procedure is used to demonstrate that the potential impacts of the chemicals that may be released are acceptable and ALARP.

Cement

Bulk cement is transferred as powder from the supply vessel to the MODU prior to being mixed into a slurry in the cement unit. Additives are required to form a cement slurry; these are transferred to the MODU in drums from the supply vessel to the MODU. Unplanned discharge to the marine environment may occur due to crane operator error or machinery failure resulting in loss of a drum of cement additive, which cannot be recovered. Cement additives are typically stored in drums <100 litres.

Contingency Activities

Activation of the Emergency Disconnect Sequence

The EDS is an emergency system that provides a rapid means of shutting in the well (i.e. BOP closed) and disconnecting the MODU from the BOP. The EDS could be manually activated due to an identified threat to the safety of the MODU, including loss of MODU station keeping resulting from loss of multiple moorings, potential collision by a third-party vessel or a loss of well control. During operations, this could result in a subsurface release of a combination of WBM and/or NWBM and solids at the seabed and a release of base fluid. The volume of material released depends on the water depth and, hence, the length of the riser (i.e. the entire riser volume would be lost). The base oil of the NWBM would remain in an emulsion with the other components of the mud system. Approximately 103 m^3 of base oil could be released in the event of the riser being disconnected when drilling with NWBM.

Wireline Operations

Minor leaks during wireline activities with a live well are described to include leaks such as:

- leaks from the lubricator, stuffing box and hose or fitting failure, which are expected to be less than 10 L (0.01 m^3)
- loss of containment – fluids – surface holding tanks
- backloading of raw slop fluids in an IBC
- stuffing box leak/under pressure
- draining of lubricator contents
- excess grease/lubricant leaking from the grease injection head
- wind-blown lubricant dripping from cable/on deck
- lubricant used to lubricate hole.

Woodside's operational experience demonstrates that spills are most likely to originate from hydraulic hoses and have been less than 100 L, with an average volume less than 10 L.

Detailed Impact Assessment

Assessment of Potential Impacts

Water Quality

Change in Water Quality

Unplanned discharges of non-process chemicals and hydrocarbons may decrease the water quality in the immediate vicinity of the release. Only small volumes (<0.2 m³) are anticipated, resulting in very short-term impacts to water quality, and limited to the immediate release location.

The worst-case drilling fluid or cement unplanned discharge is 8 m³ which could occur during bulk transfer from the supply vessel to the MODU during drilling. These discharges would be to the sea surface and would rapidly dilute through mixing by surface currents and wave action.

Given the occasional nature of unplanned chemical discharge, the small volumes, and the offshore location of the PAA, the change to water quality resulting from unplanned discharge of chemicals will not be substantial.

Therefore the magnitude of any potential impact of a change in water quality is Slight. Receptor sensitivity of water quality is low (low value, open ocean), and therefore the consequence of a release of hydrocarbons/chemicals on water quality is Negligible (F).

Marine Fauna

Injury or Mortality to Marine Fauna

As a result of a change in water quality, further impacts to receptors may occur, which include injury or mortality to marine fauna resulting from exposure to toxins in the released chemicals/hydrocarbons. Given that surface discharges are rapidly dispersed, and subsea discharges (from ROVs) would be of very small volumes, potential impacts would be highly localised and temporary. The magnitude of potential impact to marine fauna is no lasting effect, which results in a consequence of Slight (E) based on the high receptor sensitivity.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Risk Consequence	Likelihood	Risk rating
Water quality	Change in water quality	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Migratory Shorebirds and Seabirds	Injury/mortality to fauna	High value species	Slight (E)	Highly Unlikely	Low
Fish		High value species	Slight (E)	Highly Unlikely	Low
Marine Mammals		High value species	Slight (E)	Highly Unlikely	Low
Marine Reptiles		High value species	Slight (E)	Highly Unlikely	Low

Overall Risk Consequence: The overall risk rating for unplanned discharge of chemicals is Low based on a Slight consequence, to a high value receptor (marine fauna), and a highly unlikely likelihood. The risk rating/risk consequence for individual receptors are consistent with the levels rated in the OPP.

Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*	*Benefit in Impact/Risk Reduction*	*Proportionality*	*Control Adopted*
Legislation, Codes and Standards				
Marine Order 91 (Marine pollution prevention – oil) 2014, requires SOPEP/SMPEP (as appropriate to vessel class).	F: Yes. CS: Minimal cost. Standard practice.	By ensuring a SOPEP/SMPEP is in place for the vessel, the likelihood of a spill entering the marine environment is reduced. Although no	Controls based on legislative requirements – must be adopted.	Yes **C 6.4**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
		significant reduction in consequence could result, the overall risk is reduced.		
Where there is potential for loss of primary containment of oil and chemicals on the MODU, deck drainage must be collected via a closed drainage system. E.g. drill floor.	F: Yes. CS: Minimal cost. Standard practice.	Requirements for deck drainage and management of oily water would reduce the likelihood of contaminated deck drainage water being discharged to the marine environment. No change in consequence would occur.	Benefits outweigh cost/sacrifice.	Yes **C 6.3**
Marine riser's telescopic joint to be: • comprised of a minimum of two packers (one hydraulic and one pneumatic) • pressure tested in accordance with manufacturers recommendations.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of equipment failure leading to an unplanned release of drilling fluids. Although the consequence of an unplanned release would be reduced, the reduction in likelihood reduces the overall risk providing an overall environmental benefit.	Benefits outweigh cost/sacrifice.	Yes **C 10.1**
Liquid chemical and fuel storage areas are bunded or secondarily contained when they are not being handled/moved temporarily.	F: Yes. CS: Minimal cost. Standard practice.	Implementation of procedures for chemical storage and handling on the MODU/Installation Vessel will reduce the consequence of impacts resulting from unplanned discharges to the marine environment by ensuring chemicals have been assessed for environmental acceptability.	Controls based on legislative requirements – must be adopted.	Yes **C 10.2**
Good Practice				
Drilling, completions, cementing, and subsea control fluids and additives will have an environmental assessment completed prior to use.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the consequence of impacts resulting from discharges to the marine environment by ensuring chemicals have been	Benefits outweigh cost/sacrifice.	Yes **C 7.1**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
		assessed for environmental acceptability. Planned discharges are required for safely executing activities; therefore, no reduction in likelihood can occur.		
Contractor procedure for managing drilling fluids transfers onto, around and off the MODU, which requires: • emergency shutdown systems for stopping losses of containment (e.g. burst hoses) • break-away dry-break couplings for oil-based mud hoses • transfer hoses to have floatation devised to allow detection of a leak • the valve line-up will be checked prior to commencing mud transfers • constant monitoring of the transfer process • direct radio communications • completed PTW and JSA showing contractor procedures are implemented • recording and verification of volumes moved to identify any losses • mud pit dump valves locked closed when not in use for mud transfers and operated under a PTW.	F: Yes. CS: Minimal cost. Standard practice for Woodside to review contractor systems prior to performing activity.	Reduces the likelihood of an unplanned release occurring. Although no change in consequence would occur, the reduction in likelihood decreases the overall risk, providing environmental benefit.	Benefits outweigh cost/sacrifice.	Yes **C 10.8**
Check for the functionality of: • additional SCE (augers and cuttings dryers) • mud tanks • mud tank room • transfer hoses • NWBM base fluid transfer lines • NWBM base fluid transfer station	F: Yes. CS: Minimal cost. Standard practice	Reduces the likelihood of an event occurring and reduces the potential consequences (by limiting volume released).	Benefits outweigh cost/sacrifice.	Yes **C 10.9**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
• base fluid storage.				
Spill kits positioned in high risk locations around the rig (near potential spill points such as transfer stations).	F: Yes. CS: Minimal cost. Standard practice.	Spill kits would reduce the likelihood of a deck spill from entering the marine environment. The consequence is unchanged.	Benefits outweigh cost/sacrifice.	Yes **C 10.10**
Installation vessels have self-containing hydraulic oil drip tray management system.	F: Yes. CS: Minimal cost. Standard practice.	Requirements for self-containing hydraulic oil drip tray management system would reduce the likelihood of contaminants being discharged to the marine environment. No change in consequence would occur.	Benefits outweigh cost/sacrifice.	Yes **C 10.11**
For drilling and completion fluids, chemical reviews are performed.	F: Yes. CS: Minimal cost. Standard practice.	Regular reviews will ensure chemicals selected for drilling and completions fluids remain ALARP.	Benefits outweigh cost/sacrifice.	Yes **C 7.2**
Professional Judgement - Eliminate				
No additional controls identified				
Professional Judgement – Substitute				
Only use WBM during drilling.	F: Not feasible. While the base case is to use WBM, a contingent NWBM drilling fluid system is required for safety and technical reasons; therefore option to use must be maintained. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Engineered Solution				
Use a MODU which may have a larger tank storage capacity for WBM. As such, there would be fewer bulk transfer movements.	F: Not feasible. The use of a MODU with greater storage capacity cannot be confirmed. CS: Significant cost and schedule delay would occur if the MODU was limited to	Not considered – control not feasible.	Not considered – control not feasible.	No

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
	greater storage capacity.			
Below-deck storage of all hydrocarbons and chemicals.	F: No. During operations there is a need to keep small volumes near activities and within equipment requiring use of hydrocarbons and chemicals and can result in increased risk of leaks from transfers via hose or smaller containers. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
A reduction in the volumes of chemicals and hydrocarbons stored onboard MODU/vessels.	F: Yes. Increases the risks associated with transportation and lifting operations. CS: Project delays if required chemicals not on board. Increases the risks associated with transportation and lifting operations.	No reduction in likelihood or consequence since chemicals will still be required to enable drilling activities to occur.	Disproportionate. The cost/ sacrifice outweighs the benefit gained.	No

ALARP Statement:

On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of an unplanned release of chemicals. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.2.1.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:**

- Overall risk consequence for individual receptors are less than the significant impact level defined in the OPP.
- EPOs and controls in the OPP that are relevant to an unplanned hydrocarbon release from bunkering have been adopted.
- There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that accidental discharge of chemicals represents a low current risk rating and is unlikely to result in a risk consequence greater than Slight. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice.

The adopted controls are considered consistent with industry legislation, codes and standards, good practice and professional judgement and meet the requirements and expectations of Australian Marine Orders identified during impact assessment.

The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks and consequences of an unplanned discharge of chemicals /hydrocarbons to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 18 Undertake the Petroleum Activities Program in a manner that will prevent an unplanned release of chemicals or non-process hydrocarbons to the marine environment resulting in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**C 6.4** **See Section 6.6.6**	**PS 6.4** **See Section 6.6.6**	**MC 6.4** **See Section 6.6.6**
	C 6.3 **See Section 6.6.6**	**PS 6.3** **See Section 6.6.6**	**MC 6.3.1** **See Section 6.6.6**
	C 10.1 Marine riser's telescopic joint to be: • comprised of a minimum of two packers (one hydraulic and one pneumatic) • pressure tested in accordance with manufacturer's recommendations.	**PS 10.1** MODU's joint packer designed and maintained to reduce hydrocarbons discharged to the environment.	**MC 10.1.1** Records demonstrate that MODU's joint packer is compliant.
	C 10.2 Liquid chemical and fuel storage areas are bunded or secondarily contained when they are not being handled/moved temporarily.	**PS 10.2** Failure of primary containment in storage areas does not result in loss to the marine environment.	**MC 10.2.1** Records confirms all liquid chemicals and fuel are stored in bunded/secondarily contained areas when not being handled/moved temporarily.
	C 7.1 See **Section 6.6.7**	**PS 7.1** See **Section 6.6.7**	**MC 7.1.1** See **Section 6.6.7**
	C 10.8 Contractor procedure for managing drilling fluids transfers onto, around and off the MODU, which requires: • emergency shutdown systems for stopping losses of containment (e.g. burst hoses) • break-away dry-break couplings for oil-based mud hoses • transfer hoses to have flotation devised to allow detection of a leak • the valve line-up will be checked prior to	**PS 10.8.1** Compliance with Contractor procedures to limit accidental loss to the marine environment.	**MC 10.8.1** Records demonstrate drilling fluid transfers are performed in accordance with the applicable contractor procedures.
		PS 10.9.1 Prevents unacceptable use or discharge of NWBM/base oil.	**MC 10.9.1** Records demonstrate the functionality of the specified equipment.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	commencing mud transfers • constant monitoring of the transfer process • direct radio communications • completed PTW and JSA showing contractor procedures are implemented • recording and verification of volumes moved to identify any losses • mud pit dump valves locked closed when not in use for mud transfers and operated under a PTW. **C 10.9** Check for the functionality of: • additional SCE (augers and cuttings dryers) • mud tanks • mud tank room • transfer hoses • NWBM base fluid transfer lines • NWBM base fluid transfer station • base fluid storage.		
	C 10.10 Spill kits positioned in high risk locations around the rig (near potential spill points such as transfer stations).	**PS 10.10** Spill kits to be available for use to clean up deck spills.	**MC 10.10.1** Records confirms that spill kits are present, maintained, and suitably stocked.
	C 10.11 Installation vessels have self-containing hydraulic oil drip tray management system.	**PS 10.11** To contain any on-deck spills of hydraulic oil.	**MC 10.11.1** Records demonstrate project installation vessel is equipped with self-containing hydraulic oil drip tray management system.
	C 7.2 **See Section 6.6.7**	**PS 7.2.1** **See Section 6.6.7**	**MC 7.2.1** **See Section 6.6.7**

6.7.5 Unplanned Discharge: Bunkering

Scarborough OPP – Relevant Impact Assessment Section		
OPP Section 7.2.1 Unplanned Discharge: Chemicals		
Context		
Relevant Activities Vessel Operations – **Section 3.10.2** MODU Operations – **Section 3.10.1**	**Existing Environment** Marine Regional Characteristics – **Section 4.2**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (inc. odour)	Ecosystems / Habitat	Species	Socio-economic	Decision Type	Impact/Consequence	Likelihood	Current Risk Rating	ALARP Tools	Acceptability	Outcome
Loss of hydrocarbons (diesel/jet fuel) to marine environment from bunkering/ refuelling			✓			✓		A	D	1	M	LCS GP PJ	Broadly Acceptable	EPO 18

Description of Source of Impact/Risk

Diesel LOC from bunkering

Bunkering of marine diesel between support vessels and the MODU as well as the possible refuelling of cranes, helicopters and other equipment may take place on the MODU.

Three credible scenarios for the loss of containment of marine diesel during bunkering operations have been identified:

- Partial or total failure of a bulk transfer hose or fittings during bunkering, due to operational stress or other integrity issues could spill marine diesel to the deck and/or into the marine environment. This would be in the order of less than 200 L, based on the likely volume of a bulk transfer hose (assuming a failure of the dry break and complete loss of hose volume).
- Partial or total failure of a bulk transfer hose or fittings during bunkering, combined with a failure in procedure to shutoff fuel pumps, for a period of up to five minutes, resulting in approximately 50 m^3 marine diesel lost to the deck and/or into the marine environment.
- Partial or total failure of a bulk transfer hose or fittings during helicopter refuelling could spill aviation jet fuel to the helicopter deck and/or into the marine environment. All helicopter refuelling activities are closely supervised and leaks on the helideck are considered to be easily detectable. In the event of a leak, transfer would cease immediately. The credible volume of such a release during helicopter refuelling would be in the order of <100 L.

Given the limited volume of the potential release and offshore location no modelling has been undertaken as it is within significantly less than the 250 m^3 of MDO in **Section 6.7.2.**

Detailed Impact Assessment

Assessment of Potential Impacts

A spill at the surface as a result of bunkering activities is likely to be localised with limited potential contact with sensitive receptor locations based on the modelling presented in **Section 6.7.2** for a larger spill (250 m^3), which predicted the spill to be restrictedted to open offshore waters.

The potential biological and ecological impacts associated with much larger hydrocarbon spills are presented in **Section 6.7.2**; further detail on impacts specific to a spill of marine diesel from a bunkering loss are provided below.

The biological consequences of such a small volume spill on identified open water sensitive receptors relate to the potential for minor impacts to megafauna, plankton and fish populations (surface and water column biota) that are within the spill-affected area. No impacts to commercial fisheries are expected. Refer **to Section 6.7.2** (potential impacts of unplanned hydrocarbon release to the marine environment from vessel collision) for the detailed potential impacts. However, the extent of the EMBA associated with a marine diesel spill from loss during bunkering will be much reduced in terms of spatial and temporal scales, and hence, potential impacts from bunkering are considered slight.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Risk Consequence	Likelihood	Risk rating
Water quality	Change in water quality	Low value (open water)	Negligible (F)	Highly Unlikely	Low
Migratory Shorebirds and Seabirds	Injury/mortality to fauna	High value species	Slight (E)	Highly Unlikely	Low
Fish		High value species	Minor (D)	Highly Unlikely	Moderate
Marine Mammals		High value species	Minor (D)	Highly Unlikely	Moderate
Marine Reptiles		High value species	Minor (D)	Highly Unlikely	Moderate

Overall Risk Rating: The overall risk rating for unplanned discharge of hydrocarbons during bunkering is Moderate based on a minor risk consequence to the high value receptors (marine fauna) and a highly unlikely likelihood. The risk consequence/risk rating for individual receptors are consistent with the levels rated in the OPP.

Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*	*Benefit in Impact/Risk Reduction*	*Proportionality*	*Control Adopted*
Legislation, Codes and Standards				
Marine Order 91 (Marine pollution prevention – oil) 2014, requires SOPEP/SMPEP (as appropriate to vessel class).	F: Yes. CS: Minimal cost. Standard practice.	By ensuring a SOPEP/SMPEP is in place for the vessel, the likelihood of a spill entering the marine environment is reduced. Although no significant reduction in consequence could result, the overall risk is reduced.	Controls based on legislative requirements – must be adopted.	Yes **C 6.4**
The Australian Government Civil Aviation Safety Authority CAAP 92-4(0) 'Guidelines for the development and operation of off-shore	F: Yes. CS: Minimal cost. Standard practice.	Reduced the likelihood of an unplanned release during helicopter operations. The	Controls based on legislative requirements – must be adopted.	Yes **C 10.3**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
helicopter landing sites, including vessels.		consequence is unchanged.		
Good Practice				
Bunkering equipment controls: • All hoses that have a potential environmental risk following damage or failure shall be placed on a hose register that is linked to the MODU's preventative maintenance system. • All bulk transfer hoses shall be pressure-rated at purchase to reduce the risk of accidental hydrocarbon release during bunkering. • There shall be dry-break couplings and flotation on fuel hoses. • There shall be an adequate number of appropriately stocked, located and maintained spill kits.	F: Yes. CS: Minimal cost. Standard practice.	By ensuring the appropriate equipment is in place, tested and maintained appropriately, the likelihood of a spill occurring is reduced. Although no significant reduction in consequence could result, the overall risk is reduced.	Benefits outweigh cost/sacrifice	Yes **C 10.4**
Contractor procedures include requirements to be implemented during bunkering/refuelling operations, including: • A completed PTW and/or JSA shall be implemented for the hydrocarbon bunkering/refuelling operation. • Visually monitoring of gauges, hoses, fittings and the sea surface during the operation. • Hoses will be checked before starting. • Bunkering/refuelling will commence in daylight hours. If the transfer is to continue into darkness, the JSA risk assessment must consider lighting and the ability to determine if a spill has occurred. • Hydrocarbons shall not be transferred in marginal weather conditions.	F: Yes. CS: Minimal cost. Standard practice.	By ensuring the appropriate equipment is in place, tested and maintained appropriately, the likelihood of a spill occurring is reduced. Although no significant reduction in consequence could result, the overall risk is reduced.	Benefits outweigh cost/sacrifice.	Yes **C 10.5**

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Mitigation: Oil spill response.	Refer to **Appendix D**.			
Professional Judgement - Eliminate				
No refuelling of helicopter on MODU.	F: No. Given the distance of the Petroleum Permit from the airports suitable for helicopter operations, and the endurance of available helicopters, eliminating helicopter refuelling is not feasible. Helicopter flights cannot be eliminated and may be required in emergency situations. CS: Not assessed, control cannot feasibly be implemented.	Not considered – control not feasible.	Not considered – control not feasible.	No
The MODU/installation vessel brought into port to refuel.	F: No. Does not eliminate the fuel transfer risk. It is not operationally practical to transit MODU back to port for refuelling based on the frequency of the refuelling requirements and distance from the nearest port. CS: Significant due to schedule delay and vessel transit costs and day rates.	Eliminates the risk in the Permit Area, However, moves risk to another location. Therefore, no overall benefit.	Disproportionate. The cost/sacrifice outweighs the benefit gained.	No
Professional Judgement – Substitute				
No additional controls identified				
Professional Judgement – Engineered Solution				
No additional controls identified				

ALARP Statement:

On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of an unplanned release of chemicals. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.

Demonstration of Acceptability
Acceptability Criteria and Assessment
Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.2.1.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall risk consequence/risk ratings for individual receptors are less than the significant impact level defined in the OPP. • EPOs and controls in the OPP that are relevant to an unplanned hydrocarbon release from bunkering have been adopted. • There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that accidental discharge of hydrocarbons as a result of bunkering failure represents a moderate current risk rating and is unlikely to result in a risk consequence greater than Minor. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice. The adopted controls are considered consistent with industry legislation, codes and standards, good practice and professional judgement and meet the requirements and expectations of Australian Marine Orders. The potential risks and consequences are considered acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks of a loss of hydrocarbons during bunkering / refuelling to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 18 Undertake the Petroleum Activities Program in a manner that will prevent an unplanned release of chemicals or non-process hydrocarbons to the marine environment resulting in a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health.	**C 6.4** **See Section 6.6.6**	**PS 6.4** **See Section 6.6.6**	**MC 6.4** **See Section 6.6.6**
	C 10.3 Helicopter fuel storage areas are bunded or secondarily contained when they are not being handled/moved temporarily in accordance with the Australian Government Civil Aviation Safety Authority CAAP 92-4(0) 'Guidelines for the development and operation of off-shore helicopter landing sites, including vessels.	**PS 10.3** Failure of primary containment in storage areas does not result in loss to the marine environment.	**MC 10.3.1** Records confirms all liquid chemicals and fuel are stored in bunded/secondarily contained areas when not being handled/moved temporarily.
	C 10.4 Bunkering equipment controls: • All hoses that have a potential environmental risk following damage or failure shall be placed on the MODU's preventative maintenance system. • All bulk transfer hoses shall be pressure-	**PS 10.4.1** To ensure damaged equipment is replaced prior to failure.	**MC 10.4.1** Records confirm the MODU bunkering equipment is subject to systematic integrity checks.
		PS 10.4.2 All diesel transfer hoses to have dry break couplings and pressure rating suitable for intended use.	**MC 10.4.2** Records confirm presence of dry break of couplings and flotation on fuel hoses.
		PS 10.4.3	**MC 10.4.3**

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
	tested at purchase to reduce the risk of accidental hydrocarbon release during bunkering. • There shall be dry-break couplings and flotation on fuel hoses. • There shall be an adequate number of appropriately stocked, located and maintained spill kits.	To ensure adequate resources are available to allow implementation of SOPEP.	Records confirm presence of spill kits.
	C 10.5 Contractor procedures include requirements to be implemented during bunkering/refuelling operations, including: • A completed PTW and/or JSA shall be implemented for the hydrocarbon bunkering/refuelling operation. • Visual monitoring of gauges, hoses, fittings and the sea surface during the operation. • Hose checks prior to commencement. • Bunkering/refuelling will commence in daylight hours. If the transfer is to continue into darkness, the JSA risk assessment must consider lighting and the ability to determine if a spill has occurred. • Hydrocarbons shall not be transferred in marginal weather conditions.	**PS 10.5** Compliance with Contractor procedures for the management of bunkering/helicopter operations.	**MC 10.5.1** Records demonstrate bunkering/refuelling undertaken in accordance with contractor bunkering procedures.
Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are presented in **Appendix D**.			

6.7.6 Unplanned Discharge: Hazardous and Non – Hazardous Solid Waste/Equipment

Scarborough OPP – Relevant Impact Assessment Section
OPP Section 7.2.2 Unplanned Discharge: Solid Waste

Context

Relevant Activities	Existing Environment	Stakeholder consultation
MODU Operations – **Section 3.10.1** Vessel Operations – **Section 3.10.2**	Marine Regional Characteristics – **Section 4.2**	Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*							
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (inc. odour)	Ecosystems / Habitat	Species	Socio-economic	Decision Type	Impact/Consequence	Likelihood	Current Risk Rating	ALARP Tools	Acceptability	Outcome
Accidental loss of hazardous or non-hazardous solid wastes / equipment to the marine environment			✓			✓		A	D	0	L	LCS GP PJ	Broadly Acceptable	EPO 2, 3, 4, 8, 11, 19, 20, 21

Description of Source of Impact/Risk

The MODU and project vessels will generate a variety of solid wastes, including packaging and domestic wastes such as aluminium cans, bottles, paper and cardboard. Hence, there is the potential for solid wastes to be lost overboard to the marine environment.

Equipment may also be accidentally lost overboard. Equipment that has been recorded as being lost on previous campaigns has primarily been windblown or dropped overboard and has included things such as personal protective equipment and small tools or materials.

These events have occurred during backloading activities, periods of adverse weather and incorrect waste storage.

Detailed Impact Assessment

Assessment of Potential Impacts

The potential impacts of hazardous or non-hazardous solid waste / equipment accidentally discharged to the marine environment include contamination of the environment as well as secondary impacts relating to potential contact of marine fauna with wastes. This could result in entanglement or ingestion and lead to injury and death of individual animals and changes to aesthetic values. The temporary or permanent loss of waste materials into the marine environment is not likely to have a significant environmental impact, based on the location of the PAA, the types, size and frequency of wastes that could occur, and species present.

Water Quality

Change in Water Quality

Hazardous solid wastes such as paint cans, oily rags, etc., can cause localised contamination of the water through a release of toxins and chemicals. The level of impact to water quality will depend on the nature of the discharge, however volumes of the hazardous components are generally low (such as residual paint in cans or oily rags). Modelling of small volumes of hydrocarbons such as this (e.g. Shell, 2010) indicate rapid dilution in the offshore marine environment, with impacts limited to the immediate vicinity of the contamination.

Given likely small volumes, and the occasional nature of the event, these would result in temporary and highly localised changes to the water quality.

Based on the detailed risk evaluation, the magnitude of potential impact of a change in water quality is slight. Receptor sensitivity is low for water quality, leading to a Negligible (F) consequence.

Seabirds and Migratory Shorebirds, Fish, Marine Reptiles and Marine Mammals

Injury/Mortality to Fauna

The unplanned discharge of solid wastes can result in mortality to fauna, either through contamination or physical injury depending on the nature of the waste. Marine fauna, including fish, seabirds and shorebirds, marine mammals and marine reptiles may be impacted through ingestion or entanglement of waste or through exposure to toxic chemicals. Ingestion or entanglement of marine fauna has the potential for physical harm which may limit feeding/foraging behaviours and thus can result in mortalities. Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris was listed as a key threatening process under the EPBC Act in August 2003 (DoEE, 2018). The Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018) identifies EPBC Act-listed species for which there are scientifically documented adverse impacts resulting from marine debris. Marine turtles and seabirds in particular may be at risk from plastics which may cause entanglement or be mistaken for food (e.g. DoEE, 2018; DoEE, 2017) and ingested causing damage to internal tissues and potentially preventing feeding activities. In the worst instance this could have a lethal affect to an individual. Marine debris has been identified as threat in the Recovery Plan for Marine Turtles in Australia (2017–2027).

Impacts to species including fish, birds, marine mammals and marine reptiles from the unplanned discharge of solid waste is unlikely given low occurrence of unplanned discharges and the location of the activities at significant distance from sensitive habitats. Significant impacts are unlikely to occur at an individual level and will not occur at a population level, nor result in the decrease of the quality of the habitat such that the extent of these species is likely to decline.

While the threat abatement plan for impacts of marine debris on vertebrate marine life does not list explicit management actions for non-related industries (DEWHA, 2009), management controls will reduce the risk of unplanned discharge of solid waste.

The magnitude of potential impact to marine fauna is Slight, which results in a consequence of Minor (D) based on the high receptor sensitivity.

Summary of Assessment Outcomes

Receptor	**Impact**	**Receptor Sensitivity**	**Risk Consequence**	**Likelihood**	**Risk Rating**
Water Quality	Change in water quality	Low value (open water)	Negligible (F)	Remote	Low
Migratory Shorebirds and Seabirds	Injury/mortality to fauna	High value species	Minor (D)	Remote	Low
Fish		High value species	Minor (D)	Remote	Low
Marine Mammals		High value species	Minor (D)	Remote	Low
Marine Reptiles		High value species	Minor (D)	Remote	Low

Overall Risk Consequence: The overall risk rating for unplanned discharge of hazardous and non-hazardous solid waste is Low based on a Minor consequence, to the high value receptors (marine fauna), and a remote likelihood. The risk consequence levels/risk ratings for individual receptors are consistent with the levels rated in the OPP.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
Marine Order 95 – Pollution prevention – Garbage (as appropriate to vessel class), which requires putrescible waste and food scraps are	F: Yes. CS: Minimal cost. Standard practice.	Legislative requirements to be followed reduce the likelihood of an unplanned release.	Controls based on legislative requirements – must be adopted.	Yes **C 6.2**

passed through a macerator so that it is capable of passing through a screen with no opening wider than 25 mm.		The consequence is unchanged.		
Good Practice				
Drilling and Completions Waste Management Plan, which requires: • dedicated space for waste segregation bins and skips provided on the MODU • records of all waste to be disposed, treated or recycled • waste streams handled and managed according to their hazard and recyclability class • all non-putrescible waste (excludes all food, greywater or sewage waste) to be transported from the MODU and disposed of onshore.	F: Yes. CS: Minimal cost. Standard practice.	Controls outlined in the management plan will reduce the likelihood of an unplanned release. The consequence is unchanged.	Benefit outweighs cost sacrifice.	Yes **C 11.2**
Installation vessel waste arrangements, which require: • dedicated waste segregation bins • records of all waste to be disposed, treated or recycled • waste streams to be handled and managed according to their hazard and recyclability class.	F: Yes. CS: Minimal cost. Standard practice.	Controls will reduce the likelihood of an unplanned release. The consequence is unchanged.	Benefit outweighs cost sacrifice.	Yes **C 11.3**
MODU/Project vessel ROV, crane or project vessel may be used to attempt recovery of solid wastes /equipment lost overboard. Where safe and practicable for this activity will consider: • risk to personnel to retrieve object • whether the location of the object is in recoverable water depths • object's proximity to subsea infrastructure • ability to recover the object (i.e. nature of object, lifting equipment	F: Yes. CS: Minimal cost. Standard practice.	Occurs after an unplanned release of solid waste and therefore no change to the likelihood. Since the waste objects may be recovered, a reduction in consequence is possible.	Benefit outweighs cost sacrifice.	Yes **C 11.4**

or, ROV availability and suitable weather). Any material dropped objects / waste that remain in the title will undergo an impact assessment and be added to the inventory.				

Professional Judgement – Eliminate
No additional controls identified.
Professional Judgement – Substitute
No additional controls identified.
Professional Judgement – Engineered Solution
No additional controls identified.

ALARP Statement:

On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of accidental loss of hazardous or non-hazardous solid wastes / equipment to the marine environment. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.2.2.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:**

- Overall risk consequence/risk ratings for individual receptors are less than the significant impact level defined in the OPP.
- EPOs and controls in the OPP that are relevant to an unplanned release of hazardous and non-hazardous wastes have been adopted.
- There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that unplanned discharges from a release of solid hazardous and non-hazardous wastes / equipment represents a low current risk rating and is unlikely to result in a risk consequence greater than Minor. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice. The adopted controls are considered consistent with industry legislation, codes and standards, good practice and professional judgement and meet the requirements of Australian Marine Orders identified during impact assessment.

Further opportunities to reduce the impacts have been investigated above.

Based on an assessment against the defined acceptable levels, the risk from unplanned discharges of solid waste / equipment is considered acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria

EPO	*Adopted Control(s)*	*EPS*	*MC*
EPO 2 Undertake the Petroleum Activities Program in a	**C 6.2** **See Section 6.6.6**	**PS 6.2** **See Section 6.6.6**	**MC 6.2.1** **See Section 6.6.6**
	C 11.2	**PS 11.2**	**MC 11.2.1**

manner that will prevent a substantial adverse effect on a population of seabirds or shorebirds, or the spatial distribution of the population. **EPO 3** Undertake the Petroleum Activities Program in a manner that will not seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. **EPO 4** Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of marine reptiles or the spatial distribution of the population. **EPO 8** Undertake the Petroleum Activities Program in a manner that will not substantially modify, destroy or isolate an area of important habitat for a migratory species. **EPO 11** Undertake the Petroleum Activities Program in a manner that will prevent a substantial change in water quality which may adversely impact on biodiversity, ecological integrity, social amenity or human health. **EPO 19** Undertake the Petroleum Activities Program in a manner that will prevent an unplanned release of solid waste to the marine environment resulting in a significant impact.	Drilling and Completions Waste Management Plan, which requires: • dedicated space for waste segregation bins and skips shall be provided on the MODU. • records of all waste to be disposed, treated or recycled. • waste streams to be handled and managed according to their hazard and recyclability class. • all non-putrescible waste (excludes all food, greywater or sewage waste) to be transported from the MODU and disposed of onshore • CM15: implementation of waste management procedures which provide for safe handling and transportation, segregation and storage and appropriate classification of all waste generated.	Hazardous and non-hazardous waste will be managed in accordance with the Drilling and Completions Waste Management Plan.	Records demonstrate compliance against Drilling and Completions Waste Management Plan.
	C 11.3 Installation Vessel waste management arrangements, which require: • dedicated waste segregation bins • records of all waste to be disposed, treated or recycled • waste streams to be handled and managed according to their hazard and recyclability class • implementation of waste management procedures which provide for safe handling and transportation, segregation and storage and appropriate classification of all waste generated.	**PS 11.3** Hazardous and non-hazardous waste will be managed in accordance with the Installation vessel waste management arrangements.	**MC 11.3.1** Records demonstrate compliance against Installation Vessel waste management arrangements.

EPO 20 Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of fish, or the spatial distribution of the population. **EPO 21** Undertake the Petroleum Activities Program in a manner that will prevent a substantial adverse effect on a population of marine mammals or the spatial distribution of the population.	**C 11.4** MODU/Project vessel ROV, crane or project vessel may be used to attempt recovery of solid wastes /equipment lost overboard. Where safe and practicable for this activity will consider: • risk to personnel to retrieve object • whether the location of the object is in recoverable water depths • object's proximity to subsea infrastructure • ability to recover the object (i.e. nature of object, lifting equipment or, ROV availability and suitable weather). Any material dropped objects / waste that remain in the title will undergo an impact assessment and be added to the inventory.	**PS 11.4** Any solid waste /equipment dropped to the marine environment will be recovered where safe and practicable to do so.	**MC 11.4.1** Records detail the recovery attempt consideration and status of any waste /equipment lost to marine environment.
		Where retrieval is not practicable and / or safe, material items (property) that are lost to the marine environment will undergo an impact assessment and will be added to the inventory for the title.	First Priority records demonstrate outcomes of the safe and practicable evaluation, including an impact assessment for the objects remaining.
			Records demonstrate that material items left in title are added to the inventory.

6.7.7 Physical Presence (Unplanned): Seabed Disturbance

Scarborough OPP – Relevant Impact Assessment Section		
OPP Section 7.2.3 Physical Presence (Unplanned): Seabed Disturbance		
Context		
Relevant Activities MODU Operations – **Section 3.10.1** Vessel Operations – **Section 3.10.2**	**Existing Environment** Marine Regional Characteristics – **Section 4.2**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Dropped objects resulting in the disturbance of benthic habitat		✓			✓			A	D	1	M	LCS GP PJ	Broadly Acceptable	EPO 13,22
Failed MODU mooring leading to anchor drag and the disturbance of benthic habitat		✓			✓									

Description of Source of Impact/Risk

During MODU and project vessel operations, the primary cause for unplanned seabed disturbance is through dropped objects from the MODU or project vessels. Additional unplanned disturbance to the seabed may occur from mooring failure and subsequent anchor drag during MODU operations if a moored MODU is used for the Petroleum Activities Program.

Dropped Objects

There is the potential for objects to be dropped overboard from the MODU and project vessels to the marine environment. Objects that have been dropped during previous offshore activities include small numbers of personal protective gear (e.g. glasses, gloves, hard hats), small tools (e.g. spanners) hardware fixtures (e.g. riser hose clamp) and drill equipment (e.g. drill pipe); however, there is also potential for larger equipment to also be dropped during the activity, particularly during recovery of infrastructure from the seabed. The spatial extent in which dropped objects can occur is restricted to the Operational Area.

Anchor Drag

During drilling, the MODU will be secured on station by mooring lines (if a moored MODU is used), which are held in place by anchors deployed to the seabed. High energy weather events such as cyclones, occurring while the MODU is on station, can lead to excessive loads on the mooring lines, resulting in failure (either anchor(s) dragging or mooring lines parting). A failure of mooring integrity may lead to the mooring lines and anchors attached to the MODU being trailed across the seabed. If mooring failure is sufficient, the MODU may move off station, increasing the likelihood of anchor drag across the seafloor.

Industry statistics from the North Sea show that a single mooring line failure for MODUs is the most common failure mechanism (33 × 10-4 per line per year), followed by a double mooring line failure (11 × 10-4 per line per year) (Petroleumstilsynet, 2014). Note that single and double mooring line failures do not typically result in the loss of station keeping. If partial or complete mooring failures are sufficient to result in a loss of station keeping, industry experience indicates that MODUs may drift considerable distances from their initial position (Offshore: Risk & Technology Consulting Inc., 2002). Partial mooring failures leading to a loss of station keeping resulted in smaller MODU displacements, due to the remaining anchors dragging along the seabed when compared to complete mooring failures; complete mooring failures resulted in a freely drifting MODU (Offshore: Risk & Technology Consulting Inc., 2002).

NOPSEMA has recorded four cases of anchor drag due to loss of MODU holding station during cyclone activity between 2004 and 2015 (NOPSEMA 2015). Seabed disturbance area size from anchor drag will depend on the extent of the drag.

Detailed Impact Assessment

Assessment of Potential Impacts

In the unlikely event of an object being dropped into the marine environment or failed mooring, potential environmental effects would be limited to localised physical impacts on benthic communities. In most cases, objects will be able to be recovered and therefore these impacts will also be temporary in nature. However, there may be instances where objects are unable to be recovered due to health and safety, operational constraints or other factors such as the difficulty of recovering dropped objects at depth. When dropped objects are unable to be recovered, the impact will continue to be localised but would also be long-term.

KEFs

The temporary or permanent loss of dropped objects into the marine environment and mooring failure is likely to result in a localised impact only, as the benthic communities associated with the PAA are of low sensitivity and are broadly represented throughout the NWMR. As described in **Section 4.7**, the Exmouth Plateau KEF overlaps the PAA. Benthic communities in the PAA are representative of the Exmouth Plateau and of deep water soft sediment habitats reported in the wider region (e.g. BHP Billiton, 2004; Woodside, 2005; Woodside, 2006; Brewer et al., 2007; RPS, 2011; Woodside, 2013; Apache, 2013).

Given the nature and scale of risks and consequences from dropped objects and mooring failure, no lasting effect is expected to seabed sensitivities within the PAA. Further, considering the types, size and frequency of dropped objects that could occur, it is unlikely that a dropped object would have a significant impact on any benthic community.

Any unplanned seabed disturbance within the KEF would be highly localised and relatively small compared to the size of the KEF. There will be no substantial adverse effect on the KEF or the communities within it. On this basis, the magnitude of potential impacts to KEFs from unplanned seabed disturbance during activities is Slight. Receptor sensitivity for KEF is high, leading to a Minor (D) risk consequence.

Epifauna and Infauna

As a result of a change in water quality and change in habitat, injury or mortality to marine fauna resulting from an increase in turbidity may occur. Given a change to water quality is unlikely, the only receptors that would potentially be at risk of unplanned seabed disturbance are bottom dwelling species including epifauna and infauna. Benthic communities, including epifauna and infauna may be impacted by the dropped objects, or the drag of anchors on the seabed. If not recovered, dropped objects may result in the permanent loss of a small area under the object.

If anchor drag occurs, habitat impact will span the extent of the drag area, leading to a localised change in communities; however, substantial adverse effect is not anticipated, given the sparse marine life that are well represented elsewhere in the region.

Given generally sparse benthic communities in the PAA, no threatened or migratory species or ecological communities were identified, and those epifauna and infauna communities observed are likely to be well represented elsewhere in the region, impacts are expected to be restricted to a localised proportion of epifauna and infauna communities.

Based on the detailed evaluation, the magnitude of potential impacts to epifauna and infauna from unplanned seabed disturbance during activities associated with Scarborough is evaluated to be slight. Sensitivity for epifauna and infauna is low, leading to a Negligible (F) risk consequence.

Summary of Assessment Outcomes

Receptor	Impact	Receptor sensitivity	Risk Consequence	Likelihood	Risk Rating
Epifauna and infauna	Change in habitat Injury/ mortality to fauna	Low value	Negligible (F)	Highly Unlikely	Low
KEFs	Change in habitat	High Value	Minor (D)	Highly Unlikely	Moderate

Overall Risk Consequence: The overall risk rating for disturbance to benthic habitat from unplanned seabed disturbance is Moderate based on minor consequence to the high value receptor (KEFs) and a highly unlikely likelihood. The risk consequence/risk ratings for individual receptors are consistent with the levels rated in the OPP.

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Legislation, Codes and Standards				
No additional controls identified.				
Good Practice				
The MODU/ installation vessel work procedures for lifts, bulk transfers and cargo loading, which require: • The security of loads shall be checked prior to commencing lifts. • Loads shall be covered if there is a risk of loss of loose materials. • Lifting operations shall be conducted using the PTW and JSA systems to manage the specific risks of that lift, including consideration of weather and sea state.	F: Yes. CS: Minimal cost. Standard practice.	Occurs after a dropped object event and therefore no change to the likelihood. Since the object may be recovered, a reduction in consequence is possible.	Benefits outweigh cost/sacrifice.	Yes **C 12.1**
MODU/ installation vessel inductions include control measures for dropped object prevention.	F: Yes. CS: Minimal cost. Standard practice.	By ensuring crew are appropriately trained in dropped object prevention, the likelihood of a dropped object event is reduced. No change in consequence will occur.	Benefits outweigh cost/sacrifice.	Yes **C 12.2**
Specifications and requirements for station keeping equipment (mooring systems), require that: • systems are tested and inspected in accordance with API RP 21 • systems have sufficient capability such that a failure of any single component will not cause progressive failure of the remaining anchoring arrangement.	F: Yes. CS: Minimal cost. Standard practice.	Reduces the likelihood of mooring failure leading to uncontrolled anchor drag. Should mooring failure occur, no significant reduction in consequence could occur.	Benefit outweighs cost sacrifice.	Yes **C 12.3**
Professional Judgement – Eliminate				

Only use a DP MODU (no anchoring required) for all wells.	F: Yes. CS: Restricting MODU selection to only DP capable rigs would introduce unacceptable additional costs and operational delays. Woodside has a demonstrated capacity to manage the environmental risks and impacts from mooring to a level that is ALARP and acceptable.	Application of control would eliminate the risk.	Disproportionate. The cost/sacrifice associated with only using a DP capable MODU outweighs the benefit gained.	No
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
MODU tracking equipment operational when the MODU unmanned.	F: Yes. CS: Minimal cost. Standard practice.	Although no reduction in consequence would occur, the overall risk is reduced as the location of the MODU would be known at all times and response times could be improved in the event of a loss of station keeping. (E,1).	Benefit outweighs cost sacrifice.	Yes **C 12.4**
Risk Based Analysis				
Project-specific Mooring Design Analysis.	F: Yes. CS: Minimal cost. Standard practice.	By ensuring that a mooring analysis report is undertaken, the likelihood of mooring failure occurring is reduced. Although no reduction in consequence would occur, the overall risk is reduced.	Benefit outweighs cost sacrifice.	Yes **C 5.3**
Mooring system is tested to recommended tension as per API RP 2SK.	F: Yes. CS: Minimal cost. Standard practice	Reduces the likelihood of anchor drag leading to seabed disturbance.	Benefit outweighs cost sacrifice.	Yes **C 12.5**

ALARP Statement:

On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of unplanned seabed disturbance. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.

Demonstration of Acceptability
Acceptability Criteria and Assessment
Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.2.3.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**): • Overall risk consequence/risk ratings for individual receptors are less than the significant impact level defined in the OPP. • EPOs and controls in the OPP that are relevant to an unplanned seabed disturbance have been adopted. • There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that disturbance to seabed from dropped objects or a loss of station keeping of the MODU represents a moderate current risk rating and is unlikely to result in a risk consequence greater than Minor. The adopted controls are considered industry good practice. The potential risks and consequences are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks of seabed disturbance from dropped objects / anchor drag to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 13 Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in an area defined as a Key Ecological Feature. **EPO 22** Undertake the Petroleum Activities Program in a manner which prevents unplanned seabed disturbance.	**C 12.1** The MODU/ installation vessel work procedures for lifts, bulk transfers and cargo loading, which require: • the security of loads shall be checked prior to commencing lifts • loads shall be covered if there is a risk of loss of loose materials. Lifting operations shall be conducted using the PTW and JSA systems to manage the specific risks of that lift, including consideration of weather and sea state.	**PS 12.1** All lifts conducted in accordance with applicable MODU/ installation vessel work procedures to limit potential for dropped objects.	**MC 12.1.1** Records show lifts conducted in accordance with the applicable MODU/ installation vessel work procedures.
	C 12.2 MODU/ installation vessel inductions include control measures for dropped object prevention.	**PS 12.2** To ensure awareness of requirements for dropped object prevention.	**MC 12.2.1** Records show dropped object prevention training is provided to the MODU/ installation vessel.
	C 12.3 Specification and requirements for station keeping equipment (mooring systems), require that: • systems are tested and inspected in	**PS 12.3** MODU mooring system tested and in place to ensure no complete mooring failure.	**MC 12.3.1** Records demonstrate mooring system tests and inspection.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	**Adopted Control(s)**	**EPS**	**MC**
	accordance with API RP 21 • systems have sufficient capability such that a failure of any single component will not cause progressive failure of the remaining anchoring arrangement.		
	C 12.4 Moored MODU tracking equipment operational when the MODU unmanned.	**PS 12.4** Tracking of the MODU is possible when the MODU is unmanned.	**MC 12.4.1** Records show the moored MODU has functional tracking equipment for instances when MODU is unmanned.
	C 5.3 **See Section 6.6.5**	**PS 5.3.1** **See Section 6.6.5**	**MC 5.3.1** **See Section 6.6.5**
	C 12.5 Mooring system is tested to recommended tension as per API RP 2SK	**PS 12.5** Monitoring compliant with ISO 19901-7:2013	**MC 12.5** Records confirm mooring system is tested to recommended tension as per API RP 2SK.

6.7.8 Physical Presence (Unplanned): Accidental Introduction and Establishment of Invasive Marine Species

Scarborough OPP – Relevant Impact Assessment Section		
OPP Section 7.2.4 Physical Presence (Unplanned): IMS		
Context		
Relevant Activities Installation of Subsea Infrastructure – **Section 3.7.10** MODU Operations – **Section 3.10.1** Vessel Operations – **Section 3.10.2**	**Existing Environment** Marine Regional Characteristics – **Section 4.2**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	***Environmental Value Potentially Impacted***							***Evaluation***						
	Soil and Groundwater	**Marine Sediment**	**Water Quality**	**Air Quality (inc. odour)**	**Ecosystems / Habitat**	**Species**	**Socio-economic**	**Decision Type**	**Impact/Consequence**	**Likelihood**	**Current Risk Rating**	**ALARP Tools**	**Acceptability**	**Outcome**
Introduction and establishment of invasive marine species (IMS) within the PAA.					✓	✓	✓	A	E	0	L	LCS	Broadly Acceptable	EPO 13, 23

Description of Source of Impact/Risk

Installation of Subsea Infrastructure, and MODU and Vessel Operations

During the Petroleum Activities Program, vessels will be transiting to and from the PAA, potentially including traffic mobilising from beyond Australian waters. These project vessels may include the MODU, installation vessel or general support vessels **(Section 3.10.2**).

All vessels are subject to some level of marine fouling whereby organisms attach to the vessel hull. This could particularly occur in areas where organisms can find a good attachment surface (e.g. seams, strainers and unpainted surfaces) or where turbulence is lowest (e.g. niches, sea chests, etc.). Organisms can also be drawn into ballast tanks during onboarding of ballast water as cargo is loaded or to balance vessels under load.

During the Petroleum Activities Program, project vessels have the potential to introduce IMS to the PAA through marine fouling (containing IMS) on vessels as well as within high risk ballast water discharge. Cross contamination between vessels can also occur (e.g. IMS translocated between project vessels) during times when vessels need to be alongside each other.

Detailed Impact Assessment

Assessment of Potential Impacts

IMS are a subset of Non-indigenous Marine Species (NIMS) that have been introduced into a region beyond their natural biogeographic range resulting in impacts to social/cultural, human health, economic and/or environmental values. NIMS are species that have the ability to survive, reproduce and establish founder populations. However, not all NIMS introduced into an area will thrive or cause demonstrable impacts; the majority of NIMS around the world are relatively benign and few have spread widely beyond sheltered ports and harbours. NIMS are only considered IMS when they result in impacts to environmental values and/or have social/cultural, economic and/or human health impacts.

Once introduced, IMS may prey on local species (which had previously not been subject to this kind of predation and therefore not have evolved protective measures against the attack), they may outcompete indigenous species for food, space or light and can also interbreed with local species, creating hybrids such that the endemic species is lost. These changes to the local marine environment result in changes to the natural ecosystem.

IMS have also proven economically damaging to areas where they have been introduced and established. Such impacts include direct damage to assets (fouling of vessel hulls and infrastructure) and depletion of commercially harvested marine life (e.g. shellfish stocks). IMS have proven particularly difficult to eradicate from areas once established. If the introduction is detected early, eradication may be effective but is likely to be expensive, disruptive and, depending on the method of eradication, harmful to other local marine life.

Potential IMS have historically been introduced and translocated around Australia by a variety of natural and human means, including marine fouling and ballast water. Potential IMS vary from one region to another depending on various environmental factors such as water temperature, salinity, nutrient levels and habitat type, which dictate their survival and invasive capabilities. IMS typically require hard substrate in the photic zone; therefore, requiring shallow waters to become established. Highly-disturbed, shallow-water environments such as shallow coastal waters, ports and marinas are more susceptible to IMS colonisation, whereas IMS are generally unable to successfully establish in deep-water ecosystems and open-water environments where the rate of dilution and the degree of dispersal are high.

Epifauna and Infauna

Epifauna and infauna are susceptible to impacts from IMS due to the risk of changes to the ecosystem dynamics such as competition for resources and predation.

Benthic productivity on the outer continental shelf and slope is low, and is a function of water depth, low nutrient availability, and the absence of hard substrates. Studies completed within the region indicate that benthic composition in deep-water habitats is generally lower in abundance than shallow water habitats of the region (DEWHA, 2008a; Brewer et al., 2007). The seafloor in the PAA is characterised by sparse marine life dominated by motile organisms (ERM, 2013). Such motile organisms included shrimp, sea cucumbers, demersal fish and small, burrowing worms and crustaceans. This soft bottom habitat is also supporting patchy distributions of mobile epibenthos, such as sea cucumbers, ophiuroids, echinoderms, polychaetes and sea-pens (DEWHA, 2008). The dominant types of epifauna were arthropods and echinoderms (especially shrimp and sea cucumbers, respectively), while the dominant infauna groups were crustaceans and polychaetes (ERM, 2013). Benthic communities in the PAA are representative of the Exmouth Plateau and of deep-water soft sediment habitats reported in the region.

While project vessels have the potential to introduce IMS into the PAA, the deep offshore open waters of the PAA (approximately 900 to 955 m) are not conducive to the settlement and establishment of IMS. Furthermore, the PAA are away from shorelines and/or critical habitat. The likelihood of IMS being introduced and establishing viable populations within the PAA or immediate surrounds is considered not credible.

Accordingly, impact to epifauna/infauna in the PAA is not considered credible. Receptor sensitivity for epifauna and infauna is low, leading to a Negligible (F) risk consequence.

Industry, Shipping, Defence

The establishment of IMS has the potential to cause changes to the functions, interests or activities of other users through indirect impact such as changes to fisheries target species resulting in economic and social implications, or due to compromised reputation to the oil and gas industry.

Given the low likelihood of IMS translocation to, and colonisation of environments within the PAA, project activities will not result in establishment of IMS, and as such not adversely affect other marine user activities in the region.

Based on the detailed impact evaluation, the magnitude of potential impacts of a change to the functions, interests or activities of other users is slight (see **Table 6-16**). Receptor sensitivity for industry, shipping and defence is medium, leading to a Slight (E) risk consequence. The likelihood of the risk event occurring is Remote, therefore the risk is assessed as Low.

Summary

In support of Woodside's assessment of the risks and consequences of IMS introduction associated with the Petroleum Activities Program, Woodside conducted a risk and impact evaluation of the different aspects of a marine pest translocation. The results of this assessment are presented in **Table 6-16**.

As a result of this assessment, Woodside has presented the highest potential consequence as a Slight (E) and likelihood as Remote (0), resulting in an overall Low risk following the implementation of identified controls.

Table 6-16: Credibility, consequence and likelihood of introducing IMS

IMS Introduction Location	Credibility of Introduction	Consequence of Introduction	Likelihood
Introduced to Operational Area and establishment	**Not Credible**		

on the seafloor or subsea structures	The deep offshore open waters of the Permit Area, away from shorelines and/or critical habitat, more than 50 km from a shoreline and in waters more than 100 m deep are not conducive to the settlement and establishment of IMS.		
Introduced to Operational Area and establishment on a project vessel.	**Credible** There is potential for the transfer of marine pests between project vessels within the Operational Area.	**Environment – Not Credible** The translocation of IMS from a colonised MODU or project vessel to shallower environments via natural dispersion is not considered credible given the distances of the PAA from nearshore environments (i.e. greater than 12 nm/50 m water depth). There is therefore no credible environmental risk and the assessment is limited to Woodside's reputation. **Reputation – E** If IMS were to establish on a project vessel (i.e. MODU, installation vessel, activity project vessels) this could potentially impact the vessel operationally through the fouling of intakes, result in translocation of an IMS into the PAA and, depending on the species, potentially transfer of an IMS to other project vessels, which would likely result in the quarantine of the vessel until eradication could occur (through cleaning and treatment of infected areas), which would be costly to perform. Such introduction would be expected to have slight impact to Woodside's reputation, particularly with Woodside's contractors, and would likely have a reputational impact on future proposals.	**Remote (0)** Interactions between project vessel will be limited during the Petroleum Activities Program, with minimum 500 m safety exclusion zones being adhered to around the MODU and installation vessel, and interactions limited short periods of time alongside (i.e. during backloading, bunkering activities). There is also no direct contact (i.e. they are not tied up alongside) during these activities. Spread of marine pests via ballast water or spawning in these open ocean environments is also considered remote.
Transfer between project vessels and from project vessels to other marine environments beyond the PAA.	**Not Credible** This risk is considered so remote that it is not credible for the purposes of the activity. The transfer of a marine pest between project vessels was already considered remote, given the offshore open ocean environment (i.e. transfer pathway discussed above). For a marine pest to then establish into a mature spawning population on the new project vessel (which would have been through Woodside's IMS process) and then transfer to another environment is not considered credible (i.e. beyond the Woodside risk matrix).		

	Project vessels will be located in an offshore, open ocean, deep environment, where IMS survival is implausible. Furthermore, this marine pest once transferred would need to survive on a new vessel with good vessel hygiene (i.e. has been through Woodside's risk assessment process) and survive the transport back from the PAA to shore. In the event it was to survive this trip, it would then need to establish a viable population in nearshore waters.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Risk Consequence	Likelihood	Risk Rating
Epifauna and infauna	Change in ecosystem dynamics	Low value habitat (homogenous)	Negligible (F)	Remote	Low
Industry, Shipping, Defence	Changes to the functions, interests or activities of other users	Medium value	Slight (E)	Remote	Low

Overall Risk Consequence: The overall risk rating for the accidental introduction of IMS is Low given the remote offshore location of the PAA. The risk consequence/risk ratings for individual receptors are consistent with the levels rated in the OPP.

Demonstration of ALARP

Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
		Legislation, Codes and Standards		
Project vessels will manage their ballast water using one of the approved ballast water management options, as specified in the Australian Ballast Water Management Requirements.	F: Yes. CS: Minimal cost. Standard practice.	The use of an approved ballast water treatment system will reduce the likelihood of transfer of marine pests between project vessels within the PAA. No change in consequence would occur.	Controls based on legislative requirements under the *Biosecurity Act 2015* – must be adopted.	Yes **C 13.1**
		Good Practice		
Woodside's IMS risk assessment process[7] will be applied to the MODU, project vessels and relevant immersible equipment undertaking the Petroleum Activities Program. Assessment will consider these risk factors: For vessels/ MODU: • vessel/MODU/ type • recent IMS inspection and cleaning history,	F: Yes. CS: Minimal cost. Good practice implemented across all Woodside Operations.	Identifies potential risks and additional controls implemented accordingly. In doing so, the likelihood of transferring marine pests between project vessels within the Operational Area is reduced. No change in consequence would occur.	Benefits outweigh cost/sacrifice.	Yes **13.2**

[7] Woodside's IMS risk assessment process was developed with regard to the national biofouling management guidelines for the petroleum production and exploration industry and guidelines for the control and management of a ships' biofouling to minimise the transfer of invasive aquatic species (IMO Guidelines, 2011).

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
including for internal niches • out-of-water period before mobilisation • age and suitability of antifouling coating at mobilisation date • internal treatment systems and history • origin and proposed area of operation • number of stationary/slow speed periods >7 days • region of stationary or slow periods • type of activity – contact with seafloor. For immersible equipment: • region of deployment since last thorough clean, particularly coastal locations • duration of deployments • duration of time out of water since last deployment • transport conditions during mobilisation • post-retrieval maintenance regime. Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk (such as treating internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced.				
Professional Judgement - Eliminate				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
No discharge of ballast water during the Petroleum Activities Program.	F: No. Ballast water discharges are critical for maintaining vessel stability. Given the nature of the Petroleum Activities Program, the use of ballast (including the potential discharge of ballast water) is considered to be a safety critical requirement. CS: Not assessed, control not feasible.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Eliminate use of MODU/vessels.	F: No. Given that vessels must be used to implement project, there is no feasible means to eliminate the source of risk. CS: Loss of the project.	Not assessed, control not feasible.	Not assessed, control not feasible.	No
Professional Judgement - Substitute				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
Source project vessels based in Australia only.	F: Potentially. Limiting activities to only use local project vessels could potentially pose a significant risk in terms of time and duration of sourcing a vessel, as well as the ability of the local vessels to perform the required tasks. For example, there are limited installation vessels based in Australian waters. While the project will attempt to source project vessels locally it is not always possible. Availability cannot always be guaranteed when considered competing Oil and Gas activities in the region. In addition, sourcing Australian based vessels only will cause increases in cost due to pressures of vessel availability. CS: Significant cost and schedule impacts due to restrictions of vessel hire opportunities.	Sourcing vessels from within Australian will reduce the likelihood of IMS from outside Australian waters, however, it does not reduce the likelihood of introduction of species native to Australia but alien to the PAA and NWMR, or of IMS that have established elsewhere in Australia. The consequence is unchanged.	Disproportionate. Sourcing vessels from Australian waters may result in a reduction in the likelihood of IMS introduction to the PAA; however, the potential cost of implementing this control is grossly disproportionate to the minor environmental gain (or reducing an already remote likelihood of IMS introduction) potentially achieved by using only Australian based vessels, consequently this risk is considered not reasonably practicable.	No
IMS inspection of all vessels.	F: Yes. Approach to inspect vessels could be a feasible option. CS: Significant cost and schedule impacts. In addition, Woodside's IMS risk assessment process (**C 13.2**) is seen to be more cost effective as this control allows Woodside to manage the introduction of marine pests through biofouling, while targeting its efforts to and resources to areas of greatest concern.	Inspection of all vessels for IMS would reduce the likelihood of IMS being introduced to the PAA. However, this reduction is unlikely to be significant given the other control measures implemented. No change in consequence would occur.	Disproportionate. The cost/sacrifice outweighs the benefit gained, as other controls to be implement achieve an ALARP position.	No
Professional Judgement – Engineered Solution				
None identified.				

Demonstration of ALARP				
Control Considered	***Control Feasibility (F) and Cost/Sacrifice (CS)***	***Benefit in Impact/Risk Reduction***	***Proportionality***	***Control Adopted***
ALARP Statement: On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type, Woodside considers the adopted controls appropriate to manage the risks and consequences of IMS introduction. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.				

Demonstration of Acceptability
Acceptability Criteria and Assessment
Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.2.4.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)*:* • Overall risk consequence for individual receptors are less than the significant impact level defined in the OPP. • EPOs and controls in the OPP that are relevant to an unplanned introduction of IMS have been adopted. • There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.
Acceptability Statement: The impact assessment has determined that the accidental introduction and establishment of IMS represents a low current risk rating and is unlikely to result in a risk consequence greater than Slight. The adopted controls are considered consistent with industry legislation, codes and standards. Further opportunities to reduce the impacts have been investigated above The potential risks and consequences are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks of invasive marine species to an acceptable level.

Environmental Performance Outcomes, Standards and Measurement Criteria			
EPO	***Adopted Control(s)***	***EPS***	***MC***
EPO 13 Undertake the Petroleum Activities Program in a manner which does not modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in an area defined as a Key Ecological Feature. **EPO 23**	**C 13.1** Project vessels will manage their ballast water using one of the approved ballast water management options, as specified in the Australian Ballast Water Management Requirements.	**PS 13.1** Prevent the translocation of IMS within the vessel's ballast water from high risk locations to the Operational Area.	**MC 13.1.1** Ballast Water Records System maintained by vessels which verifies compliance against Australian Ballast Water Management Requirements.
	C 13.2 Woodside's IMS risk assessment process[8] will be applied to the MODU, project vessels and relevant immersible equipment undertaking the Petroleum Activities Program. Assessment will consider these risk factors: For vessels/ MODU:	**PS 13.2** Before entering the Operational Area, project vessels, MODU and relevant immersible equipment are determined to be low risk of introducing IMS of concern, and maintain this low risk status to mobilisation.	**MC 13.2.1** Records of IMS risk assessments maintained for all project vessels and relevant immersible equipment entering the operational area or IMS management area to undertake the Petroleum Activities Program.
		PS 19.2.2	**MC 19.2.2**

[8] Woodside's IMS risk assessment process was developed with regard to the national biofouling management guidelines for the petroleum production and exploration industry and guidelines for the control and management of a ships' biofouling to minimise the transfer of invasive aquatic species (IMO Guidelines, 2011).

Undertake the Petroleum Activities Program in a manner which prevents a known or potential pest species (IMS) becoming established.	• vessel/MODU/ type • recent IMS inspection and cleaning history, including for internal niches • out-of-water period before mobilisation • age and suitability of antifouling coating at mobilisation date • internal treatment systems and history • origin and proposed area of operation • number of stationary/slow speed periods >7 days • region of stationary or slow periods • type of activity – contact with seafloor. For immersible equipment: • region of deployment since last thorough clean, particularly coastal locations • duration of deployments • duration of time out of water since last deployment • transport conditions during mobilisation • post-retrieval maintenance regime. Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk (such as treating internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced.	In accordance with Woodside's IMS risk assessment process, the IMS risk assessments will be undertaken by an authorised environment adviser who has completed relevant Woodside IMS training or by qualified and experienced IMS inspector.	Records confirm that the IMS risk assessments undertaken by an Environment Adviser or IMS inspector (as relevant).

6.7.9 Physical Presence (Unplanned): Collision with Marine Fauna

Scarborough OPP – Relevant Impact Assessment Section		
OPP Section 7.2.5 Physical Presence (Unplanned): Collision with Marine Fauna		
Context		
Relevant Activities Vessel Operations – **Section 3.10.2**	**Existing Environment** Marine Fauna of Conservation Significance – **Section 4.6**	**Stakeholder consultation** Consultation – **Section 5**

Impact/Risk Evaluation Summary

Source of Impact/Risk	*Environmental Value Potentially Impacted*							*Evaluation*						
	Soil and Groundwater	Marine Sediment	Water Quality	Air Quality (inc. odour)	Ecosystems / Habitat	Species	Socio-economic	Decision Type	Impact/Consequence	Likelihood	Current Risk Rating	ALARP Tools	Acceptability	Outcome
Accidental collision between MODU/project vessels and protected marine fauna						✓		A	E	1	L	LCS GP PJ	Broadly Acceptable	EPO 26

Description of Source of Impact/Risk

Vessel Operations

Activities associated with the Petroleum Activities Program will require vessels for subsea installation, support operations and supply/transport. The type and number of vessels in the PAA at any one time, and the duration of presence, will differ depending on the activities being undertaken. Physical presence of vessels may result in unplanned collision with marine fauna including marine mammals, marine reptiles and fish.

Detailed Impact Assessment

Assessment of Potential Impacts

Project vessels operating in and around the PAA may present a potential hazard to marine mammals and other protected marine fauna, such as marine turtles. Vessel movements can result in collisions between the vessel (hull and propellers) and marine fauna, potentially resulting in superficial injury, serious injury that may affect life functions (e.g. movement and reproduction), or mortality. Marine fauna are also at risk of mortality through being caught in thrusters during station keeping operations (dynamic positioning).

The likelihood of vessel/fauna collision being lethal is influenced by vessel speed—the greater the speed at impact, the greater the risk of mortality (Jensen and Silber, 2004; Laist et al., 2001). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike increases from about 20% at 8.6 knots to 80% at 15 knots. Project vessels within the Operational Area are likely to be travelling <8 knots (and will often be stationary) within the 500 m zone for the MODU. At times, vessels will be transiting between wells where speed could be up to a maximum of about 15 knots, however these would only be transitory through the area. Therefore, the chance of a vessel collision with protected species resulting in a lethal outcome is considered unlikely.

The risk of marine life getting caught in operating thrusters is unlikely, given the low presence of individuals, combined with the avoidance behaviour commonly displayed during dynamic positioning operations.

Marine Mammals

As described above, vessel speed influences the probability of a vessel collision with a cetacean and also whether a collision may result in lethal injury (Vanderlaan and Taggart, 2007). Additionally, behaviour of individuals may also influence the likelihood of a collision occurring. Although large cetaceans are expected to show localised avoidance in response to vessel noise, studies have reported limited behavioural response to approaching ships (McKenna et al.,

2015) and individuals engaging in behaviours such as feeding, mating or nursing may be less aware of their surroundings and more susceptible to collision (Laist et al., 2001).

No known key aggregation areas for marine mammals (resting, breeding or feeding) are located within or immediately adjacent to the PAA. However, individuals may occasionally be present in the PAA, including pygmy blue whales during seasonal migrations (**Section 4.6.5**). Eleven species of dolphin were identified that may occur in the PAA. However, most dolphins show preference for coastal habitats over deep offshore waters. This reduces the likelihood of dolphin species being encountered in the PAA and interacting with project vessels.

According to the data of Vanderlaan and Taggart (2007), it is estimated that the risk of lethal injury to a large whale as a result of a vessel strike is less than 10% at a speed of 4 knots. Vessel-whale collisions at this speed are uncommon and, based on reported data contained in the NOAA database (Jensen and Silber, 2004) there are only two known instances of collisions when the vessel was travelling at less than 6 knots; both of these were from whale-watching vessels that were deliberately positioned amongst whales

Smaller cetaceans, such as dolphins, comprise a lower proportion of vessel collision records (DoEE, 2016), though it is difficult to determine if this is due to a lower collision rate or lower detection rate of incidents. Dolphins often engage in bow riding which may make them more vulnerable to entanglement with propellers or thrusters compared to larger cetaceans.

Marine Reptiles

The Recovery Plan for Marine Turtles in Australia recognises turtles are at risk from vessel strikes, particularly in shallow coastal foraging habitats and internesting areas where there are high numbers of recreational and commercial vessels (Commonwealth of Australia, 2017). Considering the offshore location, it is expected that the presence of marine turtles would be very unlikely and only comprise individuals transiting the open, offshore waters for short periods of time. It is expected that individuals will respond to vessel presence by avoiding the immediate vicinity of the vessels and, combined with low vessel speed, will reduce the likelihood of a vessel-turtle collision.

It is unlikely that vessel movement associated with the Petroleum Activities Program will have a significant impact on marine fauna populations, given the low presence of transiting individuals and the low operating speed of the support vessels (generally <8 knots or stationary, unless operating in an emergency).

Marine Fauna Summary

Potential impacts from collision with marine fauna will not result in a substantial adverse effect on a population or the spatial distribution of the population. Additionally, no adverse impact on marine ecosystem functioning or integrity or impacts to lifecycles of the population of migratory whales will occur.

Summary of Assessment Outcomes

Receptor	Impact	Receptor Sensitivity	Risk Consequence	Likelihood	Risk Rating
Marine Mammals	Injury to/ mortality of fauna	High value species	Slight (E)	Highly Unlikely	Low
Marine Reptiles	Injury to/ mortality of fauna	High value species	Slight (E)	Highly Unlikely	Low

Overall Risk Consequence: The overall risk rating is Low based on slight consequence, to the high value receptors (marine mammals and reptiles) and a highly unlikely likelihood. The risk rating/risk consequence for individual receptors are consistent with the levels rated in the OPP.

Demonstration of ALARP

Control Considered	*Control Feasibility (F) and Cost/Sacrifice (CS)*	*Benefit in Impact/Risk Reduction*	*Proportionality*	*Control Adopted*
Legislation, Codes and Standards				
EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans,	F: Yes. CS: Minimal cost. Standard practice.	Implementation of these controls will reduce the likelihood of a collision between a cetacean occurring. The consequence of	Controls based on legislative requirements – must be adopted.	Yes **C 3.1**

including the following measures[9]: • Project vessels will not travel greater than 6 knots within 300 m of a cetacean or turtle (caution zone) and not approach closer than 100 m from a whale. • Project vessels will not approach closer than 50 m for a dolphin or turtle and/or 100 m for a whale (with the exception of animals bow riding). • If the cetacean or turtle shows signs of being disturbed, project vessels will immediately withdraw from the caution zone at a constant speed of less than 6 knots.		a collision is unchanged.		
Good Practice				
Variation of the timing of the Petroleum Activities Program to avoid whale migration periods.	F: No. Timing of activities is linked to MODU schedule. Timing of all activities is currently not determined, and due to MODU availability and operational requirements, undertaking activities during migration seasons may not be able to be avoided. CS: Not considered – control not feasible.	Not considered – control not feasible.	Not considered – control not feasible.	No
Professional Judgement – Eliminate				
No additional controls identified.				
Professional Judgement – Substitute				
No additional controls identified.				
Professional Judgement – Engineered Solution				
The use of dedicated MFOs on project vessels for the duration of each activity to watch for whales and provide direction on and monitor compliance with Part 8 of the EPBC Regulations.	F: Yes. However, vessel bridge crews already maintain a constant watch during operations in compliance with the Woodside Marine – Charterers Instructions on the requirements of	Given that project vessel bridge crews already maintain a constant watch during operations in compliance with the Woodside Marine – Charterers Instructions,	Disproportionate. The cost/sacrifice outweighs the benefit gained.	No

[9] For safety reasons, the distance requirements below are not applied for a vessel holding station or with limited manoeuvrability e.g. anchor handling, loading, back-loading, bunkering, close standby cover for overside working and emergency situations.

	vessel and whale interactions, and crew undertake specific cetacean observation training. CS: Additional cost of MFOs	additional MFOs would not significantly further reduce the risk.		

ALARP Statement:

On the basis of the environmental risk assessment outcomes and use of the relevant tools appropriate to the decision type (i.e. Decision Type A, **Section 2.3.3**), Woodside considers the adopted controls appropriate to manage the risks and consequences of potential vessel collision with protected marine fauna. As no reasonable additional/alternative controls were identified that would further reduce the risks and consequences without grossly disproportionate sacrifice, the risks and consequences are considered ALARP.

Demonstration of Acceptability

Acceptability Criteria and Assessment

Demonstration of acceptability for the sources of aspect and associated impacts assessed in this section are provided in Section 7.2.5.3 of the Scarborough OPP (SA0006AF0000002, rev 5). The Petroleum Activities Program meets the acceptability criteria (**Section 2.3.5**)**:**

- Overall risk consequence/risk ratings for individual receptors are less than the significant impact level defined in the OPP.
- EPOs and controls in the OPP that are relevant to an unplanned seabed disturbance have been adopted.
- There are no changes to internal/external context specific to this risk from the OPP, including issues raised during stakeholder consultation.

Acceptability Statement:

The impact assessment has determined that, given the adopted controls, a vessel collision with marine fauna represents a low current risk rating that is unlikely to result in a risk consequence to marine fauna greater than Slight. There are no BIAs for any EPBC Act listed Threatened or Migratory species overlapping or adjacent to the PAA. Relevant recovery plans and conservation advice have been considered during the impact assessment, and the Petroleum Activities Program is not considered to be inconsistent with the overall recovery objectives and actions of these recovery plans and conservation advice (**Section 6.8**). The adopted controls are considered consistent with industry good practice and professional judgement and meet the requirements of Part 8 (Division 8.1) of the EPBC Regulations 2000. The potential risks and consequences are considered broadly acceptable if the adopted controls are implemented. Therefore, Woodside considers the adopted controls appropriate to manage the risks of vessel collision with marine fauna to a level that is broadly acceptable.

Environmental Performance Outcomes, Standards and Measurement Criteria

EPO	*Adopted Control(s)*	*EPS*	*MC*
EPO 26 Undertake the Petroleum Activities Program in a manner which prevents a vessel strike with protected marine fauna during project activities.	**C 3.1** **See Section 6.6.3**	**PS 3.1** **See Section 6.6.3**	**MC 3.1.1** **See Section 6.6.3**

6.8 Recovery Plan and Threat Abatement Plan Assessment

As described in **Section 1.10.2.2**, an EP must not be inconsistent with a recovery plan or threat abatement plan for a listed threatened species or ecological community. This section describes the assessment that Woodside has undertaken to demonstrate that the Petroleum Activities Program is not inconsistent with any relevant recovery plans or threat abatement plans. For the purposes of this assessment, the relevant Part 13 statutory instruments (recovery plans and threat abatement plans are:

- Recovery Plan for Marine Turtles in Australia 2017 – 2027 (Commonwealth of Australia, 2017).
- Conservation Management Plan for the Blue Whale - A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2015-2025 (Commonwealth of Australia, 2015a).
- Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans 2018 (DoEE, 2018).

Table 6-17 lists the objectives and (where relevant) the action areas of these plans, and also describes whether these objectives/action areas are applicable to government, the Titleholder and/or the Petroleum Activities Program. For those objectives/action areas applicable to the Petroleum Activities Program, the relevant actions of each plan have been identified, and an evaluation has been conducted as to whether impacts and risks resulting from the activity are clearly inconsistent with that action or not. The results of this assessment against relevant actions are presented in **Table 6-18** to **Table 6-20.**

The assessment of potential impacts and risks to pygmy blue whales from underwater noise emissions in **Section 6.6.3** has taken into account the definitions of terminology in the CMP, as described in the DAWE and NOPSEMA guidance released in September 2021. Similarly, the assessment against relevant actions in the CMP in **Table 6-20** has been undertaken in the context of the definitions included in the guidance note.

Table 6-17: Identification of applicability of recovery plan and threat abatement plan objectives and action areas

EPBC Act Part 13 Statutory Instrument	Applicable to:		
	Government	***Titleholder***	***Petroleum Activities Program***
Marine Turtle Recovery Plan			
Long-term Recovery Objective: Minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so they can be removed from the EPBC Act threatened species list	Y	Y	Y
Interim Recovery Objectives			
Current levels of legal and management protection for marine turtle species are maintained or improved, both domestically and throughout the migratory range of Australia's marine turtles	Y		
The management of marine turtles is supported	Y		
Anthropogenic threats are demonstrably minimised	Y	Y	Y
Trends in nesting numbers at index beaches and population demographics at important foraging grounds are described	Y	Y	
Action Areas			
A. Assessing and addressing threats			
A1. Maintain and improve efficacy of legal and management protection	Y		
A2. Adaptively manage turtle stocks to reduce risk and build resilience to climate change and variability	Y		
A3. Reduce the impacts of marine debris	Y	Y	Y
A4. Minimise chemical and terrestrial discharge	Y	Y	Y
A5. Address international take within and outside Australia's jurisdiction	Y		
A6. Reduce impacts from terrestrial predation	Y		
A7. Reduce international and domestic fisheries bycatch	Y		
A8. Minimise light pollution	Y	Y	Y
A9. Address the impacts of coastal development/infrastructure and dredging and trawling	Y	Y	
A10. Maintain and improve sustainable Indigenous management of marine turtles	Y		
B. Enabling and measuring recovery			
B1. Determine trends in index beaches	Y	Y	Y
B2. Understand population demographics at key foraging grounds	Y		
B3. Address information gaps to better facilitate the recovery of marine turtle stocks	Y	Y	Y
Blue Whale Conservation Management Plan			
Long-term recovery objective: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list	Y	Y	Y
Interim Recovery Objectives			

EPBC Act Part 13 Statutory Instrument	Applicable to:		
	Government	***Titleholder***	***Petroleum Activities Program***
The conservation status of blue whale populations is assessed using efficient and robust methodology	Y		
The spatial and temporal distribution, identification of biologically important areas, and population structure of blue whales in Australian waters is described	Y	Y	Y
Current levels of legal and management protection for blue whales are maintained or improved and an appropriate adaptive management regime is in place	Y		
Anthropogenic threats are demonstrably minimised	Y	Y	Y
Action Areas			
A. Assessing and addressing threats			
A.1: Maintain and improve existing legal and management protection	Y		
A.2: Assessing and addressing anthropogenic noise	Y	Y	Y
A.3: Understanding impacts of climate variability and change	Y		
A.4: Minimising vessel collisions	Y	Y	Y
B. Enabling and Measuring Recovery			
B.1: Measuring and monitoring population recovery	Y		
B.2: Investigating population structure	Y		
B.3: Describing spatial and temporal distribution and defining biologically important habitat	Y	Y	Y
Marine Debris Threat Abatement Plan			
Objectives			
Contribute to long-term prevention of the incidence of marine debris	Y	Y	
Understand the scale of impacts from marine plastic and microplastic on key species, ecological communities and locations	Y	Y	Y
Remove existing marine debris	Y		
Monitor the quantities, origins, types and hazardous chemical contaminants of marine debris, and assess the effectiveness of management arrangements for reducing marine debris	Y		
Increase public understanding of the causes and impacts of harmful marine debris, including microplastic and hazardous chemical contaminants, to bring about behaviour change	Y		

Table 6-18: Assessment against relevant actions of the Marine Turtle Recovery Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Marine Turtle Recovery Plan	**Action Area A3**: Reduce the impacts from marine debris	**Action**: Support the implementation of the Marine Debris Threat Abatement Plan (TAP) Priority actions at stock level: • G-NWS – understand the threat posed to this stock by marine debris • LH-WA – determine the extent to which marine debris is impacting loggerhead turtles • F-Pil and H-WA – no relevant actions	Refer **Section 6.7.6** **Not inconsistent assessment**: The assessment of accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to marine turtles.	**EPO 4, 19** **C 11.1, 11.4** **EPS 11.1, 11.4**
	Action Area A4: Minimise chemical and terrestrial discharge	**Action**: Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', e.g. nesting habitat, seagrass meadows or coral reefs Priority actions at stock level: • G-NWS – ensure that spill risk strategies and response programs include management for turtles and their habitats • LH-WA, F-Pil – ensure that spill risk strategies and response programs include management for turtles and their habitats, particularly in reference to slow to recover habitats, e.g. seagrass meadows or corals • H-WA – no relevant actions	Refer **Sections 6.7.2, 6.7.4, 6.7.5** and **Appendix D.** **Not inconsistent assessment**: The assessment of accidental release of chemicals / hydrocarbons has considered the potential risks to marine turtles. Spill risk strategies and response program include management measures for turtles and their nesting habitats.	Refer **Section 7.9**. Detailed oil spill preparedness and response performance outcomes, standards and measurement criteria for the Petroleum Activities Program are present in **Appendix D**
		Action: Routine discharges from MODU and project vessels are managed such that marine turtles are not adversely affected by changes in water quality. Priority actions at stock level: • G-NWS – as above • LH-WA, F-Pil – as above • H-WA – no relevant actions	Refer **Section 6.6.6** **Not inconsistent assessment:** The assessment of routine discharges of chemicals, deck drainage, treated sewerage, putrescible wastes and grey water has considered the potential risks to marine turtles. Individuals transiting the localised area may come into contact with routine discharges, however these are sporadic and	**EPO 11** **C 6.1, 6.3, 6.4. 6.5** **EPS 6.3, 6.4. 6.5**

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
			in small quantities, and are unlikely to pose a significant risk.	
	Action Area A8: Minimise light pollution	**Action**: Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats Priority actions at stock level: • G-NWS – as above • LH-WA – no relevant actions • F-Pil and H-WA – manage artificial light from onshore and offshore sources to ensure biologically important behaviours of nesting adults and emerging/dispersing hatchlings can continue	Refer **Section 6.6.1.** **Not inconsistent assessment**: The assessment of light emissions has considered the potential impacts to marine turtles. Internesting, mating, foraging or migrating turtles are not impacted by light from offshore vessels. Vessel light emissions could cause localised and temporary behavioural disturbance to isolated transient individuals, which is unlikely to result in displacement of adult turtles from internesting or nesting habitat critical to the survival of marine turtles.	**EPO 3, 4** **C 1.1** **EPS 1.1**
	Action Area B1: Determine trends at index beaches	**Action**: Maintain or establish long-term monitoring programs at index beaches to collect standardised data critical for determining stock trends, including data on hatchling production Priority actions at stock level: • G-NWS – continue long-term monitoring of index beaches • LH-WA – continue long-term monitoring of nesting and foraging populations • F-Pil and H-WA – no relevant actions	**Not inconsistent assessment**: Woodside contributes to Action Area B1 via its support of the Ningaloo Turtle Program[10]. Given the offshore location of the PAA, impacts to turtle nesting beaches will not occur.	N/A
	Action Area B3: Address information gaps to better facilitate the recovery of marine turtle stocks	**Action**: Understand the impacts of anthropogenic noise on marine turtle behaviour and biology Priority actions at stock level: • G-NWS – given this is a relatively accessible stock that is likely to be exposed to anthropogenic noise – Investigate the impacts of anthropogenic noise on turtle behaviour and	Refer **Section 6.6.3.** **Not inconsistent assessment**: The assessment of acoustic emissions has considered the potential impacts to flatback and olive ridley turtles. Vessel and seismic acoustic emissions could cause localised and short-term behavioural disturbance to	**EPO 3, 7, 8** **C 3.1** **PS 3.1**

[10] http://www.ningalooturtles.org.au/media_reports.html

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
		biology and extrapolate findings from the North West Shelf stock to other stocks • LH-WA, F-Pil – no relevant actions • H-WA – investigate mixed stock genetics at foraging grounds	isolated transient individuals, which is unlikely to result in displacement of adult turtles from internesting or nesting habitat critical to the survival of marine turtles.	
Assessment Summary The Marine Turtle Recovery Plan has been considered during the assessment of impacts and risks, and the Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.				

Table 6-19: Blue Whale Conservation Management Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Blue Whale Conservation Management Plan	**Action Area A.2**: Assessing and addressing anthropogenic noise	**Action 2**: Assessing the effect of anthropogenic noise on blue whale behaviour **Action 3**: Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to use the area without injury, and is not displaced from a foraging area	Refer **Section 6.6.3.** **Not inconsistent assessment**: The assessment of acoustic emissions has considered the potential impacts to pygmy blue whales.	**EPO 3, 7, 8** **C 3.1** **PS 3.1**
	Action Area A.4: Minimising vessel collisions	**Action 3**: Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented	Refer **Section 6.7.9** **Not inconsistent assessment**: The assessment of vessel collision with marine fauna has considered the potential risks to pygmy blue whales. If the Petroleum Activities Program overlaps with the northern migration, individuals may deviate slightly from migratory route, but will continue on their migration to possible breeding grounds in Indonesian waters. Vessel collisions with pygmy blue whales are highly unlikely to occur, given the very slow vessel speeds and presence of MFOs.	**EPO 26** **C 3.1** **PS 3.1**

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
	Action Area B.3: Describing spatial and temporal distribution and defining biologically important habitat	**Action 2**: Identify migratory pathways between breeding and feeding grounds **Action 3**: Assess timing and residency within Biologically Important Areas	**Not inconsistent assessment**: Woodside contributes to Action Area B3 via its support of targeted research initiatives (e.g. satellite tracking of pygmy blue whale migratory movements[11]).	N/A
Assessment Summary The Blue Whale Conservation Management Plan has been considered during the assessment of impacts and risks, and the Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.				

Table 6-20: Assessment against relevant Marine Debris Threat Abatement Plan

Part 13 Statutory Instrument	Relevant Action Areas/Objectives	Relevant Actions	Evaluation	EPO, Controls and PS
Marine Debris TAP	**Objective 1:** Contribute to long-term prevention of marine debris.	**Action 1.02**: Limit the amount of single use plastic material lost to the environment in Australia.	Refer **Section 6.7.6.** **Not inconsistent assessment**: The assessment of accidental release of solid hazardous and non-hazardous wastes has considered the potential risks to vertebrate wildlife.	**EPO 2, 3, 4, 8, 19, 20, 21** **C 11.1, 11.2, 11.3 11.4** **EPS 11.1, 11.2, 11.3 11.4**
Assessment Summary The Marine Debris TAP has been considered during the assessment of impacts and risks, and the Petroleum Activities Program is not considered to be inconsistent with the relevant actions of this plan.				

[11] Double, M.C., Andrews-Goff, V., Jenner, K.C.S., Jenner, M.-N., Laverick, S.M., Branch, T.A., Gales, N.J., 2014. Migratory movements of pygmy blue whales (*Balaenoptera musculus brevicauda*) between Australia and Indonesia as revealed by satellite telemetry. PloS One 9, e93578

7. IMPLEMENTATION STRATEGY

7.1 Overview

Regulation 14 of the Environment Regulations requires an EP to contain an implementation strategy for the activity. The implementation strategy for the Petroleum Activities Program confirms fit for purpose systems, practices and procedures are in place to direct, review and manage the activities so environmental risks and impacts are continually being reduced to ALARP and are acceptable, and that EPOs and standards outlined in this EP are achieved.

Woodside, as Operator, is responsible for ensuring the Petroleum Activities Program is managed in accordance with this Implementation Strategy and the WMS (see **Section 1.9**).

7.2 Systems, Practice and Procedures

All operational activities are planned and carried out in accordance with relevant legislation and standards, management measures (i.e. controls) identified in this EP and internal environment standards and procedures (**Section 6**).

The systems, practices and procedures that will be implemented are listed in the Performance Standards (PS) contained in this EP. Document names and reference numbers may be subject to change during the statutory duration of this EP and is managed through a Change Register and update process.

7.3 Roles and Responsibilities

Key roles and responsibilities for Woodside and contractor personnel relating to implementing, managing and reviewing this EP are described in **Table 7-1**. Roles and responsibilities for oil spill preparation and response are outlined in **Appendix D** and the *Woodside Oil Pollution Emergency Arrangements (Australia)*.

It is the responsibility of all Woodside employees and contractors to implement the Woodside *Corporate Health, Safety, Environment and Quality Policy* (**Appendix A**) in their areas of responsibility and that the personnel are suitably trained and competent in their respective roles.

Table 7-1: Roles and responsibilities

Title (role)	Environmental Responsibilities
Office-based Personnel	
Woodside Project Manager	• Monitor and manage the activity so it is undertaken as per the relevant standards and commitments in this EP. • Notify the Woodside Environment Adviser of any scope changes in a timely manner. • Liaise with regulatory authorities as required. • Review this EP as necessary and manage change requests. • Ensure all project and support vessel crew members complete an HSE induction. • Verify that contractors meet environmental related contractual obligations. • Confirm environmental incident reporting meets regulatory requirements (as outlined in this EP) and Woodside's Health, Safety and Environment Reporting and Investigation Procedure. • Monitor and close out corrective actions identified during environmental monitoring or audits.
Woodside Well Delivery Manager	• Ensure drilling operations are undertaken as per this EP and approval conditions. • Provide sufficient resources to implement the drilling-related management measures (i.e. controls, EPOs, PSs and MC) in this EP. • Ensure MODU and support vessel personnel are given an Environmental Induction as per **Section 7.4.2** of this EP at the start of the drilling programs. • Confirms controls and performance standards in this EP are actioned, as required, before drilling commences. • Ensures the MODU start-up meets the requirements of the Drilling and Managing Rig Operations Process.
Woodside Subsea and Pipelines Installation Manager	• Ensure the subsea installation activities are undertaken as per this EP and approval conditions. • Provide sufficient resources to implement the subsea installation-related management measures (i.e. controls, EPOs, PSs and MC) in this EP. • Ensure installation vessel personnel are given an Environmental Induction as per **Section 7.4.2** this EP at the start of the installation activities. • Confirm controls and performance standards in this EP are actioned, as required, before installation activities commence. • Ensure relevant vessels meet the requirements of Woodside's Marine Operations Operating Standard. • Manage change requests for the activity and notify the Woodside Environment Adviser of any scope changes in a timely manner. • Confirm that site-based personnel are given an Environmental Induction as per **Section 7.4.2** of this EP at the start of the activity. • Ensure all chemicals and drill fluids proposed to be discharged are assessed and approved as per the requirements of the EP.

Title (role)	Environmental Responsibilities
Woodside Drilling Superintendent	• Ensure the drilling program meets the requirements detailed in this EP. • Ensure changes to the drilling program are communicated to the Woodside Environmental Adviser. • Ensure the Woodside's Well Site Manager is provided with the resources required to ensure the management measures (i.e. controls, EPOs, EPs and MC) in this EP are undertaken. • Confirm environmental incident reporting meets regulatory requirements (as outlined in this EP) and Woodside's Health, Safety and Environment Reporting and Investigation Procedure. • Monitor and close out corrective actions identified during environmental monitoring or audits.
Woodside Drilling Engineers	• Ensure changes to the drilling program are communicated to the Woodside Environmental Adviser. • Ensure all drill and completions fluid chemical components and other fluids that may be used downhole have been reviewed by the Drilling and Completions Environmental Adviser.
Woodside Environmental Adviser	• Verify relevant Environmental Approvals for the activities exist prior to commencing activity. • Track compliance with performance outcomes and performance standards as per the requirements of this EP. • Prepare environmental component of relevant Induction Package. • Assist with the review, investigation and reporting of environmental incidents. • Ensure environmental monitoring and inspections/audits are undertaken as per the requirements of this EP. • Liaise with relevant regulatory authorities as required. • Assist in preparation of external regulatory reports required, in line with environmental approval requirements and Woodside incident reporting procedures. • Monitor and close out corrective actions (Campaign Action Register (CAR)) identified during environmental monitoring or audits. • Provide advice to relevant Woodside personnel and contractors to assist them to understand their environment responsibilities. • Liaise with primary installation contractors to ensure communication and understanding of environment requirements as outlined in this EP and in line with Woodside's Compass values and management systems.
Woodside Corporate Affairs Adviser	• Prepare and implement the Stakeholder Consultation Plan for the Petroleum Activities Program. • Report on stakeholder consultation. • Ongoing liaison and notification as required as per **Section 5**.
Woodside Marine Assurance Superintendent	• Conducts relevant audit and inspection to confirm vessels comply with relevant Marine Orders and Woodside Marine Charters Instructions requirements to meet safety, navigation and emergency response requirements.
Woodside CICC Duty Manager	On receiving notification of an incident, the Woodside CICC Duty Manager shall:

Title (role)	Environmental Responsibilities
	• establish and take control of the IMT and establish an appropriate command structure for the incident • assess situation, identify risks and actions to minimise the risk • communicate impact, risk and progress to the Crisis Management Team and stakeholders • develop the incident action plan (IAP) including setting objectives for action • approve, implement and Manage the IAP • communicate within and beyond the incident management structure • manage and review safety of responders • address the broader public safety considerations • conclude and review activities.
MODU-based Personnel	
MODU Offshore Installation Manager (OIM)	• Ensure the MODU’s management system and procedures are implemented. • Ensure personnel starting work on the MODU receive an environmental induction that meets the requirements specified in this EP. • Ensure personnel are competent to undertake the work they have been assigned. • Verify that emergency drills are conducted as per the MODU’s schedule. • Ensure the MODU’s Emergency Response Team has been given sufficient training to implement the MODU’s SOPEP. • Ensure any environmental incidents or breaches of outcomes or standards are reported immediately to the Well Site Manager. • Ensure corrective actions for incidents or breaches are developed, communicated to the Well Site Manager, and tracked to close out in a timely manner. Close out of actions is communicated to the Well Site Manager.
Woodside Well Site Manager	• Ensure the drilling program is undertaken as detailed in this EP. • Ensure the management measures (i.e. controls, EPOs, PSs and MC) detailed in this EP (relevant to offshore activities) are implemented on the MODU (other controls will be implemented onshore). • Ensure environmental incidents or breaches of outcomes or standards are reported as per the Woodside Corporate Event Notification Matrix. Corrective actions for incidents and breaches are developed, tracked and closed out in a timely manner. • Ensure actions in the Drilling and Completions HSE Improvement Plan are undertaken. • Ensure periodic environmental inspections/reviews are completed. Corrective actions from inspections are developed, tracked and closed out in a timely manner.
Woodside Offshore HSE Adviser	• Support the Well Site Manager to ensure the controls detailed in this EP relevant to offshore activities are implemented on the MODU and help collect and record evidence of implementation (other controls are implemented, and evidence collected onshore).

Title (role)	Environmental Responsibilities
	• Support the Well Site Manager to ensure the Environmental Performance Outcomes are met and the performance standards detailed in this EP are implemented on the MODU. • Confirm actions in the Drilling and Completions HSE Improvement Plan are undertaken. • Support the Well Site Manager to ensure environmental incidents or breaches of outcomes or standards outlined in this EP, are reported, and corrective actions for incidents and breaches are developed, tracked and closed out in a timely manner. • Ensure periodic environmental inspections/reviews are completed and corrective actions from inspections are developed, tracked and closed out in a timely manner. • Review Contractors procedures, input into Toolbox talks and JSAs. • Provide day to day environmental support for activities in consultation with the Woodside Environment Adviser.
Drilling Logistics Coordinator	• Waste is managed on the MODU and sent to shore as per the Drilling and Completions Waste Management Plan.
Vessel-based Personnel	
Installation Vessel Master Activity Support Vessel Master	• Ensure the vessel management system and procedures are implemented. • Ensure personnel commencing work on the vessel receive an environmental induction that meets the relevant requirements specified in this EP. • Ensure personnel are competent to undertake the work they have been assigned. • Verify SOPEP drills are conducted as per the vessel's schedule. • Ensure the vessel Emergency Response Team (ERT) has been given sufficient training to implement the SOPEP. • Ensure any environmental incidents or breaches of relevant Environmental Performance Outcomes or performance standards detailed in this EP, are reported immediately to the Woodside Well Site Manager. • Ensure corrective actions for incidents or breaches are developed, communicated to the Well Site Manager, and tracked to close out in a timely manner. Close out of actions is communicated to the Well Site Manager.
Vessel Logistics Coordinators	• Ensure waste is managed on the relevant support vessels or installation vessel and sent to shore as per the relevant Waste Management Plan.
Vessel HSE Advisers	• Refer to Woodside HSE Offshore Adviser responsibilities detailed above under MODU-based personnel.

Title (role)	Environmental Responsibilities
Contractor Project Manager	• Confirm that activities are undertaken in accordance with this EP, as detailed in the Woodside approved Contactor Environmental Management Plan • Ensure personnel commencing work on the project receive a relevant environmental induction that meets the requirements specified in this EP • Ensure personnel are competent to undertake the work they have been assigned • Ensure any environmental incidents or breaches of objectives, standards or criteria outlined in this EP, are reported immediately to the Woodside Responsible Engineer or Vessel Master.
Woodside Site Representative/ Resident Engineer	• Ensure activities are undertaken as detailed in this EP. • Ensure the management measures made in this EP are implemented on the vessel • Ensure environmental incidents or breaches of objectives, standards or criteria outlined in this EP, are reported as per the Woodside Corporate Event Notification Matrix • Verify HSE improvement actions identified during the project are implemented where practicable • Ensure periodic environmental inspections are completed.

7.4 Training and Competency

7.4.1 Overview

Woodside as part of its contracting process undertakes assessments of a proposed Contractor's environmental management system to determine the level of compliance with the standard AS/NZS ISO 14001. This assessment is undertaken for the Petroleum Activities Program as part of the pre-mobilisation process. The assessment determines whether there is a clearly defined organisational structure that clearly defines the roles and responsibilities for key positions. The assessment also assesses whether there is an up-to-date training matrix that defines any corporate and site/activity-specific environmental training and competency requirements.

As a minimum, environmental awareness during inductions is required for all MODU personnel, detailing awareness and compliance with the MODU and project vessel Contractor's environmental policy and environmental management system.

7.4.2 Inductions

Inductions are provided to all relevant personnel (e.g. contractors and Company representatives) before mobilising to or on arrival at the activity location. The induction covers the HSE requirements and environmental information specific to the activity location. Attendance records will be maintained.

The Petroleum Activities Program induction may cover information about:

- Description of the activity.
- Ecological and socio-economic values of the activity location, including an overview of pygmy blue whales.
- Regulations relevant to the activity.
- Woodside's Environmental Management System – Health, Safety and Environment Policy.
- EP importance/structure/implementation/roles and responsibilities.
- Main environmental aspects/hazards and potential environmental impacts and related performance outcomes.
- Oil spill preparedness and response.
- Monitoring and reporting on performance outcomes and standards using MC.
- Incident reporting.

In addition, the inductions will cover the requirement that there will be no recreational fishing from the MODU and / or vessels.

7.4.3 Activities Program Specific Environmental Awareness

Before petroleum activities begin, a pre-activity meeting will be held on-board the MODU and project vessels with all relevant personnel. The pre-activity meeting provides an opportunity to reiterate specific environmental sensitivities or commitments associated with the activity. Relevant sections of the pre-activity meeting will also be communicated through to the support vessel personnel. Attendance lists are recorded and retained.

During operations, regular HSE meetings will be held on the MODU and project vessels which cover all crew. During these meetings, recent environmental incidents are regularly reviewed, and awareness material presented.

7.4.4 Pygmy Blue Whale Observation Training

Relevant crew onboard the MODU and installation vessel will undertake pygmy blue whale observation training prior to commencing activities. This training will include as a minimum:

- an overview of the potential impacts to pygmy blue whales
- on overview of cetaceans that may be present during activities and relevant behaviours
- the management procedures in place for pygmy blue whales
- the observation and reporting requirements.

Records should be maintained as evidence of the personnel who have completed the pygmy blue whale observation training.

7.4.5 Management of Training Requirements

All personnel on the MODU and project vessels are required to be competent to perform their assigned positions. This may be in the form of external or 'on the job' training. The vessel Safety Training Coordinator (or equivalent) is responsible for identifying training needs, keeping records of training performed and identifying minimum training requirements.

7.5 Monitoring, Auditing, Management of Non-conformance and Review

7.5.1 Monitoring

Woodside and its contractors will perform a program of periodic monitoring during the Petroleum Activities Program – starting at mobilisation of each activity and continuing through the duration of each activity to activity completion. This information will be collected using the tools and systems outlined below, developed based on the EPOs, controls, standards and MC in this EP. The tools and systems will collect, as a minimum, the data (evidence) referred to in the MC in **Section 6** and **Appendix D**.

The collection of this data (against the MC) will form part of the permanent record of compliance maintained by Woodside and will form the basis for demonstrating that the EPOs and standards are met, which will be summarised in a series of routine reporting documents.

7.5.1.1 Source-based Impacts and Risks

The tools and systems to monitor environmental performance, where relevant, will include:

- Daily reports which include leading indicator compliance.
- Periodic review of waste management and recycling records.
- Use of contractor's risk identification program that requires recording and submitting safety and environment risk observation cards routinely (frequency varies with contractor).
- Collection of evidence of compliance with the controls detailed in the EP relevant to offshore activities by the Woodside Offshore HSE Adviser (other compliance evidence is collected onshore).
- Environmental discharge reports that record volumes of planned and unplanned discharges downhole (in the well), to ocean and atmosphere.
- Monitoring of progress against the Drilling and Completions function scorecard for KPIs.
- Internal auditing and assurance program as described in **Section 7.5.2**.

Throughout this activity, Woodside will continuously identify new source-based risks and impacts through the Monitoring and Auditing systems and tools described above and in **Section 7.5.2**.

7.5.1.2 Management of Knowledge

Review of knowledge relevant to the existing environment is undertaken in order to identify changes relating to the understanding of the environment or legislation that supports the risk and impact assessments for EPs (in-force and in-preparation). Relevant knowledge is defined as:

- Environmental science supporting the description of the existing environment.
- Socio-economic environment and stakeholder information.
- Environmental legislation.

The frequency and documentation of reviews, communication of relevant new knowledge and consideration of management of change are documented in the WMS Environment Plan Guideline.

Under the Oil Spill Scientific Monitoring Program preparedness, an annual review and update to the environmental baseline studies database is completed and documented. Periodic location-focused environmental studies and baseline data gap analyses are completed and documented. Any subsequent studies scoped and executed as a result of such gap analysis are managed by the Environment Science Team and tracked via the Corporate Environment Baseline Database.

7.5.2 Auditing

Environmental performance auditing will be performed to:

- Identify potential new or changes to existing environmental impacts and risk, and methods for reducing those to ALARP.
- Confirm that mitigation measures detailed in this EP are effectively reducing environmental impacts and risk, that mitigation measures proposed are practicable and provide appropriate information to verify compliance.
- Confirm compliance with the Performance Outcomes, Controls and Standards detailed in this EP.

Internal auditing will be performed to cover each key project activity as summarised below.

7.5.2.1 MODU Activities

Internal auditing is performed on a MODU-specific schedule, rather than a schedule to align with each well. This enables continuous review and improvement of environmental performance over the term of the MODU contract. The following internal audits, inspections and reviews will be performed to review the environmental performance of the activities:

- Survey environment rig equipment for a newly contracted MODU (if not previously contracted to Woodside within the last two years) against Woodside's Engineering Standard – Rig Equipment. This standard covers functional and technical requirements for Woodside contracted rigs and their associated equipment. An environment rig equipment survey scope typically includes mud and solids control systems, environmental discharge control (including drainage management), and loss of containment management.
- Complete a minimum of monthly environmental inspection (conducted by offshore Woodside personnel or a delegate) which may include verifying:
    - bunkering/transfers between support vessels and MODU/project vessels

- environment containment including chemical storage, spill response equipment and housekeeping
- general MODU environment risks including waste management, drilling fluids oil/water separation, and inspection of subsea and moonpool areas.

- Perform at least one environment audit during the Petroleum Activities Program, while the MODU is on location (by a Woodside Environment Adviser or delegate), which may include:
  - operational compliance audits relevant to environmental risk of activities which may include compliance with training commitments, discharge requirements, bunkering activities, verification of use of approved chemicals, and satisfactory close out of items from previous audits
  - inspection of selected risk areas/activities (which may include shaker house, drill floor and mud management while commencing riser drilling or reservoir interception) during routine MODU visits throughout the MODU campaign, determined by risk, previous incidents or operation specification requirements.

7.5.2.2 Subsea Scope Activities

The following internal assurance will be performed for the subsea scope activities:

- Pre-mobilisation inspection/audit report will be conducted by a relevant person (before commencing). The scope of the audits are risk-based and specific to the relevant activity, but will generally focus on aspects relating to ensuring appropriate understanding of environmental commitments and the operational readiness of the activity scope, including appropriate environmental controls in place. All installation vessels associated with the above scopes will be audited by Woodside. Support or transport vessels will be assessed on a risk-based approach, but will be audited via the primary subsea installation contractor’s process.
- At least one operational compliance audit relevant to applicable EP commitments will be conducted by a Woodside Environment Adviser for the subsea campaign. The audit may be conducted offshore or office-based, subject to the duration of the activity and logistics of performing the audit offshore for short duration scopes (e.g. pipelay).
- Contractor-specific HSE audits will also be conducted of the associated support vessels. The audits will consider the implementation of HSE management, risk management, as well as pre-mobilisation and offshore readiness.
- Vessel based HSE inspections will be conducted fortnightly by vessel HSE personnel. Each inspection will focus on a specific risk area relevant to the project activity and a formal report will be issued (for example, bunkering controls, chemical and discharge management, cetacean reporting, etc).

The internal audits and reviews, combined with the ongoing monitoring described in **Section 7.5.1**, and collection of evidence for MC are used to assess EPOs and standards.

As part of Woodside’s EMS and/or assurances processes, activities may also be periodically selected for environmental audits as per Woodside’s internal auditing process. Audit, inspection and review findings relevant to continuous improvement of environmental performance are tracked through the Environmental Commitments and Actions Register.

This Environmental Commitments and Actions Register is used to track subsea support vessel and subsea activity compliance with EP commitments, including any findings and corrective actions.

Non-conformances identified will be reported and/or tracked in accordance with **Section 7.5.3**.

7.5.2.3 Marine Assurance

Woodside's marine assurance is managed by the Marine Assurance Team of the Logistics Function in accordance with Woodside's Marine Offshore Vessel Assurance Procedure. The Woodside process is based on industry standards and consideration of guidelines and recommendations from recognised industry organisations such as Oil Companies International Marine Forum and International Maritime Contractors Association.

Woodside's Marine Offshore Assurance process is mandatory for all vessels (other than Tankers and Floating Production Storage and Offloading vessels) that are chartered directly by or on behalf of Woodside, including for short term hires (i.e. <3 months in duration). It defines applicable marine offshore assurance activities, ensuring all vessel operators operate seaworthy vessels that meet the requirements for a defined scope of work and are managed with a robust Safety Management System.

The process is multi-faceted and encompasses the following marine assurance activities:

- Safety Management System Assessment
- Dynamic Positioning (DP) System Verification
- Vessel Inspections
- Project support for tender review, evaluation and pre/post contract award.

Vessel inspections are used to verify actual levels of compliance with the company's Safety Management System, the overall condition of the vessel and the status of the planned maintenance system onboard. Woodside Marine Assurance Specialist will conduct a risk assessment on the vessel to determine the level of assurance applied and the type of vessel inspection required.

Methods of vessel inspection may include, and are not limited to:

1. Woodside Marine Vessel Inspection
2. OCIMF OVID Inspection
3. IMCA CMID Inspection
4. Marine Warranty Survey

Upon completion of the marine assurance process, to confirm that identified concerns are addressed appropriately and conditions imposed are managed, the Woodside Marine Assurance Team will issue the vessel a statement of approval. Should a vessel not meet the requirements of the Woodside Marine Offshore Vessel Assurance Process and be rejected, there does exist an opportunity to further scrutinise the proposed vessel.

Where a vessel inspection and/or OVMSA Verification Review is not available and all reasonable efforts based on time and resource availability to complete an vesselinspection and/or OVMSA Verification Review are performed (i.e. short term vessel hire), the Marine Assurance Specialist Offshore may approve the use of an alternate means of inspection, known as a risk assessment.

7.5.2.4 Risk Assessment

Woodside conducts a risk assessment of vessels where either an OVMSA Verification Review and/or vessel inspection cannot be completed. This is not a regular occurrence and is typically used when the requirements of the assurance process are unable to be met or the processes detailed are not applicable to a proposed vessel(s). The Marine Vessel Risk Assessment will be conducted by the Marine Assurance Specialist, where the vessel meets the short term hire prerequisites.

The risk assessment is a semi-quantitative method of determining what further assurance process activity, if any, is required to assure a vessel for a particular task or role. The process compares the level of management control a vessel is subject to against the risk factors associated with the activity or role.

Several factors are assessed as part of a vessel risk assessment, including:

- Management control factors:
  - Company audit score (i.e. management system)
  - vessel HSE incidents
  - vessel Port State Control deficiencies
  - instances of Port State Control vessel detainment
  - years since previous satisfactory vessel inspection
  - age of vessel
  - contractors' prior experience operating for Woodside.
- Activity risk factors:
  - people health and safety risks (a function of the nature of the work and the area of operation)
  - environmental risks (a function of environmental sensitivity, activity type and magnitude of potential environment damage (e.g. largest credible oil spill scenario))
  - value risk (likely time and cost consequence to Woodside if the vessel becomes unusable)
  - reputation risk
  - exposure (i.e. exposure to risk based on duration of project)
  - industrial relations risk.

The acceptability of the vessel or requirement for further vessel inspections or audits is based on the ratio of vessel score to activity risk. If the vessel management control is not deemed to appropriately manage activity risk, a satisfactory company audit and/or vessel inspection may be required before awarding work.

The risk assessment is valid for the period a vessel is on hire and for the defined scope of work.

7.5.3 Management of Non-conformance

Woodside classifies non-conformances with EPOs and standards in this EP as environmental incidents. Woodside employees and contractors are required to report all environmental incidents, and these are managed as per Woodside's internal event recording, investigation and learning requirements.

An internal computerised database called First Priority is used to record and report these incidents. Details of the event, immediate action taken to control the situation, investigation outcomes and corrective actions to prevent reoccurrence are all recorded. Corrective actions are monitored using First Priority and closed out in a timely manner.

Woodside uses a consequence matrix for classification of environmental incidents, with the significant categories being A, B and C (as detailed in **Section 2.3**). Detailed investigations are completed for all categories A, B, C and high potential environmental incidents.

7.5.4 Review

7.5.4.1 Management Review

Within the Environment Function, senior management regularly monitor and review environmental performance and the effectiveness of managing environmental risks and performance. Within each Function and Business Unit Leadership Team (e.g. Drilling and Completions, Subsea and Developments/Projects), managers review environmental performance regularly, including through quarterly HSE review meetings.

Woodside's Drilling and Completions Environment Team will perform six-monthly reviews of the effectiveness of the implementation strategy and associated tools. This will involve reviewing the:

- Drilling and Completions environment KPIs (leading and lagging).
- Tools and systems to monitor environmental performance (detailed in **Section 7.5.1**)
- Lessons learned about implementation tools and throughout each campaign.

Reviews of oil spill arrangements and testing are performed in accordance with **Section 7.9**.

7.5.4.2 Learning and Knowledge Sharing

Learning and knowledge sharing occurs via a number of different methods including:

- Event investigations.
- Event bulletins.
- After action review conducted at the end of each well, including review of environmental incidents as relevant.
- Ongoing communication with MODU operators.
- Formal and informal industry benchmarking.
- Cross asset learnings.
- Engineering and technical authorities discipline communications and sharing.

7.5.4.3 Review of Impacts, Risks and Controls Across the Life of the EP

In the unlikely case that activities described in this EP do not occur continuously or sequentially, before recommencing activities after a cessation period greater than 12 months, impacts, risks and controls will be reviewed.

The process will identify or review impacts and risks associated with the newly-commencing activity, and will identify or review controls to ensure impacts and risks remain/are reduced to ALARP and acceptable levels. Information learned from previous activities conducted under this EP will be considered. Controls which have previously been excluded on the basis of proportionality will be reconsidered. Any required changes will be managed by the MOC process outlined below (**Section 7.6**).

7.6 Management of Change and Revision

7.6.1 EP Management of Change

Management of changes are managed in accordance with Woodside's Environmental Approval Requirements Australia Commonwealth Guideline. Management of changes relevant to this EP, concerning the scope of the activity description (**Section 3**) including: review of advances in technology at stages where new equipment may be selected such as vessel contracting; changes in understanding of the environment, DAWE EPBC Act listed threatened and migratory species status, Part 13 statutory instruments (recovery plans, threat abatement plans, conservation advice, wildlife conservation plans) and current requirements for AMPs (**Section 4**); and potential new advice from external stakeholders (**Section 5**), will be managed in accordance with Regulation 17 of the Environment Regulations.

Risk will be assessed in accordance with the environmental risk management methodology (**Section 2.3**) to determine the significance of any potential new environmental impacts or risks not provided for in this EP. Risk assessment outcomes are reviewed in compliance with Regulation 17 of the Environment Regulations.

Minor changes where a review of the activity and the environmental risks and impacts of the activity do not trigger a requirement for a formal revision under Regulation 17 of the Environment Regulations, will be considered a ‘minor revision’. Minor administrative changes to this EP, where an assessment of the environmental risks and impacts is not required (e.g. document references, phone numbers, etc.), will also be considered a ‘minor revision’. Minor revisions as defined above will be made to this EP using Woodside’s document control process. Minor revisions will be tracked in an MOC Register to ensure visibility of cumulative risk changes, as well as enable internal EP updates/reissuing as required. This document will be made available to NOPSEMA during regulator environment inspections.

7.6.2 OPEP Management of Change

Relevant documents from the OPEP will be reviewed in the following circumstances:

- implementation of improved preparedness measures
- a change in the availability of equipment stockpiles
- a change in the availability of personnel that reduces or improves preparedness and the capacity to respond
- the introduction of a new or improved technology that may be considered in a response for this activity
- to incorporate, where relevant, lessons learned from exercises or events
- if national or state response frameworks and Woodside’s integration with these frameworks changes.

Where changes are required to the OPEP, based on the outcomes of the reviews described above, they will be assessed against Regulation 17 to determine if EP, including OPEP, resubmission is required (see **Section 7.6.1**). Changes with potential to influence minor or technical changes to the OPEP are tracked in management of change records, project records and incorporated during internal updates of the OPEP or the five-yearly revision.

7.7 Record Keeping

Compliance records (outlined in MC in **Section 6**) will be maintained.

Record keeping will be in accordance with Regulation 14(7) that addresses maintaining records of emissions and discharges.

7.8 Reporting

To meet the EPOs and standards outlined in this EP, Woodside reports at a number of levels, as outlined in the next sections.

7.8.1 Routine Reporting (Internal)

7.8.1.1 Daily Progress Reports and Meetings

Daily reports for drilling activities are prepared and issued to key support personnel and stakeholders, by relevant managers responsible for the well. The report provides performance information about drilling activities, heath, safety and environment, and current and planned work activities.

Meetings between key personnel are used to transfer information, discuss incidents, agree plans for future activities and develop plans and accountabilities for resolving issues.

7.8.1.2 Regular HSE Meetings

Regular dedicated HSE meetings are held with the offshore and Perth-based management and advisers to address targeted HSE incidents and initiatives. Minutes of these meetings are produced and distributed as appropriate.

7.8.1.3 Performance Reporting

Monthly and quarterly performance reports are developed and reviewed by the Function and Business Unit Leadership Teams (e.g. Drilling and Completions). These reports cover a number of subject matters, including:

- HSE incidents (including high potential incidents and those related to this EP) and recent activities.
- Corporate KPI targets, which include environmental metrics.
- Outstanding actions as a result of audits or incident investigations.
- Technical high and low lights.

7.8.2 Routine Reporting (External)

7.8.2.1 Start and End Notifications of the Petroleum Activities Program

In accordance with Regulation 29, Woodside will notify NOPSEMA and DMIRS of the commencement of the Petroleum Activities Program at least ten days before the activity commences, and will notify NOPSEMA and DMIRS within ten days of completing the activity.

7.8.2.2 Environmental Performance Review and Reporting

In accordance with applicable environmental legislation for the activity, Woodside is required to report information about environmental performance to the appropriate regulator. Regulatory reporting requirements are summarised in **Table 7-2**.

Table 7-2: Routine external reporting requirements

Report	Recipient	Frequency	Content
Monthly Recordable Incident Reports (**Appendix E)**	NOPSEMA	Monthly, by the 15th of each month.	Details of recordable incidents that have occurred during the Petroleum Activities Program for previous month (if applicable).
Environmental Performance Report	NOPSEMA	Annually, with the first report submitted within 12 months of the commencement of the Petroleum Activities Program covered by this EP (as per the requirements of Regulation 14(2).	Compliance with EPOs, controls and standards outlined in this EP, in accordance with the Environment Regulations.

7.8.2.3 End of the Environmental Plan

The EP will end when Woodside notifies NOPSEMA that the Petroleum Activities Program has ended and all of the obligations identified in this EP have been completed, and NOPSEMA has accepted the notification, in accordance with Regulation 25A of the Environment Regulations.

7.8.3 Incident Reporting (Internal)

The process for reporting environmental incidents is described in **Section 7.8.4** of this EP. It is the responsibility of the Woodside Project Manager to ensure reporting of environmental incidents meets Woodside and regulatory reporting requirements as detailed in the Woodside HSE Event Reporting and Investigation Procedure and this section of this EP.

7.8.4 Incident Reporting (External) – Reportable and Recordable

7.8.4.1 Reportable Incidents

7.8.4.1.1 Definition

A reportable incident is defined under Regulation 4 of the Environment Regulations as:

- ‘an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage’.

A reportable incident for the Petroleum Activities Program is:

- an incident that has caused environmental damage with a Consequence Level of Moderate (C) or above (as defined under Woodside’s Risk Table (refer to **Section 2.3.2**)).
- an incident that has the potential to cause environmental damage with a Consequence Level of Moderate (C) or above (as defined under Woodside’s Risk Table (refer to **Section 2.3.2**).

No impacts or risk were identified that have the potential to cause a consequence level of Moderate (C) for the Petroleum Activities Program (**Section 6**).

Any such incidents represent potential events which would be reportable incidents. Incident reporting is performed with consideration of NOPSEMA (2014) guidance stating, ‘if in doubt, notify NOPSEMA’, and assessed on a case-by-case basis to determine if they trigger a reportable incident as defined in this EP and by the Regulations.

7.8.4.1.2 Notification

NOPSEMA will be notified of all reportable incidents, according to the requirements of Regulations 26, 26A and 26AA of the Environment Regulations. Woodside will:

- Report all reportable incidents to the regulator (orally) ASAP, but within two hours of the incident or of its detection by Woodside.
- Provide a written record of the reported incident to NOPSEMA, the National Offshore Petroleum Titles Administrator (NOPTA) and the Department of the responsible State Minister (DMIRS) ASAP after orally reporting the incident.
- Complete a written report for all reportable incidents using a format consistent with the NOPSEMA Form FM0831 – Reportable Environmental Incident (**Appendix E**) which must be submitted to NOPSEMA ASAP, but within three days of the incident or of its detection by Woodside.
- Provide a copy of the written report to the NOPTA and DMIRS, within seven days of the written report being provided to NOPSEMA.

AMSA will be notified of oil spill incidents ASAP after their occurrence, and DoAWE notified if MNES are to be affected by the oil spill incident.

7.8.4.2 Recordable Incidents

Definition

A recordable incident as defined under Regulation 4 of the Environment Regulations is an incident arising from the activity that 'breaches an environmental performance outcome or environmental performance standard, in the EP that applies to the activity, that is not a reportable incident'.

Notification

NOPSEMA will be notified of all recordable incidents, according to the requirements of Regulation 26B(4), no later than 15 days after the end of the calendar month using the NOPSEMA Form – Recordable Environmental Incident Monthly Summary Report (**Appendix E**) detailing:

- All recordable incidents that occurred during the calendar month.
- All material facts and circumstances concerning the recordable incidents that the operator knows or is able, by reasonable search or enquiry, to find out.
- Any action taken to avoid or mitigate any adverse environment impacts of the recordable incidents.
- The corrective action that has been taken, or is proposed to be taken, to prevent similar recordable incidents.
- The action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

7.8.4.3 Other External Incident Reporting Requirements

In addition to the notification and reporting of environmental incidents defined under the Environment Regulations and Woodside requirements, **Table 7-3** describes the incident reporting requirements that also apply in the PAA.

Table 7-3: External Incident Reporting Requirements

Event	Responsibility	Notifiable party	Notification requirements	Contact	Contact detail
Any marine incidents during Petroleum Activities Program	Vessel Master	AMSA	Incident Alert Form 18 as soon as reasonably practicable* Within 72 hours after becoming aware of the incident, submit Incident Report Form 19	AMSA	reports@amsa.gov.au
Oil pollution incidents in Commonwealth waters	Vessel Master	AMSA Rescue Coordination Centre (RCC)	As per Article 8 and Protocol I of MARPOL within two hours via the national emergency 24-hour notification contacts and a written report within 24 hours of the request by AMSA	AMSA RCC Australia	If the ship is at sea, reports are to be made to: Free call: 1800 641 792 Phone: 08 9430 2100 (Fremantle)
Oil pollution incidents in Commonwealth waters	Vessel Master	AMSA	Without delay as per *Protection of the Sea Act*, part II, section 11(1), AMSA RCC notified verbally via the national emergency 24-hour notification contact of the hydrocarbon spill; follow up with a written Pollution Report ASAP after verbal notification	RCC Australia	Phone: 1800 641 792 or +61 2 6230 6811 AFTN: YSARYCYX
Any oil pollution incident which has the potential to enter a National Park or requires oil spill response activities to be conducted within a National Park	Vessel Master	DoAWE	Reported verbally, ASAP	Director of National Parks	Phone: 02 6274 2220
Activity causes unintentional death of or injury to fauna species listed as Threatened or Migratory under the EPBC Act	Vessel Master	DoAWE	Within seven days of becoming aware	Secretary of the DoAWE	Phone: 1800 803 772 Email: protected.species@environment.gov.au

The following activities should also be reported to AMSA via RCC Australia by the Vessel Master:

- loss of plastic material
- garbage disposed of in the sea within 12 nm of land (garbage includes food, paper, bottles, etc)
- any loss of hazardous materials.

For oil spill incidents, other agencies and organisations will be notified as appropriate to the nature and scale of the incident as per procedures and contact lists in the Oil Pollution Emergency Arrangements (Australia) and the Scarborough Drilling and Completions Oil Pollution First Strike Plan (**Appendix H**).

External incident reporting requirements under the *OPGGS (Safety) Regulations*, including under Subregulation 2.42, notices and reports of dangerous occurrences will be reported to NOPSEMA under the approved activity safety cases.

7.9 Emergency Preparedness and Response

7.9.1 Overview

Under Regulation 14(8), the implementation strategy must contain an Oil Pollution Emergency Plan (OPEP) and provide for updating the OPEP. Regulation 14(8AA) outlines the requirements for the OPEP which must include adequate arrangements for responding to and monitoring oil pollution.

A summary of how this EP and supporting documents address the various requirements of Environment Regulations relating to oil pollution response arrangements is shown in **Table 7-4**.

Table 7-4: Oil pollution and preparedness and response overview

Content	Environment Regulations Reference	Document/Section Reference
Details of (oil pollution response) control measures that will be used to reduce the impacts and risks of the activity to ALARP and an acceptable level	Regulation 13(5), (6), 14(3)	Oil Spill Preparedness and Response Mitigation Assessment (**Appendix D**)
Describes the OPEP	Regulation 14(8)	EP: Woodside's oil pollution emergency plan has the following components: • Woodside Oil Pollution Emergency Arrangements (Australia) • Oil Pollution First Strike Plan (**Appendix H**) • Oil Spill Preparedness and Response Mitigation Assessment (**Appendix D**)
Details the arrangements for responding to and monitoring oil pollution (to inform response activities), including control measures	Regulation 14(8AA)	Oil Spill Preparedness and Response Mitigation Assessment (**Appendix D**) Oil Pollution First Strike Plan (**Appendix H**)
Details the arrangements for updating and testing the oil pollution response arrangements	Regulation 14(8), (8A), (8B), (8C)	EP: **Section 7.9.5** Oil Spill Preparedness and Response Mitigation Assessment (**Appendix D**)
Details of provisions for monitoring impacts to the environment from oil pollution and response activities	Regulation 14(8D)	Oil Spill Preparedness and Response Mitigation Assessment **(Appendix D**)

Content	Environment Regulations Reference	Document/Section Reference
Demonstrates that the oil pollution response arrangements are consistent with the national system for oil pollution preparedness and control	Regulation 14(8E)	Oil Pollution Emergency Arrangements (Australia)

7.9.2 Emergency Response Training

Regulation 14(5) requires that the implementation strategy includes measures to ensure that employees and contractors have the appropriate competencies and training. Woodside has conducted a risk-based training needs analysis on positions required for effective oil spill response. Following the mapping of training to Woodside identified competencies, training was then mapped to positions based on their required competencies.

Table 7-5: Minimum levels of competency for key IMT positions

IMT Position	Minimum Competency
Corporate Incident Coordinate Centre (CICC) Leader	• Incident and Crisis Leadership Development Program (ICLDP) • Oil Spill Response Skills Enhancement Course (OSREC – internal course) • Participation in L2 oil spill exercise (initial) Participation in L2 oil spill exercise (refresher)
Security & Emergency Manager Duty Manager	• ICLDP • OSREC • IMO2 or equivalent spill response specialist level with an oil spill response organisation (OSRO) • Participation in L2 oil spill exercise (initial) Participation in L2 oil spill exercise (refresher)
Operations, Planning, Logistics, Safety	• OSREC • ICC Fundamentals Course (internal course) • Participation in L2 oil spill exercise (initial) Participation in L2 oil spill exercise (refresher)
Environment Coordinator	• ICC Fundamentals • OSREC • IMO2 or equivalent spill response specialist level with an OSRO • Participation in L2 oil spill exercise (initial) Participation in L2 oil spill exercise (refresh
Note on competency/equivalency	
In 2018 Woodside undertook a review of incident and crisis systems, processes and tools to assess whether these were fit-for purpose and has rolled out a change to the Incident and Crisis Management training and the oil spill response training requirements for both ICC and field-based roles. The revised ICC Fundamentals training Program and Incident and Crisis Leaders Development Program (ICLDP) align with the performance requirements of the *PMAOMIR320 – Manage Incident Response Information* and *PMAOM0R418 - Coordinate Incident Response.* Regarding training specific equivalency; • ICLDP is mapped to *PMAOM0R418* (and which is equivalent to IMOIII when combined with Woodside's OSREC course) and ensures broader incident management principles aligned with Australasian Inter-service Incident Management System (AIIMS).	

- The revised ICC Fundamentals Course is mapped to *PMAOMIR320* (and which is equivalent to IMOII). The blended learning program offers modules aligned to IMOIII, IMOII, IMOI and AMOSC Core Group Training Oil Spill Response Organisation Specialist Level training.
- OSREC involves the completion of two (2) online AMSA Modules (Introduction to National Plan and Incident management; and Introduction to oil spills) as well as elements of IMOI and IMOII tailored to Woodside specific OSR capabilities.

Woodside Learning Services (WLS) are responsible for collating and maintaining personnel training records. The HSP Dashboard reflects the competencies required for each oil spill role (IMT/operational).

7.9.3 Emergency Response Preparation

The CICC, based in Woodside's head office in Perth, is the onshore coordination point for an offshore emergency. The CICC is staffed by a roster of appropriately skilled personnel available on call 24 hours a day. The CICC, under the leadership of the CICC Leader, supports the site-based Incident Management Team by providing additional support in areas such as operations, logistics, planning, people management and public information (corporate affairs). A description of Woodside's Incident Command Structure and arrangements is further detailed in the Woodside Oil Pollution Emergency Arrangements (Australia).

Woodside will have an Emergency Response Plan (ERP) in place relevant to the Petroleum Activities Program. The ERP provides procedural guidance specific to the asset and location of operations to control, coordinate and respond to an emergency or incident. For a drilling activity, the ERP will be a bridging document to the contracted rig's emergency documentation. This document summarises the emergency command, control and communications processes for the integrated operation and management of an emergency. It is developed in collaboration with the contracted rig and ensures roles and responsibilities between the contracted rig and Woodside personnel are identified and understood. The ERPs will contain instructions for vessel emergency, medical emergency, search and rescue, reportable incidents, incident notification, contact information and activation of the contractor's emergency centre and Woodside Communication Centre (WCC).

In the event of an emergency of any type:

- On the MODU the OIM will assume overall onsite command and act as the Incident Controller (IC). All persons aboard the MODU will be required to act under the IC's directions. The MODU/vessels will maintain communications with the onshore Drilling Superintendent and/or other emergency services in the event of an emergency. Emergency response support can be provided by the contractor's emergency centre or WCC if requested by the IC.
- Vessel Master (depending on the location of the emergency) will assume overall onsite command and act as the IC. All persons will be required to act under the IC's directions. The vessels will maintain communications with the onshore project manager and/or other emergency services in the event of an emergency. Emergency response support can be provided by the contractor's emergency centre or WCC if requested by the IC.
- The MODU and project vessels will have on-board equipment for responding to emergencies including medical equipment, fire-fighting equipment and oil spill response equipment.

7.9.4 Oil and Other Hazardous Materials Spill

A significant hydrocarbon spill during the proposed Petroleum Activities Program is unlikely, but should such an event occur, it has the potential to result in a serious safety or environmental incident and cause asset and reputational damage if not managed properly. The Woodside Oil Pollution Emergency Arrangements (Australia) document, supported by the Oil Pollution First Strike Plan (**Appendix H**) which provides tactical response guidance to the activity/area and **Appendix D** this EP, cover spill response for this Petroleum Activities Program.

The Security and Emergency Management Function is responsible for managing Woodside's hydrocarbon spill response equipment and for maintaining oil spill preparedness and response documentation. In the event of a major spill, Woodside will request that AMSA (administrator of the National Plan) provides support to Woodside through advice and access to equipment, people and liaison. The interface and responsibilities, as defined under the National Plan, are described in the Woodside Oil Pollution Emergency Arrangements (Australia). AMSA and Woodside have a Memorandum of Understanding in place to support Woodside in the event of an oil spill.

The Oil Pollution First Strike Plan provides immediate actions required to commence a response (**Appendix H**).

The MODU and project vessels will have SOPEPs in accordance with the requirements of MARPOL 73/78 Annex I. These plans outline responsibilities, specify procedures and identify resources available in the event of a hydrocarbon or chemical spill from vessel activities. The Oil Pollution First Strike Plan is intended to work in conjunction with the SOPEPs, if hydrocarbons are released to the marine environment from a vessel.

Woodside has established EPOs, performance standards and MC to be used for oil spill response during the Petroleum Activities Program, as detailed in **Appendix D**.

7.9.5 Emergency and Spills Response

Woodside categorises incidents and emergencies in relation to response requirements as follows:

7.9.5.1 Level 1

Level 1 incidents are those that can be resolved using existing resources, equipment and personnel. A Level 1 incident is contained, controlled and resolved by site/regionally based teams using existing resources and functional support services.

7.9.5.2 Level 2

Level 2 incidents are characterised by a response that requires external operational support to manage the incident. It is triggered if the capabilities of the tactical level response are exceeded. This support is provided to the activity by activating all or part of the responsible CICC.

7.9.5.3 Level 3

A Level 3 incident or crisis is identified as a critical event that seriously threatens the organisation's people, the environment, company assets, reputation, or livelihood. At Woodside, the Crisis Management Team (CMT) manages the strategic impacts in order to respond to and recover from the threat to the company (material impacts, litigation, legal and commercial, reputation etc.). The ICC may also be activated as required to manage the operational incident response.

7.9.6 Source Control Response Capability

Source Control IMT Structure

The Woodside Incident and Crisis Management Structure is outlined in the Woodside Oil Pollution Emergency Arrangements (Australia). In a Level 3 Incident, the Source Control Functional Support Team (FST) will be formed reporting to the Operations Coordinator. The structure of the Source Control FST is shown in **Figure 7-1**.

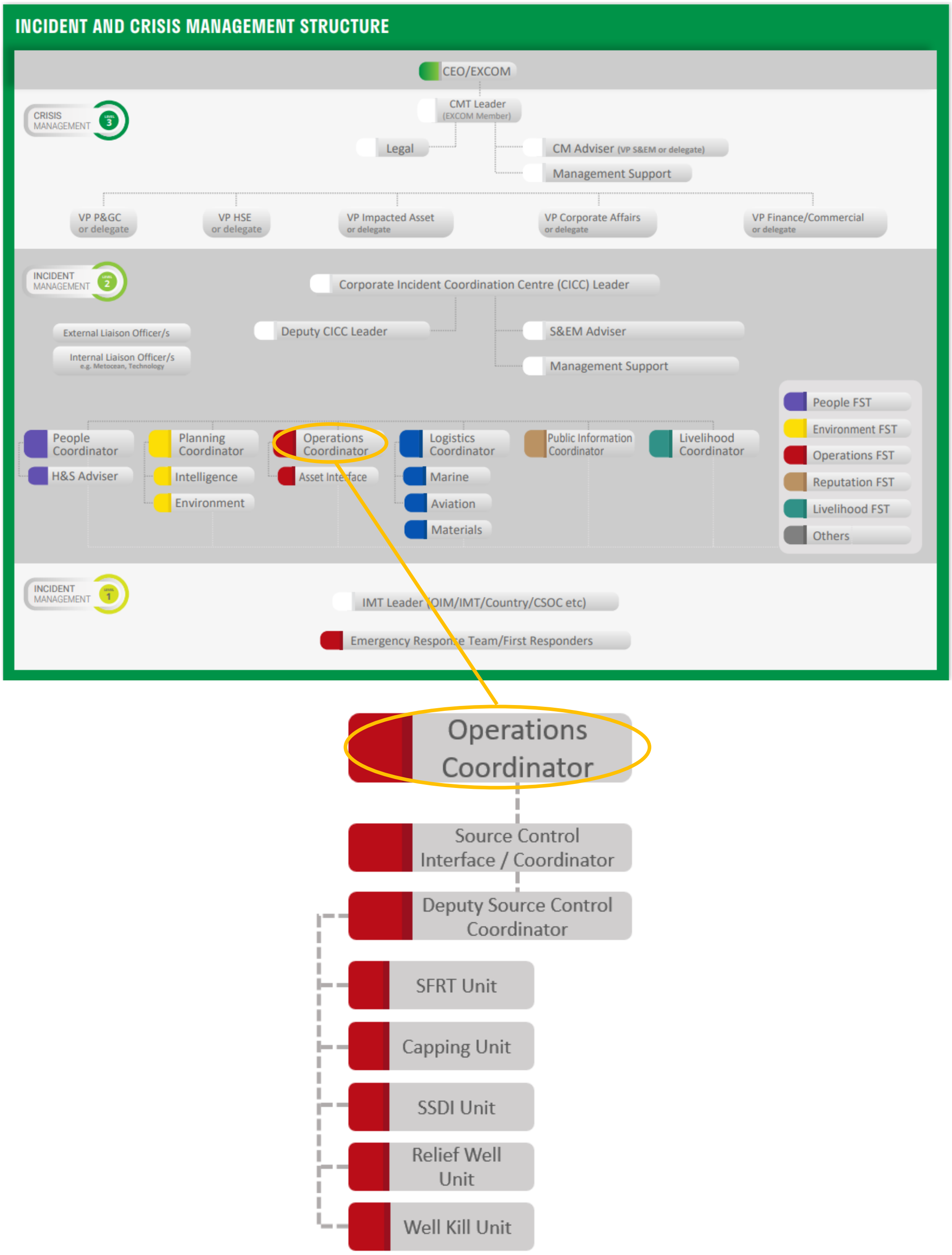


Figure 7-1: Source Control Functional Support Team structure

Roles and responsibilities of the Source Control FST Leaders are summarised in **Table 7-6**.

Table 7-6: Source Control Functional Support Team roles and responsibilities

Role	Key Responsibilities
Source Control Coordinator	• Activate Source Control responses • Approve operational plans • Manage Source Control FST • Report to Operations Coordinator
Deputy Source Control Coordinator	• Approve operational plans • Manage Source Control Function and ensure coordination among groups/units
Subsea First Response Toolkit (SFRT) Unit Coordinator	• Mobilise vessel with work class ROVs • Survey and attempt to function BOP • Debris clearance survey and operations
Capping Unit Coordinator	• Mobilise capping stack and support equipment • Assemble and test capping stack for deployment • Hydrate remediation • Capping stack operations as required
Subsea Dispersant Injection (SSDI) Unit Coordinator	• Develop dispersant application and monitoring plans • Apply for local Government approvals • Conduct subsea dispersant application and monitoring operations
Relief Well Unit Coordinator	• Determine if impacted rig may be utilised for relief rig or capping stack deployment • Determine number of relief wells to be drilled • Obtain and assess information on reservoir and wellbore geometry • Coordinates mobilisation of relief well rig(s) and execution of relief well(s)
Well Kill Unit Coordinator	• Obtain and review reservoir and wellbore data • Determine kill weights and pumping rates • Develop the well kill plan • Conduct kill operations

The Source Control units described in **Figure 7-1**, may include the following support positions:

- HSE Adviser/s
- Well Delivery Manager/s
- Subsea Manager/s
- D&C Superintendent/s
- Subsea Vessel Superintendent/s
- Lead D&C and Subsea Engineers
- D&C Engineering support, as required
- Subsea Engineering support, as required
- Contractor Representatives including source control contractors
- Logistics Coordinator/s

7.9.6.1 Source Control Response Personnel Resourcing and Competency

All Source Control unit leader positions will be filled with Woodside personnel from the Subsea and Pipeline (SSPL) and Drilling and Completions (D&C) Departments.

All personnel will hold a relevant tertiary qualification, well control certifications and industry experience commensurate with the position being held.

Initial Source Control functional response will typically be led by a Subsea and Pipeline Manager or Well Delivery Manager in the role of the Source Control Coordinator and the remaining FST roles would be filled by suitably experienced people, sourced from the operational team and across the broader SSPL and D&C functions.

The Source Control teams will be scaled with additional resources depending on the specifics of the scenario. As the emergency response duration increases suitable arrangements will be made to establish shifts and duty roster cycles to ensure ongoing functional support. Woodside has access to sufficient personnel to cover 24 hour operations on a rolling roster through existing personnel capabilities.

The Source Control IMT response structure indicated in Figure 7-1 is estimated to require from 4 up to 12 positions per shift varying with the scale of response, 8 to 24 positions for 24 hour coverage. For an prolonged response resources to provide on/off weekly cycles, an additional 8 to 24 positions will be required, totalling 16 to 48 positions over the scale of response. These numbers are indicative and will vary depending on scale and complexity of operations.

The current organisational review indicates Woodside has > 80 internal staff members to support the Source Control IMT positions. In the event of a level 3 incident, response activities will be given priority and other projects may be reduced or suspended allowing reallocation of significant additional resources. Woodside would require access to external resources primarily for Specialist Services and Expertise in Source Control / Well Control operations.

Additional personnel to support the Source Control FST will be filled through the following avenues:

- Well Control Specialists through existing contracts e.g. Wild Well Control, Add Energy
- Secondment of Personnel from other Titleholders through APPEA Industry Memorandum of Understanding (2021)
- Engineering support through call-off frame agreements.

Following personnel call-off, online briefings will be held for external personnel prior to commencing work. If building access is required, onboarding will commence as per the Woodside`s Office Access Management Procedures. In the event of an emergency, building access can be expedited at the discretion of the CICC or identified senior leaders and facilities for remote operations would also be set up.

7.9.7 Emergency and Spill Response Drills and Exercises

Woodside’s capability to respond to incidents will be tested periodically, in accordance with the Emergency and Crisis Management Procedure. The scope, frequency and objective of these tests is described in Table 7-7. Emergency response testing is aligned to existing or developing risks associated with Woodside’s operations and activities. Corporate hazards/risks outlined in the corporate risk register, respective Safety Cases or project Risk Registers, are reference points developing and scheduling emergency and crisis management exercises. External participants may be invited to attend exercises (e.g. government agencies, specialist service providers, oil spill response organisations, or industry members with which Woodside has mutual aid arrangements).

The overall objective of exercises is to test procedures, skills and the teamwork of the Emergency Response and Command Teams in their ability to respond to major accident / major environment events. After each exercise, the team holds a debriefing session, during which the exercise is reviewed. Any lessons learned or areas for improvement are identified and incorporated into revised procedures, where appropriate.

Table 7-7: Testing of response capability

Response Category	Scope	Response Testing Frequency	Response Testing Objective
Level 1 Response	Exercises are MODU/ vessel specific	One Level 1 'First Strike' drill conducted within two weeks of commencing activity. [Note: a Level 1 drill must be conducted within two weeks of the campaign commencing and then at least every 6 month hire period thereafter]	Comprehensive exercises test elements of the Oil Pollution First Strike Plan (**Appendix I**). Emergency drills are scheduled to test other aspects of the Emergency Response Plan.
Level 2 Response	Exercises are MODU specific	A minimum of one Emergency Management exercise per MODU per campaign [Note: must be conducted within one month of campaign commencing and at least one Level 2 exercise per 6 month hire period].	Testing both the facility IMT response and/or that of the CICC following handover of incident control. Exercises may include testing of Source Control Response Strategies.
Level 3 Response	Exercises are relevant to all Woodside assets	The number of CMT exercises conducted each year is determined by the Chief Executive Officer, in consultation with the Vice President of Security and Emergency Management.	Test Woodside's ability to respond to and manage a crisis level incident

7.9.8 Hydrocarbon Spill Response Testing of Arrangements

Woodside is required to test hydrocarbon spill response arrangements as per regulations 8B and 8C of the Environment Regulations. Woodside's arrangements for spill response are common across its Australian operating assets and activities to ensure the controls are consistent. The overall objective of testing these arrangements is to ensure that Woodside maintains an ability to respond to a hydrocarbon spill, specifically to:

- Ensure relevant responders, contractors and key personnel understand and practise their assigned roles and responsibilities.
- Test response arrangements and actions to validate response plans.
- Ensure lessons learned are incorporated into Woodside's processes and procedures and improvements are made where required.

If new response arrangements are introduced, or existing arrangements significantly amended, additional testing is undertaken accordingly. If the MODU leaves the field for an extended period, additional testing will be undertaken when it returns to routine operations. Additional activities or activity locations are not anticipated to occur; however, if they do, testing of relevant response arrangements will be undertaken as soon as practicable.

In addition to the testing of response capability described in Table 7-7, up to eight formal exercises are planned annually, across Woodside, to specifically test arrangements for responding to a hydrocarbon spill to the marine environment.

7.9.8.1 Testing of Arrangements Schedule

Woodside's Testing of Arrangements Schedule (**Figure 7-2**) aligns with international good practice for spill preparedness and response management; the testing is compatible with the IPIECA Good Practice Guide and the Australian Emergency Management Institute Handbook. If a spill occurs, enacting these arrangements will underpin Woodside's ability to implement a response across its petroleum activities. **Figure 7-2** shows a condensed snapshot of Woodside's 5-year rolling Testing of Arrangements Schedule.

HSP ARRANGEMENTS TESTING SCHEDULE - FIVE YEAR ROLLING SCHEDULE
WOODSIDE ID: 10058092

5 YEAR ROLLING SCHEDULE

Arrangement #	Support Agency / Company	Woodside OSR Arrangements
1	WEL	Personnel
2	WEL	Equipment
3	WEL	Vessel aquistion - internal processes
4	AMOSC	Equipment
5	AMOSC	Personnel
6	OSRL	Equipment
7	OSRL	Personnel
8	Worley Parsons	Equipment
9	Worley Parsons	Personnel
10	ERM	Equipment
11	ERM	Personnel
12	Jacobs	Equipment
13	Jacobs	Personnel
14	AMSA	Equipment
15	AMSA	Personnel
16	DOT (Department of Transport)	Equipment
17	DOT (Department of Transport)	Staging Area Support
18	WEL	Predictive Modelling - Rapid Assessment Tool
19	RPS APASA	Predictive Modelling
20	KSAT	Satellite remote sensing
21	Bristows	Aircraft
22	MSRC	Personnel
23	Sci Aero	Equipment and Personnel
24	Centurion	Logistics Support
25	Harold E Holt	Support and Access
26	Fergusons	Equipment
27	Swires	Equipment
28	Toll Mermaid	Staging Area Support
29	Norwest Air Works	Dispersant Aircraft (access and support)
30	Exmouth Aerodrome	Dispersant Aircraft (access and support)
31	Broome International Airport	Dispersant Aircraft (access and support)
32	Learmonth Airport	Dispersant Aircraft (access and support)
33	Exmouth Freight and Logistics	Logistics Support
34	Veolia	Equipment and Personnel

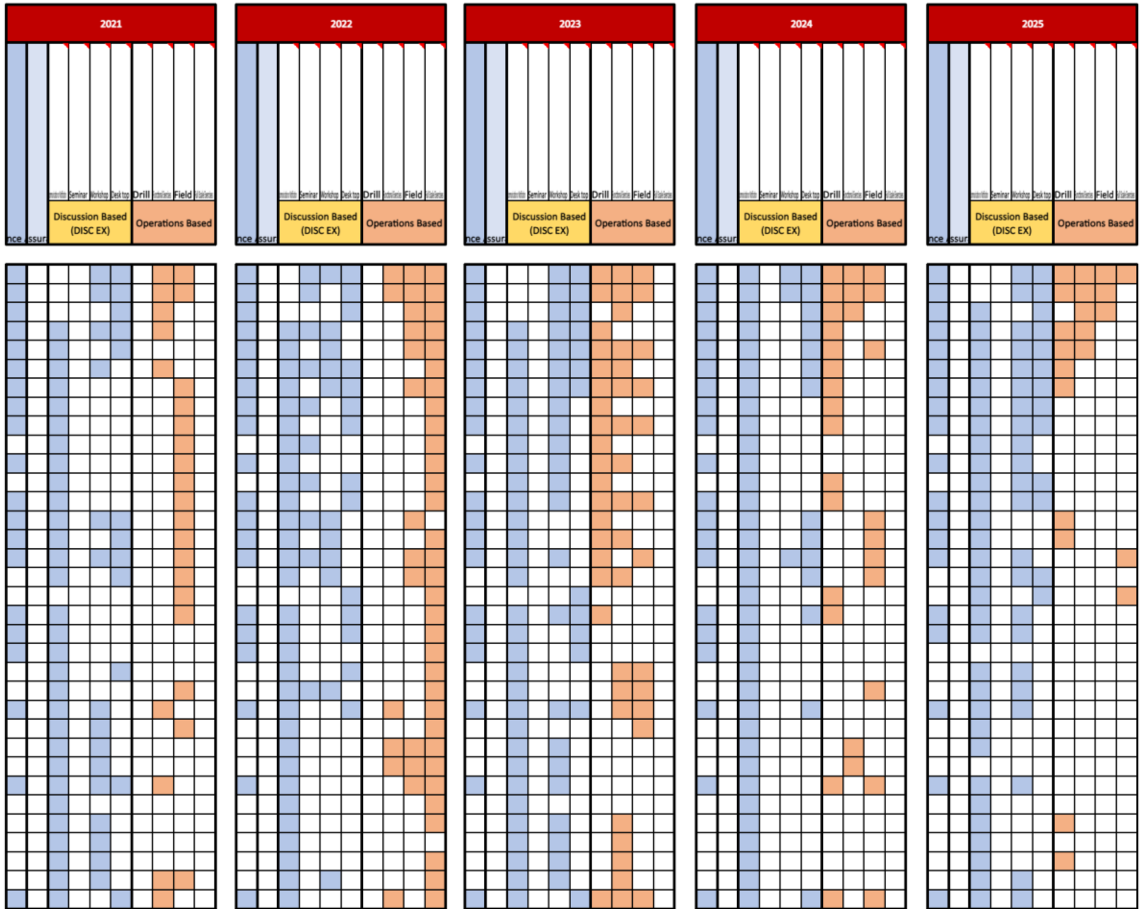


Figure 7-2: Indicative 5-yearly testing of arrangements schedule

(Snapshot of a selection of oil spill response arrangements tested annually; Note: schedule is subject to change; additional detail is included in the live document)

Numbered hydrocarbon spill arrangements listed in the rows of the schedule are taken from the support plans and operational plans described in Section 1.4 of **Appendix D**. Each arrangement has a support agency/company and an area to be tested (e.g. capability, equipment and personnel). For example, an arrangement could be to test Woodside's personnel capability for conducting scientific monitoring, or the ability of the Australian Marine Oil Spill Centre to provide response personnel and equipment. About 75 hydrocarbon spill preparedness arrangements are tested annually across the eight planned exercises, as described above.

The vertical columns under each year in **Figure 7-2** relate to an individual exercise or additional assurance actions that are conducted over the 5-year rolling schedule. The sub-heading for the column describes the standard method of testing (e.g. discussion exercise, desktop exercise), and the blue cells indicate the arrangements that could be tested for each method.

Arrangements in the schedule are tested at least once a year; however, some arrangements may be tested across multiple exercises (e.g. critical arrangements) or via other 'additional assurance' methods outside the formal Testing of Arrangements Schedule that also constitute sufficient evidence of testing of arrangements (e.g. audits, no-notice drills, internal exercises, assurance drills) (refer to the first and second vertical columns for each year in **Figure 7-2**).

7.9.8.2 Exercises, Objectives, and KPIs

Exercises are designed to cumulatively provide assurance for all arrangements within Woodside's Testing of Arrangements Schedule annually across all facilities. Exercise-initiating scenarios are derived from the worst-case credible scenarios as described in the relevant facility's First Strike Plans.

Objectives and KPIs for each exercise are determined by reviewing:

- The Testing of Arrangements Schedule, which identifies which arrangements can be tested for each testing method (**Section 7.9.8.1**).
- The objectives and KPIs master generic plan, which summarises generic objectives and KPIs that could be tested for specific response strategies, based on industry good practice guidance (i.e. IPIECA) for testing oil spill arrangements.
- The oil spill ALARP commitments register, which summarises all spill response commitments from accepted EPs (e.g. timings, numbers) for different response strategies, and considers priority commitments and worst-cast spill scenarios.
- Actions undertaken from recommendations from previous exercises, where relevant.

The required capabilities, number of personnel, equipment, and timeframes (i.e. arrangements) form specific KPIs during an exercise. Where this is the case, the ALARP commitments register indicates the specific response strategy performance standards to use/test the arrangements against. Where relevant the most stringent performance standard across all in-force EPs is used as the KPI. After each exercise, a report is produced that includes recommendations for improvements, which are then converted to actions and tracked in the Testing of Arrangements Register.

Additional assurance actions are also routinely undertaken outside formal exercises (e.g. response audits, no-notice drills), which support testing of these arrangements. Evidence and outcomes from additional assurance actions are used, where relevant, to support testing individual arrangements, including from external sources (e.g. evidence of suppliers testing their own arrangements).

7.9.8.3 Source Control testing and exercise arrangements

This section aims to present the testing and exercise arrangements for Source Control techniques as recommended in the recent industry guidelines such as the APPEA *Australian Offshore*

Titleholders Source Control Guideline (issued June 2021) and the NOPSEMA Information Paper: *Source Control Planning and Procedures* (issued June 2021)

The paragraphs below elaborate on the scope, testing frequency, objectives and close-out processes applicable to testing/ exercises for Source Control techniques.

Scope, objectives and KPIs:

- The objective of tests/exercises is to verify the capability of Woodside and/or contractors to manage and deliver elements of the Source Control Plans presented in OPEP.
- Tests may include specific elements of the response cycle for source control strategy, e.g. activation of arrangements, mobilisation of equipment and personnel and if relevant, testing of specific operational plans (e.g. SFRT, capping and relief well).
- Objectives typically include; testing of IMT capabilities, communications requirements, testing of source control response plans and evaluating specific aspects of source control arrangements, e.g. number of personnel, equipment, mobilisation plans and timeframes for response.
- An example of test objectives from recent exercise are presented below for reference –
  - Objective 1 – Exercising Source Control IMT against worst case credible loss of containment scenario
  - Objective 2 – Sourcing of Relief well MODU
  - Objective 3 – Verify key equipment and services availability to support Relief well operations.
  - Objective 4 – Delivery of xx day Relief well as per Activity SCERP.
- KPIs are taken from the ALARP commitments as stated in the OSPRMA (Appendix D).
- The exercises are planned utilising SMEs from the function with independent observers/ agencies as available (e.g. AMOSC, OSRL) along with Industry collaboration as available/ permitted.
- Formal exercise plans are produced prior to tests and exercises to document the scope, objectives, allocate resources and select relevant plans and previous lessons learnt for the test or exercise.
- **Table 7-7**: Testing of Response Capability provides indicative scope, testing frequency and objectives of the emergency and spill response drills and exercises which includes Source Control response techniques.

Frequency of tests

In addition to Testing of Arrangements for all responses listed in the schedule, source control techniques are tested on an annual basis; at least one technique per year. The schedule for testing of Source Control techniques is described in **Section 7.9.8.1**.

Woodside has tested the below response techniques in last two years:

- SSDI and relief well response in 2019
- SFRT response (joint industry exercise hosted by Woodside) in 2020

Woodside plans to test:

- capping response in Q4 2021.
- in addition, Woodside Source Control team members participate in joint industry exercises on source control as available for continuous improvements to response plans.

Close out Processes

Post-exercise debriefs are held with the exercise team to identify gaps and capture learnings. The recommendations and actions are documented and assigned to the relevant function within the organisation and tracked until close-out. Close-out reports are distributed to relevant function leads and captured under Woodside’s document management systems and relevant processes. Lessons learned are incorporated into Woodside's processes and procedures and improvements are made where required.

7.9.8.4 Cyclone and Dangerous Weather Preparation

As the timing of some activities associated with the Petroleum Activities Program are not yet determined, it is possible drilling and subsea activities will overlap with the cyclone season (November to April, with most cyclones occurring between January and March). If drilling in cyclone season, the MODU contractor and vessel contractors must have a Cyclone Contingency Plan (CCP) in place outlining the processes and procedures that would be implemented during a cyclone event, which will be reviewed and accepted by Woodside.

The MODU and project vessels will receive daily forecasts from the Bureau of Meteorology. If a cyclone (or severe weather event) is forecast, the path and its development will be plotted and monitored using the BoM data. If there is the potential for the cyclone (severe weather event) to affect the Petroleum Activities Program, the CCP will be actioned. If required, vessels can transit from the proposed track of the cyclone (severe weather event).

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9. GLOSSARY AND ABBREVIATIONS

9.1 Glossary

Term	Meaning
(the) Regulator	The Government Agency (State or Commonwealth) that is the decision maker for approvals and performs ongoing regulation of the approval once granted
3D seismic data	A set of numerous closely-spaced seismic lines that provide a high spatially sampled measure of subsurface reflectivity and 3D image
Acceptability	The EP must demonstrate that the environmental impacts and risks of an activity will be of an acceptable level as per Regulation 10A(c).
ALARP	A legal term in Australian safety legislation, it is taken here to mean that all contributory elements and stakeholdings have been considered by assessment of costs and benefits, and which identifies a preferred course of action
API (gravity)	A measure of how heavy or light a petroleum liquid is compared to water
Australian Standard	An Australian Standard that provides criteria and guidance on design, materials, fabrication, installation, testing, commissioning, operation, maintenance, re-qualification and abandonment
Ballast	Extra weight taken on to increase a ship's stability to prevent rolling and pitching. Most ships use seawater as ballast. Empty tank space is filled with inert (non-combustible) gas to prevent the possibility of fire or explosion.
Bathymetry	Related to water depth, a bathymetry map shows the depth of water at a given location on the map.
Benthos/Benthic	Relating to the seabed and includes organisms living in or on sediments/rocks on the seabed
Biodiversity	Relates to the level of biological diversity of the environment. The EPBC Act defines biodiversity as "the variability among living organisms from all sources (including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part) and includes: (a) diversity within species and between species; and (b) diversity of ecosystems".
Biota	The animal and plant life of a particular region, habitat or geological period
Cetacean	Whale and dolphin species
Consequence	The worst-case credible outcome associated with the selected event, assuming some controls (prevention and mitigation) have failed. Where more than one impact applies (e.g. environmental and legal/compliance), the consequence level for the highest severity impact is selected.
Coral	Anthozoa that are characterised by stone-like, horny or leathery skeletons (external or internal). The skeletons of these animals are also called coral.
Coral Reef	A wave-resistant structure resulting from skeletal deposition and cementation of hermatypic corals, calcareous algae, and other calcium carbonate-secreting organisms
Crustacean	A large and variable group of mostly aquatic invertebrates that have a hard external skeleton (shell), segmented bodies, with a pair of often very modified appendages on each segment, and two pairs of antennae (e.g. crabs, crayfish, shrimps, wood lice, water fleas and barnacles)
Cyclone	A rapidly-rotating storm system characterised by a low-pressure centre, strong winds, and a spiral arrangement of thunderstorms that produce heavy rain
Datum	A reference location or elevation that is used as a starting point for subsequent measurements
dB	Decibel, a measure of the overall noise level of sound across the audible spectrum with a frequency weighting (that is, 'A' weighting) to compensate for the varying sensitivity of the human ear to sound at different frequencies

Term	Meaning
dB re 1 µPa^2	Measure of underwater noise, in terms of sound pressure. Because the dB is a relative measure rather than an absolute measure, it must be referenced to a standard 'reference intensity', in this case 1 micro Pascal (1 mPa), which is the standard reference that is used. The dB is also measured over a specified frequency, which is usually either a one Hertz bandwidth (expressed as dB re 1 mPa2/Hz), or over a broadband that has not been filtered. Where a frequency is not specified, it can be assumed that the measurement is a broadband measurement.
dB re 1 µPa^2.s	Normal unit for sound exposure level
Demersal	Living close to the floor of the sea (typically of fish)
Drill casing	Steel pipe placed in the well as drilling progresses to isolate particular formations or zones, prevent the wall of the well bore formations from caving in, providing pressure integrity as the well is constructed to deeper depths
Drilling fluids	The main functions of drilling fluids are to control formation pressures, remove cuttings from the wellbore, seal permeable formations encountered while drilling, cool and lubricate the drill bit, transmit hydraulic energy to downhole tools and the bit and, maintain wellbore stabilit
DRIMS	Woodside's internal document management system
Dynamic positioning	In reference to a marine vessel that uses satellite navigation and radio transponders in conjunction with thrusters to maintain its position
EC_{50}	The concentration of a drug, antibody or toxicant which induces a response halfway between the baseline and maximum after a specified exposure time
Echinoderms	Any of numerous radially symmetrical marine invertebrates of the phylum Echinodermata, which includes the starfishes, sea urchins and sea cucumbers, that have an internal calcareous skeleton and are often covered with spines
Endemic	A species that is native to or confined to a certain region
Environment	The surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans and their interrelations (Source: ISO 14001)
EP	Prepared in accordance with the *OPGGS (Environment) Regulations 2009*, which must be assessed and accepted by the Designated Authority (NOPSEMA) before any petroleum-related activity can be performed
Environment Regulations	OPGGS (Environment) Regulation 2009
Environmental approval	The action of approving something, which has the potential to have an adverse impact on the environment. Environmental impact assessment is generally required before environmental approval is granted.
Environmental Hazard	The characteristic of an activity or event that could potentially cause damage, harm or adverse effects on the environment
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's activities, products or services (Source: HB 203:2006).
Environmental impact assessment	An orderly and systematic process for evaluating a proposal or scheme (including its alternatives), and its effects on the environment, and mitigation and management of those effects (Source: Western Australian *Environmental Impact Assessment Administrative Procedures 2010*)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*. Commonwealth legislation designed to promote the conservation of biodiversity and protection of the environment.
Epifauna	Benthic animals that live on the surface of a substrate
Fauna	Collectively, the animal life of a particular region
Flora	Collectively, the plant life of a particular region
IC_{50}	A measure of the effectiveness of a compound in inhibiting biological or biochemical function

Term	Meaning
Infauna	Aquatic animals that live in the substrate of a body of water, especially in a soft sea bottom
ISO 14001	ISO 14001 is an international standard that specifies a process (called an EMS) for controlling and improving a company's environmental performance. An EMS provides a framework for managing environmental responsibilities so they become more efficient and more integrated into overall business operations.
Jig Fishing	Fishing with a jig, which is a type of fishing lure. A jig consists of a lead sinker with a hook moulded into it and usually covered by a soft body to attract fish.
LC_{50}	The concentration of a substance that is lethal to 50% of the population exposed to it for a specified time
Likelihood	The description that best fits the chance of the selected consequence actually occurring, assuming reasonable effectiveness of the prevention and mitigation controls
MARPOL (73/78)	The International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978. MARPOL 73/78 is one of the most important international marine environmental conventions. It was designed to minimise pollution of the seas, including dumping, oil and exhaust pollution. Its stated objective is to preserve the marine environment through the complete elimination of pollution by oil and other harmful substances and the minimisation of accidental discharge of such substances.
Meteorology	The study of the physics, chemistry and dynamics of the earth's atmosphere, including the related effects at the air–earth boundary over both land and the oceans
Mitigation	Management measures that minimise and manage undesirable consequences
NOHSC (1008:2004)	National Occupational Health and Safety Commission – Approved Criteria for Classifying Hazardous Substances
Oligotrophic	Low in plant nutrients and having a large amount of dissolved oxygen throughout
pH	Measure of the acidity or basicity of an aqueous solution
Protected Species	Threatened, vulnerable or endangered species that are protected from extinction by preventive measures. Often governed by special Federal or State laws.
Putrescible	Refers to food scraps and other organic waste associated with food preparation that will be subject to decay and rot (putrefaction)
Risk	The combination of the consequences of an event and its associated likelihood. For guidance, see Environmental Guidance on Application of Risk Management Procedure.
Stereo-BRUVS	Stereo-baited remote underwater video systems
Sessile	Organism that is fixed in one place; immobile
Syngnathids	Family of fish which includes the seahorses, the pipefishes, and the weedy and leafy sea dragons
Teleost	A fish belonging to the Teleostei or Teleostomi, a large group of fishes with bony skeletons, including most common fishes. The teleosts are distinct from the cartilaginous fishes such as sharks, rays, and skates.
Thermocline	A temperature gradient in a thermally stratified body of water
Zooplankton	Plankton consisting of small animals and the immature stages of larger animals

9.2 Abbreviations

Abbreviation	Meaning
µm	Micrometer
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACS	Australian Custom Service
AFFF	Aqueous Film Forming Foam
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHO	Australian Hydrographic Office
AHS	Australian Hydrographic Service
AHV	Anchor Handling Vessels
AIIMS	Australasian Inter-service Incident Management System
AIMS	Australian Institute of Marine Science
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
AS (NZS)	Australian Standard (New Zealand Standard)
ASAP	As soon as practicable
ASL	Above sea level
ATSB	Australian Transport Safety Bureau
AusSAR	Australian Search and Rescue
bbl	Oil barrel
BC	Bioconcentration
BCF	Bioconcentration Factor
BIA	Biologically Important Area
BOD	Biological Oxygen Demand
BoM	Bureau of Meteorology
BOP	Blow-out Preventer
BRUVS	Baited Remote Underwater Video System
CALM	Department of Conservation and Land Management
CAR	Campaign Action Register
CCL	Casing Collar Locator
CCP	Cyclone Contingency Plan
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFA	Commonwealth Fisheries Association
CH4	Methane
CICC	Corporate Incident Coordination Centre

Abbreviation	Meaning
CMT	Crisis Management Team
CO	Carbon Monoxide
CO2	Carbon Dioxide
CoA	Commonwealth of Australia
COLREGS	International Regulations for Prevention of Collisions at Sea
CS	Cost/Sacrifice
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Cth	Commonwealth
CV	Company Values
DAA	Department of Aboriginal Affairs
DAWR	Department of Agriculture and Water Resources (now DAWE)
dB	Decibel
DEC	Department of Environment and Conservation
DEWHA	Department of Environment, Water, Heritage and the Arts
DGPS	Differential Global Surface Positioning System
DIIS	Department of Industry Innovation and Science
DMIRS	Department of Mines, Industry Regulation and Safety
DMP	Department of Mines and Petroleum
DNP	Director of National Parks
DoAWE	Department of Agriculture, Water and the Environment
DoD	Department of Defence
DoEE	Department of the Environment and Energy
DoF	Department of Fisheries (now part of DMIRS)
DoT	Department of Transport
DP	Dynamically Positioned
DPIRD	Department of Primary Industries and Regional Development
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EC_{50}	half maximal effective concentration
EDS	Emergency Disconnect Sequence
EEZ	Exclusive Economic Zone
EHU	Electrohydraulic umbilical
EMBA	Environment that May Be Affected
EMS	Environmental Management System
ENVID	Environmental hazard Identification
EP	Environment Plan
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ERM	Environmental Resource Management
ERP	Emergency Response Plans

Abbreviation	Meaning
ERT	Emergency Response Team
ESD	Ecological Sustainable Development
F	Control Feasibility
FEWD	Formation Evaluation While Drilling
FFFP	Film Forming Fluroprotein Foams
FLNG	Floating Liquefied Natural Gas units
FPSO	Floating Production, Storage and Offtake vessel
FRDC	Fisheries Research and Development Centre
FSP	First Strike Plan
g/m^2	Grams per square metre
GDSF	Gascoyne Demersal Scalefish Fishery
GHG	Greenhouse Gas
GP	Good Practice
GR	Gamma Ray
GWA	Goodwyn Alpha
HDPE	High Density Polyethylene
HF	High Frequency
HFC	Hydrofluorocarbons
HFO	Heavy Fuel Oil
HOCNF	Harmonised Offshore Chemical Notification Format
HQ	Hazard Quotient
HSE	Health, Safety and Environment
HSPU	Hydrocarbon Spill Preparedness Unit
IAP	Incident Action Plan
IAPP	International Air Pollution Prevention
IC	Incident Controller
ICLDP	Incident and Crisis Leadership Development Program
IC_{50}	Half maximal inhibitory concentration
IMMR	Inspection, Maintenance, Monitoring, Repair
IMO	International Marine Organisation
IMS	Invasive Marine Species
IOPP	International Oil Pollution Prevention
IPIECA	International Petroleum Industry Environmental Conservation Association
IS	Implementation Strategy
ISPP	International Sewage Pollution Prevention Certificate
ITF	Indonesian Through Flow
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
IUTB	Infield umbilical termination basket

Abbreviation	Meaning
JRCC	Joint Rescue Coordination Centre
JSA	Job Safety Analysis
KBGFC	King Bay Game Fishing Club
KEF	Key Ecological Feature
kHz	Kilohertz
km	Kilometre
kPa	Kilopascal
KPI	Key Performance Indicator
L	Litres
LARS	Launch and Recovery Systems
LBL	Long Baseline
LC_{50}	Lethal concentration, 50%
LCS	Legislation, Codes and Standards
LF	Low Frequency
LNG	Liquefied Natural Gas
LOEC	Lowest Observable Effect Concentration
LWI	Light Well Intervention
MARPOL	International Convention for the Prevention of Pollution from Ships
MC	Measurement Criteria
MCDA	Multi Criteria Decision Assessment
MDO	Marine Diesel Oil
MEG	Mono-ethylene Glycol
MF	Mid Frequency
MFO	Marine Fauna Observers
MIMI	Japan Australia LNG Pty Ltd
MMA	Marine Management Area
MMSI	Maritime Mobile Service Identity
MNES	Matters of National Environmental Significance
MOC	Management of Change
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
MP	Marine Park
MPA	Marine Protected Areas
MPRA	Marine Parks and Reserves Authority
ms^1	Metres per second
MSIN	Maritime Safety Information Notifications
N_2O	Nitrous Oxide
NBSFC	Nickol Bay Sport Fishing Club
NCDSF	North Coast Demersal Scalefish Fishery

Abbreviation	Meaning
NGERS	National Greenhouse and Energy Reporting
NICNA'S	National Industrial Chemicals Notification ad Assessment Scheme
NIMS	Non-indigenous Marine Species
nm	Nautical mile (1,852 m) a unit of distance on the sea
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOEC	No Observed Effect Concentration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NORM	Naturally Occurring Radioactive Material
NOx	Oxides of Nitrogen
NRC	North Rankin Complex
NTM	Notice to Mariners
NWBM	Non Water-Based Mud
NWMR	North-west Marine Region
NWP	Northwest Province
NWS	North-west Shelf
NWSTF	North West Slope Trawl Fishery
OCNS	Offshore Chemical Notification Scheme
OEM	Original Equipment Manufacturer
OILMAP	Oil Spill Mapping and Analysis Program
OIM	Offshore Installation Manager
OIW	Oil in Water
OOC	Oil on cuttings
OPP	Offshore Project Proposal
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OSPAR	Oslo and Paris Commission for the Convention for the Protection of the Marine Environment of the North-East Atlantic
OSREC	Oil Spill Response Skills Enhancement Course
OSRO	Oil Spill Response Organisation
OWS	Oily Water Separator
OVID	Offshore Vessel Inspection Database
OVMSA	Offshore Vessel Safety Management System assessment
PAA	Petroleum Activity Area
PAH	Polyaromatic Hydrocarbon
PBA	Pre-emptive Baseline Areas
PFC	Perfluorocarbons
PIC	Person In Charge

Abbreviation	Meaning
PJ	Professional Judgement
PLONOR	OSPAR definition of a substance Poses Little Or NO Risk to the environment
PM10	Particulate Matter less than 10 microns
PMST	Protected Matters Search Tool
PNEC	Predicted No Effect Concentration
PPA	Pearl Producers Association
ppb	Parts Per Billion
ppm	Parts Per Million
PS	Performance Standards
PSD	Particle Size Distribution
psi	Pounds per square inch
PSU	Practical Salinity Unit
PTS	Permanent Threshold Shift
PTW	Permit To Work
RBA	Risk Based Analysis
RBI	Risk-Based Inspection
RCC	Rescue Coordination Centre
RMR	Riserless Mud Recovery
RMS	Root Mean Square
RO	Reverse Osmosis
ROV	Remotely Operated Vehicle
SA	South Australia
S-BRUVS	Stereo-baited Remote Underwater Video System
SBTF	Southern Bluefin Tuna Fishery
SCE	Solids Control Equipment
SCERP	Source Control Emergency Response Plan
SEEMP	Ship Energy Efficiency Management Plan
SF6	Sulphur hexafluoride
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous Operations
SMPEP	Spill Monitoring Programme Execution Plan
SO2	Sulphur Dioxide
SOLAS	Safety of Life at SEA
SOPEP	Ship Oil Pollution Emergency Plan
SPL	Sound Pressure Levels
SSIV	Subsea Isolation Valve
SV	Societal Values
SW	Southwest
SWMR	South-west Marine Region

Abbreviation	Meaning
TPS	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids
TTS	Temporary Threshold Shift
UK	United Kingdom
USBL	Ultra-short baseline
USIT	Ultrasonic Imaging Tool
VOC	Volatile Organic Hydrocarbons
VLS	Vertical Lay System
WA	Western Australia
WAF	Water Accommodated Fraction
WAFIC	Western Australian Fishing Industry Council
WBM	Water-Based Mud
WCC	Woodside Communication Centre
WCBD	Well Control Bridging Document
WDTF	Western Deepwater Trawl Fishery
WEL	Woodside Energy Ltd
WHA	World Heritage Area
WLS	Woodside Learning Service
WMP	Waste Management Plan
WMS	Woodside Management System
WOMP	Well Operation Management Plan
Woodside	Woodside Energy Ltd
XPT	Formation Pressures

APPENDIX A. WOODSIDE ENVIRONMENT AND RISK MANAGEMENT POLICIES

WOODSIDE POLICY

Woodside

Health, Safety and Environment Policy

OBJECTIVES

Strong health, safety and environment (HSE) performance is essential for the success and growth of our business. Our aim is to be recognised as an industry leader in HSE through managing our activities in a sustainable manner with respect to our workforce, our communities and the environment.

At Woodside we believe that process and personal safety related incidents, and occupational illnesses, are preventable. We are committed to managing our activities to minimise adverse health, safety or environmental impacts.

PRINCIPLES

Woodside will achieve this by:

- implementing a systematic approach to HSE risk management
- complying with relevant laws and regulations and applying responsible standards where laws do not exist
- setting, measuring and reviewing objectives and targets that will drive continuous improvement in HSE performance
- embedding HSE considerations in our business planning and decision-making processes
- integrating HSE requirements when designing, purchasing, constructing and modifying equipment and facilities
- maintaining a culture in which everybody is aware of their HSE obligations and feels empowered to speak up and intervene on HSE issues
- undertaking and supporting research to improve our understanding of HSE and using science to support impact assessments and evidence-based decision making
- taking a collaborative and pro-active approach with our stakeholders
- requiring contractors to comply with our HSE expectations in a mutually beneficial manner
- publicly reporting on HSE performance

APPLICATION

Responsibility for the application of this Policy rests with all Woodside employees, contractors and joint venturers engaged in activities under Woodside operational control. Woodside managers are also responsible for promotion of this Policy in non-operated joint ventures.

Updated by the Board in April 2021

WOODSIDE POLICY

Risk Management Policy

OBJECTIVES

Woodside recognises that risk is inherent in our business and the effective management of risk is vital to deliver our strategic objectives, continued growth and success. We are committed to managing risks in a proactive and effective manner as a source of competitive advantage.

Our approach protects us against potential negative impacts, enables us to take risk for reward and improves our resilience against emerging risks. The objective of our risk management framework is to provide a single consolidated view of risks across the company to understand our full risk exposure and prioritise risk management and governance.

The success of our approach lies in the responsibility placed on everyone at all levels to proactively identify, assess and treat risks relating to the objectives they are accountable for delivering.

PRINCIPLES

Woodside achieves these objectives by:

- Applying a structured and comprehensive framework for the identification, assessment and treatment of current risks and response to emerging risks;
- Ensuring line of sight of financial and non-financial risks at appropriate levels of the organisation;
- Demonstrating leadership and commitment to integrating risk management into our business activities and governance practices;
- Recognising the value of stakeholder engagement, best available information and proactive identification of potential changes in external and internal context;
- Embedding risk management into our critical business processes and control framework;
- Understanding our exposure to risk and tolerance for uncertainty to inform our decision making and assure that Woodside is operating with due regard to the risk appetite endorsed by the Board; and
- Evaluating and improving the effectiveness and efficiency our approach.

APPLICATION

The Managing Director of Woodside is accountable to the Board of Directors for ensuring this policy is effectively implemented.

Managers are responsible for promoting and applying the Risk Management Policy. Responsibility for the effective application of this policy rests with all Woodside employees, contractors and joint venturers engaged in activities under Woodside operational control.

This policy will be reviewed regularly and updated as required.

Revised by the Woodside Petroleum Ltd Board on 4 December 2020.

APPROVED

APPENDIX B. RELEVANT REQUIREMENTS

The below table refers to Commonwealth Legislation related to the project.

Commonwealth Legislation	Legislation Summary
Air Navigation Act 1920 • *Air Navigation Regulations 1947* • *Air Navigation (Aerodrome Flight Corridors) Regulations 1994* • *Air Navigation (Aircraft Engine Emissions) Regulations 1995* • *Air Navigation (Aircraft Noise) Regulations 1984* • *Air Navigation (Fuel Spillage) Regulations 1999*	This Act relates to the management of air navigation.
Australian Maritime Safety Authority Act 1990	This Act establishes a legal framework for the Australian Maritime Safety Authority (AMSA), which represents the Australian Government and international forums in the development, implementation and enforcement of international standards including those governing ship safety and marine environment protection. AMSA is responsible for administering the Marine Orders in Commonwealth waters.
Australian Radiation Protection and Nuclear Safety Act 1998	This Act relates to the protection of the health and safety of people, and the protection of the environment from the harmful effects of radiation.
Biosecurity Act 2015 • *Quarantine Regulations 2000* • *Biosecurity Regulation 2016* • *Australian Ballast Water Management Requirements 2017*	This Act provides the Commonwealth with powers to take measures of quarantine, and implement related programs as are necessary, to prevent the introduction of any plant, animal, organism or matter that could contain anything that could threaten Australia's native flora and fauna or natural environment. The Commonwealth's powers include powers of entry, seizure, detention and disposal. This Act includes mandatory controls on the use of seawater as ballast in ships and the declaration of sea vessels voyaging out of and into Commonwealth waters. The Regulations stipulate that all information regarding the voyage of the vessel and the ballast water is declared correctly to the quarantine officers.
Environment Protection and Biodiversity Conservation Act 1999 • *Environment Protection and Biodiversity Conservation Regulations 2000*	This Act protects matters of national environmental significance (NES). It streamlines the national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and culturally significant places. Under this Act, actions that may be likely to have a significant impact on matters of NES must be referred to the Commonwealth Environment Minister.
Environment Protection (Sea Dumping) Act 1981 • *Environment Protection (Sea Dumping) Regulations 1983*	This Act provides for the protection of the environment by regulating dumping matter into the sea, incineration of waste at sea and placement of artificial reefs.
Industrial Chemicals (Notification and Assessment Act) 1989 • *Industrial Chemicals (Notification and Assessment) Regulations 1990*	This Act creates a national register of industrial chemicals. The Act also provides for restrictions on the use of certain chemicals which could have harmful effects on the environment or health.

Commonwealth Legislation	Legislation Summary
National Environment Protection Measures (Implementation) Act 1998 • *National Environment Protection Measures (Implementation) Regulations 1999*	This Act and Regulations provide for the implementation of National Environment Protection Measures (NEPMs) to protect, restore and enhance the quality of the environment in Australia and ensure that the community has access to relevant and meaningful information about pollution. The National Environment Protection Council has made NEPMs relating to ambient air quality, the movement of controlled waste between states and territories, the national pollutant inventory, and used packaging materials.
National Greenhouse and Energy Reporting Act 2007 • *National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015*	This Act and associated Rule establishes the legislative framework for the NGER scheme for reporting greenhouse gas emissions and energy consumption and production by corporations in Australia.
Navigation Act 2012 • *Marine order 12 – Construction – subdivision and stability, machinery and electrical installations* • *Marine order 30 - Prevention of collisions* • *Marine order 47 – Offshore Industry units* • *Marine order 57 - Helicopter operations* • *Marine order 91 - Marine pollution prevention—oil* • *Marine order 93 - Marine pollution prevention—noxious liquid substances* • *Marine order 94 - Marine pollution prevention—packaged harmful substances* • *Marine order 96 - Marine pollution prevention—sewage* • *Marine order 97 - Marine pollution prevention—air pollution*	This Act regulates navigation and shipping including Safety of Life at Sea (SOLAS). The Act will apply to some activities of the MODU and project vessels. This Act is the primary legislation that regulates ship and seafarer safety, shipboard aspects of marine environment protection and pollution prevention.
Offshore Petroleum and Greenhouse Gas Storage Act 2006 • *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* • *Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011* • *Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009*	This Act is the principal Act governing offshore petroleum exploration and production in Commonwealth waters. Specific environmental, resource management and safety obligations are set out in the Regulations listed.
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 • *Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995*	This Act provides for measures to protect ozone in the atmosphere by controlling and ultimately reducing the manufacture, import and export of ozone depleting substances (ODS) and synthetic greenhouse gases, and replacing them with suitable alternatives. The Act will only apply to Woodside if it manufactures, imports or exports ozone depleting substances.
Protection of the Sea (Powers of Intervention) Act 1981	This Act authorises the Commonwealth to take measures for the purpose of protecting the sea from pollution by oil and other noxious substances discharged from ships and provides legal immunity for persons acting under an AMSA direction.

Commonwealth Legislation	Legislation Summary
Protection of the Sea (Prevention of Pollution from Ships) Act 1983 *Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994* • *Marine order 91 - Marine pollution prevention—oil* • *Marine order 93 - Marine pollution prevention—noxious liquid substances* • *Marine order 94 - Marine pollution prevention—packaged harmful substances* • *Marine order 95 - Marine pollution prevention—garbage* • *Marine order 96 - Marine pollution prevention—sewage* *Maritime Legislation Amendment (Prevention of Air Pollution from Ships) Act 2007* MARPOL Convention	This Act relates to the protection of the sea from pollution by oil and other harmful substances discharged from ships. Under this Act, discharge of oil or other harmful substances from ships into the sea is an offence. There is also a requirement to keep records of the ships dealing with such substances. The Act applies to all Australian ships, regardless of their location. It applies to foreign ships operating between 3 nautical miles (nm) off the coast out to the end of the Australian Exclusive Economic Zone (200 nm). It also applies within the 3 nm of the coast where the State/Northern Territory does not have complementary legislation. All the Marine Orders listed, except for Marine Order 95, are enacted under both the *Navigation Act 2012* and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*. This Act is an amendment to the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*. This amended Act provides the protection of the sea from pollution by oil and other harmful substances discharged from ships.
Protection of the Sea (Harmful Antifouling Systems) Act 2006 • *Marine order 98—(Marine pollution—anti-fouling systems)*	This Act relates to the protection of the sea from the effects of harmful anti-fouling systems. It prohibits the application or reapplication of harmful anti-fouling compounds on Australian ships or foreign ships that are in an Australian shipping facility.

APPENDIX C. EPBC ACT PROTECTED MATTERS SEARCH

Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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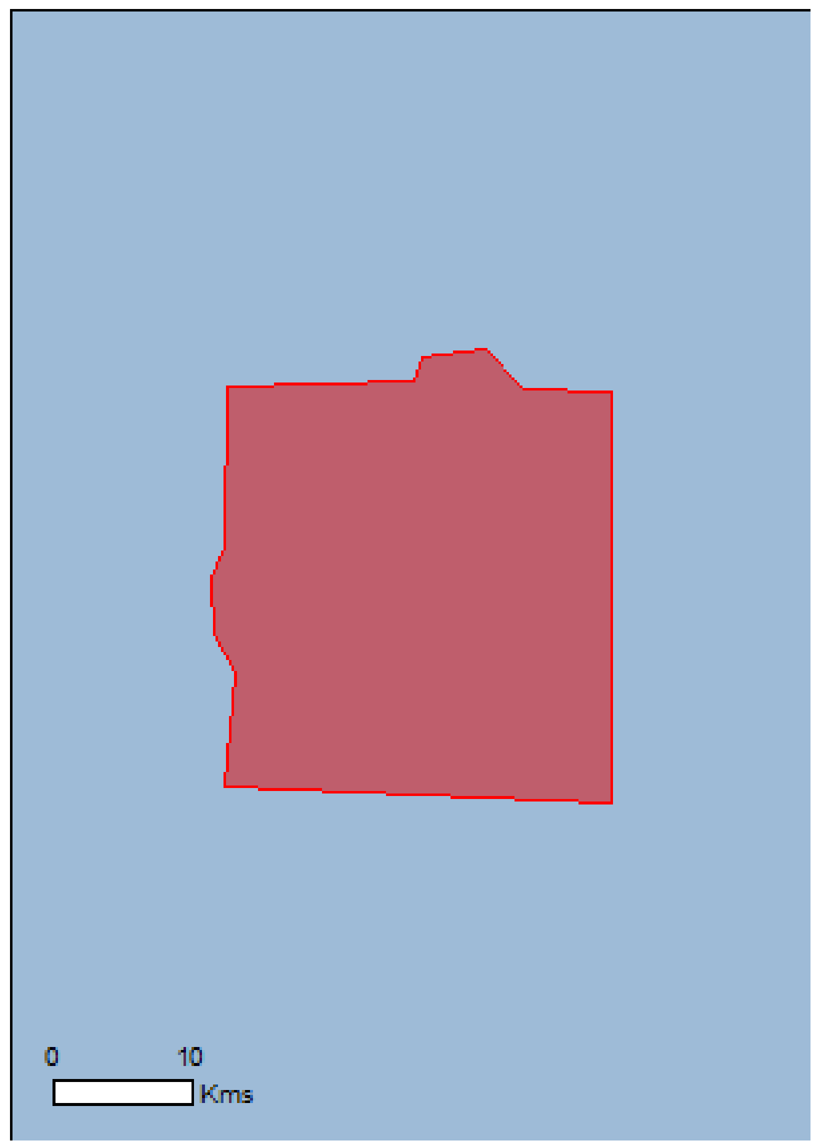

Coordinates

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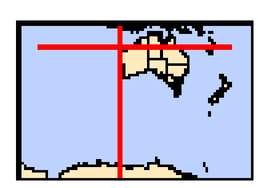

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	12
Listed Migratory Species:	25

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	15
Whales and Other Cetaceans:	25
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Reptiles		
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area

Name	Status	Type of Presence
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Exmouth Plateau	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-19.7517 113.3332,-19.7497 113.2768,-19.7256 113.2514,-19.7305 113.2114,-19.7442 113.2058,-19.7485 113.0837,-19.8461 113.0831,-19.8649 113.0738,-19.8991 113.0754,-19.9215 113.0898,-19.9917 113.082,-20.0015 113.3336,-19.7517 113.3332

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Australian Government

Department of Agriculture, Water and the Environment

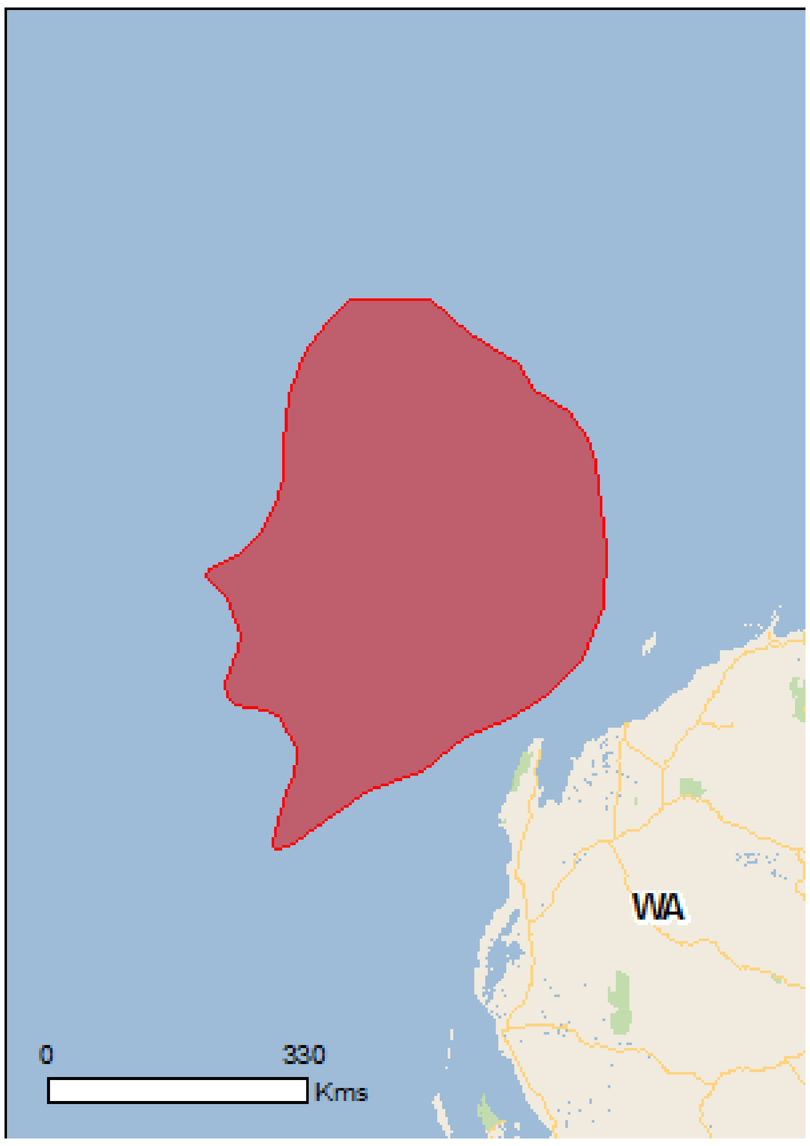
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

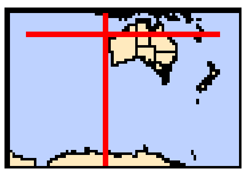
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 14/10/21 16:49:23



Coordinates

Buffer: 0.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	21
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	35
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	3

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	3

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed	Vulnerable	Species or species

Name	Status	Type of Presence
Albatross [64459]		habitat may occur within area
Mammals		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat likely to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat may occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat may occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to

Name	Threatened	Type of Presence
		occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Canyons linking the Cuvier Abyssal Plain and the	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-17.0722 112.8911,-17.0818 111.9803,-17.12 111.9023,-17.2924 111.7078,-17.662 111.4436,-17.8071 111.3788,-18.1078 111.2691,-18.6459 111.1964,-18.9942 111.2024,-19.2807 111.1082,-19.6126 110.9186,-19.8372 110.7019,-19.9959 110.338,-20.0754 110.3216,-20.2946 110.5534,-20.6997 110.7023,-20.8473 110.6921,-21.2105 110.5208,-21.3532 110.5659,-21.4401 110.6623,-21.4788 110.9899,-21.5393 111.1327,-21.879 111.3613,-21.9869 111.3715,-22.1615 111.3274,-22.3804 111.2371,-22.7666 111.1025,-22.9173 111.0894,-22.9525 111.1385,-22.8872 111.3372,-22.7189 111.5715,-22.5959 111.7846,-22.3372 112.1853,-22.1276 112.7742,-21.7708 113.2822,-21.5652 113.7809,-21.4424 114.0283,-21.3104 114.221,-20.9449 114.6288,-20.6784 114.7314,-20.3875 114.8487,-19.7718 114.8876,-18.8428 114.7703,-18.5642 114.6659,-18.2993 114.465,-18.0531 114.054,-17.7591 113.8806,-17.4546 113.3322,-17.0722 112.8911

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- -Office of Environment and Heritage, New South Wales
- -Department of Environment and Primary Industries, Victoria
- -Department of Primary Industries, Parks, Water and Environment, Tasmania
- -Department of Environment, Water and Natural Resources, South Australia
- -Department of Land and Resource Management, Northern Territory
- -Department of Environmental and Heritage Protection, Queensland
- -Department of Parks and Wildlife, Western Australia
- -Environment and Planning Directorate, ACT
- -Birdlife Australia
- -Australian Bird and Bat Banding Scheme
- -Australian National Wildlife Collection
- -Natural history museums of Australia
- -Museum Victoria
- -Australian Museum
- -South Australian Museum
- -Queensland Museum
- -Online Zoological Collections of Australian Museums
- -Queensland Herbarium
- -National Herbarium of NSW
- -Royal Botanic Gardens and National Herbarium of Victoria
- -Tasmanian Herbarium
- -State Herbarium of South Australia
- -Northern Territory Herbarium
- -Western Australian Herbarium
- -Australian National Herbarium, Canberra
- -University of New England
- -Ocean Biogeographic Information System
- -Australian Government, Department of Defence
- Forestry Corporation, NSW
- -Geoscience Australia
- -CSIRO
- -Australian Tropical Herbarium, Cairns
- -eBird Australia
- -Australian Government – Australian Antarctic Data Centre
- -Museum and Art Gallery of the Northern Territory
- -Australian Government National Environmental Science Program
- -Australian Institute of Marine Science
- -Reef Life Survey Australia
- -American Museum of Natural History
- -Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
- -Tasmanian Museum and Art Gallery, Hobart, Tasmania
- -Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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APPENDIX D. OIL SPILL PREPAREDNESS AND RESPONSE STRAETEGY SELECTION AND EVALUATION

Oil Spill Preparedness and Response Mitigation Assessment for Scarborough Drilling and Completions

Security & Emergency Management
Hydrocarbon Spill Preparedness

November 2021
Revision 0

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EXECUTIVE SUMMARY

Woodside Energy Ltd (Woodside) has developed its oil spill preparedness and response position for the Scarborough Drilling and Completions Activity, hereafter known as the Petroleum Activities Program (PAP). This document demonstrates that the risks and impacts from an unplanned hydrocarbon release, and the associated response operations, are controlled to As Low As Reasonably Practicable (ALARP) and Acceptable levels. It achieves this by evaluating response options to address the potential environmental impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the Environment Plan (EP). This document then outlines Woodside's decisions and techniques for responding to a hydrocarbon release event and the process for determining its level of hydrocarbon spill preparedness.

A summary of the key facts and references to additional detail within this document are presented below.

Table 0-1: Summary of the key details for assessment

Key details of assessment	Summary	Reference to additional detail
Worst Case Credible Scenario	**Credible Scenario-01 (CS-01): Instantaneous hydrocarbon release of marine diesel caused by vessel collision.** A short-term (instantaneous) uncontrolled release of 250 m^3 of marine diesel from a vessel, representing a fuel tank rupture after a collision.	**Section 2.2**
Other Credible Scenario	**Credible Scenario-03 (CS-03): Loss of well control during drilling of development well** Dry gas – no liquid hydrocarbon is expected at atmospheric temperatures.	
Hydrocarbon Properties	**Marine diesel** Under constant 5 kn wind conditions approximately 45% of the oil is predicted to evaporate within 24 hours. The majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes. Under variable wind conditions where winds are of a greater strength, more entrainment of oil into the water column is predicted (about 45% after 24 hours). A further 35% is forecast to evaporate, leaving only a small proportion of the oil floating on the water surface (<1%). **Dry gas** The Scarborough reservoir properties are dry gas, primarily methane (approximately 95%) and nitrogen (approximately 4%), with some ethane, CO_2 contents and limited heavier hydrocarbon components. No liquid hydrocarbons are expected at atmospheric conditions. Furthermore, worst case discharge rate ('blowout' rate) modelling predicts that the gas plume will not breach the water's surface.	Section 6.7.2 of the EP Appendix A of the First Strike Plan
Modelling Results	**Stochastic modelling** A quantitative, stochastic assessment has been undertaken for CS-01 to help assess the environmental risk of a hydrocarbon spill. A total of 200 replicate simulations were completed for the scenarios to test for trends and variations in the trajectory and weathering of the spilled oil, with an even number of replicates completed using samples of metocean data that commenced within each calendar quarter. The stochastic modelling did not predict the threshold concentrations required to trigger deterministic modelling. Deterministic modelling was therefore not undertaken and stochastic modelling has been used to scale the response. No receptors are predicted to be contacted by floating oil concentrations at the 10 g/m^2 threshold. Deterministic modelling was not undertaken for CS-01.	**Section 2.3**

	No stochastic or deterministic hydrocarbon spill modelling was undertaken for CS-03.			
		CS-01: Hydrocarbon release caused by vessel collision (instantaneous release of 250 m^3 marine diesel)	**CS-03: Loss of well control during drilling of development well** Dry gas release – no liquid hydrocarbon.	
	Minimum time to shoreline contact (above 100 g/m^2)	No contact at threshold	N/A – dry gas	
	Largest volume ashore at any single Response Priority Area (RPA) (above 100g/m^2)	No contact at threshold	N/A – dry gas	
	Largest total shoreline accumulation (above 100g/m^2) all shorelines	No contact at threshold	N/A – dry gas	
Net Environmental Benefit Assessment	Techniques identified as potentially having a net environmental benefit (dependent on the actual spill scenario) and carried forward for further assessment are: • monitor and evaluate • source control via vessel SOPEP (Shipboard Oil Pollution Emergency Plan) • source control via capping stack • source control via relief well drilling • oiled wildlife response			**Section 4**
ALARP evaluation of selected response techniques	The evaluation of the selected response techniques shows the proposed controls reduced the risk to an ALARP and acceptable level for the risk are presented in **Section 2**, without the implementation of considered additional, alternative or improved control measures.			**Section 7**

1 INTRODUCTION

1.1 Overview

Woodside Energy Ltd (Woodside) has developed its oil spill preparedness and response position for the Scarborough Drilling and Completions Activity, hereafter known as the Petroleum Activities Program (PAP). This document outlines Woodside's decisions and techniques for responding to a hydrocarbon loss of containment event and the process for determining its level of hydrocarbon spill preparedness.

1.2 Purpose

This document, together with the documents listed below, meet the requirements of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS Environment Regulations) relating to hydrocarbon spill response arrangements.

- The Scarborough Drilling and Completions Environment Plan (EP)
- Oil Pollution Emergency Arrangements (OPEA) (Australia)
- The Scarborough Drilling and Completions Oil Pollution Emergency Plan (OPEP) including;
  - First Strike Plan (FSP)
  - Relevant Operations Plans
  - Relevant Tactical Response Plans (TRPs, also see ANNEX E: Tactical Response Plans)
  - Relevant Supporting Plans
  - Data Directory.

The purpose of this document is to demonstrate that the risks and impacts from an unplanned hydrocarbon release and the associated response operations are controlled to As Low as Reasonably Practicable (ALARP) and Acceptable levels.

1.3 Scope

This document demonstrates that the risks and impacts from an unplanned hydrocarbon release and dry gas loss of well control (LOWC), and the associated response operations, are controlled to ALARP and Acceptable levels. It achieves this by evaluating response options to address the potential environmental risks and impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the EP. This document then outlines Woodside's decisions and techniques for responding to a hydrocarbon release event and the process for determining its level of hydrocarbon spill preparedness. It should be read in conjunction with the documents listed in **Table 1-1**. The location of the Petroleum Activity Program is shown in Figure 3-2 of the EP.

1.4 Oil spill response document overview

The documents outlined in **Table 1-1** and **Figure 1-1** are collectively used to manage the preparedness and response for a hydrocarbon release.

The Oil Pollution First Strike Plan (FSP) contains a pre-operational Net Environmental Benefit Analysis (NEBA) summary, outlining the selected response techniques for this PAP. Relevant Operational Plans to be initiated for associated response techniques are identified in the FSP and relevant forms to initiate a response are appended to the FSP.

The process to develop an Incident Action Plan (IAP) begins once the Oil Pollution FSP is underway. The IAP includes inputs from the Monitor and Evaluate operations and the operational NEBA (**Section 4**). Planning, coordination and resource management are initiated by the Incident Management Team

(IMT). In some instances, technical specialists may be utilised to provide expert advice. The planning may also involve liaison officers from supporting government agencies.

During each operational period, field reports are continually reviewed to evaluate the effectiveness of response operations. In addition, the operational NEBA is continually reviewed and updated to ensure the response techniques implemented continue to result in a net environmental benefit (see **Section 4**).

The response will continue as described in **Section 5** until the response termination criteria have been met.

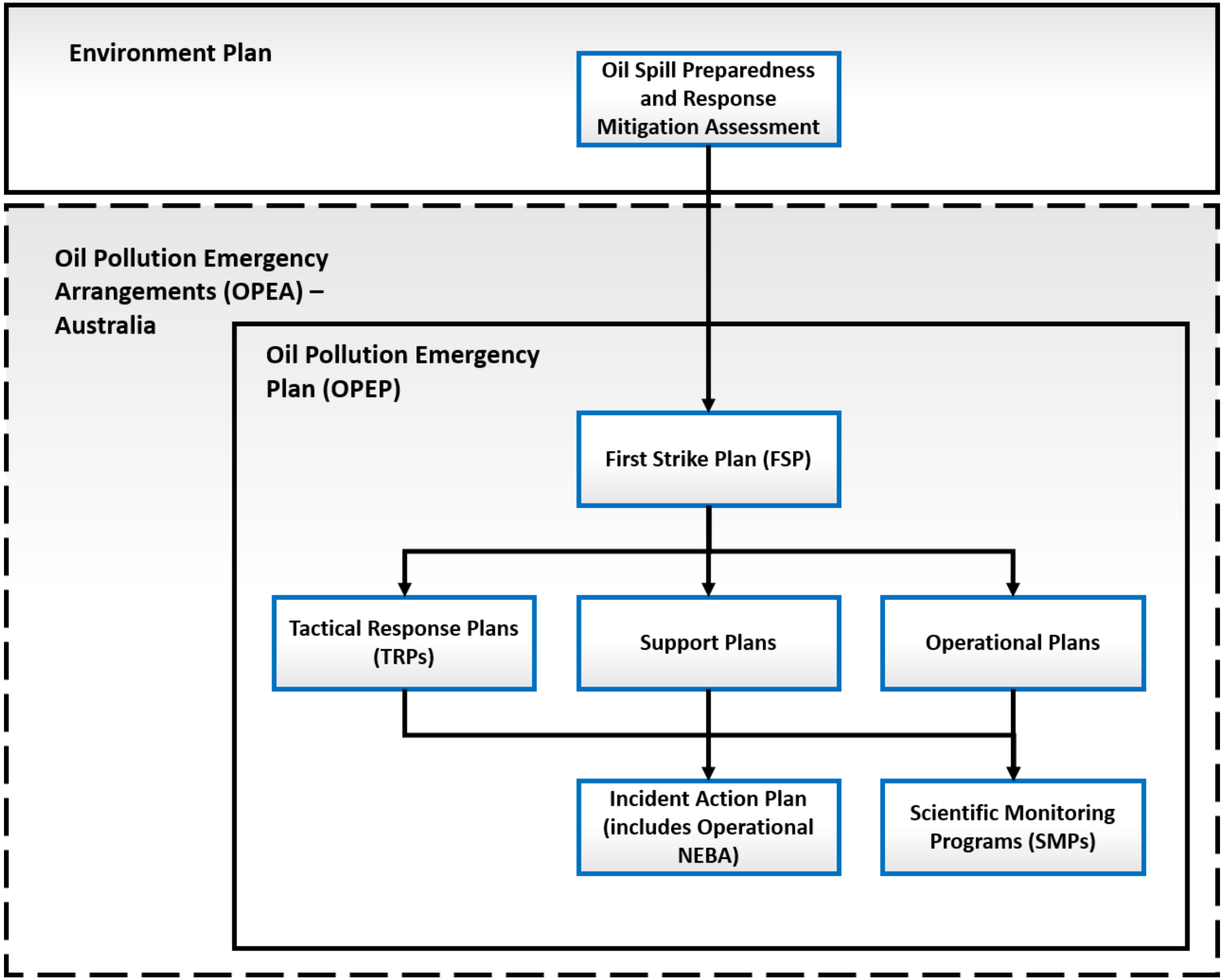


Figure 1-1: Woodside hydrocarbon spill document structure

Table 1-1: Hydrocarbon Spill preparedness and response – document references

Document	Document overview	Stakeholders	Relevant information	Document subsections (if applicable)
Scarborough Drilling and Completions Environment Plan (EP)	Demonstrates that potential adverse impacts on the environment associated with Scarborough Drilling and Completions activities (during both routine and non-routine operations) are mitigated and managed to ALARP and will be of an acceptable level.	NOPSEMA Woodside internal	EP Section 6 (Identification and evaluation of environmental risks and impacts, including credible spill scenarios) EP Section 6 (Performance outcomes, standards and measurement criteria) EP Section 7 (Implementation strategy – including emergency preparedness and response) EP Section 7 (Reporting and compliance)	
Oil Pollution Emergency Arrangements (OPEA) Australia	Describes the arrangements and processes adopted by Woodside when responding to a hydrocarbon spill from a petroleum activity.	Regulatory agencies Woodside internal	All	Link
Oil Spill Preparedness and Response Mitigation Assessment for the Scarborough Drilling and Completions (this document)	Evaluates response options to address the potential environmental impacts resulting from an unplanned loss of hydrocarbon containment associated with the PAP described in the EP.	Regulatory agencies Corporate Incident Control Centre (CICC): Control function in an ongoing spill response for activity-specific response information.	All Performance outcomes, standards and measurement criteria related to hydrocarbon spill preparedness and response are included in this document.	

Document	Document overview	Stakeholders	Relevant information	Document subsections (if applicable)
Scarborough Drilling and Completions Oil Pollution First Strike Plan	Facility specific document providing details and tasks required to mobilise a first strike response. Primarily applied to the first 24 hours of a response until a full IAP specific to the event is developed. Oil Pollution First Strike Plans are intended to be the first document used to provide immediate guidance to the responding IMT.	Site-based IMT for initial response, activation and notification. CICC for initial response, activation and notification. CICC: Control function in an ongoing spill response for activity-specific response information.	Initial notifications and reporting required within the first 24 hours of a spill event. Relevant spill response options that could be initiated for mobilisation in the event of a spill. Recommended pre-planned tactics. Details and forms for use in immediate response. Activation process for oil spill trajectory modelling (OSTM), aerial surveillance and oil spill tracking buoy details.	
Operational Plans	Lists the actions required to activate, mobilise and deploy personnel and resources to commence response operations. Includes details on access to equipment and personnel (available immediately) and steps to mobilise additional resources depending on the nature and scale of a release. Relevant operational plans will be initially selected based on the Oil Pollution First Strike Plan; additional operational plans will be activated depending on the nature and scale of the release.	CICC: Operations and Logistics functions for first strike activities. CICC: Planning Function to help inform the IAP on resources available.	Locations from where resources may be mobilised. How resources will be mobilised. Details of where resources may be mobilised to and what facilities are required once the resources arrive. Details on how to use resources to undertake a response.	Operational Monitoring Plan Source Control Emergency Response Plan Oiled Wildlife Scientific Monitoring

Document	Document overview	Stakeholders	Relevant information	Document subsections (if applicable)
Tactical Response Plans	Provides options for response techniques in selected RPAs. Provides site, access and deployment information to support a response at the location.	CICC: Planning Function to help develop IAPs, and Logistics Function to assist with determining resources required.	Indicative response techniques. Access requirements and/or permissions. Relevant information for undertaking a response at that site. Where applicable, may include equipment deployment locations and site layouts.	For full list of relevant Tactical Plans, refer to **ANNEX E: Tactical Response Plans**.
Support Plans	Support Plans detail Woodside's approach to resourcing and the provision of services during a hydrocarbon spill response.	CICC: Operations, Logistics and Planning functions.	Technique for mobilising and managing additional resources outside of Woodside's immediate preparedness arrangements.	Marine Logistics People & Global Capability Surge Labour Requirement Plan Health & Safety Aviation IT Response Plan Communications Response Plan Stakeholder Engagement Accommodation & Catering Waste Management Guidance for Oil Spill Claims Management Security Support Plan Hydrocarbon Spill Responder Health Monitoring Guideline

2 RESPONSE PLANNING PROCESS

This document details Woodside's process for identifying potential response options for the hydrocarbon release scenarios, identified in the EP. **Figure 2-1** outlines the interaction between Woodside's response, planning/preparedness and selection process.

This structure has been used because it shows how the planning and preparedness activities inform a response and provides indicative guidance on what activities would be undertaken, in sequential order, if a real event were to occur. The process also evaluates alternative, additional and/or improved control measures specific to the PAP.

The Scarborough Drilling and Completions First Strike Plan then summarises the outcome of the response planning process and provides initial response guidance and a summary of ongoing response activities, if an incident were to occur.

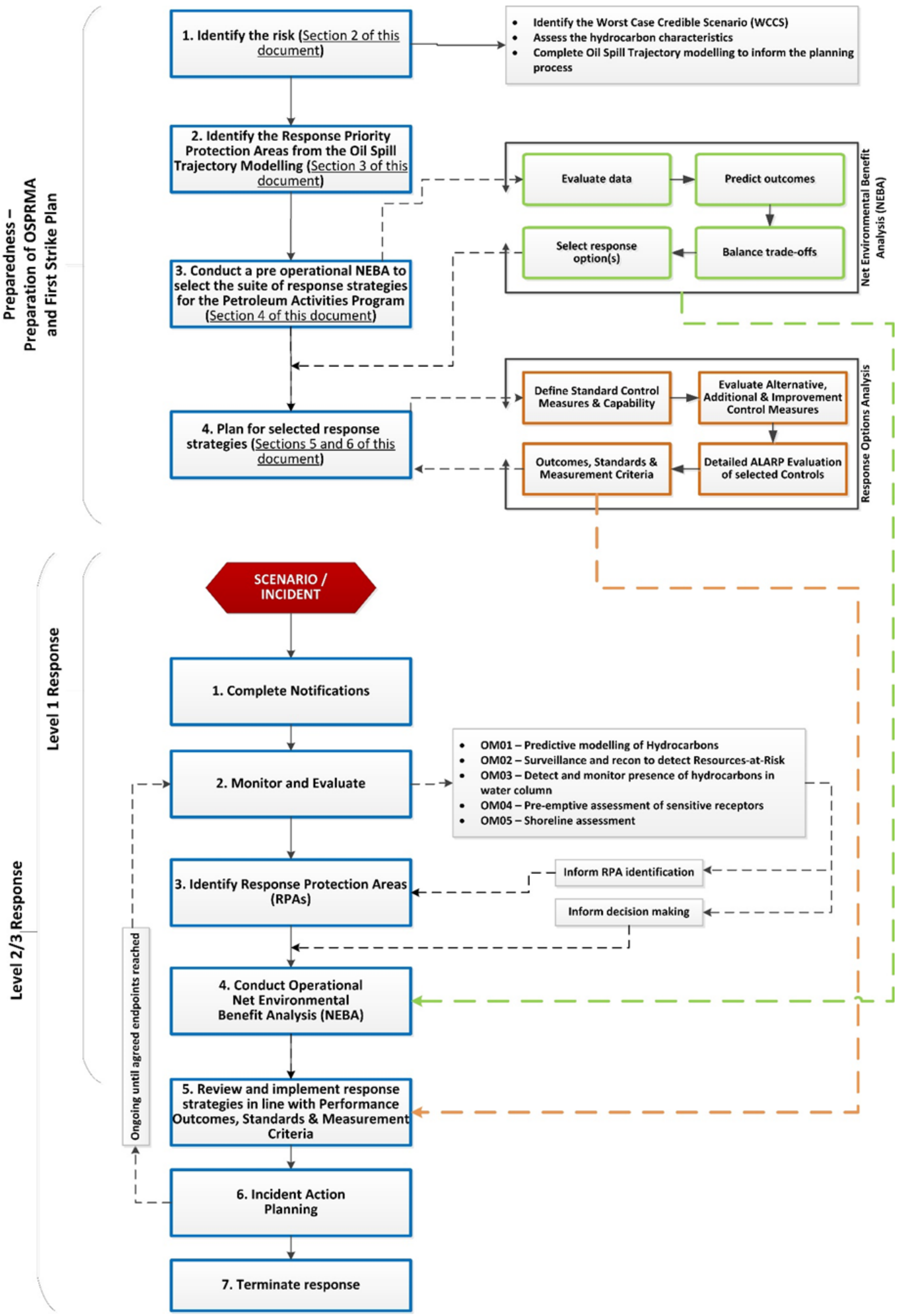


Figure 2-1: Response planning and selection process

2.1 Response planning process outline

This document is expanded below to provide additional context on the key steps in determining capability, evaluating ALARP and hydrocarbon spill response requirements.

Section 1. INTRODUCTION

Section 2. RESPONSE PLANNING PROCESS

- Identification of worst-case credible scenario(s) (WCCS)
- Spill modelling for WCCS.

Section 3. IDENTIFY RESPONSE PROTECTION AREAS (RPAs)

- Areas predicted to be contacted at concentration >100 g/m^2.[1]

Section 4. NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA)

- Pre-operational NEBA (during planning/ALARP evaluation): this must be reviewed during the initial response to an incident to ensure its accuracy
- Selected response techniques prioritised and carried forward for ALARP assessment.

Section 5. HYDROCARBON SPILL ALARP PROCESS

- Determines the response need based on predicted consequence parameters
- Details the environmental performance of the selected response options based on the need
- Sets the environmental performance outcomes, environmental performance standards and measurement criteria.

Section 6. ALARP EVALUATION

- Evaluates alternative, additional, and improved options for each response technique to demonstrate the risk has been reduced to ALARP
- Provides a detailed ALARP assessment of selected control measure options against:
  - predicted cost associated with implementing the option
  - predicted change to environmental benefit
  - predicted effectiveness / feasibility of the control measure.

Section 7. ENVIRONMENTAL RISK ASSESSMENT OF SELECTED RESPONSE TECHNIQUES

- Evaluation of impacts and risks from implementing selected response options.

Section 8. ALARP CONCLUSION

Section 9. ACCEPTABILITY CONCLUSION

[1] This represents the threshold that could impact the survival and reproductive capacity of benthic epifaunal invertebrates living in intertidal habitat.

2.1.1 Response Planning Assumptions

For the purpose of defining terms related to response planning and timing, the following definitions have been developed:

IMT Call-out/ Notification	Contract Activation	Response Option Mobilisation	Response Option Deployment	Response Option Effectiveness
This is the time taken from call-out to mobilise the IMT to the designated Incident Control Centre	This is the time taken once the IMT has been mobilised to activate specific contracts for resources (SFRT, FWADC, AMOSC, AMSA, OSRL, etc)	This is the time taken to mobilise resources from home location to laydown/staging area (expected to be airport or sea port) close to response area	This is the time taken to deploy resources from laydown/staging area (expected to be airport or sea port) to response area/field	This relates to the performance of equipment/response option as well as required personnel resourcing (Specialists/Supervisors + support personnel)
Approx 2-4 hours	Approx 2-4 hours	Response Technique specific	Field/Location specific	Response Strategy specific

Figure 2-2: Response Planning Assumptions – Timing, Resourcing and Effectiveness

2.2 Environment plan risk assessment (credible spill scenarios)

Potential hydrocarbon release scenarios from the PAP have been identified during the risk assessment process (Section 6 of the EP). Further descriptions of risk, impacts and mitigation measures (which are not related to hydrocarbon preparedness and response) are provided in Section 6 of the EP. Three unplanned events or credible spill scenarios for the PAP have been selected as representative across types, sources and incident/response levels, up to and including the WCCS.

Table 2-1 presents the credible scenarios for the PAP. The WCCS for the activity is then used for response planning purposes, as all other scenarios are of a lesser scale and extent. By demonstrating capability to manage the response to the WCCS, Woodside assumes other scenarios that are smaller in nature and scale can also be managed by the same capability. Response performance measures have been defined based on a response to the WCCS.

- CS-01, the surface release of marine diesel caused by vessel collision, is considered the worst case when responding to floating hydrocarbons, given the large volume released instantaneously.
- CS-02, marine fuel loss during bunkering, has a significantly smaller marine diesel release volume and is considered to be within the risk profile and spill response capability requirements of CS-01.
- CS-03, a loss of well control, has also been considered, however, this scenario involves dry gas with no liquid hydrocarbon thus only operational monitoring and source control techniques are applicable.

Table 2-1: Petroleum Activities Program credible spill scenarios

Scenarios	Scenario selected for planning purposes	Scenario description	Maximum credible volume released (liquid m^3)[1]	Incident Level	Hydrocarbon (HC) type	Residual proportion	Residual volume (liquid m^3)
Credible Scenario-01 (CS-01) (Worst Case)	Yes	Hydrocarbon release caused by marine vessel collision. Instantaneous release of 250 m^3 of marine diesel within the Operational Area.	Instantaneous release of 250 m^3 marine diesel	Level 2	Marine Diesel	5%	12.5
Credible Scenario-02 (CS-02)	No	Marine Fuel Loss during bunkering	Instantaneous release of 8 m^3 marine diesel	Level 1	Marine diesel	5%	0.4 m^3
Credible Scenario-03 (CS-03)	Yes	Loss of well control during drilling of development well	Dry gas release – no liquid hydrocarbons	Level 3	Dry gas	N/A	N/A

2.2.1 Hydrocarbon characteristics

Marine Diesel (~American Petroleum Institute (API) 35) (CS-01)

Marine Diesel Oil is typically classed as an International Tanker Owners Federation (ITOPF) Group I/II oil.

Marine diesel is a mixture of volatile and persistent hydrocarbons with low proportions of highly volatile and residual components. Under constant 5 kn wind conditions, approximately 45% of the oil is predicted to evaporate within 24 hours. Under these calm conditions the majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes. Under variable wind conditions where winds are of a greater strength, more entrainment of oil into the water column is predicted (about 45% after 24 hours). A further 35% is forecast to evaporate, leaving only a small proportion of the oil floating on the water surface (<1%).

The heavier (low volatility) components of the oil have a tendency to entrain into the upper water column due to wind-generated waves but can subsequently resurface if wind-waves abate. Therefore, the heavier components of this oil can remain entrained or on the sea surface for an extended period, with associated potential for dissolution of the soluble aromatic fraction.

Dry gas (CS-03)

The Scarborough reservoir properties are dry gas, primarily methane (approximately 95%) and nitrogen (approximately 4%), with some ethane, CO_2 contents and limited heavier hydrocarbon components. No liquid hydrocarbons are expected at atmospheric conditions. Furthermore, worst case discharge rate ('blowout' rate) modelling predicts that the gas plume will not breach the water's surface.

2.3 Hydrocarbon spill modelling

Oil spill trajectory modelling tools are used for environmental impact assessment and during response planning to understand spatial scale and timeframes for response operations. Woodside recognises that there is a degree of uncertainty related to the use of modelling data and has subsequently utilised conservative approaches to volumes, weathering, spatial areas, timing and response effectiveness to scale capability to need.

The Oil Spill Model and Response System (OILMAP) and Integrated Oil Spill Impact Model System (Spill Impact Mapping and Analysis Program, SIMAP) models are both used for stochastic and deterministic trajectory modelling. They have been developed over three decades of planning, exercises, actual responses, several peer reviews, and validation studies. OILMAP was originally derived from the United States Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Type A model (French et al. 1996), for assessing marine transport, biological impact and economic impact that was also used under the United States Oil Pollution Act 1990 Natural Resource Damage Assessment (NRDA) regulations. Notable spills where the model has been used and validated against actual field observations include, Exxon Valdez (French McCay 2004), North Cape Oil Spill (French McCay 2003), along with an assessment of 20 other spills (French McCay and Rowe, 2004). In addition, test spills designed to verify fate, weathering and movement algorithms have been conducted regularly and in a range of climate conditions (French and Rines 1997; French et al. 1997; Payne et al. 2007; French McCay et al. 2007).

Further to this, the algorithms have been updated using the latest findings from the Macondo/Deepwater Horizon well blowout in the Gulf of Mexico and validated according to the Deepwater Horizon (DWH) oil spill in support of the Natural Resource Damage Assessment (NRDA) (Spaulding et al. 2015; French McCay et al. 2015, 2016). Finally, the OILMAP and SIMAP models have been used extensively in Australia to prosecute pollution offences, predict discharge locations and likely spill volumes based on weathering and surveillance observations, and has been used as expert witness evidence in Australian court proceedings, aiding the prosecution to determine spill quantum estimates.

2.3.1 Stochastic modelling

Stochastic modelling has been completed for CS-01 outlined in **Table 2-1**, to help assess the environmental consequences of a hydrocarbon spill. A total of 200 replicate simulations were completed for the scenario to test for trends and variations in the trajectory and weathering of the spilled oil over an annual period, with an even number of replicates completed using samples of metocean data that commenced within each month. Further details relating to the assessments for the scenario can be found in Section 6 of the EP.

No stochastic modelling was carried out for a dry gas spill from CS-03, as no liquid hydrocarbon are expected to be released at atmospheric temperatures.

2.3.1.1 Environmental impact thresholds – EMBA and hydrocarbon exposure

The outputs of the stochastic spill modelling are used to assess the potential environmental impact from the credible scenarios. The stochastic modelling results are used to delineate areas of the marine and shoreline environment that could be exposed to hydrocarbon levels exceeding environmental impact threshold concentrations. The summary of all the locations where hydrocarbon thresholds could be exceeded by any of the simulations modelled is defined as Environment that May Be Affected (EMBA) and is discussed further in Section 6 of the EP. As the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean mechanism of transportation, a different EMBA is presented for each fate within the EP.

A conservative approach – adopting accepted contact thresholds for impacts on the marine environment – is used to define the EMBA. These hydrocarbon thresholds are presented in **Table 2-2** below and described in Section 6 of the EP.

Table 2-2: Summary of thresholds applied to the stochastic hydrocarbon spill modelling to determine environment that maybe affected and environmental impacts

Threshold	Description
10 g / m^2	Surface hydrocarbon
100 ppb	Entrained hydrocarbon (ppb)
50 ppb	Dissolved aromatic hydrocarbon (ppb)
100 g / m^2	Shoreline accumulation

2.3.2 Deterministic Modelling

Deterministic modelling is undertaken where initial stochastic modelling has indicated that floating oil is present at an impact threshold of 50 g/m^2 and/or where there is shoreline accumulations at an impact threshold of 100 g/m^2. The deterministic modelling outputs are then used to scale the required capability for the offshore (containment and recovery and dispersant) and/or shoreline responses.

The stochastic modelling used as a representative of this PAP did not predict the threshold concentrations required to trigger the undertaking of deterministic modelling. Deterministic modelling was therefore not undertaken and stochastic modelling has been used to scale the response.

2.3.3 Response Planning Thresholds for Surface and Shoreline Hydrocarbon Exposure

Thresholds to determine the EMBA are used to predict and assess environmental impacts and inform the scientific monitoring program (SMP), however they do not appropriately represent the thresholds at which an effective response can be implemented. Additional response thresholds are used for response planning and to determine areas where response techniques would be most effective. The spill modelling results are then used to assess the nature and scale of a response.

In the event of an actual response, existing modelling would be reviewed for suitability and additional modelling would be conducted using real-time data and field information to inform Incident Management Team decisions.

The spill modelling outputs are presented at response planning thresholds for surface hydrocarbons for the WCCS. Surface spill concentrations are expressed as grams per square metre (g/m^2). The thresholds used are derived from oil spill response planning literature and industry guidance and are summarised below.

2.3.3.1 Surface hydrocarbon concentrations

Table 2-3: Surface hydrocarbon thresholds for response planning

Surface hydrocarbon concentration (g/m^2)	Description	Bonn Agreement Oil Appearance Code (BAOAC)	Mass per area (g/m^2)
>10	Predicted minimum threshold for commencing operational monitoring	Code 3 – Dull metallic colours	5 to 50
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [2]	Code 4 – Discontinuous true oil colour	50 to 200
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application	Code 5 – Continuous true oil colour	>200
Shoreline hydrocarbon concentration (g/m^2)	**Description**	**National Plan Guidance on Oil Contaminated Foreshores**	**Mass per area (g/m^2)**
100	Predicted minimum shoreline accumulation threshold for shoreline assessment operations	Stain	>100
250	Predicted minimum threshold for commencing shoreline clean-up operations	Level 3 - Thin Coating	200 - 1000

The surface thickness of oil at which dispersants are typically effective is approximately 100 g/m^2. However, substantial variations occur in the thickness of the oil within the slick, and most fresh crude oils spread within a few hours, so that overall the average thickness is 0.1 mm (or approx. 100 g/m^2) (International Tanker Owners Pollution Federation [ITOPF] 2011). Additionally, the recommended rate of application for surface dispersant is typically 1-part dispersant to 20 or 25 parts of spilled oil. These figures assume a 0.1 mm slick thickness, averaged over the thickest part of the spill, to calculate a litres/hectare application rate from vessels and aircraft. In practice, this can be difficult to achieve as it is not possible to accurately assess the thickness of the floating oil.

Some degree of localised over-dosage and under-dosage is inevitable in dispersant response. An average oil layer thickness of 0.1 mm is often assumed, although the actual thickness can vary over a wide range (from less than 0.0001 mm to more than 1 mm) over short distances (International Petroleum Industry Environment Conservation Association [IPIECA] 2015).

Guidance from Australian Maritime Safety Authority (AMSA, 2015) indicates that spreading of spills of Group II or III products will rapidly decrease slick thickness over the first 24 hours of a spill resulting

[2] At 50g/m^2, containment and recovery and surface dispersant application operations are not expected to be particularly effective. This threshold represents a conservative approach to planning response capability and containing the spread of surface oil.

in the potential requirement of up to a ten (10) fold increase in capability on day 2 to achieve the same level of performance.

Further guidance from the European Maritime Safety Authority (EMSA) states that spraying the ‘metallic’ looking area of an oil slick (Bonn Agreement Oil Appearance Code [BAOAC] 3, approx. 5 – 50 µm) with dispersant from spraying gear designed to treat an oil layer 0.1 mm (100 µm) thick, will inevitably cause dispersant over-treatment by a factor of 2 to 20 times (EMSA 2012).

Therefore, dispersant application should be concentrated on the thickest areas of an oil slick and Woodside intends on applying surface dispersants to only BAOAC 4 and 5. Spraying areas of oil designated as BAOAC Code 4 (Discontinuous true oil colour) with dispersant will, on average, deliver approximately the recommended treatment rate of dispersant.

Spraying areas of oil designated as BAOAC Code 5 with dispersant (Continuous true oil colour and more than 0.2 mm thick) will, on average, deliver approximately half the recommended treatment rate of dispersant. Repeated application of these areas of thicker oil, or increased dosage ratios, will be required to achieve the recommended treatment rate of dispersant (EMSA 2012).

Guidance from the National Oceanic and Atmospheric Administration (NOAA) in the United States is found in the document: *Characteristics of Response Techniques: A Guide for Spill Response Planning in Marine Environments 2013 (NOAA 2013).* This guide outlines advice for response planning across all common techniques, including surface dispersant spraying and containment and recovery. It states that oil thickness can vary by orders of magnitude within distinct areas of a slick, thus the actual slick thickness and oil distribution of target areas are crucial for determining response method feasibility. Further to this, ITOPF also states that in terms of oil spill response, sheen can be disregarded as it represents a negligible quantity of oil, cannot be recovered or otherwise dealt with to a significant degree by existing response techniques, and is likely to dissipate readily and naturally (ITOPF, 2014).

Figure 2-3 below from AMSA’s Identification of Oil on Water – Aerial Observation and Identification Guide (AMSA, 2014) shows expected percent coverage of surface hydrocarbons as a proportion of total surface area. Wind-rows, heavy oil patches and tar balls, for example, must be considered, as they influence oil encounter rates, chemical dosages and ignition potential. Each method has different thickness thresholds for effective response.

From this information and other relevant sources (Allen and Dale, 1996, EMSA, 2012, Spence, 2018) the surface threshold of 50g/m^2 was chosen as an average / equilibrium thickness (50g/m^2 is an average is 50% coverage of 0.1mm Bonn Agreement Code 4 - discontinuous true oil colour, or 25% coverage of 0.2mm Bonn Agreement Code 5 – continuous true oil colour which would represent small patches of thick oil or wind-rows.

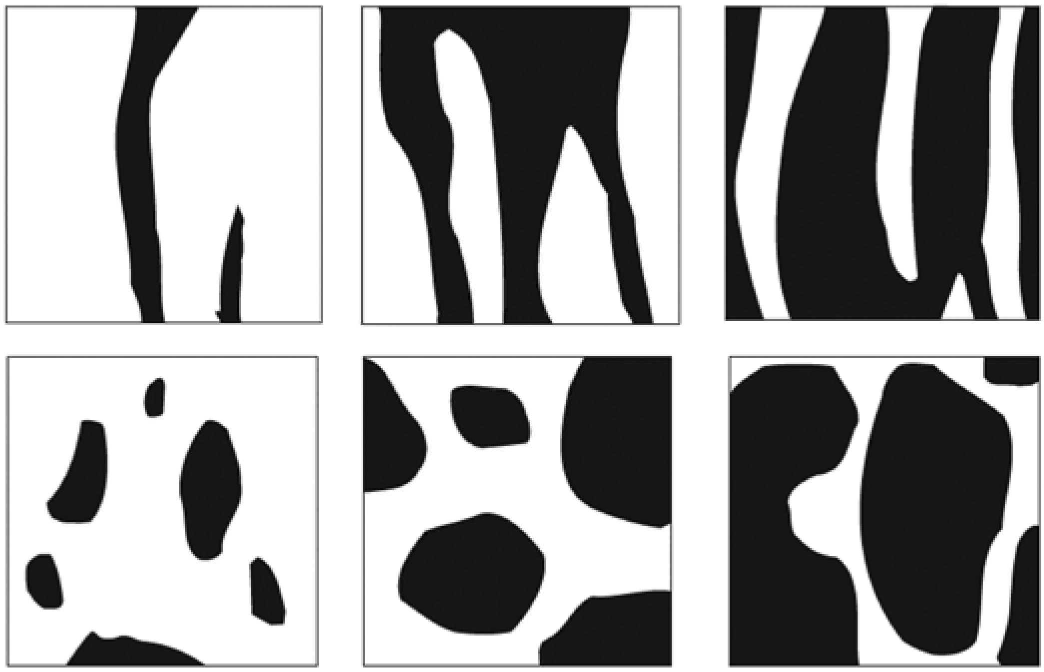


Figure 2-3: Proportion of total area coverage (AMSA, 2014)

Figure 2-4 illustrates the general relationships between on-water response techniques and slick thickness. Wind-rows, heavy oil patches and tar balls, for example, must be considered, as they influence oil encounter rates, chemical dosages and ignition potential. Each method has different thickness thresholds for effective response.

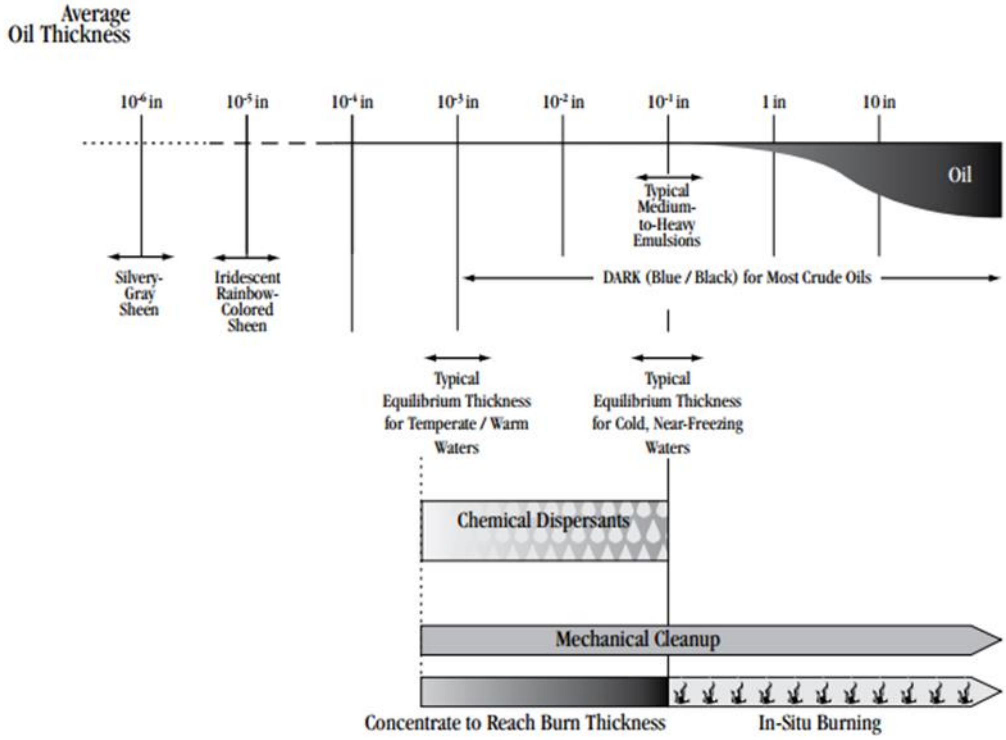


Figure 2-4: Oil thickness versus potential response options (from Allen & Dale 1996)

Wind and waves influence the feasibility of mechanical clean-up operations, dropping the effectiveness significantly because of entrainment and/or splash-over as short period waves develop beyond two to three feet (0.6–0.9 m) in height. Waves and wind can also be limiting factors for the safe operation of vessels and aircraft.

2.3.3.2 Surface hydrocarbon viscosity

Table 2-4: Surface hydrocarbon viscosity thresholds

Surface viscosity (cSt)	Description	European Maritime Safety Authority (EMSA)	Viscosity at sea temperature (cSt)
5,000	Predicted optimum viscosity for surface dispersant operations	Generally possible to disperse	500-5000
10,000	Predicted maximum viscosity for effective surface dispersant operations	Sometimes possible to disperse	5,000-10,000

Further to the required thickness for surface dispersant application and containment and recovery to be deployed effectively as outlined above, changes to viscosity will also limit the treatment of offshore response techniques. As outlined in the EMSA Manual on the Applicability of Oil Spill Dispersants (EMSA, 2012), guidance around changes to viscosity and likely effectiveness of surface dispersant application is provided.

This includes the following statements; “It has been known for many years that it is more difficult to disperse a high viscosity oil than a low or medium viscosity oil. Laboratory testing had shown that the effectiveness of dispersants is related to oil viscosity, being highest for modern “Concentrate, UK Type 2/3” dispersants at an oil viscosity of about 1,000 or 2,000 mPa.s (1,000 – 2,000 cSt) and then declining to a low level with an oil viscosity of 10,000 mPa.s (10,000 cSt). It was considered that some generally applicable viscosity limit, such as 2,000 or 5,000 mPa.s (2,000 – 5,000 cSt), could be applied to all oils.”

However, modern oil spill dispersants are generally effective up to an oil viscosity of 5,000 mPa.s (5,000 cSt) or more, and their performance gradually decreases with increasing viscosity; oils with a viscosity of more than 10,000 are, in most cases, no longer dispersible. Guidance from EMSA (2012) also indicates that products with a range of 500 – 5,000 cSt at sea temperature are generally possible to disperse, while 5,000 – 10,000 cSt at sea temperature above pour point are sometimes possible to disperse, with products beyond 10,000 cSt at sea temperature below pour point are generally impossible to disperse.

To support decision making and response planning, a threshold of 10,000 cSt at sea temperature was chosen as a conservative estimate of maximum viscosity for surface dispersant spraying operations.

The thresholds described above are compared with the modelling results for the WCCS (**Table 2-5**).

2.3.4 Spill modelling results

Details of the scenario, selected stochastic modelling inputs and results are included in **Table 2-5**.

Table 2-5: Worst case credible scenario modelling results

Response parameter	Modelled result	
	CS-01: Marine diesel release caused by vessel collision	**CS-03: Loss of well control during drilling of development well**
Maximum instantaneous liquid hydrocarbon release rate and duration	Modelled instantaneous surface release of 250 m^3 marine diesel.	N/A – dry gas with no liquid hydrocarbons
Maximum residual surface hydrocarbon after weathering	12.5 m^3	N/A – dry gas
Modelling results		
Minimum time to commencement of hydrocarbon accumulation at any shoreline receptor (at a threshold of 100 g/m^2)	No contact at threshold	N/A – dry gas
Minimum time to floating hydrocarbon contact with the offshore edge(s) of any shoreline receptor polygon (at a threshold of 10 g/m^2)	No contact at threshold	N/A – dry gas
Maximum cumulative hydrocarbon volume accumulated at any individual shoreline receptor	No contact at threshold	N/A – dry gas
Maximum cumulative hydrocarbon volume accumulated across all shoreline receptors contacted by accumulated hydrocarbons (including those contacted at <100 g/m^2 accumulation concentration)	No contact at threshold	N/A – dry gas
Minimum time to entrained/dissolved hydrocarbon contact with the offshore edges of any receptor polygon (at a threshold of 100 ppb/50 ppb)	55 hours at Gascoyne Australian Marine Park (AMP) for entrained hydrocarbon contact/ No contact at threshold for dissolved hydrocarbon	N/A – dry gas

The stochastic modelling results for the worst case credible scenario are summarised as follows:

- Surface hydrocarbon concentrations equal to or greater than 10 g/m^2 are predicted to extend up to 52 km from the release location. No contact with sensitive receptors is predicted at this threshold.
- No shoreline receptors are predicted to be contacted by floating oil concentrations at any of the assessed thresholds.
- No accumulation of oil on shorelines is predicted.
- The Gascoyne Australian Marine Park (AMP) is predicted to receive entrained oil concentrations at the 100 ppb threshold with a probability of 4% after 55 hours.

Spreading and weathering of the surface oil occurs rapidly due to the loss of light, volatile components and the spreading. Dispersant application and containment and recovery are not appropriate for use on spills of marine diesel due to these weathering characteristics.

3 IDENTIFY RESPONSE PROTECTION AREAS (RPAs)

In a response, operational monitoring programs – including trajectory modelling and vessel/aerial observations – would be used to predict RPAs that may be impacted. For the purposes of planning and appropriately scaling a response, modelling has been used to identify RPAs as outlined below in Figure 3-1.

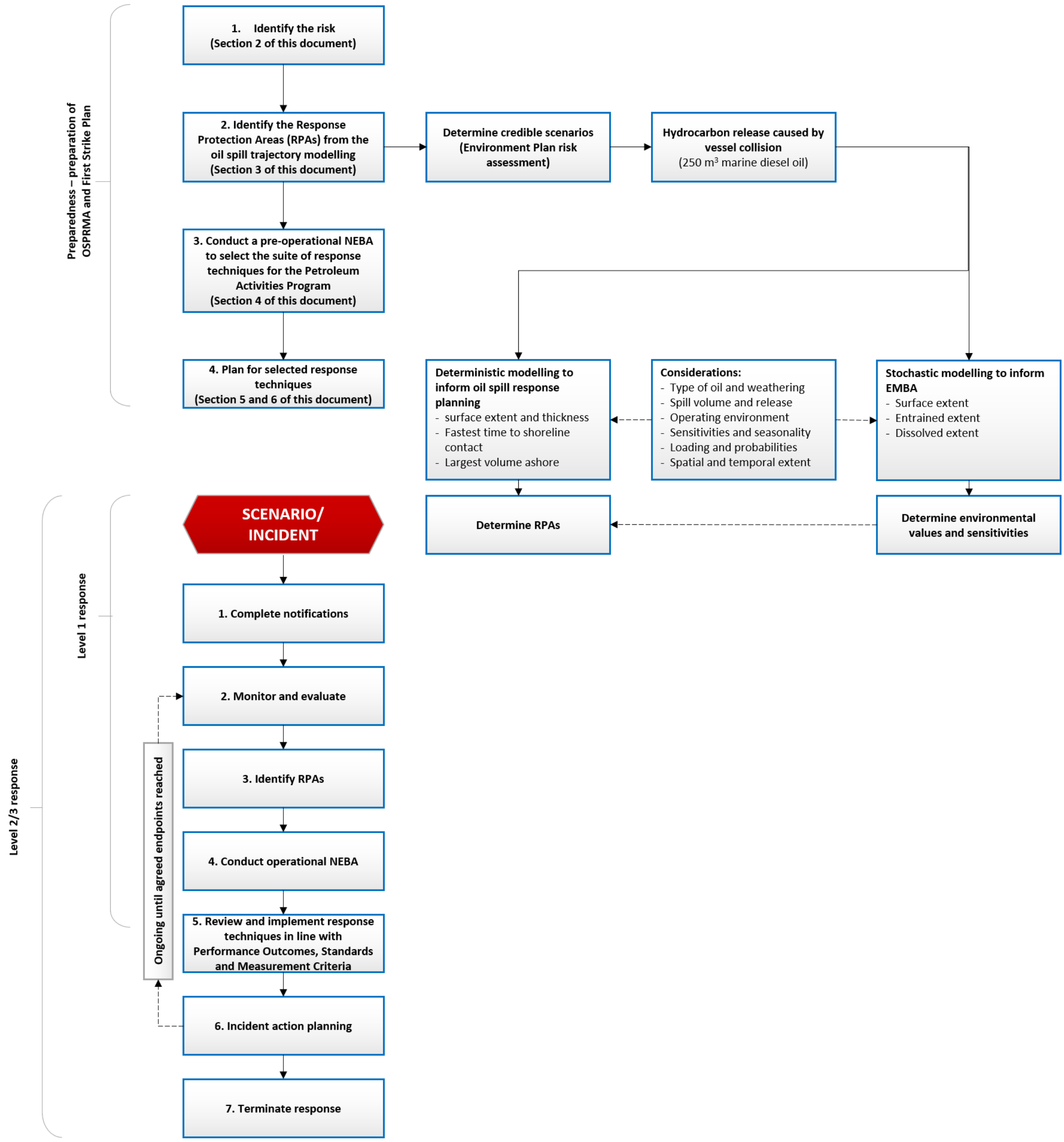


Figure 3-1: Identify RPAs flowchart

3.1 Identified Sensitive Receptor Locations

Section 6 of the EP includes the list of sensitive receptor locations that have been identified by stochastic modelling as meeting the requirements outlined below:

- Receptors with the potential to incur surface, entrained or shoreline accumulation contact above environmental impact thresholds.
- Receptors within the EMBA which meet the following:
  - A number of priority protection criteria/categories
  - International Union of Conservation of Nature (IUCN) marine protected area categories
  - High conservation value habitat and species
  - Important socio-economic/heritage value.

3.1.1 Identify Response Protection Areas

From the identified sensitive receptors described in Section 6 of the EP, only those which a shoreline response could feasibly be conducted (accumulation >100 g/m^2 for shoreline assessment and/or contact with surface slicks >10 g/m^2 for operational monitoring) are selected for response planning purposes.

3.1.2 Response Protection Areas

Response Protection Areas (RPAs) are selected on the basis of their environmental (ecological, social, economic, cultural and heritage) values and sensitivities and considering the minimum response thresholds and the ability to conduct a response based on the minimum response thresholds (**Section 2.3.3**).

Contact from floating hydrocarbons above 10 g/m^2 is not predicted for any shoreline receptor based on the stochastic modelling. Additionally, accumulation above 100 g/m^2 on any shoreline is not predicted and no accumulated volume of hydrocarbons is predicted at any shorelines. Consequently, no RPAs have been selected for response planning.

For this PAP deterministic modelling was not required because the stochastic spill modelling predicted no contact with shoreline from floating oil.

4 NET ENVIRONMENTAL BENEFIT ANALYSIS (NEBA)

A NEBA is a structured process to consider which response techniques are likely to provide the greatest net environmental benefit.

The NEBA process typically involves four key steps outlined in **Figure 4-1**: evaluate data, predict outcomes, balance trade-offs, and select response options. These steps are followed in the planning/preparedness process and would also be followed in a response.

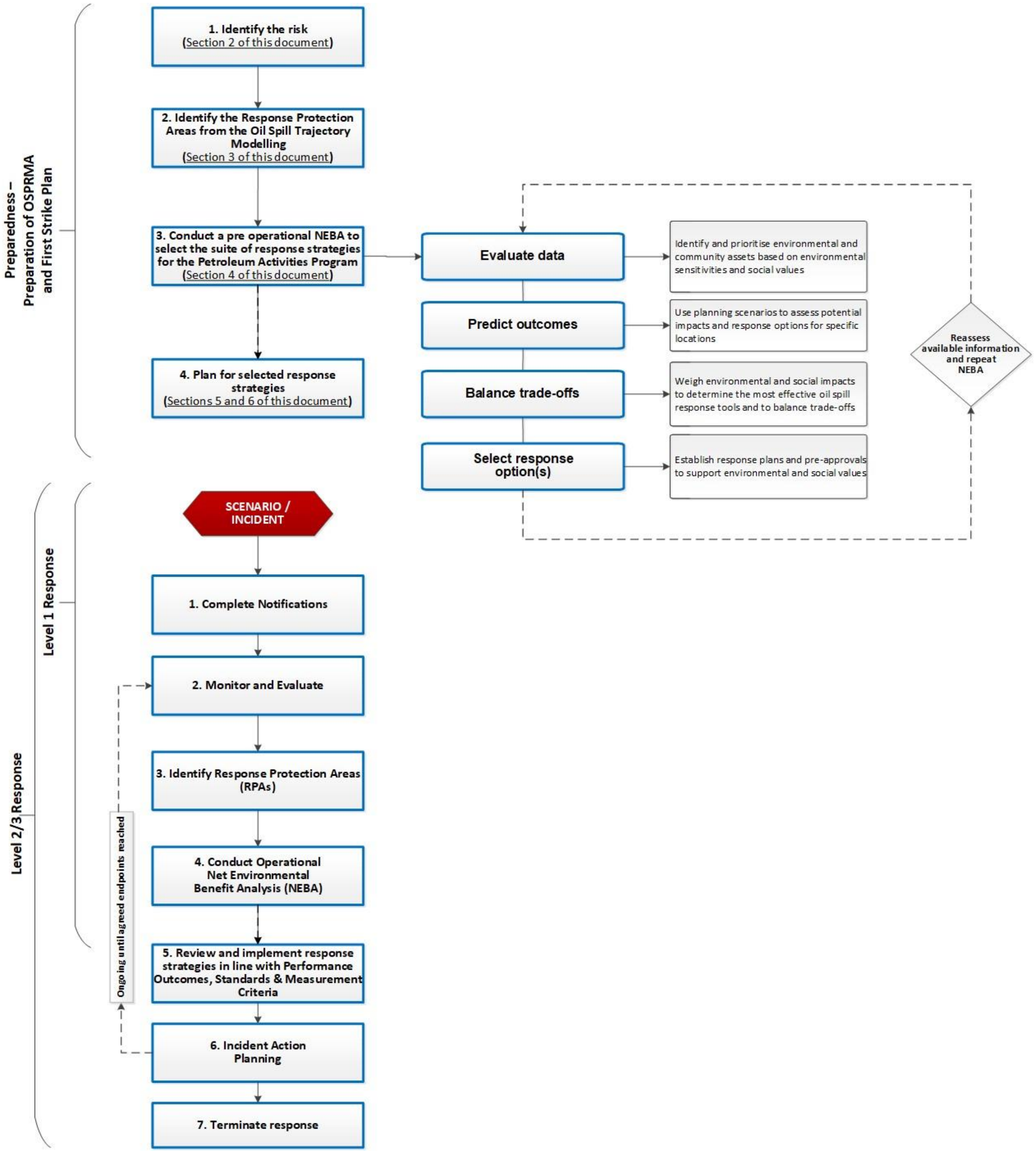


Figure 4-1: Net Environmental Benefit Assessment (NEBA) flowchart

4.1 Pre-operational / strategic NEBA

The pre-operational NEBA identifies positive and negative impacts to sensitive receptors from implementing the response techniques. Feasibility is considered by assessing the receptors potentially impacted above response thresholds (Section 2.3.3).

Completing a pre-operational NEBA is a key response planning control that reduces the environmental risks and impacts of implementing the selected response techniques. Comprehensive details of the pre-operational NEBA for this PAP are contained in **ANNEX A: Net Environmental Benefit Analysis detailed outcomes**.

4.2 Stage 1: Evaluate data

Woodside identifies and prioritises environmental and community assets based on environmental sensitivities and social values, informed through the use of trajectory modelling. Interpretation of stochastic oil spill modelling determines the EMBA for the release, which defines the spatial area that may be potentially impacted by the PAP activities.

4.2.1 Define the scenario(s)

Woodside uses scenarios identified from the risk assessment in the EP to assess potential impacts and response options for specific locations. The WCCS is then selected for deterministic modelling (if required) and is used for this pre-operational NEBA. For this PAP deterministic modelling was not required because the stochastic spill modelling did not predict floating oil at >50 g/m^2 or contact with shoreline at 100 g/m^2.

Outlier locations with potential environmental impacts, selected from the stochastic modelling may also be included for assessment. Response thresholds and modelling results are then used to assess the feasibility/effectiveness and scale of the response.

Table 4-1: Scenario summary information (WCCS)

Scenario summary information (CS-01)	
Scenario	Short-term uncontrolled release of marine diesel from a vessel collision
Location	19° 55’ 33.60”, S 113° 14’ 31.20” E
Oil Type	Marine Diesel
Fate and Weathering	Refer to **Section 2.2.1**
Volume of release	250 m^3 - instantaneous
Scenario summary information (CS-03)	
Scenario	Loss of well control during drilling of development well
Location	19° 55’ 33.60”, S 113° 14’ 31.20” E
Oil Type	Dry gas
Fate and Weathering	N/A – dry gas
Volume of release	Dry gas release – no liquid hydrocarbon.

4.2.2 Determining potential response options

The available response techniques based on current technology can be summarised under the following headings:

- Monitor and evaluate (including operational monitoring)
- Vessel source control
- Source control
    - Remotely operated vehicle (ROV) intervention
    - debris clearance and/or removal
    - capping stack
    - containment dome
    - relief well drilling
- Subsea dispersant injection
- Surface dispersant application:
    - aerial dispersant application
    - vessel dispersant application
- Containment and recovery
- Mechanical dispersion
- In-situ burning
- Shoreline protection and deflection:
    - protection
    - deflection
- Shoreline clean-up:
    - Phase 1 – Mechanical clean-up
    - Phase 2 – Manual clean-up
    - Phase 3 – Final polishing
- Oiled wildlife response
- Waste management
- Post spill monitoring/scientific monitoring

An assessment of which response options are feasible for the scenarios is included below in Table 4-2. Against the scenario's parameters, including oil type, volume and characteristics, prevailing weather conditions, logistical support, and resource availability to determine their deployment feasibility.

A shortlist of the feasible response options is then carried forward for the ALARP assessment with a justification for the exclusion of other response techniques included in Section 4.2.3. This assessment will typically result in a range of available options, that are deployed at different areas (at-source, offshore, nearshore and onshore) and times through the response. The NEBA process assists in prioritising which options to use where and when and timings throughout the response.

Table 4-2: Response technique evaluation – Marine Diesel (CS-01)

Response Technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Marine Diesel				
Monitor and Evaluate	Will be effective in tracking the location of the spill, predicting potential impacts and triggering further monitoring and response techniques as required. Operational Monitoring (OM) techniques include: • OM01 Predictive modelling of hydrocarbons – used throughout spill. 'Ground-truthed' using the outputs of all other monitoring techniques. • OM02 Surveillance and reconnaissance to detect hydrocarbons and resources at risk – from outset of spill. • OM03 Monitoring of hydrocarbon presence, properties, behaviour and weathering in water – from outset of spill. • OM04 Pre-emptive assessment of sensitive receptors at risk – triggered once OM01, OM02 and OM03 inform likely RPAs at risk. • OM05 Shoreline assessment – once OM02, OM03 and OM04 inform which RPAs have been impacted.	Monitoring of a Marine Diesel spill is a feasible response technique and outputs will be used to guide decision making on the use of other monitoring/response techniques and providing information to regulatory agencies including AMSA and Western Australia's Department of Transport (WA DoT).	**Yes**	Monitoring the spill will be necessary to: • Validate trajectory and weathering models • Determine the behaviour of the oil in water • Determine the location and weathering condition of the slick • Provide forecasts of spill trajectory • Determine appropriate response techniques • Determine effectiveness of response techniques • Confirm impact pathways to receptors
Source Control (vessel)	Controlling the spill of diesel at source would be the most effective way to limit the quantity of hydrocarbon entering the marine environment.	A spill of diesel from a vessel collision will be instantaneous and source control will be limited to what the vessel can achieve whilst responding to the incident.	**Yes**	Ability to stop the spill at source will be dependent upon the specific spill circumstances and whether or not it is safe for response personnel to access/isolate the source of the spill.
Surface Dispersant Application	Dispersants are not considered effective when applied on thin surface films such as marine diesel as the dispersant droplets tend to pass through the surface films without binding to the hydrocarbon.	Marine diesel is prone to rapid spreading and evaporation thus the use of dispersant would be deemed an unnecessary response technique.	**No**	The application of dispersant to marine diesel is unnecessary as the diesel will rapidly evaporate and would thus unnecessarily introduce additional chemical substances to the marine environment. The additional entrainment would also increase exposure of subsea species and habitats to hydrocarbons.
Containment and Recovery	Containment and recovery has an effective recovery rate of 5-10% when a hydrocarbon encounter rate of 25-50% is achieved at BAOAC 4 and 5. Containment and recovery requires a spill to be BAOAC 4 or 5 with a 50-100% coverage of 100 g/m^2 to 200 g/m^2.	Marine diesel is prone to rapid spreading and evaporation thus reducing the feasibility of containment and recovery as a response technique.	**No**	Containment and recovery would be an inappropriate response technique as the coverage requirements would not be achieved by a marine diesel spill. In addition, most of the spilled diesel would have been subject to rapid evaporation and entrainment prior to the commencement of containment and recovery operations.
Mechanical dispersion	Mechanical dispersion involves the use of a vessel's prop wash and/or fire hose to target surface hydrocarbons to achieve dispersion into the water column. However, this technique is of limited benefit in an open ocean environment where wind and wave action are likely to deliver similar advantages.	Although the technique is feasible, highly volatile hydrocarbons are likely to weather, spread and evaporate quickly. The volatile nature of the oil is also likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon. Additionally, any vessel used for mechanical dispersion activities would be contaminated by the hydrocarbon and could potentially cause secondary contamination of unimpacted areas when exiting the spill area. The decontamination of a vessel used for mechanical dispersion activities would result in additional quantities of oily waste requiring appropriate handling and treatment.	**No**	Given the limited benefit of mechanical dispersion over natural wind and wave action, secondary contamination and waste issues, and the associated safety risk of implementing the response for this activity, this strategy is deemed unsuitable.
In-situ Burning	In-situ burning is only effective where minimum slick thickness can be achieved.	Use of in-situ burning as a response technique for marine diesel is unfeasible as the minimum slick thickness cannot be attained due to rapid spreading. In addition, there is a limited window of opportunity in which this technique can be applied (prior to evaporation of the volatiles) which is unlikely to be achieved. Furthermore, entering a volatile environment to undertake this technique would be unsafe for response personnel.	**No**	Diesel characteristics are not appropriate for the use of in-situ burning as the minimum thickness will not be attained due to rapid spreading. Furthermore, it would unnecessarily cause an increase in the release of atmospheric pollutants.

Shoreline Protection and Deflection	Shoreline protection and deflection can be effective at preventing contamination of at-risk areas.	Use of shoreline protection and deflection for a spill of marine diesel is unlikely to provide any significant environmental benefit as the diesel will be subject to rapid spreading and evaporation prior to contact with any sensitive areas. The modelling undertaken predicts no shoreline receptors are to be contacted by floating oil concentrations at any of the assessed thresholds and no accumulation of oil on shorelines, therefore shoreline protection and deflection does not require consideration.	**No**	The modelling undertaken predicts that no shorelines will be impacted thus it is unlikely that this technique would be required.
Shoreline Clean up	Shoreline clean-up is an effective means of hydrocarbon removal from contaminated shorelines where coverage is at an optimum level of 250 g/m^2.	A marine diesel spill would be prone to rapid spreading and evaporation prior to impacting any sensitive receptors. Operational monitoring will, however, be deployed from the outset of a spill to track the spill location and fate in real-time. The modelling undertaken predicts no shoreline receptors are to be contacted by floating oil concentrations at any of the assessed thresholds and no accumulation of oil on shorelines, therefore shoreline protection and deflection does not require consideration.	**No**	The modelling undertaken predicts that no shorelines will be impacted thus it is unlikely that this technique would be required.
Oiled Wildlife	Oiled wildlife response is an effective response technique for reducing the overall impact of a release on wildlife. This is mostly achieved through hazing to prevent additional wildlife from being contaminated and through rehabilitation of those already subject to contamination. Air-breathing fauna such as marine mammals are most at risk from surface exposures due to the high volatile components. Marine mammals that have direct physical contact with surface, entrained or dissolved aromatic hydrocarbons may suffer surface fouling, ingest hydrocarbons and inhale toxic vapours.	Due to the likely volatile atmospheric conditions surrounding a diesel spill, response options would be limited to hazing to ensure the safety of response personnel. In addition, any rehabilitation could only be undertaken by trained specialists.	**Potentially**	The modelling undertaken predicts that no sensitive areas will be impacted thus it is unlikely that this technique would be required. However, in the event that wildlife are at risk of contamination, oiled wildlife response will be undertaken as and where required.

Table 4-3: Response technique evaluation – dry gas release from loss of well control (CS-03)

Response technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Dry Gas				
Monitor and evaluate	For a dry gas release, established (liquid hydrocarbon) spill monitoring techniques are not applicable. Monitoring the gas plume via the ROV sonar tool may be effective, in conjunction with other well information, in determining appropriate source control techniques. If the plume breaches the surface, gas monitoring at the surface will be effective in ensuring atmospheric volatiles remain below safe operating levels and may be used to direct simultaneous operations (SIMOPS).	Monitoring the gas plume may be feasible where safe access via the ROV can be achieved and line of (sonar) sight is achievable to observe the gas plume. Outputs may be used to guide decision making on the use of source control techniques including options for safe and effective capping stack deployment, and relief well execution. Although modelling of the gas release for CS-03 predicts the plume will not breach the water's surface, gas monitoring at the surface is a feasible practice and may be undertaken via the support vessels' gas monitoring equipment.	**Yes**	If feasible and safe, monitoring the gas plume via ROV and gas monitoring at the surface may: • determine the behaviour of the plume • monitor the surface plume (if water's surface is breached) • determine appropriate source control response techniques • inform on effectiveness of response techniques • ensure safety of response personnel • guide SIMOPS
Source control via blowout preventer (BOP) intervention	Controlling a loss of well containment at source via BOP intervention would be the most effective way to limit the quantity of methane being released.	In the event of the worst-case scenario with a loss of well control during drilling operations, ROV operations to locally operate the BOP would be attempted.	**Yes**	The use of source control intervention via ROV may be feasible and would reduce quantity of methane released. This is the primary, feasible option to stop the flow from the well.
Source control via debris clearance and capping stack	Controlling a loss of well containment at source via capping stack would be an effective way to limit the quantity of hydrocarbon entering the marine environment. If the ROV intervention on the BOP is unsuccessful, the deployment of a capping stack will be the secondary feasible option to stop the flow from the well.	Woodside has developed a project specific capping stack deployment plan and also commissioned an independent, capping stack landing study for the Scarborough wells (Wild Well Control Inc (WWCI), 2021). The study indicates that deployment of the capping stack is feasible. Woodside maintains several frame agreements with various vessel service providers and maintains the ability to call off services with a capping stack and debris clearance agreement. The location of suitable vessels for capping stack deployment are monitored monthly. The supply arrangements and reliability to achieve the required mobilisation time will be revalidated prior to spud. Consideration to mobilise the capping stack from the supplier on a suitable vessel but then hand over to another vessel to conduct the capping activity will also be	**Yes**	Conventional/vertical capping stack deployment with a heavy lift vessel is feasible once metocean conditions (wind, waves etc) are appropriate for safe deployment. Since the produced gas does not breach the sea surface, the response to the incident should not be unduly hampered by plume conditions.

Response technique	Effectiveness	Feasibility	Decision	Rationale for the decision
Hydrocarbon: Dry Gas				
		made to meet response time frames. A site-specific landing force analysis through computational fluid dynamic (CFD) modelling confirms the ability to land the capping stack on either a Xmas tree or BOP.		
Source control via relief well drilling	A subsea release of methane will be stopped approximately 65.3 days after the release. Relief well drilling will be the tertiary option to stop the flow from the well.	Relief well drilling is a widely accepted and utilised technique. The modelled worst-case discharge rate ('blowout rate') will require additional equipment to deliver the required kill rate to the relief well; this includes a second mobile offshore drilling unit (MODU), subsea well kill spools and hoses.	**Yes**	Relief well drilling is a proven technique employed to control a loss of well containment event should the other containment measures be unsuccessful.
Subsea Dispersant Injection	Not applicable for a dry gas LOWC.	Not applicable for a dry gas LOWC.	**No**	Not applicable for a dry gas LOWC.
Surface dispersant application	Not applicable for a dry gas LOWC.	Not applicable for a dry gas LOWC.	**No**	Not applicable for a dry gas LOWC.
Mechanical dispersion	Not applicable for a dry gas LOWC.	Not applicable for a dry gas LOWC.	**No**	Not applicable for a dry gas LOWC.
In-situ burning	Not applicable for a dry gas LOWC.	Not applicable for a dry gas LOWC.	**No**	Not applicable for a dry gas LOWC.
Containment and recovery	Not applicable for a dry gas LOWC.	Not applicable for a dry gas LOWC.	**No**	Not applicable for a dry gas LOWC.
Shoreline protection and deflection	Not applicable for a dry gas LOWC.	Not applicable for a dry gas LOWC.	**No**	Not applicable for a dry gas LOWC.
Shoreline clean-up	Not applicable for a dry gas LOWC.	Not applicable for a dry gas LOWC.	**No**	Not applicable for a dry gas LOWC.
Oiled wildlife response	Not applicable for a dry gas LOWC.	Not applicable for a dry gas LOWC.	**No**	Not applicable for a dry gas LOWC.

4.2.3 Exclusion of response techniques

Response techniques that are not feasible for a hydrocarbon loss of containment are detailed in the subsections below, and are therefore excluded from further assessment within this document.

4.2.3.1 Subsea dispersant application

Subsea dispersant application is not applicable for surface release of marine diesel.

Subsea dispersant application is not applicable for dry gas release.

4.2.3.2 Surface dispersant application

Modelling results for a hydrocarbon release of marine diesel caused by a vessel collision (CS-01) show that surface thresholds for surface dispersant application will not be reached. Given the prediction of rapid and 95% evaporation of the oil dispersant surface application will be ineffective.

Surface dispersant application is not applicable for dry gas release.

4.2.3.3 Containment and recovery

Modelling results for a marine diesel release from a vessel collision indicate that surface thresholds required for containment and recovery (>50g/m^2) will not be reached. The effectiveness of containment and recovery is predicted to be very low based on offshore met-ocean conditions in the region, the inherent inefficiency of containment and recovery operations, and the light, volatile nature of the marine diesel.

Containment and recovery is not applicable for dry gas release.

4.2.3.4 In-situ burning

This technique requires calm sea state conditions as are required for containment and recovery operations, which limits its feasibility offshore of Exmouth. Optimum weather conditions are <20 knot wind speed and waves <1 to 1.5 m with oil collected to a minimum 3mm thick layer. Due to the conditions offshore Exmouth it is expected that the ability to contain oil may be limited as the sea state may exceed the optimum conditions.

There are health and safety risks for response personnel associated with the containment and subsequent burning of hydrocarbons. It is also suggested that the residue from attempts to burn would sink, thereby posing a risk to the environment. The longer-term effects of burn residues on the marine environment are not fully understood and therefore, no assessment of the potential environmental impact can be determined.

Until further operational and environmental information becomes available, Woodside will not consider this option.

In-situ burning is not applicable for dry gas release.

4.2.3.5 Mechanical dispersion

Mechanical dispersion involves the use of a vessel's prop wash and/or fire hose to target surface hydrocarbons to achieve dispersion into the water column. However, this technique is of limited benefit in an open ocean environment where wind and wave action are likely to deliver similar advantages. The volatile nature of the oil is likely to lead to unsafe conditions in the vicinity of fresh hydrocarbon. There are also secondary contamination and waste issues to consider.

Mechanical dispersion is not applicable for dry gas release.

4.2.3.6 Shoreline protection and deflection

Shoreline surface contact (above thresholds), as a result of a hydrocarbon spill modelling conducted for this petroleum activity program, is not expected to occur. Therefore, shoreline protection and deflection is not considered to be required.

Shoreline protection and deflection is not applicable for dry gas release.

4.2.3.7 Shoreline clean-up

Shoreline surface contact (above thresholds), as a result of a hydrocarbon spill modelling conducted for this petroleum activity program, is not expected to occur. Therefore, shoreline clean-up is not considered to be required.

Shoreline clean-up is not applicable for dry gas release.

4.3 Stage 2: Predict outcomes

Woodside uses planning scenarios to assess potential impacts and response options for specific locations. Locations with potential environmental impacts, selected from the stochastic modelling are included for assessment. Response thresholds and deterministic modelling are then used to assess the feasibility/effectiveness of a response.

4.4 Stage 3: Balance trade-offs

Woodside considers environmental impacts and response effectiveness/feasibility to determine the most effective oil spill response tools and balance trade-offs, using an automated NEBA tool. The tool considers potential benefits and impacts associated with a response at sensitive receptors and then considers the effectiveness/feasibility of the response to select the response techniques carried forward to the ALARP assessment.

4.5 Stage 4: Select best response options

To select the response technique, all the other stages in the NEBA process are considered and used to establish response plans and any pre-approvals to support protection of identified environmental and social values.

The response techniques implemented may vary according to a particular spill. The hydrocarbon type released and the sensitivities of the receptors (both ecological and socio-economic) may influence the response. The pre-operational NEBA broadly evaluates each response technique and supports decisions on whether they are feasible and of net environmental benefit. Response techniques that are not feasible or beneficial are rejected at this stage and not progressed to planning.

Further risks and impacts from implementing these selected response options are outlined in Section 7.

Table 4-4: Selection and prioritisation of response techniques

Response planning scenario	Key characteristics for response planning	Feasibility of response techniques													Outline response technique
	(times are minimum times to contact for first receptor and/or shoreline contacted above response threshold)	**Monitor and evaluate**	**Debris clearance**	**Source control – capping stack**	**Source control on the vessel**	**Source control – relief well drilling**	**Subsea dispersant injection**	**Surface dispersant application**	**Mechanical dispersion**	**In-situ burning**	**Containment and recovery**	**Shoreline protection and deflection**	**Shoreline cleanup**	**Oiled wildlife response**	
CS-01: Instantaneous release of up to 250 m^3 marine diesel from a vessel collision (residual component of 0.4 m^3)	No shoreline accumulation above 100 g/m^2	Yes	N/A	N/A	Yes	N/A	N/A	No	No	No	No	No	No	Potentially	Monitor and evaluate. Initiate vessel source control if feasible. Plan for oiled wildlife response and implement if oiled wildlife is observed.
CS-03: Loss of well control during drilling of development well Dry gas release – no liquid hydrocarbon	N/A – dry gas	Potentially	Yes	Yes	N/A	Yes	No	No	No	No	No	No	No	No	Consider whether monitor and evaluate, via ROV and surface gas monitoring, is required an feasible. Initiate debris clearance. Initiate source control via capping stack. Initiate relief well drilling.

From the NEBA undertaken on the WCCS identified for the PAP, the primary response techniques are;

- Monitor and evaluate (CS-01, potentially feasible for CS-03)
- Source control – vessel SOPEP (CS-01)
- Debris clearance (CS-03)
- Source control – capping stack (CS-03)
- Source control – relief well drilling (CS-03)
- Oiled wildlife response (CS-01)

Additional response strategies would be considered based on the inputs and field reports from the monitoring activities. This may include:

- Waste management (all scenarios)
- Scientific monitoring programs (all scenarios)

5 HYDROCARBON SPILL ALARP PROCESS

Woodside's hydrocarbon spill ALARP process is aligned with guidance provided by NOPSEMA in *Oil Spill Risk Management Guidance Note N-04750-GN1488* (2021) and is set out in the 'Woodside Hydrocarbon Oil Spill Preparedness and Response Mitigation Assessment (OSPRMA) Development Guidelines'.

From the identified response planning need and pre-operational NEBA, Woodside conducts a structured, semi-quantitative hydrocarbon spill process which has the following steps:

1. Considers the Response Planning Need identified in terms of surface area (km^2) and available surface hydrocarbon volumes (m^3) against existing Woodside capability.
2. Considers alternative, additional, and improved options for each response technique/control measure by providing an initial and, if required, detailed evaluation of
   - Predicted cost associated with adopting the control measure,
   - Predicted change/environmental benefit, and
   - Predicted effectiveness/feasibility of the control measure.
3. Evaluates the risks and impacts of implementing the proposed response techniques, and any further control measures with associated environmental performance to manage these additional risks and impacts.

Woodside considers the risks and impacts from a hydrocarbon spill to have been reduced to ALARP when:

1. A structured process for identifying and considering alternative, additional, and improved options has been completed for each selected response technique;
2. The analysis of alternate, additional, and improved control measures meets one of the following criteria:
   - All identified, reasonably practicable control measures have been adopted; or
   - No identified reasonably practicable additional, alternative and/or improved control measures would provide further overall increased proportionate environmental benefit; or
   - No reasonably practical additional, alternative, and/or improved control measures have been identified.
3. Where an alternative, additional and/or improved control measure is adopted, a measurable level of environmental performance has been assigned.
4. Higher order impacts/ risks have received more comprehensive alternative, additional, and improved control measure evaluations and do not just compare the cost of the adopted control measures to the costs of an extreme or clearly unreasonable control measure.
5. Cumulative effects have been analysed when considered in combination across the whole activity.

The response technique selection is based on the risk assessment conducted in the EP. The risk assessment identifies the type of oil, volume of release, duration of release, predicted fate, weathering and the EMBA (along with other requirements such as time to impact and predicted volumes ashore). Modelling is then used to inform the NEBA and the prioritisation of suitable response options. The scale of the response techniques selected in the pre-operational NEBA is informed through the assessment of results from deterministic modelling. For the purpose of the ALARP assessment, the following terms and definitions have been used:

- Response techniques are considered the control measures that reduce consequences from hydrocarbon spill events. The terms ‘response technique’ and ‘control measure’ are used interchangeably.
- Cost is defined as the time, effort and/or trouble taken in financial, safety, design/storage/installation, capital/lease, and/or operations/maintenance terms to adopt a control measure.
- Where the predicted change to environmental impact is compared against standard environmental values and sensitivities impacts using positive or negative criteria from the NEBA Impact Ranking Classification Guidance in **ANNEX A: Net Environmental Benefit Analysis detailed outcomes**.

5.1 Monitor and evaluate (including operational monitoring)

Monitor and evaluate includes the gathering and evaluation of data to inform the oil spill response planning and operations. It includes fate and trajectory modelling, spill tracking, weather updates and field observations. This response option is deployed in some capacity for every hydrocarbon spill event. These techniques are not applicable for a dry gas, loss of well control event i.e. CS-03 and thus only apply to CS-01.

Table 5-1 below provides the operations monitoring plans that support the successful execution of this response technique.

Table 5-1: Description of supporting operational monitoring plans

ID	Title
OM01	Predictive modelling of hydrocarbons to assess resources at risk
OM02	Surveillance and reconnaissance to detect hydrocarbons and resources at risk
OM03	Monitoring of hydrocarbon presence, properties, behaviour and weathering in water
OM04	Pre-emptive assessment of sensitive receptors at risk
OM05	Shoreline assessment

Woodside maintains an *Operational Monitoring Operational Plan*. If shoreline contact is predicted, RPAs will be identified and assessed before contact. If shorelines are contacted, a shoreline assessment survey will be completed to guide effective shoreline clean-up operations. This plan includes the process for the IMT to mobilise resources depending on the nature and scale of the spill.

The proximity of Exmouth to the spill event location means that multiple logistical options are available to monitor the spill in relatively short timeframes. The primary mobilisation base for initial monitoring activities would be Exmouth. However, in the event of an extended spill with potential to impact receptors further afield, monitoring activities may also be mobilised from Onslow, Dampier or Karratha.

5.1.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which a response need can be based:

- No receptors are predicted to be contacted by floating oil concentrations at the 10 g/m^2 threshold.
- No shoreline receptors are predicted to be contacted by floating oil concentrations at any of the assessed thresholds.
- No accumulation of oil on shorelines is predicted.
- The time to contact for oil at concentrations of entrained hydrocarbons greater than 100 ppb at shoreline receptors is 55 hours at the Gascoyne AMP.
- Arrangements for support organisations who provide specialist services or resources should be tested regularly.
- Plans, procedures and support documents need to be in place for Operational and additional support techniques. These should be reviewed and updated regularly.

5.1.2 Environmental performance based on need

Table 5-2: Environmental Performance – Monitor and Evaluate

Environmental Performance Outcome		To gather information from multiple sources to establish an accurate common operating picture as soon as possible and predict the fate and behaviour of the spill to validate planning assumptions and adjust response plans as appropriate to the scenario.		
Control measure		**Performance Standard**		**Measurement Criteria**
1	Oil spill trajectory modelling	1.1	Initial modelling available within 6 hours using the Rapid Assessment Tool	1, 3B, 3C, 4
		1.2	Detailed modelling available within 4 hours of RPS receiving information from Woodside	
		1.3	Detailed modelling service available for the duration of the incident upon contract activation	
2	Tracking buoy	2.1	Tracking buoy located on facility/vessel and ready for deployment 24/7	1, 3A, 3C, 4
		2.2	Deploy tracking buoy from facility within 2 hours as per the First Strike Plan.	1, 3A, 3B, 4
		2.3	Contract in place with service provider to allow data from tracking buoy to be received 24/7 and processed.	1, 3B, 3C, 4
		2.4	Data received to be uploaded into Woodside Common Operating Picture (COP) daily to improve the accuracy of other monitor and evaluate techniques.	1, 3B, 4
3	Satellite imagery	3.1	Contract in place with 3rd party provider to enable access and analysis of satellite imagery. Imagery source/type requested on activation of service.	1, 3C, 4
		3.2	3rd party provider will confirm availability of an initial acquisition within 2 hours	1, 3B, 3C, 4
		3.3	First image received with 24 hours of Woodside confirming to 3rd party provider its acceptance of the proposed acquisition plan.	1
		3.4	3rd party provider to submit report to Woodside per image. Report is to include a polygon of any possible or identified slick(s) with metadata.	1
		3.5	Data received to be uploaded into Woodside COP daily to improve accuracy of other monitor and evaluate techniques.	1, 3B, 4
		3.6	Satellite Imagery services available and employed during response	1, 3C, 4
4	Aerial surveillance	4.1	Two trained aerial observers available to be deployed by day 1 from resource pool.	1, 2, 3B, 3C, 4
		4.2	One aircraft available for two sorties per day, available for the duration of the response from day 1	1, 3C, 4
		4.3	Observer to compile report during flight as per first strike plan. Observers report available to the IMT within 2 hours of landing after each sortie.	1, 2, 3B, 4
5	Hydrocarbon detections in water	5.1	Activate 3rd party service provider as per first strike plan. Deploy resources within 2.5 days: • Three specialists in water quality monitoring • Two monitoring systems and ancillaries • One vessel for deploying the monitoring systems with a dedicated winch, A-frame or Hiab and ancillaries to deploy the equipment.	1, 2, 3C, 3D, 4
		5.2	Water monitoring services available and employed during response	1, 3C, 4
		5.3	Preliminary results of water sample as per contractor's implementation plan within 7 days of receipt of samples at the accredited lab	
		5.4	Daily fluorometry reports as per service provider's implementation plan will be provided to IMT to validate modelling and monitor presence/absence of entrained hydrocarbons.	
		5.5	Use of Autonomous Underwater Vehicles (AUVs) for hydrocarbon presence and detection may be used as a contingency if the operational NEBA confirms conventional methods are unsafe or not possible.	1, 2, 3C, 4
6	Pre-emptive assessment of	6.1	Within 10 days, deployment of two specialists from resource pool in establishing the status of sensitive receptors.	1, 2, 3B, 3C, 4

	sensitive receptors	6.2	Daily reports provided to IMT on the status of the receptors to prioritise RPAs and maximise effective utilisation of resources	1, 3B, 4
7	Management of environmental impact of the response risks	7.1	If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified.	1
		7.2	Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines	

The control measures and capability of Woodside and its third-party service providers are shown to support Monitor and Evaluate activities up to and including the identified WCCS. This is demonstrated by the following:

- Woodside has a documented, structured and tested capability for Monitor and Evaluate operations including internal trajectory modelling capabilities, tracking buoys located offshore and contracted aerial observation platforms with access to trained observers.
- Woodside and its third-party service providers ensure there is sufficient capability for the duration of the response.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures. Where control measures have been selected and implemented, they are included in Section 6.
- The health and safety, financial, capital and operations/maintenance costs of implementing the alternative, additional or improved control measures identified and not carried forward are considered grossly disproportionate to the environmental benefit gained and/or not reasonably practicable for this PAP.
- The Monitor and Evaluate capability outlined in this section is part of the response developed to manage potential risks and impacts associated with the scenarios to ALARP, and there are no further additional, alternative and improved control measures other than those implemented that would provide further benefit.

5.2 Source control via vessel SOPEP

Vessel source control will be conducted, where feasible and in accordance with International Convention for the Prevention of Pollution from Ships (MARPOL) 73/78 Annex I, by the Vessel Master under the SOPEP triggered by any loss of containment from the PAP vessels.

The SOPEP provides guidance to the Master and Officers on board the vessel with respect to the extra steps to be taken when an unexpected pollution incident has occurred or is likely to occur. The SOPEP contains all information and operational instructions required by International Marine Organisation (IMO) Resolution MEPC.54 (32) adopted on 6 March 1992, as amended by resolution MEPC.86 (44) adopted on 13 March 2000.

Its purpose is to set in motion the necessary actions to stop or minimise oil discharge and mitigate its effects and outlines responsibilities, pollution reporting requirements, procedures and resources needed in the event of a hydrocarbon spill from vessel activities.

In the event of a potential vessel collision, the vessel master may engage precautionary marine manoeuvres to avoid collision or commence pumping operations to transfer marine diesel and thus minimise the release.

5.2.1 Environmental performance based on need

Woodside has established control measures, environmental performance outcomes, performance standards and measurement criteria to be used for vessel-source oil spill response during the PAP which are detailed in Section 6.7 of the EP. The vessel master's roles and responsibilities are described in EP Section 7.3.

Performance standards for each contracted PAP vessel are detailed in the vessel's specific SOPEP.

These standards ensure that sufficient resources are available and are adequately tested to ensure implementation of the SOPEP in the event of a hydrocarbon spill.

5.3 Source control and well intervention

The worst-case credible scenario for a loss of well containment is considered to be loss of well control during drilling operations. This scenario would result in an uncontrolled flow of dry gas from the well as outlined in the EP. In the event of a loss of well containment, the primary response would be source control and well intervention.

The Scarborough *Source Control Emergency Response Plan* (SCERP) has been developed as part of the Woodside assurance plans and in alignment with the guidelines in the *NOPSEMA Source Control Planning and Procedures Information Paper* (N-04750-IP1979 A787102). It includes the process for the IMT to mobilise resources for BOP intervention, Subsea First Response Toolkit (SFRT) support, and capping support. This plan has pre-identified vessel specifications and contracts required for SFRT debris clearance work and Woodside monitors the availability and location of these vessels.

Woodside is a signatory to a MoU between Australian offshore operators to provide mutual aid to facilitate and expedite mobilising a MODU and drilling a relief well, if a loss of well containment incident were to occur. The MoU commits the signatories to share rigs, equipment, personnel and services to assist another operator in need. Moored and Dynamically Positioned (DP) MODUs are suitable for the Scarborough wells.

Source control operations cannot be implemented if the safety of response personnel cannot be guaranteed. Circumstances that limit the safe execution of this control measure include lower explosive limit (LEL) concentrations, volatile concentrations of hydrocarbons in the atmosphere, weather window, waves and/or sea states (>1.5m waves) and high ambient temperatures. As the dry gas plume for the PAP is not predicted to breach the water's surface, LEL concentrations and volatile concentrations of hydrocarbons in the atmosphere are unlikely to pose a safety issue for response personnel. Gas monitoring will, however, be undertaken in line with standard protocol.

5.3.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which a response need can be based:

- Prior to any source control activities, Woodside will implement protocols to ensure that the site is safe including subsea ROV surveys and surface air monitoring.
- Hydrocarbons will flow from the well until one of the following interventions can be made:
  - closure of the tubing retrievable safety valve (TRSV) if present (only present after installation of the completion)
  - closure of a BOP ram (by ROV)
  - intervention with a capping stack
  - a relief well is drilled and first attempt at well kill within 65.3 days.
- Arrangements for support organisations who provide specialist services or resources should be tested regularly.
- Plans, procedures and support documents need to be in place for Operational and Support functions. These should be reviewed and updated regularly.
- The duration of the spill may be up to 65.3 days.

In addition, a number of assumptions are required to estimate the response need for source control. These assumptions have been described in the table below.

Table 5-3: Response Planning Assumptions – Source Control

Response planning assumptions	
Capping stack feasibility	Woodside has developed a project specific capping stack deployment plan and also commissioned an independent, capping stack landing study for the Scarborough wells (WWCI, 2021). The study indicates that the safe deployment of a capping stack is feasible.
Safety considerations	Source control operations cannot be implemented if the safety of response personnel cannot be guaranteed. This requires an initial and ongoing risk assessment of health and safety hazards and risks at the site, in accordance with the Woodside Management System (WMS). Personnel safety issues may include: • hydrocarbon gas and/or liquid exposure • high winds, waves and/or sea states • high ambient temperatures.
Feasibility considerations	Woodside's primary source control options would be ROV intervention and capping stack deployment. Relief well drilling operations will begin concurrently to provide an option to permanently abandon the well after the well flow is stopped. The following approaches outline Woodside's hierarchy approach for selecting suitable MODU's for relief well operations; • Primary – review internal drilling programs and MODU availability to source appropriate rig(s) operating within Australia with an approved Safety Case; • Alternate – source and contract MODUs through Australian Petroleum Production & Exploration Association (APPEA) Memorandum of Understanding (MoU) that is operating within Australia with an approved Safety Case; • Contingency – source and contract a MODU outside Australia with an approved Australian Safety Case

5.3.2 Environmental performance based on need

Table 5-4: Environmental Performance – Source Control

Environmental Performance Outcome		**To stop the flow of hydrocarbons into the marine environment**		
Control measure		**Performance Standard**		**Measurement Criteria (Section** Error! Reference source not found.**)**
8	Subsea First Response Toolkit (SFRT)	8.1	Oceaneering support staff available all year round, via contract, to assist with the mobilisation, deployment, and operation of the SFRT equipment.	1, 3B, 3C
		8.2	Intervention vessel with minimum requirement of a working class ROV and operator.	1, 3C
		8.3	Mobilised to site for deployment within 11 days.	1, 3B, 3C
		8.4	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s).	1, 3A, 3B
9	Well intervention	9.1	Frame agreements with ROV providers in place to be mobilised upon notification. ROV equipment deployed within 7 days.	1, 3B, 3C
		9.2	Source control vessel will have the following minimum specifications: • active heave compensated crane, rated to at least 120 T • at least 90 m in length • deck has water/electricity supply • deck capacity to hold at least 110 T of capping stack.	1, 3B, 3C
		9.3	Identify source control vessel availability within 24 hours and begin contracting process. Vessel mobilised to site for deployment within 16 days for conventional capping.	1, 3B, 3C
		9.4	ROV available on MODU ready for deployment within 48 hours to attempt initial BOP well intervention.	1, 3B, 3C
		9.5	Staged deployment of multiple BOP SFRTs in the event the first system deployed fails.	1, 3B, 3C
		9.6	Hot Stab and/or well intervention attempt made using ROV and SFRT within 11 days.	1, 3B, 3C
		9.7	Staged deployment of additional capping and well intervention equipment in the event the first system deployed fails.	1, 3B, 3C
		9.8	Capping stack on suitable vessel mobilised to site within 16 days. Deployment and well intervention attempt will be made once safety and metocean conditions are suitable.	1, 3C
		9.9	Wild Well Control Inc (WWCI) staff available all year round to assist with the mobilisation, deployment, and operation of the capping stack and well intervention equipment.	1, 3B, 3C
		9.10	MODU mobilised to site for relief well drilling within 21 days.	1, 3C
		9.11	First well kill attempt completed within 65.3 days.	1, 3B, 3C
		9.12	Open communication line(s) to be maintained between IMT and infield operations to ensure awareness of progress against plan(s).	1, 3A, 3B
		9.13	Relief Well Peer review undertaken during well design which includes screening and identification of suitable MODU(s) with in-force Australian safety cases for relief well drilling.	1, 3C
		9.14	Monthly monitoring of the availability of MODUs through existing market intelligence including current Safety Case history, to meet specifications for relief well drilling. Titleholders of suitable MODUs notified.	3C
		9.15	At least two communication methods, one of which will include the capability to communicate with aviation.	1, 3A
		9.16	Prior to entering the reservoir, reconfirm that pre-identified/screened MODU(s) remain available for relief well drilling and engage titleholder.	1, 3C
		9.15	An activity-specific Source Control Emergency Response Plan will be in place prior to commencement of the campaign.	1, 3A, 3C

		9.16	An approved Relief Well Plan (as required by Relief Well Planning Procedure) shall exist prior to commencement of the campaign including: feasibility and any specific considerations for relief well kill and well capping.	1, 3A, 3C
10	Support vessels	10.1	Monthly monitoring of availability of larger vessels through existing Frame Agreements and market intelligence to meet specifications for source control.	3C
		10.2	Frame agreements for Infield Support Vessels (ISVs) require vessels maintain in-force safety case approvals covering ROV operations and provide support in the event of an emergency.	1, 3B, 3C
		10.3	MODU and vessel contracts include clause outlining requirement for support in the event if an emergency	1, 3C
11	Safety case	11.1	Woodside will prioritise MODU or vessel(s) for intervention work(s) that have an existing safety case.	1, 3C
		11.2	Woodside Planning, Logistics, and Safety Officers (on-roster/ call 24/7) to assist in expediting the safety case assessment process as far as practicable.	1, 3C
		11.3	Woodside will maintain minimum safe operating standards that can be provided to MODU and vessel operators for safety case guidance.	1, 3C

The resulting source control capability has been assessed against the WCCS. The range of techniques provide a feasible and viable approach to well intervention and relief well drilling operations to stop the well flowing.

- The health and safety, financial, capital and operations/maintenance costs of implementing the alternative, additional or improved control measures identified and not carried forward are considered clearly disproportionate to the insignificant environmental benefit gained and/or not reasonably practicable for this PAP.
- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures. Where control measures have been selected and implemented, they are included in **Section 6.2**.

5.4 Oiled wildlife response (including hazing)

Woodside would implement a response in accordance with the Western Australian *Oiled Wildlife Operational Plan* (WA OWRP). This plan includes the process for the IMT to mobilise resources depending on the nature and scale of the spill. Oiled wildlife operations would be implemented with advice and assistance from the Oiled Wildlife Advisor from the Western Australia Department of Biodiversity, Conservation and Attractions (DBCA).

Oiled wildlife response is undertaken in accordance with the WA OWRP to ensure it is conducted in accordance with legislative requirements under the Animal Welfare Act 2002. If there is a net environmental benefit, oiled wildlife operations will be conducted 24 hours per day to reduce the time for rehabilitation and release of oiled wildlife. Hazing and pre-emptive capture techniques to keep non-oiled animals away from contaminated habitat in instances where it is deemed appropriate will be conducted in accordance with the WA OWRP, specifically vessels used in hazing/pre-emptive capture will approach fauna at slow speeds to ensure animals are not directed towards the oil and deterrence/hazing and pre-emptive capture will only be conducted if Woodside has licensed authority from DBCA and approval from the Incident Controller.

5.3.1 Response need based on predicted consequence parameters

The following statements identify the key parameters upon which a response need can be based:

- Modelling predicts no shoreline impact from floating hydrocarbons >10 g/m^2
- No shoreline accumulation >100 g/m^2 threshold is expected.
- The offshore location of the release site is expected to initially result in low numbers of at-risk or impacted wildlife.
- Given there is no potential shoreline accumulation >100 g/m^2 and surface concentrations above 10g/m^2 are predicted to be limited to ~52 km from the release location, it is estimated that the oiled wildlife response would be between Level two and four, as defined in the WA OWRP (**Table 5-7**).

Table 5-5: Key at-risk species potentially in Protection Areas and open ocean

Species	Gascoyne AMP	Open ocean
Marine turtles (including foraging and inter-nesting areas and significant nesting beaches)	√	√
Whale sharks (migration to and from waters at Ningaloo)	√	√
Seabirds and/or migratory shorebirds	√	√
Cetaceans – migratory whales	√	√
Cetaceans – dolphins and porpoises	√	√
Sea snakes	√	√

The oiled wildlife response technique targets key wildlife populations at risk within Commonwealth open waters and the nearshore waters. Responding to oiled wildlife consists of eight key stages, as described in **Table 5-6** below.

Table 5-6: Oiled wildlife response stages

Stage	Description
Stage 1: Wildlife first strike response	Gather situational awareness including potential wildlife assets at risk.
Stage 2: Mobilisation of wildlife resources	Resources include personnel, equipment and facilities.
Stage 3: Wildlife reconnaissance	Reconnaissance to identify potentially affected animals.
Stage 4: IAP wildlife sub-plan development	The IAP includes the appropriate response options for oiled wildlife, including wildlife priorities for protection from oiling; deterrence measures (see below); and recovery and treatment of oiled wildlife; resourcing of equipment and personnel. It includes consideration of deterrence practices such as 'hazing' to prevent fauna from entering areas potentially contaminated by spilled hydrocarbons, as well as dispersing, displacing or relocating fauna to minimise/prevent contact and provide time for clean-up.
Stage 5: Wildlife rescue and staging	This includes the different roles of finding oiled wildlife, capturing wildlife, and holding and/or transportation of wildlife to oiled wildlife facilities.
Stage 6: Establishment of an oiled wildlife facility	Treatment facilities would be required for the first-aid, cleaning and rehabilitation of affected animals. A vessel-based 'on-water' facility would likely need to be established to enable stabilisation of oiled wildlife before transport to a suitable treatment facility. Suitable staging sites in Exmouth and Onslow have been identified in the draft Regional Oiled Wildlife Response Operational Plan (OWROP), should a land-based site be required.
Stage 7: Wildlife rehabilitation	Considerations include a suitable rehabilitation centre and personnel, wildlife housing, record keeping and success tracking.
Stage 8: Oiled wildlife response termination	Once a decision has been made to terminate operations, the Incident Controller will stand down individual participating and supporting agencies.

Reconnaissance and primary response would be done during operational monitoring and surveillance activities. Where marine fauna is observed on water or transiting near or within the spill area, observations would be recorded through surveillance records.

Staging sites would be established as forward bases for shoreline- or vessel-based field teams. Once recovered to a staging site, wildlife would be transported to the designated oiled wildlife facility or a temporary holding centre (before being transported to the oiled wildlife facility). Temporary holding centres are required when there is significant distance between a staging site and the oiled wildlife facility, to enable stabilisation of oiled animals. The oiled wildlife facility is the primary location where animals would be housed and treated. Sites proposed for staging a regional oiled wildlife response in Exmouth and Onslow have been identified.

To deploy a response that is appropriate to the nature and scale of the event, as well as scalable over time, Woodside would implement an oiled wildlife response in consultation with DBCA and use the capability outlined in the WA OWRP, with additional capability if required (e.g. volunteers) accessible through Woodside's *People & Global Capability Surge Labour Requirement Plan*.

The WA OWRP provides indicative oiled wildlife response levels (**Table 5-7**) and the resources likely to be needed at each increasing level of response.

Table 5-7: Indicative oiled wildlife response (OWR) level (adapted from the WA OWRP, 2014)

OWR Level	Indicative personnel numbers	Indicative duration	Indicative number of birds (non-threatened species)	Indicative number of birds (threatened species)	Turtles (hatchlings, juveniles, adults)	Cetaceans	Pinnipeds	Dugongs
Level 1	6	< 3 days	1–2/day < 5 total	None	None	None	None	None
Level 2	26	> 4–14 days	1–5/day < 20 total	None	< 20 hatchlings No juv/adults	None	None	None
Level 3	59	> 4–14 days	5–10/day	1–5/day < 10 total	< 5 juv/adults < 50 hatchlings	None	< 5	None
Level 4	77	> 4–14 days	5–10/day < 200 total	5–10/day	< 20 juv/adults < 500 hatchlings	< 5, or known habitats affected	5–50	Habitat affected only
Level 5	116	> 4–14 days	10–100/ day > 200 total	10–50/day	> 20 juv/adults > 500 hatchlings	< 5 dolphins	> 50	Dugongs oiled
Level 6	122	> 4–14 days	> 100/day	10–50/day	> 20 juv/adults > 500 hatchlings	> 5 dolphins	> 50	Dugongs oiled

5.4.1 Environmental performance based on need

Table 5-8: Environmental Performance – Oiled Wildlife Response

Environmental Performance Outcome		Oiled Wildlife Response is conducted in accordance with the Western Australian Oiled Wildlife Response Plan (WA OWRP) to ensure it is conducted in accordance with legislative requirements to house, release or euthanise fauna under the Animal Welfare Act 2002.		
Control measure		**Performance Standard**		**Measurement Criteria**
12	Wildlife response equipment	12.1	Contracted capability to treat 100 individual fauna for immediate mobilisation to RPAs	1, 3A, 3B, 3C, 4
		12.2	Contracted capability to treat up to an additional 250 individual fauna within a five-day period.	
		12.3	National plan access to additional resources under the guidance of the DoT (up to a Level 5 oiled wildlife response as specified in the OWRP), with the ability to treat about 600 individual fauna by the time hydrocarbons contact the shoreline.	1, 3C, 4
		12.4	Vessels used in hazing/pre-emptive capture will approach fauna at slow speeds to ensure animals are not directed towards the hydrocarbons.	1, 3A, 3B, 4
		12.5	Facilities for the rehabilitation of oiled wildlife are operational 24/7 as per WA OWRP.	1, 3A, 4
13	Wildlife responders	13.1	3 wildlife divisional commanders to lead the oiled wildlife operations who have completed an Oiled Wildlife Response Management course	1, 2, 3B
		13.2	Wildlife responders to be accessed through resource pool and additional agreements with specialist providers	1, 2, 3A, 3B, 3C, 4
		13.3	Oiled wildlife operations (including hazing) would be implemented with advice and assistance from the Oiled Wildlife Advisor from the DBCA.	1
		13.4	Open communication line to be maintained between IMT and infield operations to ensure awareness of progress against plan(s)	1, 3A, 3B
14	Management of environmental impact of the response risks	14.1	If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified.	1
		14.2	Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines	

The resulting wildlife response capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to response at identified RPAs.

Under optimal conditions, during the surface release the capability available meets the need identified. It indicates that, the wildlife response capability has the following expected performance:

- Mobilisation and deployment of one central wildlife treatment and rehabilitation locations at Exmouth and Onslow in accordance with WA OWRP.
- No additional capability will be required for this activity, given the oiled wildlife response will be limited to open water.
- Recovered wildlife from open water would be transported to a central treatment location at Exmouth or Onslow.

5.5 Waste Management

Waste management is considered a support technique to oiled wildlife response, containment and recovery and shoreline clean-up. For the purposes of this OSPRMA, waste management may be required to support wildlife response. Waste generated and collected during the response that will require handling, management and disposal may consist of:

- Liquids (hydrocarbons and contaminated liquids) collected during wildlife response, and/or
- Solids/semi-solids (oily solids, garbage, contaminated materials) and debris collected during wildlife response.

Expected waste volumes during an event are likely to vary depending on oil type, volume released, response techniques employed and extent of weathering of hydrocarbons. Waste management, handling and capacity should be scalable to ensure continuous response operations can be maintained.

All waste management activities will follow the Environment Protection (Controlled Waste) Regulations 2004 and the waste will be managed to minimise final disposal volumes. Waste treatment techniques will consider contaminated solids treatment to allow disposal to landfill and solids with high concentrations of hydrocarbon will be treated and recycled where possible or used in clean fill if suitable.

The waste products would be transported from response locations to the nearest suitable staging area/waste transfer station for treatment, disposal or recycling. Waste will be transferred with appropriately licensed vehicles. Containers will be available for temporary waste storage and will be:

- labelled with the waste type
- provided with appropriate lids to prevent waste being blown overboard
- bunded if storing liquid wastes.
- processes will be in place for transfers of bulk liquid wastes and include:
  - inspection of transfer hose undertaken prior to transfer
  - watchman equipped with radio visually monitors loading hose during transfer
  - tank gauges monitored throughout operation to prevent overflow

The *Oil Spill Preparedness Waste Management Support Plan* details the procedures, capability and capacity in place between Woodside and its primary waste services contractor (Veolia Waste Management) to manage waste volumes generated from response activities.

5.5.1 Response Need Based on Predicted Consequence Parameters

Table 5-9: Response Planning Assumptions – Waste Management

Response planning assumptions: Waste management	
Waste loading per m^3 oil recovered (multiplier)	Oiled wildlife response – approx. 1 m^3 of oily liquid waste generated for each wildlife unit cleaned

5.5.2 Environmental Performance Based on Need

Table 5-10: Environmental Performance – Waste Management

Environmental Performance Outcome		To minimise further impacts, waste will be managed, tracked and disposed of in accordance with laws and regulations.		
Control Measure		**Performance Standard**		**Measurement Criteria**
15	Waste Management	15.1	Contract with waste management services for transport, removal, treatment and disposal of waste	1, 3A, 3B, 3C, 4
		15.2	Access to at least 50 m^3 of solid and liquid waste storage available within 1 week upon activation of 3^{rd} party contract.	
		15.3	Recovered hydrocarbons and wastes will be transferred to licensed treatment facility for reprocessing or disposal.	
		15.4	Response teams will segregate liquid and solid wastes at the earliest opportunity.	
		15.5	Waste management provider support staff available year-round to assist in the event of an incident with waste management as detailed in contract.	
		15.6	Open communication line to be maintained between IMT and waste management services to ensure the reliable flow of accurate information between parties.	1, 3A, 3B
		15.7	Waste management to be conducted in accordance with Australian laws and regulations	1, 3A, 3B, 3C, 4
		15.8	Waste management services available and employed during response	

The resulting waste management capability has been assessed against the WCCS. The range of techniques provide an ongoing approach to waste management from oiled wildlife response.

It indicates that the waste management capability has the following expected performance:

- Woodside has assessed the existing capability available and considered potential alternative, additional and improved control measures.
- The waste management requirements of all credible spill scenarios are well within Woodside's and its service providers existing capacity.
- No further control measures that may result in an increased environmental benefit that involve moderate to significant cost and/or dedication of resources have been adopted as the requirements of this technique does not justify the excessive costs of identified alternate, improved or additional controls.

5.6 Scientific monitoring

A scientific monitoring program (SMP) would be activated following a level two or three unplanned oil spill, or any release event with the potential to contact sensitive environmental receptors. This would consider receptors at risk (ecological and socio-economic) for the entire predicted Environment that Maybe Affected (EMBA) and in particular, any identified Pre-emptive Baseline Areas (PBAs) for the credible spill scenarios or other identified unplanned hydrocarbon releases associated with the operational activities (refer to Table 2-5: PAP worse case credible spill scenarios).

The outputs of the stochastic hydrocarbon spill modelling were used to assess the environmental risk of the hydrocarbon affected area as delineated by the ecological impact EMBA and social-cultural EMBA based on exceedance of environmental and social-cultural hydrocarbon threshold concentrations (refer to Stochastic modelling has been completed for CS-01 outlined in **Table 2-1**, to help assess the environmental consequences of a hydrocarbon spill. A total of 200 replicate simulations were completed for the scenario to test for trends and variations in the trajectory and weathering of the spilled oil over an annual period, with an even number of replicates completed using samples of metocean data that commenced within each month. Further details relating to the assessments for the scenario can be found in Section 6 of the EP.

No stochastic modelling was carried out for a dry gas spill from CS-03, as no liquid hydrocarbon are expected to be released at atmospheric temperatures.

5.6.1.1 Environmental impact thresholds – EMBA and hydrocarbon exposure

The outputs of the stochastic spill modelling are used to assess the potential environmental impact from the credible scenarios. The stochastic modelling results are used to delineate areas of the marine and shoreline environment that could be exposed to hydrocarbon levels exceeding environmental impact threshold concentrations. The summary of all the locations where hydrocarbon thresholds could be exceeded by any of the simulations modelled is defined as Environment that May Be Affected (EMBA) and is discussed further in Section 6 of the EP. As the weathering of different fates of hydrocarbons (surface, entrained and dissolved) differs due to the influence of the metocean mechanism of transportation, a different EMBA is presented for each fate within the EP.

A conservative approach – adopting accepted contact thresholds for impacts on the marine environment – is used to define the EMBA. These hydrocarbon thresholds are presented in **Table 2-2** below and described in Section 6 of the EP.

Table 2-2: Summary of thresholds applied to the stochastic hydrocarbon spill modelling to determine environment that maybe affected and environmental impacts

Threshold	Description
10 g / m^2	Surface hydrocarbon
100 ppb	Entrained hydrocarbon (ppb)
50 ppb	Dissolved aromatic hydrocarbon (ppb)
100 g / m^2	Shoreline accumulation

5.6.2 Deterministic Modelling

Deterministic modelling is undertaken where initial stochastic modelling has indicated that floating oil is present at an impact threshold of 50 g/m^2 and/or where there is shoreline accumulations at an impact threshold of 100 g/m^2. The deterministic modelling outputs are then used to scale the required capability for the offshore (containment and recovery and dispersant) and/or shoreline responses.

The stochastic modelling used as a representative of this PAP did not predict the threshold concentrations required to trigger the undertaking of deterministic modelling. Deterministic modelling was therefore not undertaken and stochastic modelling has been used to scale the response.

5.6.3 Response Planning Thresholds for Surface and Shoreline Hydrocarbon Exposure

, Section **Error! Reference source not found.** and see Section 6 of the EP for further information on applicable thresholds and the EMBAs). The PAP worst-case credible spill CS-01: marine diesel release defines the EMBA and are the basis of the SMP approach presented in this section. The dry gas release (CS-03) would not result in the activation of a Scarborough SMP.

It should be noted that the resulting SMP receptor locations differ from the Response Protection Areas (RPAs) discussed in Section 3 of this document due to the applicability of different hydrocarbon threshold levels. The SMP would be informed by the data collected via the operational monitoring program (OMP) studies, however, it differs from the OMP in being a long-term program independent of, and not directing, the operational oil spill response or monitoring of impacts from response activities (refer to Section 5.1 Monitor and Evaluate) for the operational monitoring overview.

Key objectives of the Woodside oil spill SMP are:

- Assess the extent, severity and persistence of the environmental impacts from the spill event; and
- Monitor subsequent recovery of impacted key species, habitats and ecosystems.

The SMP comprises ten targeted environmental monitoring programs to assess the condition of a range of physico-chemical (water and sediment) and biological (species and habitats) receptors including Environment Protection and Biodiversity Conservation Act (EPBC Act 1999) listed species, environmental values associated with protected areas and socio-economic values, such as fisheries. The ten SMPs are as follows:

- SM01 - Assessment of the presence, quantity and character of hydrocarbons in marine waters (linked to OM01 to OM03)
- SM02 - Assessment of the presence, quantity and character of hydrocarbons in marine sediments (linked to OM01 and OM05)
- SM03 – Assessment of impacts and recovery of subtidal and intertidal benthos
- SM04 - Assessment of impacts and recovery of mangroves/saltmarsh habitat
- SM05 - Assessment of impacts and recovery of seabird and shorebird populations
- SM06 - Assessment of impacts and recovery of nesting marine turtle populations
- SM07 - Assessment of impacts to pinniped colonies including haul-out site populations
- SM08 - Desktop assessment of impacts to other non-avian marine megafauna
- SM09 - Assessment of impacts and recovery of marine fish (linked to SM03)

- SM10 - Assessment of physiological impacts to important fish and shellfish species (fish health and seafood quality/safety) and recovery.

These SMPs have been designed to cover all key tropical and temperate habitats and species within Australian waters and broader, if required. A planning area for scientific monitoring is also identified to acknowledge potential hydrocarbon contact below the environmental threshold concentrations and beyond the EMBA. This planning area has been set with reference to the entrained low exposure value of 10 ppb detailed in the NOPSEMA Bulletin #1 Oil Spill Modelling (2019), as shown in **Error! Reference source not found.**

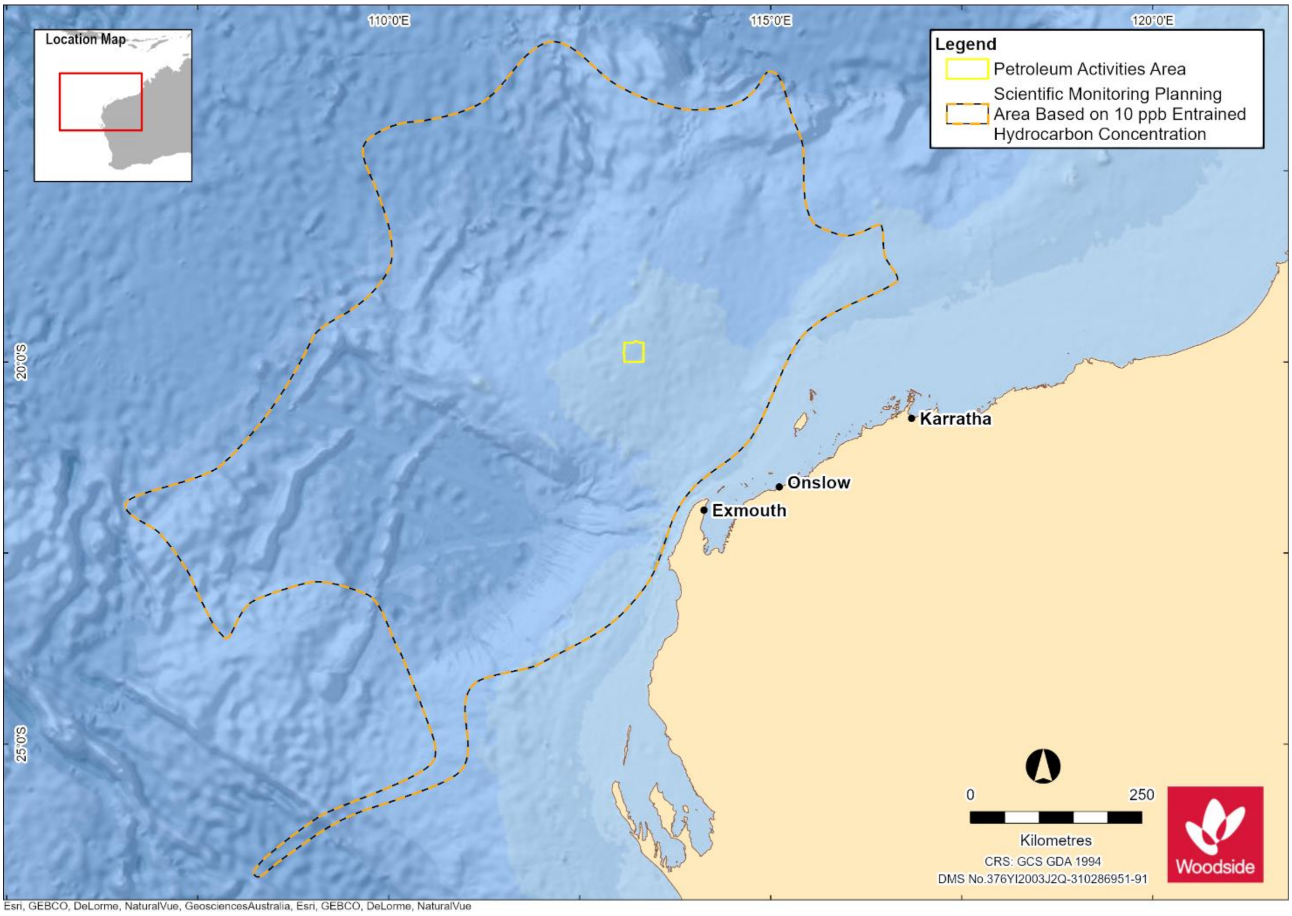


Figure 5-1:The planning area for scientific monitoring based on the area potentially contacted by the low exposure (below ecological impact) entrained hydrocarbon concentration of 10 ppb in the event of the worst-case credible spill scenario (CS-01: marine diesel release).

NOTE: Figure 5-1 represents the overall combined extent of the marine diesel spill model outputs based on a total of 200 replicate simulations over an annual period for the worst case credible scenario (CS-01) and therefore represents the largest spatial boundaries of the hydrocarbon spill combinations, not the spatial extent of a single hydrocarbon spill.

5.6.4 Scientific Monitoring Deployment Considerations

Table 5-11: Scientific monitoring deployment considerations

Scientific Monitoring Deployment Considerations	
Existing baseline studies for sensitive receptor locations predicted to be affected by a spill	PBAs of the following two categories: • PBAs within the predicted <10-day hydrocarbon contact time prediction: As part of this assessment, the approach was to conduct a desktop review of available and appropriate baseline data for key receptors for locations (if any) that are potentially impacted within ten days of a spill (based on the EMBA). Then investigate the need to conduct baseline data collection to address data gaps and demonstrate spill response preparedness (refer to ANNEX D: Scientific Monitoring Program and Baseline Studies for the Petroleum Activities Program). In the scenario, that baseline data needs are identified, planning for baseline data acquisition is typically commenced pre-PAP and execution of studies undertaken with consideration of weather, receptor type, seasonality and temporal assessment requirements. • PBAs >10 days' time to predicted hydrocarbon contact in the event of an unplanned hydrocarbon release (from the Scarborough Drilling and Completions operational activities). As part of this assessment, a desktop review is conducted of available and appropriate baseline data for key receptors for locations (if any) that are potentially impacted >10 days' time of a hydrocarbon spill event and documented (refer to Section 5.5.2). SMP activation (as per the Scarborough Drillings and Completions FSP) directs the SMP team to follow the steps outlined in the SMP Operational Plan. The steps include: checking the availability and type of existing baseline data, with particular reference to any PBAs identified as >10 days to hydrocarbon contact. Such information is used to identify response phase PBAs and plan for the activation of SMPs for pre-emptive (i.e. pre-hydrocarbon contact) baseline assessment.
Pre-emptive Baseline in the event of a spill	Activation of SMPs in order to collect baseline data at sensitive receptor locations with predicted hydrocarbon contact time >10 days (as documented in ANNEX C).
Survey platform suitability and availability	In the event of the SMP activation, suitable survey platforms are available and can support the range of equipment and data collection methodologies to be implemented in nearshore and offshore marine environments.
Trained personnel to implement SMPs suitable and available.	Access to trained personnel and the sampling equipment contracted for scientific monitoring via a dedicated scientific monitoring program standby contract.
Met-ocean conditions	The following met-ocean conditions have been identified to implement SMPs: • Waves <1 m for nearshore systems • Waves <1.5 m for offshore systems • Winds <20 knots • Daylight operations only SMP implementation will be planned and managed according to HSE risk reviews and the met-ocean conditions on a day to day basis by SMP operations.

5.6.5 Response planning assumptions

Table 5-12: Scientific monitoring response planning assumptions

Response Planning Assumptions	
PBAs	PBAs identified through the application of defined hydrocarbon impact thresholds during the Quantitative Spill Risk Assessment process and a consideration of the minimum time to contact at receptor locations fall into two categories: • PBAs (≤ 10 days minimum time to contact) for which baseline data are planned for and data collection may commence pre-PAP, where identified as a gap.

	• PBAs (> 10 days minimum time to contact) for which baseline data may be collected in the event of an unplanned hydrocarbon release. Response phase PBAs are prioritised for SMP activities due to vulnerability (i.e. time to contact and environmental sensitivity) to potential impacts from hydrocarbon contact and an identified need to acquire baseline data. Time to hydrocarbon contact of >10 days has been identified as a minimum timeframe within which it is feasible to plan and mobilise applicable SMPs and commence collection of baseline (pre-hydrocarbon contact) data, in the event of an unplanned hydrocarbon release from the Scarborough Drillings and Completions Operations. PBAs for Scarborough Drillings and Completions Operations identified and listed in ANNEX D: Scientific Monitoring Program and Baseline Studies for the Petroleum Activities Program, Table D-1. The PBAs together with the situational awareness (from the operational monitoring) are the basis for the response phase SMP planning and implementation.
Pre-spill	A review of existing baseline data for receptor locations with potential to be contacted by entrained hydrocarbons at the environmental threshold within ≤10 days has identified the offshore open waters of the Commonwealth Marine Environment (MNES) but no submerged or shoreline sensitive receivers contacted by the hydrocarbon release. Australian Marine Parks (AMPs) potentially affected includes: • Gascoyne AMP All the Australian Marine Parks (AMPs) are located in offshore waters where hydrocarbon exposure is possible on surface waters and in the upper layers of the water column.
In the event of a spill	Locations with >10 days to hydrocarbon contact, as well as the wider area, will be investigated and identified by the SMP team (in the Environment Unit of the Incident Control Centre (ICC)) as the spill event unfolds and as the situational awareness provided by the OMPs permits delineation of the spill affected area (for example, updates to the spill trajectory tracking). Based on the PAP worst case credible spill CS-01 (Table 2-5), the hydrocarbon spill affected area remains offshore (within the Commonwealth Marine Environment) with expanding hydrocarbon exposure in the upper water column of the Gascoyne AMP. In the event key receptors within geographic locations that are potentially impacted after 10 days following a spill event or commencement of the spill, and where adequate and appropriate baseline data are not available, there will be a response phase effort to collect baseline data for the following purposes: • Priority will be given to the collection of baseline data for receptors predicted to be within the spill affected area prior to hydrocarbon contact. The process is initiated with the investigation of available baseline and time to hydrocarbon contact (>10 days which is sufficient time to mobilise SMP teams and acquire data before hydrocarbon contact). • Highly sensitive and/or valued habitats and communities in coastal waters will be prioritised for pre-emptive baseline surveys over open water areas of AMPs. Collect baseline data for receptors predicted to be outside the spill affected area so reference datasets for comparative analysis with impacted receptor types can be assessed post-spill.
Baseline Data	A summary of the spill affected area and receptor locations as defined by the EMBA for the PAP worst case credible spill CS-01 (Table 2-5), is presented in the Scarborough Drillings and Completions EP (refer to Section 6 of the EP). The key receptors at risk by location and corresponding SMPs based on the EMBA for the PAP are presented in ANNEX D: Scientific Monitoring Program and Baseline Studies for the Petroleum Activities Program, as per the PAP worse case credible spill scenario. This matrix maps the receptors at risk with their location and the applicable SMPs that may be triggered in the event of a Level two or three hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors. Receptor locations and applicable SMPs are colour coded to highlight possible time to contact based on receptor locations identified as PBAs. The status of baseline studies relevant to the PAP are tracked by Woodside through the maintenance of a Corporate Environment Environmental Baseline Database (managed by the Woodside Environmental Science team), as well as accessing external databases such as the

	Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA)[3] (refer to ANNEX C: Oil Spill Scientific monitoring Program).

5.6.6 Summary – scientific monitoring

The resulting scientific monitoring capability has been assessed against the PAP worst case credible spill scenarios. The range of strategies provide an ongoing approach to monitoring operations to assess and evaluate the scale and extent of impacts. All known reasonably practicable control measures have been adopted with the cost and organisational complexity of these options determined to be moderate and the overall delivery effectiveness determined to be medium. The SMP's main objectives can be met, with no additional, alternative or improved control measures providing further benefit.

5.6.7 Response planning: need, capability and gap – scientific monitoring

The receptor locations identified in **ANNEX D**: Scientific Monitoring Program and Baseline Studies for the Petroleum Activities Program provide the basis of the SMPs likely to be selected and activated. Once the Woodside SMP Delivery team and Standby SMP contractor have been stood up and the exact nature and scale of the spill becomes known, the SMPs to be activated will be confirmed as per the process set out in the SMP Operational Plan.

Scope of SMP Operations in the event of a hydrocarbon spill

Receptor locations of interest for the SMP during the response phase are:

- Gascoyne AMP

The SMP approach in the response phase would still deploy SMP teams to maximise the opportunity to collect pre-emptive baseline data at sensitive receptor locations, not immediately contacted by hydrocarbons. As the exact locations where hydrocarbon contact occurs may be unpredictable, SM01 would be mobilised as a priority to be able to detect hydrocarbons and track the leading edge of the spill to verify where hydrocarbon contact occurs which will assist with where SMP resources are a priority need to obtain pre-emptive baseline data.

The option analysis in **Section** Error! Reference source not found. considers ways to reduce the gap by considering alternate, additional, and/or improved control measures on each selected response strategy.

[3] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

5.6.8 Environmental performance based on need

Table 5-13: Environment Performance – Scientific Monitoring

Environmental Performance Outcome		Woodside can demonstrate preparedness to stand up the SMP to quantitatively assess and report on the extent, severity, persistence and recovery of sensitive receptors impacted from the spill event.		
Control measure		**Performance Standard**		**Measurement Criteria**
16	• Woodside has an established and dedicated SMP team comprising the Environmental Science Team and additional Environment Advisers within the Health, Safety Environment (HSE) Function.	16.1	SMP team comprises a pool of competent Environment Advisers (stand up personnel) who receive training regarding the SMP, SMP activation and implementation of the SMP on an annual basis.	• Training materials. • Training attendance registers. Process that maps minimum qualification and experience with key SMP role competency and a tracker to manage availability of competent people for the SMP team including redundancy and rostering.
17	• Woodside has contracted SMP service provider to provide scientific personnel to resource a base capability of one team per SMP (SM01-SM10, see ANNEX C: Oil Spill Scientific monitoring Program Table C-2) as detailed in Woodside's SMP standby contractor Implementation Plan, to implement the oil spill scientific monitoring programs. The availability of relevant personnel is reported to Woodside on a monthly basis via a simple report on the base-loading availability of people for each of the SMPs comprising field work for data collection (SMP resourcing report register). • In the event of a spill and the SMP is activated, the base-loading availability of scientific personnel will be provided by SMP standby contractor for the individual SMPs and where gaps in resources are identified, SMP standby contractor/Woodside will seek additional personnel (if needed) from other sources including Woodside's Environmental Services Panel.	17.1	Woodside maintains the capability to mobilise personnel required to conduct scientific monitoring programs SM01 – SM10 (except desktop based SM08): • Personnel are sourced through the existing standby contract with SMP standby contractor, as detailed within the SMP Implementation Plan. • Scientific Monitoring Program Implementation Plan describes the process for standing up and implementing the scientific monitoring programs. • SMP team stand up personnel receive training regarding the stand up, activation and implementation of the SMP on an annual basis.	• Hydrocarbon Spill Preparedness Team Internal Control Environment tracks the quarterly review of the Oil Spill Contracts Master. • SMP resource report of personnel availability provided by SMP contractor on monthly basis (SMP resourcing report register. • Training materials. • Training attendance registers. • Competency criteria for SMP roles. • SMP annual arrangement testing and reporting.
18	• Roles and responsibilities for SMP implementation are captured in Table C-1 (ANNEX C) and the SMP team (as per the organisational structure of the ICC) is outlined in SMP Operational Plan. Woodside has a defined Crisis and Incident Management structure including Source	18.1	• Woodside has established an SMP organisational structure and processes to stand up and deliver the SMP.	• SMP Oil Spill Scientific Monitoring Operational Plan. • SMP Implementation Plan.

	Control, Operations, Planning and Logistics functions to manage a loss of well containment response. • SMP Team structure, interface with SMP standby contractor and linkage to the ICC is presented in Figure C-1, ANNEX C. • Woodside has a defined Command, Control and Coordination structure for Incident and Emergency Management that is based on the AIIMS framework utilised in Australia. • Woodside utilises an online Incident Management System (IMS) to coordinate and track key incident management functions. This includes specialist modelling programs, geographic information systems (GIS), as well as communication flows within the Command, Control and Coordination structure. • SMP activated via the FSP. • Step by step process to activation of individual SMPs provided in the SMP Operational Plan. • All decisions made regarding SMP logged in the online IMS (SMP team members trained in using Woodside's online Incident Management System). • SMP component input to the ICC IAP as per the identified ICC timed sessions and the SMP IAP logged on the online IMS. • Woodside Environmental Science Team provides awareness training on the activation and stand-up of the Scientific Monitoring Programme (SMP) for the Environment Advisers in Woodside who are listed on the SMP team on an annual basis. • Woodside Environmental Science Team provides awareness training on the activation and stand-up of the Scientific Monitoring Program (SMP) for the SMP Standby provider on an annual basis. • Woodside Environmental Science Team co-ordinates an annual SMP arrangement testing exercise performed by the SMP standby contractor. SMP standby contractor and the SMP arrangements (people and equipment availability) tested annually since 2016.			• SMP annual arrangement testing and reporting.
19	• Chartered and mutual aid vessels. • Suitable vessels would be secured from the Woodside support vessels, regional fleet of vessels operated by Woodside and other operators and the regional charter market. • Vessel suitability will be guided by the need to be equipped to operate grab samplers, drop camera systems and water sampling equipment (the individual vessel requirements are outlined in the relevant SMP methodologies (refer to Table C-2, ANNEX C). • Nearshore mainland waters could use the same approach as for open water. Smaller vessels may be used where available and appropriate. Suitable vehicles and machinery for onshore access to nearshore SMP	19.1	Woodside maintains standby SMP capability to mobilise equipment required to conduct scientific monitoring programs SM01 – SM10 (except desktop based SM08): • Equipment is sourced through the existing standby contract with Standby SMP standby contractor, as detailed within the SMP Implementation Plan.	• Hydrocarbon Spill Preparedness Team Internal Control Environment tracks the quarterly review of the Oil Spill Contracts Master. • SMP standby monthly resource reports of equipment availability provided by SMP contractor

	locations would be provided by Woodside's transport services contract and sourced from the wider market. • Dedicated survey equipment requirements for scientific monitoring range from remote towed video and drop camera systems to capture seabed images of benthic communities to intertidal/onshore surveying tools such as quadrats, theodolites and spades/trowels, cameras and binoculars (specific survey equipment requirements are outlined in the relevant SMP methodologies (refer to Table C-2, ANNEX C)). Equipment would be sourced through the existing SMP standby contract with Standby SMP contractor for SMP resources and if additional surge capacity is required this would be available through the other Woodside Environmental Services Panel Contractors and specialist contractors. Standby SMP contractor can also address equipment redundancy through either individual or multiple suppliers. MoUs are in place with marine sampling equipment suppliers and analytical laboratories (SMP resourcing report register). • Availability of SMP equipment for offshore/onshore scientific monitoring team mobilisation is within one week to ten days of the commencement of a hydrocarbon release. This meets the SMP mobilisation lead time that will support meeting the response objective of 'acquire, where practicable, the environmental baseline data prior to hydrocarbon contact required to support the post-response SMP.			(SMP resourcing report register). • SMP annual arrangement testing and reporting.
20	Woodside's SMP approach addresses the pre-PAP acquisition of baseline data for PBAs with ≤10 days if required following a baseline gap analysis process. Woodside maintains knowledge of Environmental Baseline data through: • Documentation annual reviews of the Woodside Baseline Environmental Studies Database, and specific activity baseline gap analyses. • Accessing external databases such as the Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA)[4] (refer to ANNEX C: Oil Spill Scientific monitoring Program).	20.1	• Annual reviews of environmental baseline data. • PAP specific Pre-emptive Baseline Area baseline gap analysis.	• Annual review/update of Woodside Baseline Environmental Studies Database. • Desktop review to assess the environmental baseline study gaps completed prior to EP submission. • Accessing baseline knowledge via the SMP annual arrangement testing.

[4] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

Environmental Performance Outcome		SMP plan to acquire response phase monitoring targeting pre-emptive data achieved.		
Control measure		**Performance Standard**		**Measurement Criteria**
21	Woodside's SMP approach addresses: • Scientific data acquisition for PBAs >10 days to hydrocarbon contact and activated in the response phase and • Transition into post-response SMP monitoring.	21.1	**PBA baseline data acquisition in the response phase** If baseline data gaps are identified for PBAs that has predicted hydrocarbon contact (contact time >10 days), there will be a response phase effort to collect baseline data with priority in implementing SMPs given to receptors where pre-emptive baseline data can be acquired or improved. SMP team (within the Environment Unit of the ICC) contribute SMP component of the ICC Planning Function in development of the IAP.	• Response SMP plan. • Woodside's online Incident Management System Records. • SMP component of the Incident Action Plan (IAPs).
		21.2	**Post Spill contact** For the receptors contacted by the spill in where baseline data are available, SMPs programs to assess and monitor receptor condition will be implemented post spill (i.e. after the response phase).	• SMP planning document. • SMP Decision Log. • IAPs.

<table>
<tr><th colspan="2">Environmental Performance Outcome</th><td colspan="3">Implementation of the SMP (response and post-response phases).</td></tr>
<tr><th colspan="2">Control measure</th><th colspan="2">Performance Standard</th><th>Measurement Criteria</th></tr>
<tr><td rowspan="3">22</td><td rowspan="3">• Scientific monitoring will address quantitative assessment of environmental impacts of a level two or three spill or any release event with the potential to contact sensitive environmental receptors. The SMP comprises ten targeted environmental monitoring programs.
• SMP supporting documentation: (1) Oil Spill Scientific Monitoring Operational Plan; (2) SMP Implementation Plan and (3) SMP Process and Methodologies Guideline.
• The Oil Spill Scientific Monitoring Operational Plan details the process of SMP selection, input to the Incident Action Plan (IAP) to trigger operational logistic support services. Methodology documents for each of the ten SMPs are accessible detailing equipment, data collection techniques and the specifications required for the survey platform support.
• The SMP standby contractor holds a Woodside SMP implementation plan detailing activation processes, linkage with the Woodside SMP team and the general principles for the planning and mobilisation of SMPs to deliver the individual SMPs activated. Monthly resourcing report are issued by the SMP standby contractor (SMP resourcing report register). All SMP documents and their status are tracked via SMP document register.</td><td>22.1</td><td>Implementation of SM01
SM01 will be implemented to assess the presence, quantity and character of hydrocarbons in marine waters during the spill event in nearshore areas.</td><td>Evidence SM01 has been triggered:
• Documentation as per requirements of the SMP Operational Plan.
• Woodside’s online Incident Management System Records.
• SMP component of the IAP.
• SMP data records from field.</td></tr>
<tr><td>22.2</td><td>Implementation of SM02-SM10
SM02-SM10 will be implemented in accordance with the objectives and activation triggers as per Table C-2 of ANNEX C.</td><td>Evidence SMPs have been triggered:
• Documentation as per requirements of the SMP Operational Plan.
• Woodside’s online Incident Management System Records.
• SMP component of the IAP.
• SMP data records from field.</td></tr>
<tr><td>22.3</td><td>Termination of SMP plans
The Scientific Monitoring Program will be terminated in accordance with termination triggers for the SMP’s detailed in Table C-2 of ANNEX C, and the Termination Criteria Decision-tree for Oil Spill Environmental Monitoring (Figure C-3 of ANNEX C):</td><td>Evidence of Termination Criteria triggered:
• Documentation and approval by relevant stakeholders to end SMPs for specific receptor types.</td></tr>
</table>

5.7 Incident Management System (IMS)

The IMS is both a control measure and a measurement criterion. As a control measure the IMS function is to prompt, facilitate and record the completion of three key response planning processes detailed below. As a measurement criterion the IMS records the evidence of the timeliness of all response actions included in the environmental performance standards and the plans used of the PAP. As the IMS does not directly remove hydrocarbons spilt into the marine environment there is no direct relationship to the response planning need.

5.7.1 Incident action planning

The ICC will be required to collect and interpret information from the scene of the incident to determine support requirements to the site-based IMT, develop an IAP and assist the IMT with the execution of that plan. The site-based incident controller (IC) may request the ICC to complete notifications internally within Woodside, to stakeholders and government agencies as required. Depending on the type and scale of the incident either the ICC Duty Manager (DM) or IC will be responsible for ensuring the development of the IAP. Incident Action Planning is an ongoing process that involves continual review to ensure techniques to control the incident are appropriate to the situation at the time.

5.7.2 Operational NEBA process

In the event of a response Woodside will confirm that the response techniques adopted at the time of Environment Plan/Oil Pollution Emergency Plan (EP/OPEP) acceptance remain appropriate to reduce the consequences of the spill. This process verifies that there is a continuing net environmental benefit associated with continuing the response technique through the operational NEBA process. This process manages the environmental risks and impacts of response techniques during the spill response, an operational NEBA will be undertaken throughout the response, for each operational period.

The operational NEBA will consider the risks and benefits of conducting and response activity. For example, if vessels are required for access to nearshore or onshore areas, anchoring locations will be selected to minimise disturbance to benthic habitats. Vessel cleanliness would be commensurate with the receiving environment. The operational NEBA will consider the risks and benefits of conducting other response techniques.

The operational NEBA process is also used to terminate a response. Using data from operational and scientific monitoring activities the response to a hydrocarbon spill will be terminated in accordance with the termination process outlined in the Oil Pollution Emergency Arrangements (Australia). In effect the operational NEBA will determine whether there is net environmental benefit to continue response operations.

5.7.3 Stakeholder engagement process

Woodside will ensure stakeholders are engaged during the spill response in accordance with internal standards as outlined in **Table 5-14**. This process requires that Woodside will:

- Undertake all required notifications (including government notifications) for stakeholders in the region (identified in the First-Strike Response Plan). This includes notification to mariners to communicate navigational hazards introduced through response equipment and personnel.
- In the event of a response, identify and engage with relevant stakeholders and continually assess and review.

5.7.4 Environmental performance based on need

Table 5-14: Environmental Performance – Incident Management System

Environmental Performance Outcome		To support the effectiveness of all other control measures and monitor/record the performance levels achieved.		
Control measure		**Performance Standard**		**Measurement Criteria**
23	Operational NEBA	23.1	Confirm that the response techniques adopted at the time of acceptance remain appropriate to reduce the consequences of the spill within 24 hours.	
		23.2	Record the evidence and justification for any deviation from the planned response activities.	
		23.3	Record the information and data from operational and scientific monitoring activities used to inform the NEBA.	
24	Stakeholder engagement	24.1	Prompt and record all notifications (including government notifications) for stakeholders in the region are made	1, 3A
		24.2	In the event of a response, identification of relevant stakeholders will be re-assessed throughout the response period.	
		24.3	Undertake communications in accordance with: Woodside Crisis Management Functional Support Team Guideline – Reputation External Communication and Continuous Disclosure Procedure External Stakeholder Engagement Procedure	
25	Personnel required to support any response	25.1	Action planning is an ongoing process that involves continual review to ensure techniques to control the incident are appropriate to the situation at the time.	1, 3B
		25.2	A duty roster of trained and competent people will be maintained to ensure that minimum manning requirements are met all year round.	3C
		25.3	Immediately activate the IMT with personnel filling one or more of the following roles: • Operations Duty Manager; • D&C Duty Manager; • Operations Coordinator; • Deputy Operations Coordinator; • Planning Coordinator; • Logistics (materials, aviation, marine and support positions); • Management Support; • Health and Safety Advisor; • Environment Duty Manager; • People Coordinator; • Public Information Coordinator; • Intelligence Coordinator; and • Finance Coordinator.	1, 2, 3B, 3C, 4
		25.4	Collect and interpret information from the scene of the incident to determine support requirements to the site-based IMT, develop an IAP and assist with the execution of that plan.	
		25.5	Security and emergency management (S&EM) advisors will be integrated into ICC to monitor performance of all functional roles.	
		25.6	Continually communicate the status of the spill and support Woodside to determine the most appropriate response by delivering on the responsibilities of their role.	
		25.7	Follow the OPEA, Operational Plans, FSPs, support plans and the IAPs developed.	1, 2, 3A, 4
		25.8	Contribute to Woodside's response in accordance with the aims and objectives set by the Duty Manager.	1, 2, 3B, 3C, 4

5.8 Measurement criteria for all response techniques

Woodside ensures compliance with environmental performance outcomes and standards through four primary mechanisms. The performance tables aforementioned identify which of these four mechanisms monitors the readiness and records the effectiveness and performance of the control measures adopted.'

1. The incident management system

The Incident Management System (IMS) supports the implementation of the Emergency & Crisis Management Procedure. The IMS provides a near real-time, single source of information for monitoring and recording an incident and measuring the performance of those control measures.

The Emergency & Crisis Management Procedure defines the management framework, including roles and responsibilities, to be applied to any size incident (including hydrocarbon spills). The organisational structure required to manage an incident is developed in a modular fashion and is based on the specific requirements of each incident. The structure can be scaled up or down.

IAP process formally documents and communicated the:

- Incident objectives;
- Status of assets;
- Operational period objectives;
- Response techniques (defined during response planning); and
- The effectiveness of response techniques.

The information captured in the IMS (including information from personal logs and assigned tasks/close outs) confirms the response techniques implemented remain appropriate to reduce the consequences of the spill. The system also records all information and data that can be used to support the site-based IMT, development and the execution of the IAP.

2. The S&EM competency dashboard

The Security and Emergency Management (S&EM) competency dashboard records the number of trained and competent responders that are available across Woodside, and some external providers, to participate in a response.

This number varies dependent on expiry of competency certificates, staff attrition, internal rotations, leave and other absences. As such the Dashboard is designed to identify the minimum manning requirements and to identify sufficient redundancy to cater for the variances listed above.

Figure 5-2 shows the minimum manning numbers for the different hydrocarbon spill response roles and the number of qualified persons against those roles.

Woodside's pool of trained responders is composed of but not limited to personnel from the following organisations:

- Woodside internal
- Australian Marine Oil Spill Centre (AMOSC) core group
- AMOSC
- Oil Spill Response Limited (OSRL)
- Marine Spill Response Corporation (MSRC)
- AMSA
- Woodside contracted workforce

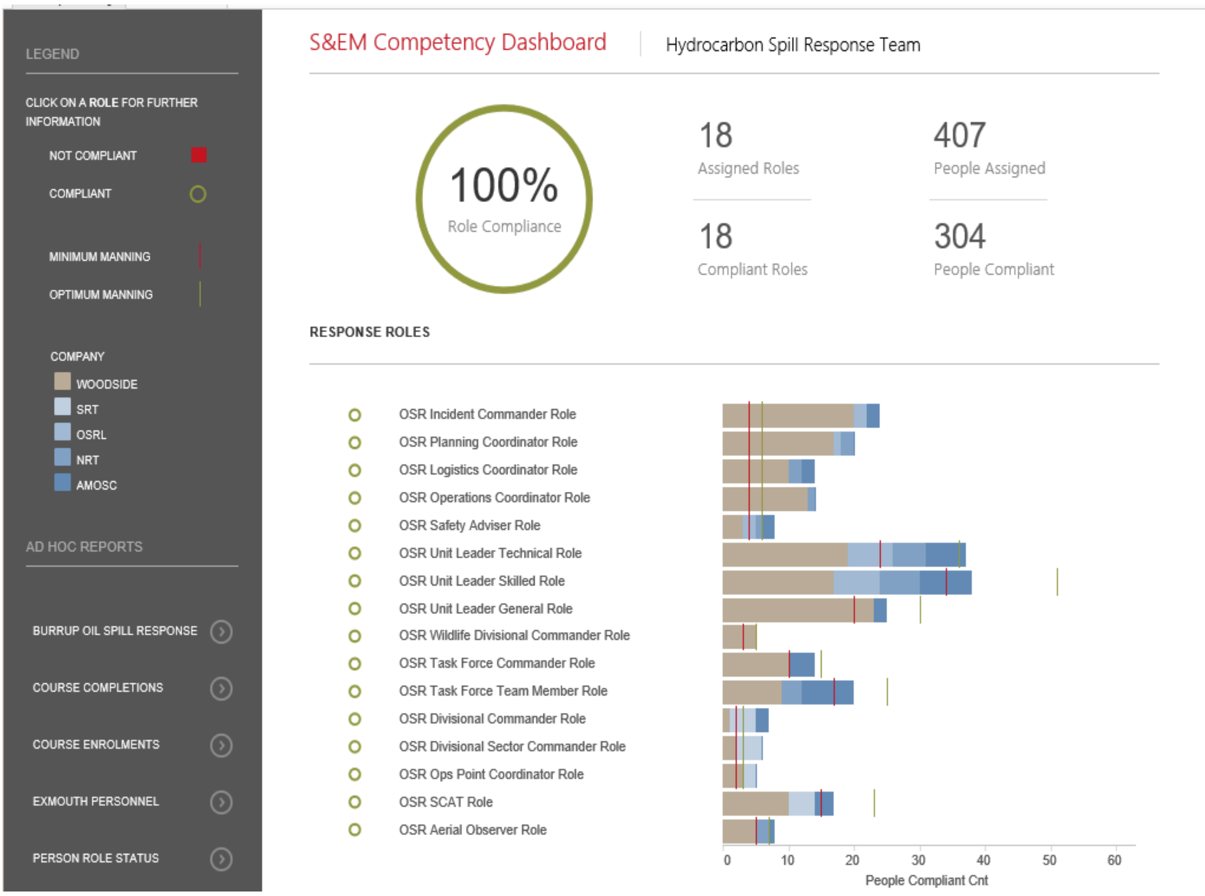
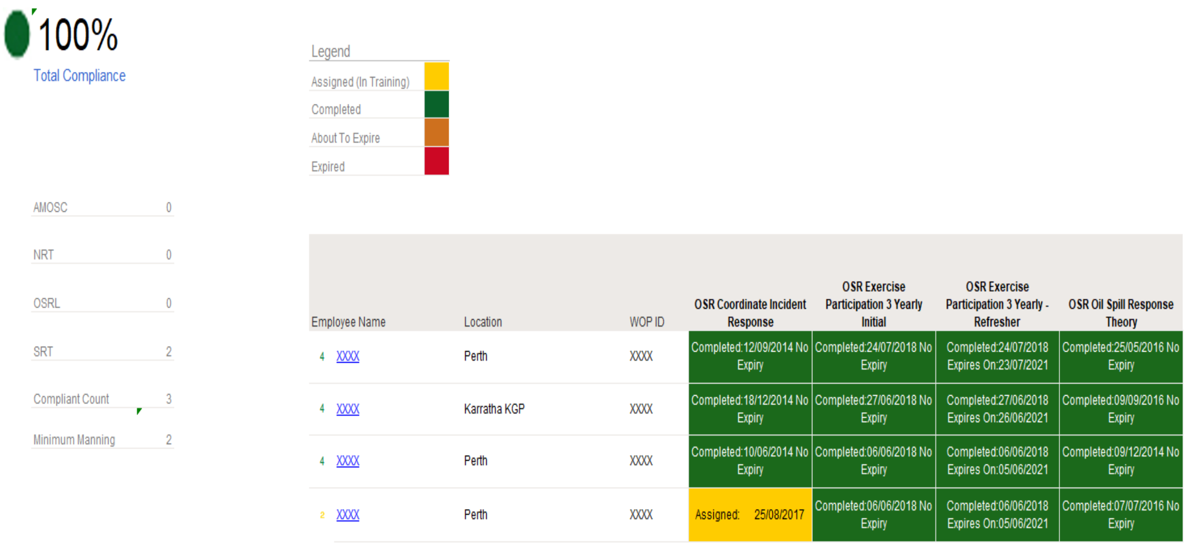


Figure 5-2: Example screen shot of the hydrocarbon spill preparedness (HSP) competency dashboard

The Dashboard is one of Woodside's key means of monitoring its readiness to respond. It also and shows that Woodside can meet the requirements of the environmental performance standard that relate to filling certain response roles.

Figure 5-3 shows deeper dive into the Ops Point Coordinator role and the training modules required to show competence.



	Employee Name	Location	WOP ID	OSR Coordinate Incident Response	OSR Exercise Participation 3 Yearly Initial	OSR Exercise Participation 3 Yearly - Refresher	OSR Oil Spill Response Theory
4	XXXX	Perth	XXXX	Completed:12/09/2014 No Expiry	Completed:24/07/2018 No Expiry	Completed:24/07/2018 Expires On:23/07/2021	Completed:25/05/2016 No Expiry
4	XXXX	Karratha KGP	XXXX	Completed:18/12/2014 No Expiry	Completed:27/06/2018 No Expiry	Completed:27/06/2018 Expires On:26/06/2021	Completed:09/09/2016 No Expiry
4	XXXX	Perth	XXXX	Completed:10/06/2014 No Expiry	Completed:06/06/2018 No Expiry	Completed:06/06/2018 Expires On:05/06/2021	Completed:09/12/2014 No Expiry
2	XXXX	Perth	XXXX	Assigned: 25/08/2017	Completed:06/06/2018 No Expiry	Completed:06/06/2018 Expires On:05/06/2021	Completed:07/07/2016 No Expiry

Figure 5-3: Example screen shot for the Ops Point Coordinator role

3. The hydrocarbon spill Preparedness ICE assurance process

The Hydrocarbon Spill Response Team has developed a Hydrocarbon Spill Preparedness and Response Internal Control Environment (ICE) process to align and feed into the Woodside Management System Assurance process for hydrocarbon spill. The process tracks compliance over four key control areas:

a) **Plans –** Ensures all plans (including: Oil Pollution Emergency Arrangements, first strike plans, operational plans, support plans and tactical response plans inANNEX E: Tactical Response Plans) are current and in line with regulatory and internal requirements.

b) **Competency** – Ensures the competency dashboard is up to date and there are the minimum competency numbers across ICC, Crisis Management Team (CMT) and hydrocarbon spill response roles. The hydrocarbon spill training plan and exercise schedule, including testing of arrangements is also tracked. The Testing of Arrangements (TOA) register tracks the testing of all hydrocarbon spill response arrangements, key contracts and agreements in place with internal and external parties to ensure compliance.

c) **Capability –** Tracks and monitors capability that could be required in a hydrocarbon incident, including but not limited to: integrated fleet[5] vessel schedule, dispersant availability, rig/vessels monitoring, equipment stockpiles, tracking buoy locations and the CICC duty roster.

d) **Compliance & Assurance** – Ensures all regulator inspection outcomes are actioned and closed out, the global legislation register is up to date and that the key assurance components are tracked and managed. Assurance activities (including Audits) conducted on memberships with key Oil Spill Response Organisations (OSROs) including AMOSC and OSRL are also tracked and recorded in the ICE.

The ICE assurance process records how each commitment listed in the performance tables above is managed to ensure ongoing compliance monitoring. The level of compliance can be reviewed in real time and is reported on a monthly basis through the S&EM Function.

The completion of the assurance checks (over and above the ICE process) is also applied via the Woodside Integrated Risk & Compliance System (WiRCs) and subject to the requirements of Woodside's Provide Assurance Procedure.

4. The hydrocarbon spill preparedness and response procedure

This procedure sets out how to plan and prepare for a liquid hydrocarbon spill to the marine environment. (Note, this procedure does not apply to scenarios relating to gas releases in the marine environment).

This procedure details the:

- Requirement for an Oil Pollution Emergency Plan (OPEP) to be developed, maintained, reviewed, and approved by appropriate regulators (where applicable) including:
  - Defining how spill scenarios are developed on an activity specific basis;
  - Developing and maintaining all hydrocarbon spill related plans;
  - Ensuring the ongoing maintenance of training and competency for personnel;
  - Developing the testing of spill response arrangements; and
  - Maintaining access to identified equipment and personnel.
- Planning for hydrocarbon spill response preparedness
- Accountabilities for hydrocarbon spill response preparedness

[5] The Integrated fleet consists of vessels from multiple operators that have been contracted to Woodside to undertake a number of duties including hydrocarbon spill response

- Spill training requirements
- Requirements for spill exercising / testing of spill response arrangements
- Spill equipment and services requirements.

The procedure also details the roles and responsibilities of the dedicated Woodside Hydrocarbon Spill Preparedness team. This team is responsible for:

- Assuring that Woodside hydrocarbon spill responders meet competency requirements.
- Establishing the competency requirements, annual training schedule and a training register of trained personnel.
- Establishing and maintaining the total numbers of trained personnel required to provide an effective response to any hydrocarbon spill incident.
- Ensuring equipment and services contracts are maintained
- Establishing OPEPs
- Establishing OPEAs
- Priority response receptor determination
- ALARP determination
- Ensuring compliance and assurance is undertaken in accordance with external and internal requirements.

6 MONITOR AND EVALUATE – ALARP ASSESSMENT

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.1 Monitor and Evaluate – Control Measure Options Analysis

6.1.1 Alternative Control Measures

Alternative Control Measures considered

Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control

Option considered	Environmental consideration	Feasibility	Approximate cost	Assessment conclusions	Implemented
Aerostat (or similar inflatable observation platform) for localised aerial surveillance.	Lead time to Aerostat surveillance is disproportionate to the environmental benefit. The system also provides a very limited field of visibility around the vessel it is deployed from.	Long lead time to access (>10 days). Each system would require an operator to interpret data and direct vessels accordingly. Requires multiple systems for shoreline use.	Purchase cost per system approx. A$300,000.	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost and complexity of its implementation.	No

6.1.2 Additional Control Measures

Additional Control Measures considered

Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures

Option considered	Environmental consideration	Feasibility	Approximate cost	Assessment conclusions	Implemented
Additional personnel trained to use systems.	Current arrangement provides an environmental benefit in the availability of trained personnel facilitating access to monitoring data used to inform all other response techniques. No improvement required.	No improvement can be made, all personnel in technical roles e.g. intelligence unit are trained and competent on the software systems. Personnel are trained and exercised regularly. Use of the software and systems forms part of regular work assignments and projects.	Cost for training in-house staff would be approx. A$25,000.	This option is not adopted as the current capability meets the need.	No
Additional satellite tracking buoys to enable greater area coverage.	Increased capability does not provide an environmental benefit compared to the disproportionate cost in having an additional contract in place.	Tracking buoy on location at manned facility, additional needs are met from Woodside owned stocks in King Bay Support Base (KBSB) and Exmouth or can be provided by service provider.	Cost for an additional satellite tracking buoy would be A$200 per day or A$6000 to purchase.	This option is not adopted as the current capability meets the need, but additional units are available if required.	No
Additional trained aerial observers.	Woodside has access to a pool of trained, competent observers at strategic locations to ensure timely and sustainable response. Additional observers are available through current contracts with AMOSC and OSRL.	Aviation standards and guidelines ensure all aircraft crews are competent for their roles. Woodside maintains a pool of trained and competent aerial observers with various home base locations to be called upon at the time of an incident. Regular audits of oil spill response organisations ensure training and competency is maintained.	Cost for additional trained aerial observers would be A$2000 per person per day.	This option is not adopted as the current capability meets the need, but additional observers are available via response contractors if required.	No

6.1.3 Improved Control Measures

Additional Control Measures considered

Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures

Option considered	Environmental consideration	Feasibility	Approximate cost	Assessment conclusions	Implemented
Faster turnaround time from modelling contractor.	Improved control measure does not provide an environmental benefit compared to the disproportionate cost in having an additional contract in place.	External contractor on ICC roster to be called as soon as required. However initial information needs to be gathered by ICC team to request an accurate model. External contractor has person on call to respond from their own location.	Modelling service with a faster activation time would be achieved via membership of an alternative modelling service at an annual cost of A$50,000 for 24hr access plus an initial A$5000 per modelling run.	This option is not adopted as the minimal environmental benefit gained is disproportionate to the cost and complexity of its implementation.	No
Night time aerial surveillance.	The risk of undertaking the aerial observations at night is disproportionate to the limited environmental benefit. The images would be of low quality and as such the variable is not adopted.	Flights will only occur when deemed safe by the pilot. The risk of night operations is disproportionate to the benefit gained, as images from sensors (IR, UV, etc) will be low quality. Flight time limitations will be adhered to.	No improvement can be made without risk to personnel health and safety and breaching Woodside's Golden Rules.	This option is not adopted as the safety considerations outweigh any environmental benefit gained.	No

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Faster mobilisation time (for water quality monitoring).	Due to the restriction on accessing the spill location on Day one there is no environmental benefit in having vessels available from day one. The cost of having dedicated equipment and personnel is disproportionate to the environmental benefit. The availability of vessels and personnel meets the response need. Shortening the timeframes for vessel availability would require dedicated response vessels on standby in KBSB. The cost and organisational complexity of employing two dedicated response vessels (approximately $15M/year per vessel) is considered disproportionate to the potential environmental benefit to be realised by adopting this delivery options.	Operations are not feasible on day 1 as the hydrocarbon will take time to surface, and volatility has potential to cause health concerns within the first 24 hours of the response.	Cost for purchase of equipment approx. A$200,000. Ongoing costs per annum for cost of hire and pre-positioning for life of asset/activity would be larger than the purchase cost. Dedicated equipment and personnel, living locally and on short notice to mobilise. The cost would be approx. A$1 m per annum, which is disproportionate to the incremental benefit this would provide, assets are already available on day 1. 2 integrated fleet vessels are available from day 1, however these could be tasked with other operations.	This option is not adopted as the area could not be accessed earlier due to safety considerations. Additionally, the cost and complexity of implementation outweighs the benefits.	No

6.1.4 Selected Control Measures

Following review of alternative, additional and improved control measures as outlined above, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.2 Source control via Vessel SOPEP – ALARP assessment

Alternative, Additional and Improved options have been assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.2.1 Source Control via Vessel SOPEP – Control Measure Options Analysis

6.2.1.1 Alternative control measures

Alternative Control Measures considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.1.2 Additional Control Measures

Additional Control Measures considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.1.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*				
Option considered	**Environmental consideration**	**Feasibility**	**Cost**	**Implemented**
No reasonably practical alternative control measures identified.				N/A

6.2.2 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.3 Source Control – ALARP Assessment

Woodside has based its response planning on the worst-case credible scenarios (as described in **Section 2.2**). This includes the following selection of source control and well intervention techniques which would be initiated concurrently:

- ROV intervention
- debris clearance and/or removal
- capping stack deployment
- relief well drilling

6.3.1 ROV Intervention

Following confirmation of an LOWC event, Woodside would mobilise inspection class ROVs to assess the status of the wellhead and BOP equipment (BOPE). If available, the ROV on the MODU can be deployed for this purpose within 48 hours. Work class ROVs for well intervention are also available through the existing frame agreements and are available for deployment within seven days (**Table 6-1**). It is not expected that any additional regulatory approvals would be required as inspection, maintenance and repair is within the scope of activities for the Scarborough Operations Safety Case as well as the scope of activities for contracted Frame Agreement vessels.

As Woodside holds Frame Agreements for vessels along with contracts for ROV providers and pilots, inspection activities using ROVs are expected to commence within seven days.

A hydraulic accumulator contained as part of the SFRT can be mobilised and deployed with well intervention attempted within 11 days.

Table 6-1: ROV timings

ROV inspection duration for Scarborough Wells	Time Estimate (days)
Source and mobilise vessel with work class ROV	2 days
Liaise with Regulator regarding risks and impacts*	4 days
Undertake ROV Inspection	1 day
TOTAL	**7 days***

** Based on timings from the Report into the Montara Commission of Enquiry, submission and discussion of revised documentation for limited activities inside the Petroleum Safety Zone (water deluge operations) to manage personnel risks and impacts was up to 20 days.*

6.3.1.1 Safety Case considerations

Woodside has assessed against the NOPSEMA safety case guidance (NOPSEMA N-09000-GN1661), confirming that vessels conducting subsea intervention operations are not classified as an “associated offshore place” but as a facility and therefore require the appropriate Safety Case arrangements to be in place. In the event of an emergency, Woodside has access to suitable vessels (ISVs) for well intervention through existing frame agreements. The frame agreements for ISV vessels require the vessels to maintain in-force safety case approval covering a range of subsea activities. This would cover the requirement for intervention operations such as subsea manifold installation, maintenance and repair, commissioning, cargo transfer (including bulk liquids) and ROV operations. With frame agreements in place, the credible Safety Case Scenario from those presented in

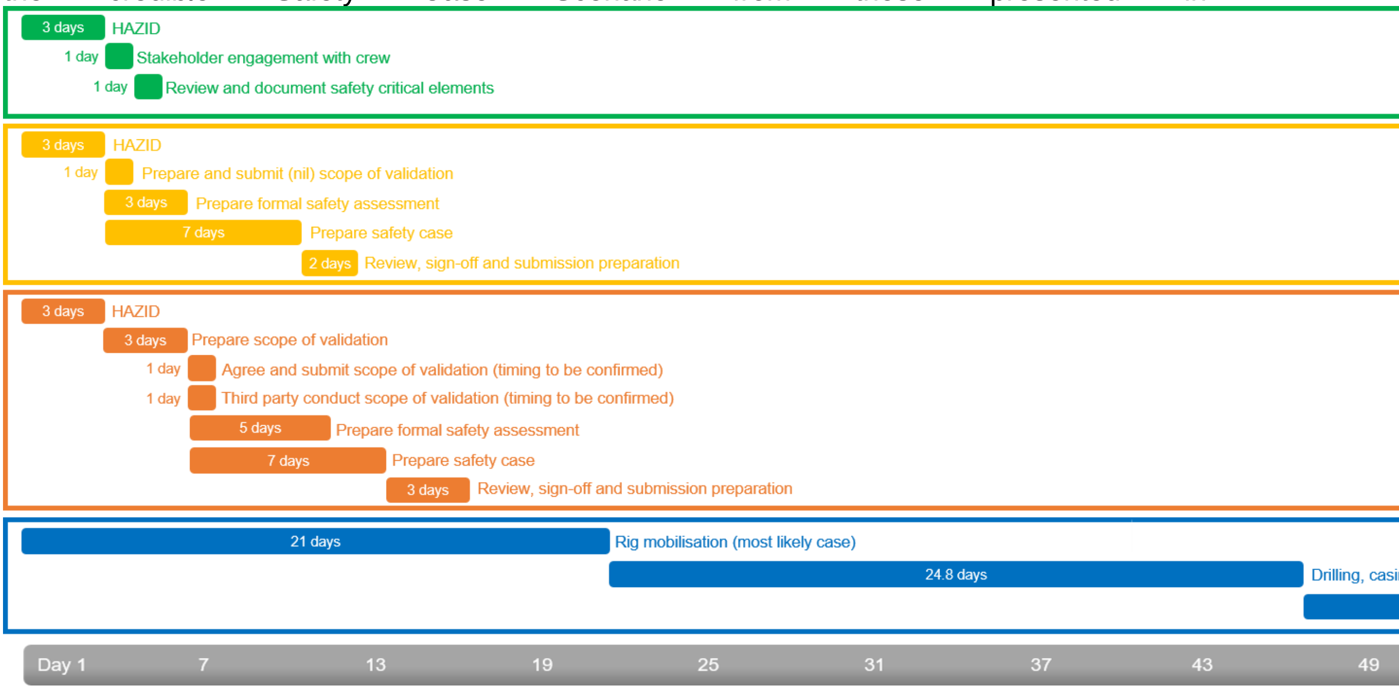


Figure 6-3 for implementing this response would be “no safety case revision required”. Timeframes for well intervention are detailed in

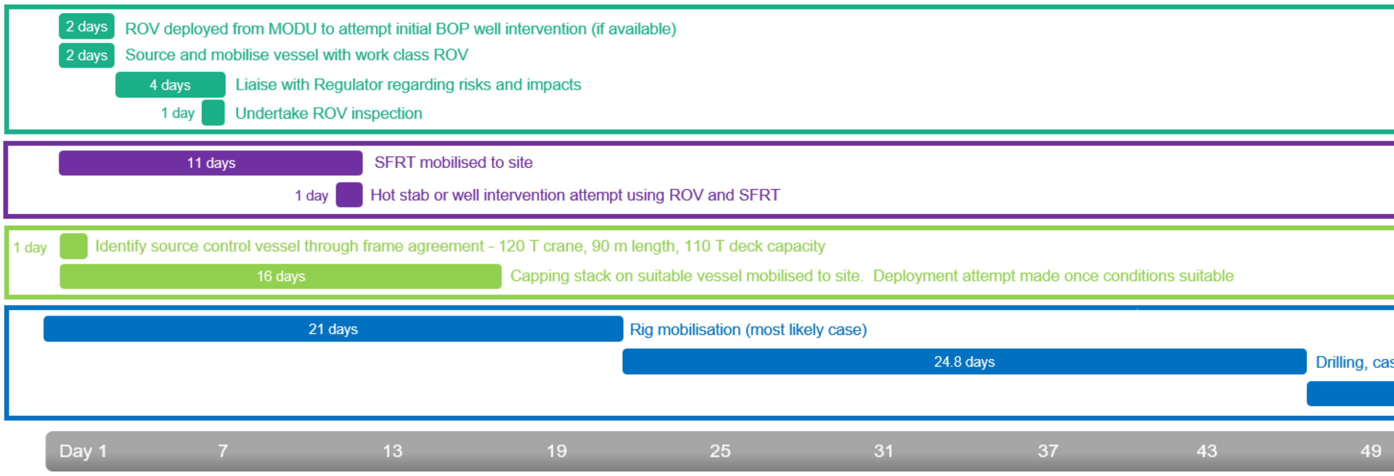


Figure 6-2 and would be implemented concurrently to the actions required by the "no Safety Case" revision scenario detailed in

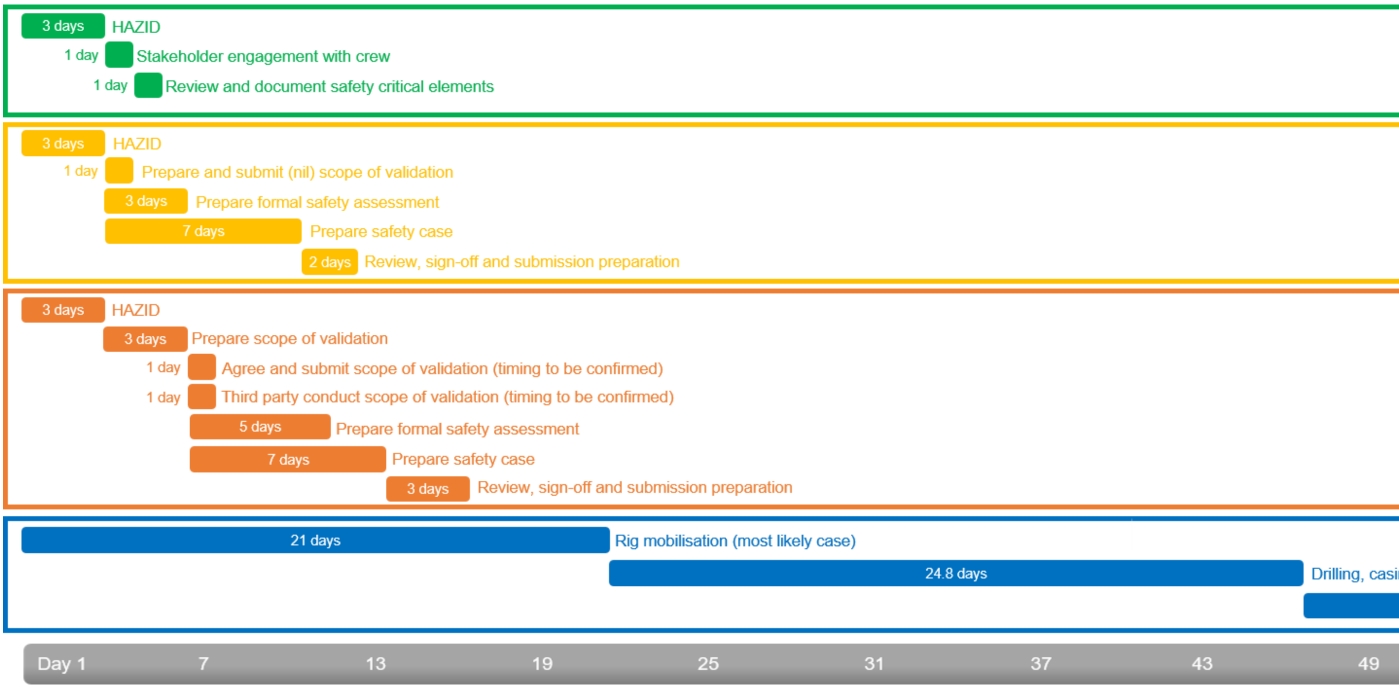


Figure 6-3, therefore, the Safety Case scenario will have no impact on the delivery of the strategy.

6.3.2 Debris clearance and/or removal

The Woodside Source Control Response Guideline details the mobilisation and resource requirements for implementing this strategy. Debris clearance may be required as a prerequisite to deployment of the capping stack. The AMOSC SFRT would be mobilised from Fremantle. The mobilisation of the SFRT would take place in parallel with mobilisation of the capping stack to ensure initial ROV surveys and debris clearance have commenced before the arrival of the capping stack. The SFRT comprises ROV-deployed cutters and tools that are used to remove damaged or redundant items from the wellhead and allow improved access to the well. The SFRT can be mobilised and deployed with well intervention attempted within 11 days.

6.3.2.1 Safety Case considerations

Woodside has assessed against the NOPSEMA safety case guidance (NOPSEMA N-09000-GN1661) and can confirm that vessels conducting debris clearance and removal operations are not classified as an "associated offshore place" but as a facility and therefore require the appropriate Safety Case arrangements in place. In the event of an emergency, Woodside has access to suitable ISVs for these operations through existing frame agreements. The frame agreements for ISVs require the vessels to maintain in-force safety case approval covering a range of subsea activities. This would cover the requirement for debris clearance and removal operations such as subsea manifold installation, commissioning, cargo transfer (including bulk liquids) and ROV operations. With frame agreements in place, the credible Safety Case

Scenario, from those presented in

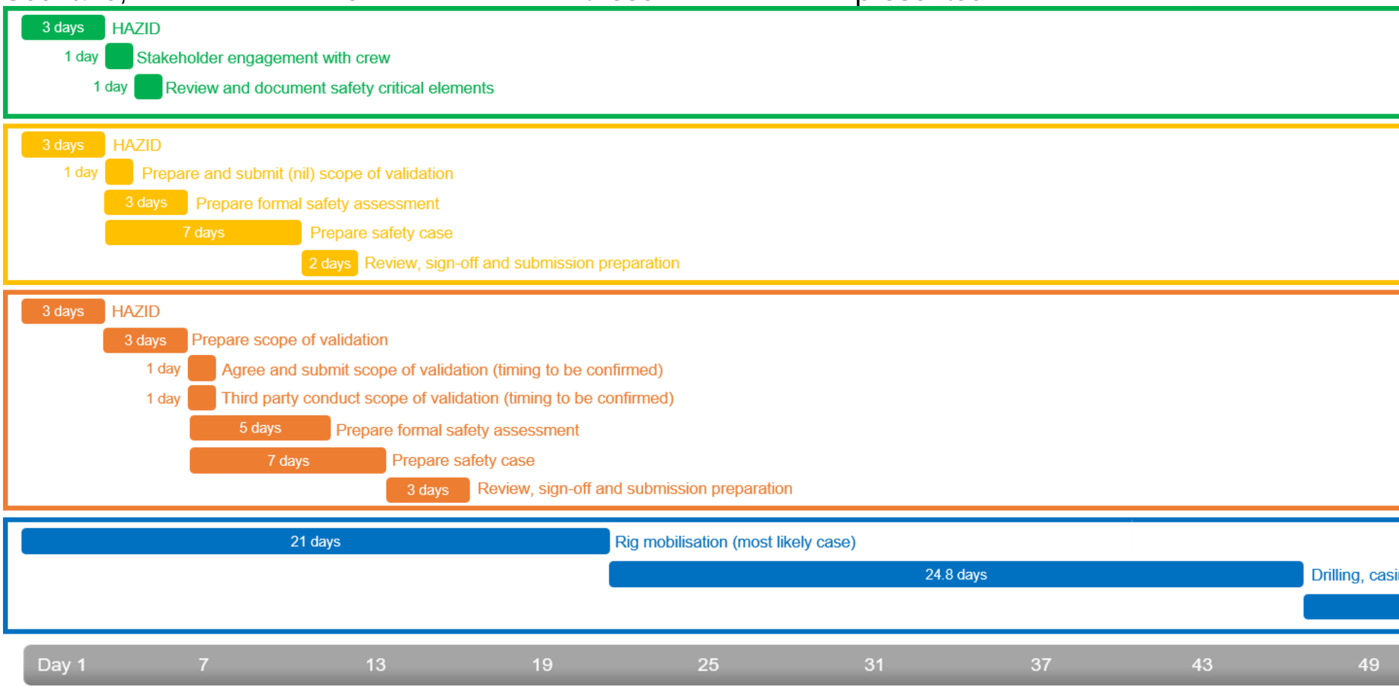


Figure 6-3 for implementing this response would be "no safety case revision required". Timeframes for debris clearance and removal equipment deployment are detailed in

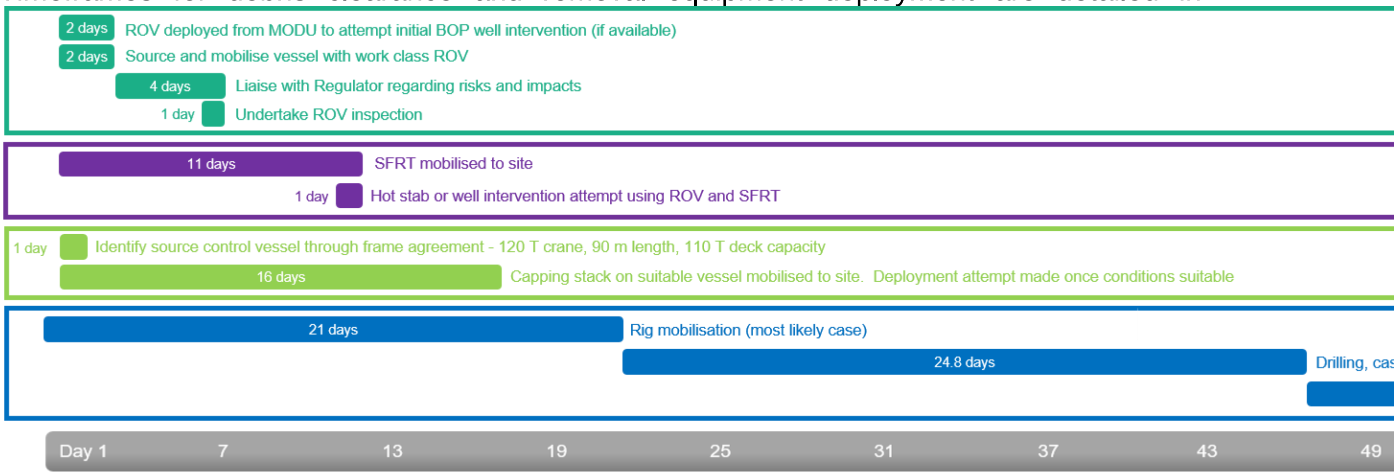


Figure 6-2 and would be implemented concurrently to the actions required by the "No Safety Case" revision scenario detailed in

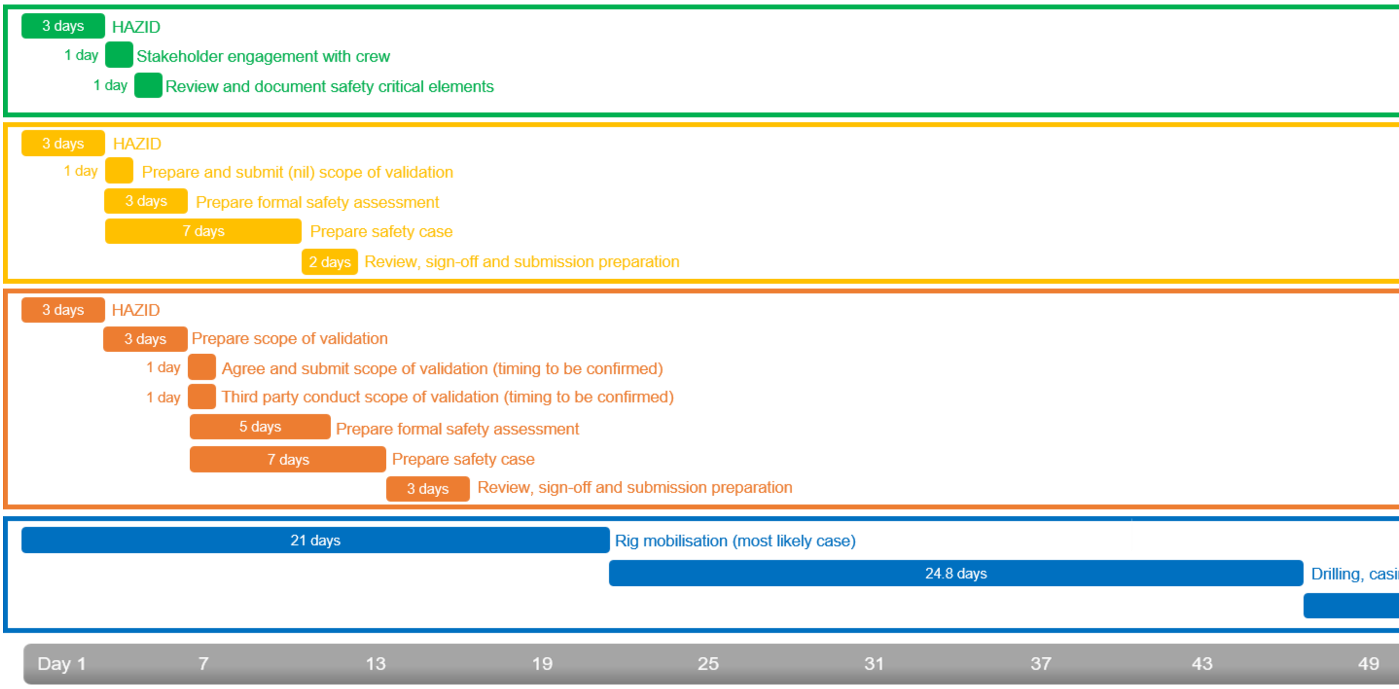


Figure 6-3, therefore, the Safety Case scenario will have no impact on the delivery of the strategy.

6.3.3 Capping stack

The Woodside Source Control Response Guideline details the mobilisation and resource requirements for implementing this strategy. A capping stack is designed to be installed on a subsea well and provides a temporary means of sealing the well, until a permanent well kill can be performed through either a relief well or well re-entry.

Woodside has developed a project specific capping stack deployment plan and also commissioned an independent, capping stack landing study for the Scarborough wells (WWCI, 2021). The study indicates that the safe deployment of a capping stack is feasible.

Woodside assumes that sourcing conventional capping stack deployment vessels would be per the Source Control Response Guideline. This plan has pre-identified vessel specifications for the capping stack deployment and Woodside monitors the availability and location of these vessels on a monthly basis. Woodside maintain several frame agreements with various vessel service providers and maintains the ability to call off services with a capping stack and debris clearance agreement. The location of suitable vessels for capping stack deployment are monitored monthly. The supply arrangements and reliability to achieve the required mobilisation time will be revalidated prior to spud. Consideration to mobilise the capping stack from the supplier on a suitable vessel but then hand over to another vessel to conduct the capping activity will also be made to meet response time frames.

A capping stack will be mobilised to site within 16 days. Woodside will monitor the conditions around the wellsite and deployment for well intervention attempt will be undertaken once safety and metocean conditions are suitable.

6.3.3.1 Safety Case considerations

Woodside has assessed against the NOPSEMA safety case guidance (NOPSEMA N-09000-GN1661) and can confirm that vessels conducting capping stack are not classified as an "associated offshore place" but as a facility and therefore require the appropriate Safety Case arrangements in place.

The timeframe to mobilise the vessel is based on the following assumptions:

- existing frame agreement vessel, located outside the region with approved Australian Safety Case
- a safety case revision and scope of validation is required
- vessel has an active heave compensated crane, rated to at least 120 T and at least 90 m in length and a deck capacity to hold at least 110 T of capping stack.

Timeframes for capping stack deployment detailed in

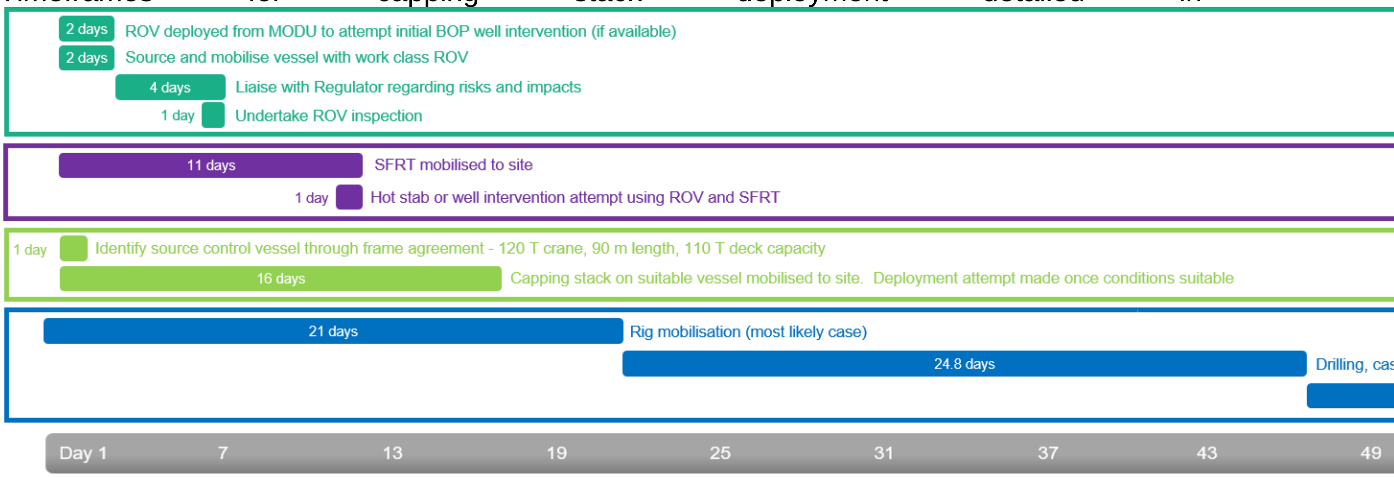


Figure 6-2 would be implemented concurrently with the actions required for the Safety Case revision development scenarios detailed in

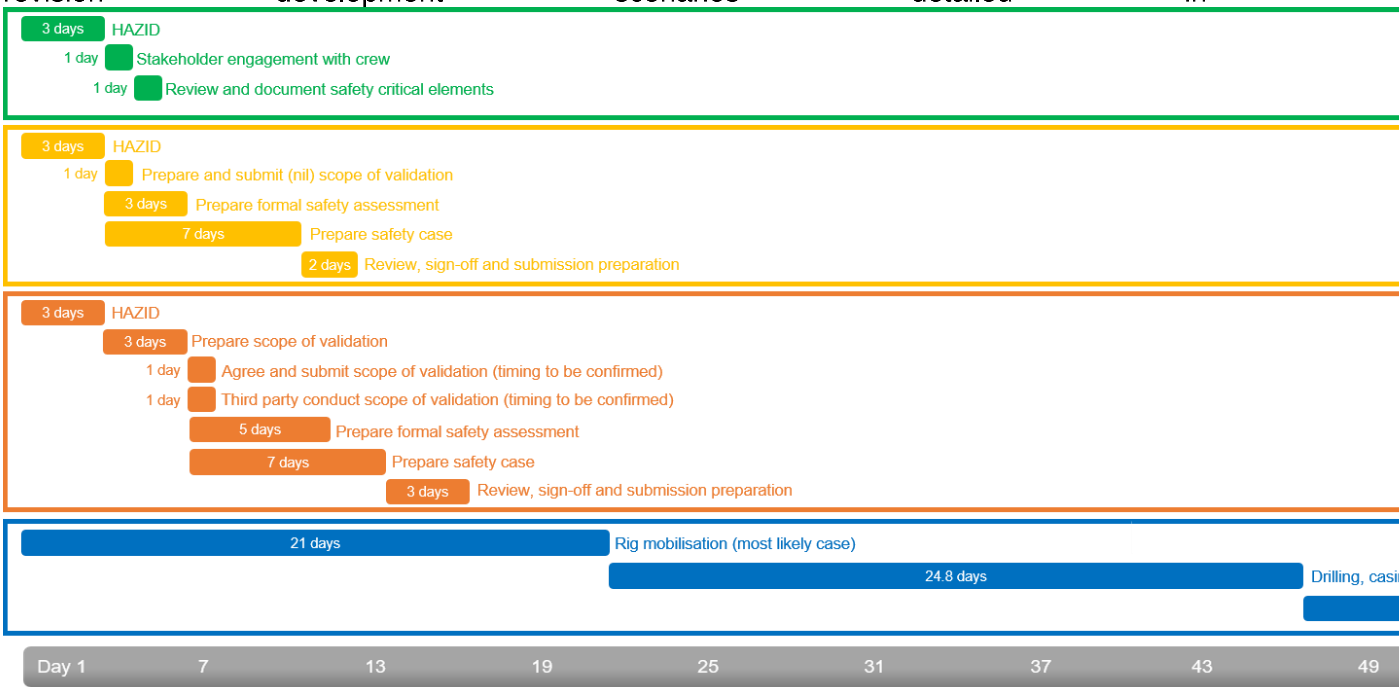


Figure 6-3 and

Table 6-3. To reduce uncertainty in regulatory approval timeframe, Woodside is collaborating with The Drilling Industry Steering Committee (DISC) and a contracted ISV Vessel Operator to develop a generic Safety Case Revision that contemplates a capping stack deployment. This Safety Case Revision will be used to reduce uncertainty in permissioning timeframes in the event a capping stack deployment is required. Woodside will execute the capping stack response in the fastest possible timeframe, provided the required safety and metocean conditions allow. Woodside has considered a broad range of alternate, additional, and improved options as outlined later in **Section 6.3.5**.

6.3.4 Relief Well drilling

The options analysis detailed in this section considers options to source, contract and mobilise a MODU or MODUs and ensure necessary regulatory approvals are in place to meet timelines for relief well drilling. The screening for relief well drilling MODUs is based on the following and the process used for Scarborough is illustrated in **Figure 6-1**:

- Primary – review internal Woodside drilling programs and MODU availability to source appropriate rig(s) operating within Australia with an approved Safety Case.
- Alternate – source and contract a MODU through APPEA MoU that is operating within Australia with an approved Safety Case.
- Contingency – Source and contract a MODU outside Australia with an approved Australian Safety Case.

For the worst-case discharge scenario modelled, an additional MODU, subsea well kill spools and hoses is required to provide pumping assistance to the primary relief well drilling rig. The MODU will be obtained per the above hierarchy.

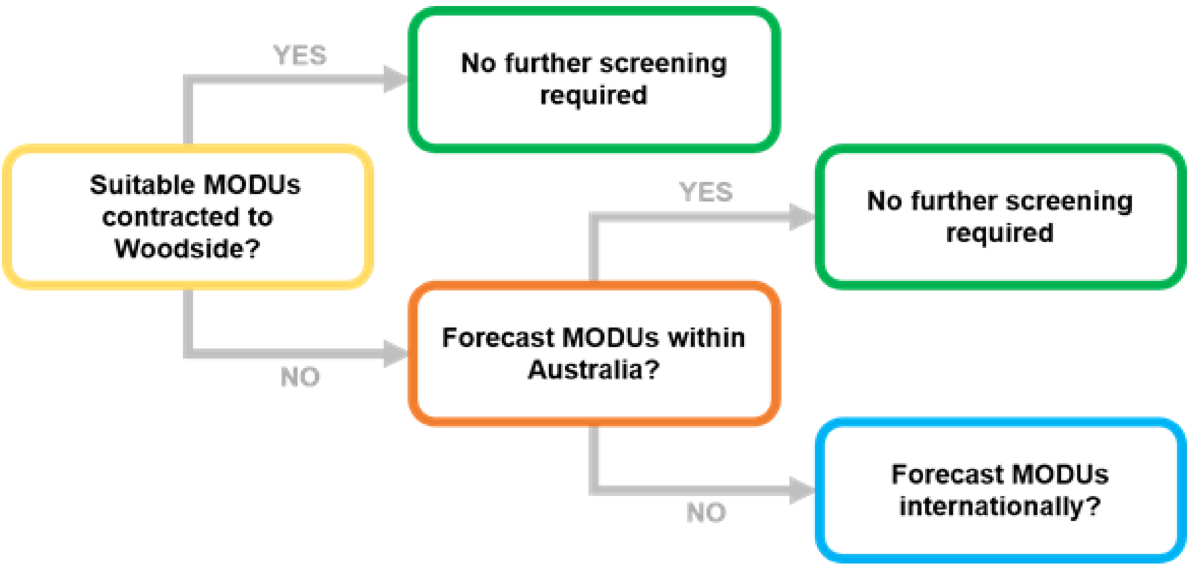


Figure 6-1: Process for sourcing relief well MODU

Screening of a relief well MODU from international waters is undertaken only if required, i.e. there is low confidence in local (Australian) availability. The screening of relief well MODUs is undertaken and presented at a well design stage peer assessment. The capability, location and Australian Safety Case status is assessed for each Woodside contracted MODU. In the event the Woodside contracted MODUs are unsuitable, screening is extended to all MODUs operating in Australian Waters. The suitability and location of pre-identified relief well MODUs is tested again prior to the operation. Though the APPEA MoU will serve as the instrument to facilitate the transfer of drilling units and well site services between operators in the event of an emergency, Woodside will engage each of the identified titleholders in advance to maintain confidence in MODU suitability and availability.

Based on the detail provided, the Primary and Alternate approaches are expected to be achieved within the 21-day period.

The internal and external availability of moored and DP MODUs, plus rig activities of registered operators and rigs with approved safety cases, are tracked by Woodside on a monthly basis, with a two-year look ahead, to ensure that the best available option can be sourced and utilised in the event of the worst-case credible scenario.

If the above forecast indicates a gap in availability of a suitable MODU for relief well drilling within Australia, screening would be extended to MODUs with a valid safety case outside Australia. If an international MODU with an Australian safety case is not identified, an internal review will be undertaken, NOPSEMA notified and the issue tabled at the APPEA Drilling Industry Safety Committee. A review of the significance of the change in risk will be undertaken in accordance with Woodside's environment management of change requirements and relevant regulatory triggers. The aforementioned lookahead timeframe would allow two years' warning of any potential gap. Woodside will execute relief well drilling in the fastest possible timeframe.

The detail of these arrangements demonstrates that the risks have been reduced to ALARP and Acceptable levels through the control measures and performance standards outlined in Section 5.2.

6.3.4.1 Relief Well drilling timings

The duration of a blowout (from initiation to a successful kill) is assessed as 65.3 days. The Scarborough development wells are very similar in their lengths, depths and casings. The wells with the worst-case discharge rates were modelled for relief well planning.

Details on the steps and time required to drill a relief well is shown in **Table 6-2** below. Moored and DP MODUs are suitable.

To validate the effectiveness of the relief MODU supply arrangements through the APPEA MoU, the 21-day mobilisation period was tested in April 2019 in an exercise facilitated by an external party. This exercise included suspension of the assisting operator's activities, contracting the MODU, vessel safety case revision and transit to location. The testing of mobilisation arrangements has been incorporated into Woodside's Hydrocarbon Spill Arrangements Testing Schedule.

Table 6-2: Relief well drilling timings

Estimated Time to Relief Well Intersection / Well Kill	
Source and contract MODU:	**21.0 days**
Activate MoU. Secure and suspend well.	*8.0 days*
Complete relief well design.	
Secure relief well materials.	
Transit to location based on mobilization from Northwest shelf region.	*2.0 days*
Backload and loadout bulks and equipment, complete internal assurance of relief well design.	*2.0 days*

Contingency for unforeseen event (e.g.: Longer transit from another area of Australia, problems in securing well, cyclone event)	*9.0 days*
Relief Well Construction: Note: This includes the time taken to install subsea kill spools and hoses	**24.8 days**
Intersection & Well Kill:	**19.5 days**
Drill out shoe, conduct formation integrity test and drill towards intersection point	*1.5 days*
Execute well-specific ranging plan to intersect blowout wellbore in minimum timeframe, with highest possible accuracy (3x open hole ranging sidetracks).	*15.0 days*
Pump kill weight drilling fluid per the relief well plan. Confirm the well is static with no further flow.	*0.5 days*
Contingency for unforeseen technical issues (e.g.: more ranging runs required to make intersect, additional mud circulations required to execute kill	*2.5 days*
Total	**65.3 days**

Woodside has considered a broad range of alternate, additional, and improved options as outlined in **Section 6.3.5**.

Intersect and kill duration is estimated at 19.5 days. This is a moderately conservative estimate. During the intersect process, the relief well will be incrementally drilled and logged to accurately approach and locate the existing well bore. This will result in the highest probability of intersecting the well on the first attempt and thus will reduce the overall time to kill the well. During the Montara incident, it took five attempts to achieve a successful intersect.

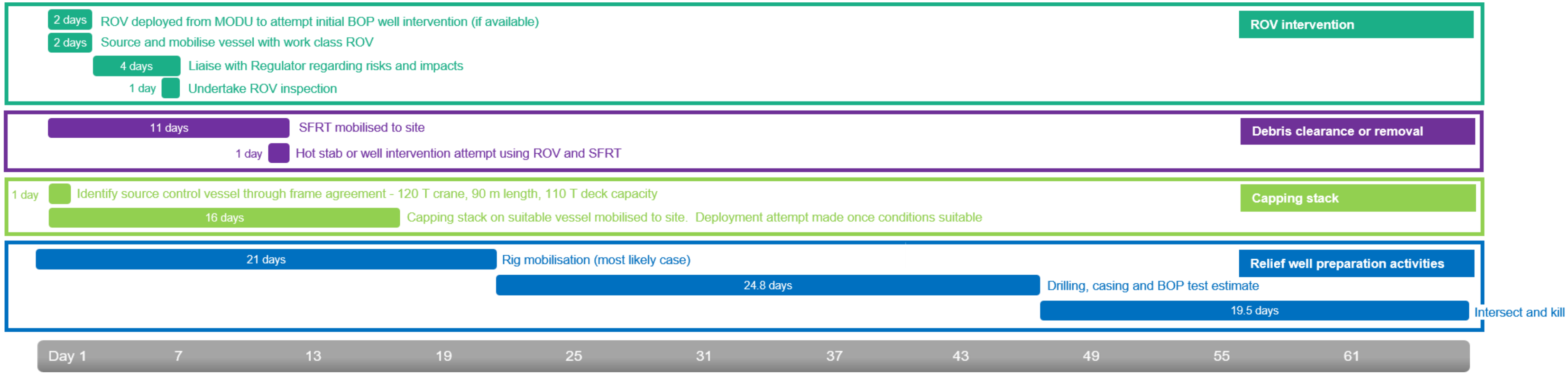


Figure 6-2: Source control and well intervention response strategy deployment timeframes for Scarborough Development Wells

6.3.4.2 Safety Case considerations

Woodside recognises that it will not be the Operator or holder of the Safety Case for the MODU and/or vessels involved in relief well activities. In the event that a revision to the Operator's Safety Case is required for relief well drilling, Woodside has identified measures to ensure timely response and optimise preparedness as far as practicable that can be undertaken to expedite a straightforward Safety Case revision for a MODU/ vessel to commence drilling a relief well. Performance standards associated with these measures have been included in Section 5.2.

These include;

- Access to Safety and Risk discipline personnel with specialist knowledge.
- Monitoring internal and external rigs and vessel availability in the region and extended area through contracted arrangements on a monthly basis, with a two-year lookahead.
- Prioritisation of rigs/vessels with current or historical contracting arrangements. Woodside maintains records of previous contracting arrangements and companies. All current contracts for vessels and rigs are required to support Woodside in the event of an emergency.
- Leverage mutual aid arrangements such as the APPEA MoU for vessel and rig support.
- Woodside Planning and Logistics, and Safety Officers (on-Roster/Call 24/7) which can articulate need for, and deliver Woodside support, in key delivery tasks including sitting with potential outside operators.
- Ongoing strategic industry engagement and collaboration with NOPSEMA to work toward time reductions in regulatory approvals for emergency events.

Woodside has identified three safety case revision development and submission scenarios for a MODU and plotted these alongside the relief well preparation activities in

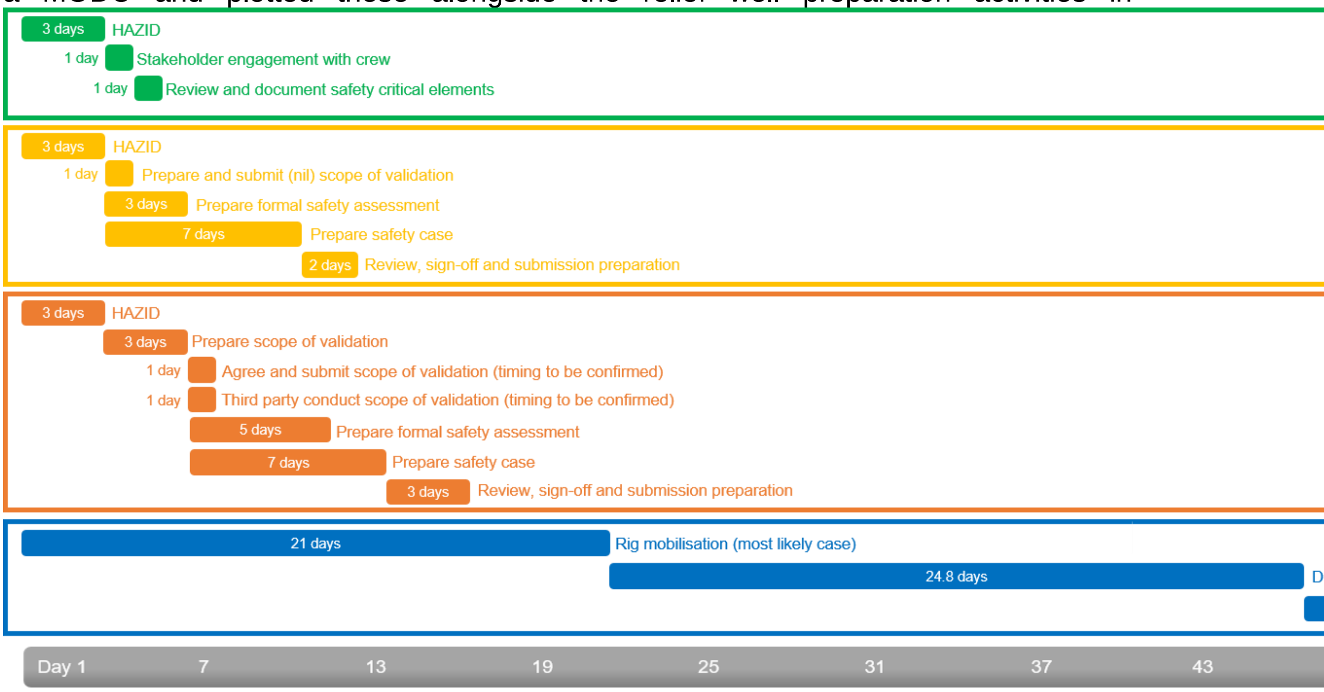


Figure 6-3. The assumptions for each of the cases are detailed in subsequent

Table 6-3.

The MODUs screened for contingency relief well drilling all operate under an Accepted base Safety Case. A relief well Safety Case Revision would leverage the previously accepted Safety Case Revision for the PAP, including the associated site-specific well hazards. As such, there is less new detail for the regulator to review and should present a short review timeframe with no impact expected to the commencement of relief well drilling activities.

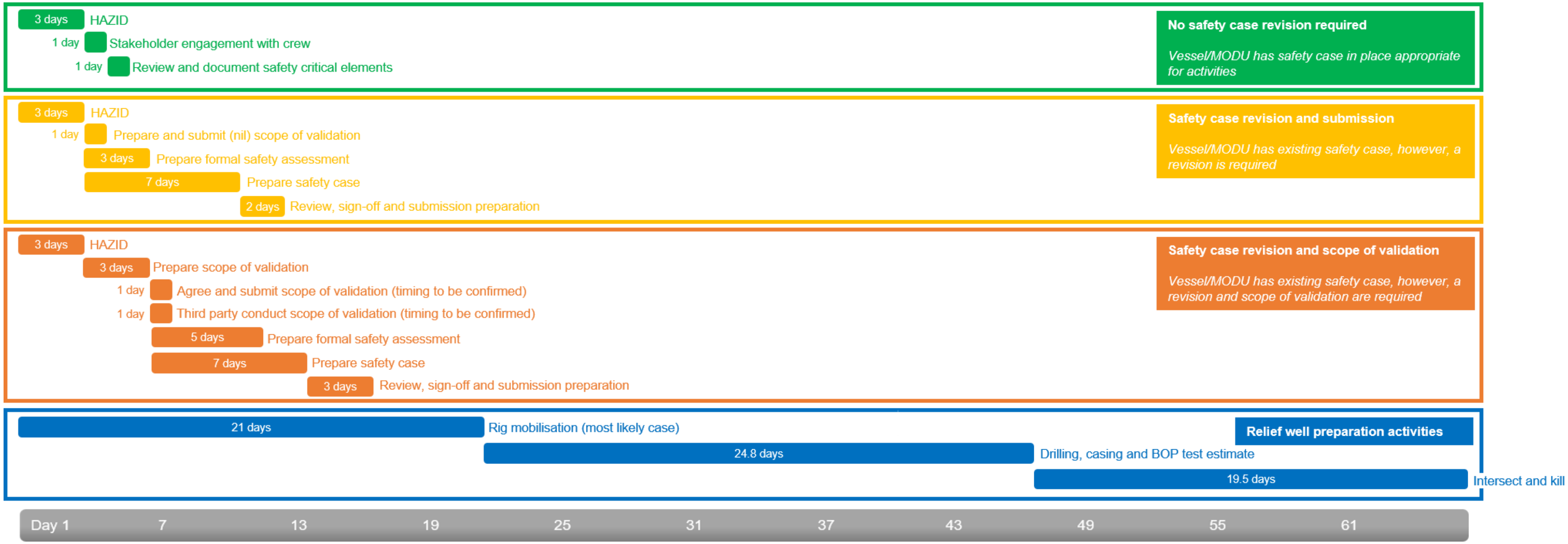


Figure 6-3: Timeline showing safety case revision timings alongside other relief well preparation activity timings for Scarborough Development Wells

Table 6-3: Safety case revision conditions and assumptions

Case	No safety case revision required	Safety case revision and submission	Safety case revision and scope of validation
Description	Vessel/MODU has a safety case in place appropriate for activities.	Vessel/MODU has an existing safety case, however, a revision is required.	Vessel/MODU has an existing safety case, however, a revision is required plus scope of validation.
Conditions/ assumptions	• Assumes that existing vessel/MODU safety case covers working under the same conditions or the loss of containment is not severe enough to result in any risk on the sea surface.	• Safety case timing assumes vessel/MODU selected and crew and available for workshops and safety case studies.	• Safety case timing assumes vessel/ MODU selected and crew and available for workshops and safety case studies.
		• Assumes nil scope of validation. This assumes that the vessel for subsea dispersant injection allows for working in a hydrocarbon environment and control measures are already in place in the existing safety case. For MODU, it assumes that the relief well equipment is already part of the MODU facility and MODU safety case.	• Validation will be required for new facilities only. The time needed for the validator to complete the review (from the last document received) and prepare validation statement is undetermined. This is not accounted for here as the safety case submission is not dependent on the validation statement, however the safety case acceptance is.
		• Assumes safety case preparation is undertaken 24/7.	• Assumes safety case preparation is undertaken 24/7.

6.3.5 Source Control – Control Measure Options Analysis

The assessments described in Sections 6.3.1, 6.3.2, 6.3.3 and 6.3.4 outline the primary and alternate approaches that Woodside would implement for source control. In Sections 6.3.6 and 6.3.7, Woodside has outlined the options considered against the activation/mobilisation (alternative, additional and improved options) and deployment (additional and improved options) processes as described in Section 2.1.1. This assessment provides an evaluation of:

- predicted cost associated with adopting the option
- predicted change/environmental benefit
- predicted effectiveness/feasibility of the option.

Alternative, Additional and Improved options have been identified and assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical.

- Alternative options, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control.
- Additional control measures are evaluated in terms of their ability to reduce an impact or risk when added to the existing suite of control measures.
- Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility.

Options where there is not a clear justification for their inclusion or exclusion may be subject to a detailed assessment.

6.3.5.1 Activation/Mobilisation Options considered

Alternative

- Standby MODU shared for all Woodside activities
- Standby MODU shared across APPEA MoU Titleholders

Additional

- Implement and maintain minimum standards for Safety Case development

Improved

- Monitor internal drilling programs for rig availability
- Monitor external activity for rig availability
- Monitor status of Registered Operators/ Approved Safety cases for rigs

6.3.5.2 Deployment Options considered

Additional

- Offset capping alternative to conventional capping stack deployment
- Dual vessel capping stack deployment
- Subsea Containment System alternative to capping stack deployment
- Pre-drilling top-holes
- Purchase and maintain mooring system
- Contract in place with WWCI and Oceaneering

Improved

- Maintaining relief well drilling supplies (mud, casing, etc).

6.3.6 Activation/Mobilisation – Control Measure Options Analysis

This section details the assessment of alternative, additional or improved control measures that were considered to ensure the selected level of performance in Section 5.3 reduces the risk to ALARP. The Alternative, Additional and Improved control measures that have been assessed and selected are highlighted in green and the relevant performance of the selected control is cross referenced. Items highlighted in red have been considered and rejected on the basis that they are not feasible or the costs are clearly grossly disproportionate compared to the environmental benefit.

6.3.6.1 Alternative control measures

Alternative Control Measures Considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*					
Option considered	**Feasibility**	**Environmental benefits/impacts**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Standby MODU shared for all Woodside activities	A standby MODU shared across all Woodside activities is likely to provide a moderate environmental benefit as it may reduce the 21-day sourcing, contracting and mobilisation time by up to 10 days (to 11 days). This would reduce the volume and duration of release and may reduce impacts on receptors and sensitivities.	This option is not considered feasible for all Woodside activities as there are a large range of well depths, complexities, geologies and geophysical properties across all Woodside's operations. The large geographic area of Woodside activities also means that the MODU is unlikely to be in the correct location at the right time when required.	Even with costs shared across Woodside operations, the costs (approximately A$219 m per annum, A$1.95 b over the five years) of maintaining a shared MODU are considered disproportionate to the environmental benefit potentially achieved by reducing mobilisation times by up to 10 days.	The costs and complexity of having a MODU and maintaining this arrangement for the duration of the Petroleum Activities Program are disproportionate to the environmental benefit gained above finding a MODU through the MoU agreement for all spill scenarios.	No
Standby MODU shared across APPEA MoU Titleholders	A standby MODU shared across all titleholders who are signatories to the APPEA MoU is likely to provide a minor environmental benefit as it may reduce the 21-day sourcing, contracting and mobilisation time by up to seven days (to 14 days). This would reduce the volume and duration of release and may reduce impacts on receptors and sensitivities.	This option is not considered feasible for a number of Titleholders due to the remote distances in Australia as well as a substantial range of well depths, types, complexities, geologies and geophysical properties across a range of Titleholders	As the environmental benefit is only considered minor and the reduction in timing would only be for the mobilisation period (reduction from 21 days to 14 days) the costs are considered disproportionate to the minor benefit gained.	The costs and complexity of having a MODU and maintaining a shared arrangement for the duration of the Petroleum Activities Program are disproportionate to the environmental benefit gained above finding a MODU through the MoU agreement for all spill scenarios.	No

6.3.6.2 Additional control measures

Additional Control Measures Considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*					
Option considered	**Feasibility**	**Environmental benefits/impacts**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Implement and maintain minimum standards for Safety Case development	Woodside's contingency planning consideration would be to source rigs from outside Australia with an existing Safety Case. This would require development and approval of a safety case revision for the rigs and activities prior to commencing well kill operations.	This option is considered feasible and would require Woodside to develop minimum standards for safe operations for relevant Safety Case input along with maintaining key resources to support review of Safety Cases. Woodside would not be the operator for relief well drilling and would therefore not develop or submit the Safety Case revision. Woodside's role as Titleholder would be to provide minimum standard for safe operations that MODU operators would be required to meet and/or exceed.	Woodside has outlined control measures and performance standards regarding template Safety Case documentation and maintenance of resources and capability for expedited Safety Case review.	This option has been selected based on its feasibility, low cost and the potential environmental benefits it would provide.	Yes

6.3.6.3 Improved control measures

Improved control measures Considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*					
Option considered	**Feasibility**	**Environmental benefits/impacts**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Monitor internal drilling programs for rig availability	Woodside may be conducting other campaigns that overlap with the Petroleum Activities Program, potentially providing availability of relief well drilling rigs within Woodside. The environmental benefit of monitoring other drilling programs internally is that Woodside would be in a position to understand which other rigs might be rapidly available for relief well operations if required, potentially reducing the time to drill the relief well, resulting in less hydrocarbon to the environment.	Woodside monitors vessel and MODU availability through market intelligence services for location. Woodside will continually monitor other drilling and exploration activities within Australia and as available throughout the region to track rigs and explore rig availability during well intervention operations.	Associated cost of implementation is minimal to the environmental benefit gained. Woodside has outlined control measures and performance standards.	This option is a low-cost control measure with potential to reduce the volume of hydrocarbon released to the environment.	Yes
Monitor external activity for rig availability	The environmental benefit achieved by monitoring drilling programs and rig movements across industry provides the potential for increased availability of suitable rigs for relief well drilling. Additional discussions with other Petroleum Titleholders may be undertaken to potentially gain faster access to a rig and reduce the time taken to kill the well and therefore volume of hydrocarbons released.	Woodside will source relief well drilling rigs in accordance with the APPEA MoU on rig sharing in the unlikely event this is required. Commercial and operational provisions do not allow Woodside to discuss current and potential drilling programs in detail with other Petroleum Titleholders.	Associated cost of implementation is moderate to the environmental benefit gained. Woodside will continually engage with other Titleholders and Operators regarding activities within Australia and as available throughout the region to track rigs and explore rig availability during well intervention operations.	This option is a low-cost control measure with potential to reduce the volume of hydrocarbon released to the environment.	Yes
Monitor status of Registered Operators / Approved Safety cases for rigs	Woodside can monitor the status of Registered Operators for rigs operating within Australia (and therefore safety case status) on a monthly basis. This allows for a prioritised selection of rigs in the event of a response with priority given to those with an existing safety case.	The environmental benefit of monitoring other drilling programs internally is that Woodside would be in a position to understand which other rigs might be rapidly available for relief well operations if required, potentially reducing the time to drill the relief well, resulting in less hydrocarbon to the environment.	The cost is minimal.	This option is a low-cost control measure with potential to reduce the volume of hydrocarbon released to the environment.	Yes

6.3.7 Deployment – Control Measure Options Analysis

6.3.7.1 Additional Control Measures

Additional Control Measures considered
Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures

Option considered	Environmental consideration	Feasibility	Approximate cost	Assessment conclusions	Implemented
Offset capping alternative to conventional capping stack deployment	While the use of an offset capping system could reduce the quantity of hydrocarbon entering the marine environment, the mobilisation lead times for both a cap and required vessels/ support equipment, would minimise any environmental benefit gained over conventional capping.	• The base case considerations for offset installation equipment (OIE) requires a coordinated response by 4 to 7 vessels working simultaneously outside of the 500m exclusion zone introducing complex SIMOPS issues. Due to the OIE's size and scale, fabrication of equipment, e.g. mooring anchors, outside of the contractor's scope of supply is likely to require engagement of international suppliers, further increasing complexity and uncertainty in associated time frames. • Screening indicates that mobilising some components of the OIE, based in Italy, can only be done so by sea and is likely to erode any time savings realised through killing the well via a relief well. • The March 2019 OSRL exercise in Europe tested deployment of the OIE and highlighted that it will require a >600 T crane vessel for deployment to ensure there is useable hook height for the crane to conduct the lift of the carrier. Vessels with such capability and a current Australian vessel safety case are not locally or readily available.	Due to risks, uncertainty and complexity of this option, and the inability to realise any environmental gains, any cost would be disproportionate to the benefits gained over conventional capping.	Woodside has confidence in availability of suitable relief well MODUs across the required drilling time frame thus the OIE would provide no advantage. Implementation of OIE has been assessed as a highly complex SIMOPs operation. Implementation of a novel technology such as OIE culminates in low certainty of success while at the same time increasing associated health and safety risks. As such the primary source control response and ALARP position remain conventional capping and drilling a relief well.	No
Dual vessel capping stack deployment	While the use of dual vessel to deploy the capping system could reduce the quantity of hydrocarbon entering the marine environment, this is an unproven technology. Additionally, the feasibility issues surrounding a dual vessel capping deployment together with mobilisation lead times for both a cap and required vessels and support equipment, would minimise any environmental benefit gained over conventional capping.	A dual vessel deployment is somewhat feasible provided a large enough deck barge can be located. Deck barges of 120 m are not, however, very common and will present a logistical challenge to identify and relocate to the region. Further, the longer-length barges may need mooring assist to remain centred over the well. The capping stack would be handed off from a crane vessel to the anchor handler vessel (AHV) work wire outside of the exclusion zone. The AHV would then manoeuvre the barge into the plume to get the capping stack over the well. In this method, the barge would be in the plume, but the AHV and all personnel would be able to maintain a safe position outside of the gas zone. The capping stack would actually be lowered on the AHV work wire so a crane would not be required on the barge.	Due to there being minimal environmental benefits gained by the prolonged lead times needed to execute this technique, plus a potential increase in safety issues, any cost would be disproportionate to the benefits gained over conventional capping.	Given there is minimal environmental benefit and an increase in safety issues surrounding SIMOPS and deployment in shallow waters, this option would not provide an environmental or safety benefit.	No
Subsea containment system alternative to capping stack deployment	While the use of a subsea containment system could reduce the quantity of hydrocarbon entering the marine environment, this is an unproven technology. Additionally, the system is unlikely to be feasibly deployed and activated for at least 90 days following a blowout due to equipment requirements and logistics. No environmental benefit is therefore predicted given the release duration is 65.3 days before drilling of a relief well under the adopted control measure.	The timing for mobilisation, deployment and activation of the subsea containment system is likely to be >90 days which is longer than the expected 65.3 days relief well drilling operations based on the location, size and scale of the equipment required, including seabed piles that can only be transported by vessel.	Woodside has investigated the logistics of reducing this timeframe by pre-positioning equipment but the costs of purchasing dedicated equipment by Woodside for this Petroleum Activities Program is not considered reasonably practical and are considered disproportionate to the environmental benefit gained.	This option would not provide an environmental benefit.	No
Pre-drilling (relief well) top-holes	This option represents additional environmental impacts associated with discharge of additional drill cuttings and fluids along with benthic habitat disturbance. It is also not expected to result in a significant decrease in relief well timings	This option is not considered feasible due to the uncertainties related to the location and trajectory of the intervention well, which may vary according to the actual conditions at the time the loss of containment event occurs. Additionally, there is only expected to be a minor reduction in timing for this option of 1-2 days based on the drilling schedule. Duration to drill and kill may be reduced by 1-2 days, but top-hole may have to be relocated, due to location being unsafe or unsuitable and further works will be required each year to maintain the top holes.	Utilising an existing MODU and pre-drilling top-hole for relief well commencement would significantly increase costs associated the Petroleum Activities Program. Estimated cost over the program's life is approx. A$555,000 per day over the PAP	This option would not provide an environmental benefit due to the additional environmental impacts coupled with a lack of improved relief well timings.	No

			based on 2-4 days of top-hole drilling (plus standby time) for the well as the worst-case scenario.		
Purchase and maintain mooring system	Purchasing and maintaining a mooring system could provide a moderate environmental benefit as it may reduce equipment sourcing time. However, due to the continued need for specialists to install the equipment plus sourcing a suitable vessel, the timeframe reduction would be minimal.	Woodside is not a specialist in installing and maintaining moorings so would require specialists to come in to install the moorings and would also require specialist vessels to be sourced to undertake the work.	The cost of purchasing, storing and maintaining pre-lay mooring systems with anchors, chains, buoys and ancillary equipment is considered disproportionate to the environmental benefit gained.	This option would not provide an environmental benefit as timeframe reductions would be minimal.	No
Contract in place with WWCI and Oceaneering	Woodside has an agreement in place with WWCI and Oceaneering to provide trained personnel in the event of an incident. This will ensure that competent personnel are available in the shortest possible timeframe.	Having contracts in place to access trained, competent personnel in the event of an incident would reduce mobilisation times. This option is considered reasonably practicable.	Minimal cost implications – Woodside has standing contract in place to provide assistance across all activities.	This control measure is adopted as the costs and complexity are not considered disproportionate to any environmental benefit that might be realised.	Yes

6.3.7.2 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*					
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Assessment conclusions**	**Implemented**
Maintaining relief well drilling supplies	There is not predicted to be any reduction in relief well timing or spill duration from Woodside maintaining stocks of drilling supplies (mud, casing, cement, etc.)	It would be feasible to source some relief well drilling supplies such as casing but the actual composition of the cement and mud required will need to be specific to the well. This option is also not deemed necessary as the lead time for sourcing and mobilising these supplies is included in the 21 days for sourcing and mobilising a rig.	The capital cost of Woodside purchasing relevant drilling supplies is expected to be approximately A$600,000 with additional costs for storage and ongoing costs for replenishment. These costs are considered disproportionate to the environmental benefit gained.	This option would not provide an environmental benefit.	No

6.3.8 Selected Control Measures

Following review of alternative, additional and improved control measures as outlined above, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - Implement and maintain minimum standards for Safety Case development
  - Contract in place with WWCI and Oceaneering to supply trained, competent personnel
- Improved
  - Monitor internal drilling programs for MODU availability
  - Monitor external activity for MODU availability
  - Monitor status of Registered Operators / Approved Safety cases for MODUs

6.4 Wildlife response – ALARP assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.4.1 Existing capability – wildlife response

Woodside's exiting level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, re-fuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.4.2 Wildlife response – control measure options analysis

6.4.2.1 Alternative Control Measures

Alternative Control Measures Considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Direct contracts with service providers instead of those sources through Scarborough	Adoption of this control would provide minimal net environmental benefit as the resources supplied through AMOSC and OSRL would likely be shared by the direct contracts.	It is feasible to have direct contracts with service providers; however, this option duplicates the capability accessed through AMOSC and OSRL, potentially competing for the same resources.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	No

6.4.2.2 Additional Control Measures

Additional Control Measures Considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Additional wildlife treatment systems	Current arrangements allow for all wildlife to be treated. Hydrocarbon is only limited to open water above the impact threshold. Therefore, there is no environmental benefit for having additional wildlife treatment systems as current capability meets the need.	Current arrangements allow response equipment and personnel to be delivered by day one, scaling up by day six, enough to treat up to 600 wildlife. An additional wildlife treatment system is feasible and would potentially reduce the time to deploy additional wildlife systems.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	No
Additional trained wildlife responders	Current numbers meet the needs required and additional personnel are available through existing contracts with oil spill response organisations and environmental panel contractors. Numbers of oiled wildlife are expected to be low in the remote offshore setting of the oiled wildlife response, given the distance from known aggregation areas. The potential environmental benefit of training additional personnel is expected to be low.	Providing additional trained wildlife responders is feasible, however current capacity provides the capacity to treat approximately 600 wildlife units (primarily avian fauna) by day six, with additional capacity available from OSRL.	Given there is no environmental benefit, any costs are disproportionate to the benefit gained.	No

6.4.2.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Faster mobilisation time for wildlife response through pre-positioned equipment and personnel.	Response time is limited by specialist personnel mobilisation time. Current timing is sufficient considering there is no potential for shoreline receptors to be contacted. This control measure provides increased effectiveness through faster mobilisation of specialists. However, no significant net environmental benefit is expected due to shoreline stranding times.	The selected delivery options provide the capacity to mobilise an oiled wildlife response capable of treating up to 600 wildlife from at least day six and exceeds the estimated Level 4 OWR response thought to be applicable. This delivery option provides the maximum expertise pooled across the participating operators, backed up by the international resources provided by OSRL.	The cost of having dedicated equipment and personnel available to respond faster is considered disproportionate to the environmental benefit.	No

6.4.3 Selected control measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.5 Waste Management – ALARP Assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in **Section 5** with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.5.1 Existing Capability – Waste Management

Woodside's existing level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, refuelling/re-stocking provisions, and other similar logistic and operational limitation that are beyond Woodside's direct control.

6.5.2 Waste Management – Control Measure Options Analysis

6.5.2.1 Alternative Control Measures

Alternative Control Measures Considered *Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
No reasonably practical alternative control measures identified.				

6.5.2.2 Additional Control Measures

Additional Control Measures Considered *Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Increased waste storage capability	The procurement of waste storage equipment options on the day of the event will allow immediate response and storage of collected waste. The environmental benefit of immediate waste storage is to reduce ecological consequence by safely securing waste, allowing continuous response operations to occur.	Access to Veolia's storage options provides the resources required to store and transport sufficient waste to meet the need. Access to waste contractors existing facilities enables waste to be stockpiled and gradually processed within the regional waste handling facilities. Additional temporary storage equipment is available through existing contract and arrangements with OSRL. Existing arrangements meet identified need for the PAP.	The cost of having increased waste storage capability is considered disproportionate to the environmental benefit. There is also no shoreline impact predicted, therefore, increased waste storage capability is not considered a benefit.	No

6.5.2.3 Improved Control Measures

Improved Control Measures considered *Improved control measures are evaluated for improvements they could bring to the effectiveness of adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility*				
Option considered	**Environmental consideration**	**Feasibility**	**Approximate cost**	**Implemented**
Faster response time	The access to Veolia waste storage options provides the resources to store and transport waste, permitting the wastes to be stockpiled and gradually processed within the regional waste handling facilities. Bulk transport to Veolia's licensed waste management facilities would be undertaken via controlled-waste-licensed vehicles and in accordance with Environmental Protection (Controlled Waste) Regulations 2004. The environmental benefit from successful waste storage will reduce pressure on the treatment and disposal facilities reducing ecological consequences by safely securing waste. In addition, waste storage and transport will allow continuous response operations to occur. This delivery option would increase known available storage, eliminating the risk of additional resources not being available at the time of the event. However, the environmental benefit of Woodside procuring additional waste storage is considered minor as the risk of additional storage not being available at the	Woodside already maintains an equipment stockpile in Exmouth to enable shorter response times to incidents. This stockpile includes temporary waste storage equipment. Woodside has access to stockpiles of waste storage and equipment in Dampier and Exmouth through existing contracts and arrangements.	The incremental benefit of having a dedicated local Woodside owned stockpile of waste equipment and transport is considered minor and cost is considered disproportionate to the benefit gained given there is no predicted shoreline contact.	No

	time of the event is considered low and existing arrangements provide adequate storage to support the response.			

6.5.3 Selected Control Measures

Following review of alternative, additional and improved control measures as outlined above, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected
- Additional
  - None selected
- Improved
  - None selected

6.6 Scientific monitoring – ALARP assessment

Alternative, Additional and Improved options have been identified and assessed against the base capability described in Section 5 with those that have been selected for implementation highlighted in green. Items highlighted in red have been considered and rejected on the basis that they are not feasible, the costs are clearly disproportionate to the environmental benefit, and/or the option is not reasonably practical. Control measures where there is not a clear justification for their inclusion or exclusion may be subject to a detailed ALARP assessment.

6.6.1 Existing Capability – Scientific Monitoring

Woodside's existing level of capability is based on internal and third-party resources that are available 24 hours, 7 days per week. The capability presented below is displayed as ranges to incorporate operational factors such as weather, crew/vessel/aircraft/vehicle location and duties, survey or classification society inspection requirements, overflight/port/quarantine permits and inspections, crew/pilot duty and fatigue hours, re-fuelling/re-stocking provisions, and other similar logistic and operational limitations that are beyond Woodside's direct control.

6.6.2 Scientific Monitoring – Control Measure Options Analysis

6.6.2.1 Alternative Control Measures

Evaluate Alternative, Additional and Improved Control Measures

Alternative Control Measures considered
Alternative, including potentially more effective and/or novel control measures are evaluated as replacements for an adopted control

Ref	Control Measure Category	Option considered	Implemented	Environmental Consideration	Feasibility / Cost
SM01	System	Analytical laboratory facilities closer to the likely spill affected area	No	SM01 water quality monitoring requires water samples to be transported to National Association of Testing Authorities (NATA) rated laboratories in Perth or interstate. Consider the benefit of laboratory access and transportation times to deliver water samples and complete lab analysis. There is a time lag from collection of water samples to being in receipt of results and confirming hydrocarbon contact to sensitive receptors). The environmental consideration of having access to suitable laboratory facilities in Exmouth or Karratha to carry out the hydrocarbon analysis would provide faster turnaround in reporting of results only by a matter of days (as per the time to transport samples to laboratories).	Laboratory facilities and staff available at locations closer to the spill affected area can reduce reporting times only to a moderate degree (days) with associated high costs of maintaining capability do not improve the environmental benefit.
SM01	System	Dedicated contracted SMP vessel (exclusive to Woodside)	No	Would provide faster mobilisation time of scientific monitoring resources, environmental benefit associated with faster mobilisation time would be minor compared to selected options.	Chartering and equipping additional vessels on standby for scientific monitoring has been considered. The option is reasonably practicable but the sacrifice (charter costs and organisational complexity) is significant, particularly when compared with the anticipated availability of vessels and resources within in the required timeframes. The selected delivery provides capability to meet the scientific monitoring objectives, including collection of pre-emptive data where baseline knowledge gaps are identified for receptor locations where spill predictions of time to contact are >10 days. The effectiveness of this alternative control (weather dependency, availability and survivability) is rated as very low The cost and organisational complexity of employing a dedicated response vessel is considered disproportionate to the potential environmental benefit by adopting these delivery options.

6.6.2.2 Additional Control Measures

Additional Control Measures considered
Additional control measures are evaluated in terms of them reducing an environmental impact or an environmental risk when added to the existing suite of control measures

Ref	Control Measure Category	Option considered	Implemented	Environmental Consideration	Feasibility / Cost
SM01	System	Determine baseline data needs and provide implementation plan in the event of an unplanned hydrocarbon release	Yes	Address resourcing needs to collect post spill (pre-contact) baseline data as spill expands in the event of a loss of well containment from the PAP activities.	Woodside relies on existing environmental baseline for receptors which have predicted hydrocarbon contact (above environment threshold) <10 days and acquiring pre-emptive data in the event of an instantaneous marine diesel spill from the PAP activities based on receptors predicted to have hydrocarbon contact >10 days. Ensure there is appropriate baseline for key receptors for all geographic locations that are potentially impacted <10 days of spill event, where practicable. Address resourcing needs to collect pre-emptive baseline as spill expands in the event of an instantaneous marine diesel spill from the activities.

6.6.3 Selected Control Measures

Following review of alternative, additional and improved control measures, the following controls were selected for implementation for the PAP.

- Alternative
  - None selected.
- Additional
  - Determine baseline data needs and activate SMPs for any identified PBAs in the event of an unplanned hydrocarbon release.
- Improved
  - None Selected.

6.6.4 Operational Plan

Key actions from the Scientific Monitoring Program Operational Plan for implementing the response are outlined in Table 6-4.

Table 6-4: Scientific monitoring program operational plan actions

Responsibility	Action
Activation	
Perth ICC Planning (ICC Planning – Environment Unit)	Mobilise SMP Lead/Manager and SMP Coordinator to the ICC Planning function.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager and SMP Coordinator)	Constantly assess all outputs from OM01, OM02 and OM03 (Section 5 and **Error! Reference source not found.**) to determine receptor locations and receptors at risk. Confirm sensitive receptors likely to be exposed to hydrocarbons, timeframes to specific receptor locations and which SMPs are triggered. Review baseline data for receptors at risk.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager and SMP Coordinator)	SMP co-ordinator stands up the SMP contractor. Stands up subject matter experts, if required.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager SMP Coordinator, SMP standby contractor SMP manager)	Establish if, and where, pre-contact baseline data acquisition is required. Determine practicable baseline acquisition program based on predicted timescales to contact and anticipated SMP mobilisation times. Determine scope for preliminary post-contact surveys during the Response Phase. Determine which SMP activities are required at each location based on the identified receptor sensitivities.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP standby contractor SMP manager)	If response phase data acquisition is required, stand up the contractor SMP teams for data acquisition and instruct them to standby awaiting further details for mobilisation from the ICC.

Responsibility	Action
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP standby contactor SMP manager)	SMP contractor, SMP standby contractor to prepare the Field Implementation Plan. Prepare and obtain sign-off of the Response Phase SMP work plan and Field Implementation Plan. Update the IAP.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator SMP standby contactor SMP manager)	Liaise with ICC Logistics, and determine the status and availability of aircraft, vessels and road transportation available to transport survey personnel and equipment to point of departure. Engage with SMP standby contactor SMP Manager and ICC Logistics to establish mobilisation plan, secure logistics resources and establish ongoing logistical support operations, including: • Vessels, vehicles and other logistics resources • Vessel fit-out specifications (as • Detailed in the Scientific Monitoring Program Operational Plan • Equipment storage and pick-up locations • Personnel pick-up/airport departure locations • Ports of departure • Land based operational centres and forward operations bases Accommodation and food requirements.
Perth ICC Planning (ICC Planning – Environment Unit) (SMP Lead/Manager, SMP Coordinator, SMP standby contactor (SMP manager)	Confirm communications procedures between Woodside SMP team, SMP contractor SMP Duty Manager, SMP Team Leads and Operations Coordinator (ICC).
Mobilisation	
Perth ICC Logistics	Engage vessels and vehicles and arrange fitting out as specified by the mobilisation Plan Confirm vessel departure windows and communicate with the SMP contractor SMP Duty Manager. Agree SMP mobilisation timeline and induction procedures with the Operations Coordinator (ICC).
Perth ICC Logistics	Coordinate with SMP contactor SMP Duty Manager to mobilise teams and equipment according to the logistics plan and Sector induction procedures.
SMP Survey Team Leads	SMP Survey Team Leader(s) coordinate on-ground/on-vessel mobilisations and support services with the Operations Coordinator (ICC).

6.6.5 ALARP and Acceptability Summary

<table>
<tr><th colspan="3">ALARP and Acceptability Summary</th></tr>
<tr><td colspan="3">Scientific Monitoring</td></tr>
<tr><td rowspan="4">ALARP Summary</td><td>X</td><td>All known reasonably practicable control measures have been adopted</td></tr>
<tr><td>X</td><td>Additional Measures: Determine baseline data needs and activate SMPs for any identified PBAs in the event of an unplanned hydrocarbon release</td></tr>
<tr><td></td><td>No reasonably practical additional, alternative, and/or improved control measure exists</td></tr>
<tr><td colspan="2">The resulting scientific monitoring capability has been assessed against the worst-case credible spill scenario. The range of strategies provide an ongoing approach to monitoring operations to assess and evaluate the scale and extent of impacts.

All known reasonably practicable control measures have been adopted with the cost and organisational complexity of these options determined to be Moderate and the overall delivery effectiveness considered Medium. The SMP’s main objectives can be met, with the addition of one alternative control measures to provide further benefit.</td></tr>
<tr><td>Acceptability Summary</td><td colspan="2">• The control measures selected for implementation manage the potential impacts and risks to ALARP.
• In the event of a hydrocarbon spill for the PAP, the control measures selected, meet or exceed the requirements of Woodside Management System and industry best-practice.
• Throughout the PAP, relevant Australian standards and codes of practice will be followed to evaluate the impacts from an instantaneous marine diesel spill.
• The level of impact and risk to the environment has been considered with regard to the principles of Environmentally Sustainable Development (ESD); and risks and impacts from a range of identified scenarios were assessed in detail. The control measures described consider the conservation of biological and ecological diversity, through both the selection of control measures and the management of their performance. The control measures have been developed to account for the worst-case credible case scenario, and uncertainty has not been used as a reason for postponing control measures.</td></tr>
<tr><td colspan="3">On the basis from the ALARP impact assessment above and in Section 6 of the EP Woodside considers the adopted controls discussed, manage the impacts and risks associated with implementing scientific monitoring activities to a level that is ALARP and acceptable.</td></tr>
</table>

7 ENVIRONMENTAL RISK ASSESSMENT OF SELECTED RESPONSE TECHNIQUES

The implementation of response techniques may modify the impacts and risks identified in the EP and response activities can introduce additional impacts and risks from response operations themselves. Therefore, it is necessary to complete an assessment to ensure these impacts and risks have been considered and specific measures are put in place to continually review and manage these further impacts and risks to ALARP and Acceptable levels. A simplified assessment process has been used to complete this task which covers the identification, analysis, evaluation and treatment of impacts and risks introduced by responding to the event.

7.1 Identification of impacts and risks from implementing response techniques

Each of the control measures can modify the impacts and risks identified in the EP. These impacts and risks have been previously assessed within the scope of the EP. Refer to the EP for details regarding how these risks are being managed. They are not discussed further in this document.

- Atmospheric emissions
- Routine and non-routine discharges
- Physical presence, proximity to other vessels (shipping and fisheries)
- Routine acoustic emissions vessels
- Lighting for night work/navigational safety
- Invasive marine species
- Collision with marine fauna
- Disturbance to seabed

Additional impacts and risks associated with the control measures not included within the scope of the EP include:

- Drill cuttings and drilling fluids environmental impact assessment for relief well drilling
- Vessel operations and anchoring
- Additional stress or injury caused to wildlife
- Waste generation.

7.2 Analysis of impacts and risks from implementing response techniques

The table below compares the adopted control measures for this activity against the environmental values that can be affected when they are implemented.

Table 7-1: Analysis of risks and impacts

	Environmental Value						
	Soil & Groundwater	Marine Sediment Quality	Water Quality	Air Quality	Ecosystems/ Habitat	Species	Socio-Economic
Monitor and evaluate		✓	✓		✓	✓	
Source control		✓	✓		✓	✓	✓
Oiled Wildlife					✓	✓	
Scientific Monitoring		✓	✓		✓	✓	✓
Waste Management	✓			✓	✓	✓	✓

7.3 Evaluation of impacts and risks from implementing response techniques

Drill cuttings and drilling fluids environmental impact assessment for relief well drilling

The identified potential impacts associated with the discharge of drill cuttings and fluids during a relief well drilling activity include a localised reduction in water and seabed sediment quality, and potential localised changes to benthic biota (habitats and communities).

A number of direct and indirect ecological impact pathways are identified for drill cuttings and drilling fluids as follows:

- temporary increase in total suspended solids (TSS) in the water column
- attenuation of light penetration as an indirect consequence of the elevation of TSS and the rate of sedimentation
- sediment deposition to the seabed leading to the alteration of the physio-chemical composition of sediments, and burial and potential smothering effects to sessile benthic biota
- potential contamination and toxicity effects to benthic and in-water biota from drilling fluids.

Potential impacts from the discharge of cuttings range from the complete burial of benthic biota in the immediate vicinity of the well site due to sediment deposition, smothering effects from raised sedimentation concentrations as a result of elevated TSS, changes to the physico-chemical properties of the seabed sediments (particle size distribution and potential for reduction in oxygen levels within the surface sediments due to organic matter degradation by aerobic bacteria) and subsequent changes to the composition of infauna communities to minor sediment loading above background and no associated ecological effects. Predicted impacts are generally confined to within a few hundred metres of the discharge point (International Association of Oil and Gas Producers 2016) (i.e. within the EMBA for a hydrocarbon spill event).

The discharge of drill cuttings and unrecoverable fluids from relief well drilling is expected to increase turbidity and TSS levels in the water column, leading to an increased sedimentation rate above ambient levels associated with the settlement of suspended sediment particles in close proximity to the seabed or below sea surface, depending on location of discharge. Cuttings with retained (unrecoverable) drilling fluids are discharged below the water line at the MODU location, resulting in drill cuttings and drilling fluids rapidly diluting, as they disperse and settle through the water column. The dispersion and fate of the cuttings is determined by particle size and density of the retained (unrecoverable) drilling fluids, therefore, the sediment particles will primarily settle in proximity to the well locations with potential for localised spread downstream (depending on the speed of currents throughout the water column and seabed) (IOGP 2016). The finer particles will remain in suspension and will be transported further before settling on the seabed.

These conclusions were supported by discharge modelling which was undertaken by Woodside in support of the Greater Enfield Development EP. Modelling results indicating that the TSS plume of suspended cuttings will typically disperse to the south-west while oscillating with the tide and diminish rapidly with increasing distance from the well locations. Maximum TSS concentrations predicted for 100 m; 250 m and 1 km distances from the wellsite were 7, 5 and 1 mg/L, respectively. Furthermore, water column concentrations below 10 mg/L remain within 235 m of the discharge location for each modelled well. For all well discharge locations (outside of direct discharge sites), TSS concentration did not exceed 10 mg/l. Nelson et al. (2016) identified <10 mg/L as a no effect or sub-lethal minimal effect concentration.

The low sensitivity of the deep-water benthic communities/habitats within and in the vicinity of relief well locations, combined with the relatively low toxicity of water based muds (WBM) and non-water based muds (NWBMs), there being no bulk discharges of NWBM and the highly localised nature and scale of predicted physical impacts to seabed biota, indicate that any localised impact would likely be of a slight magnitude (especially when considering the broader consequence of the loss of well containment event that a relief well drilling activity would be responding too).

Vessel operations and anchoring

During the implementation of response techniques, where water depths allow, it is possible that response vessels will be required to anchor (e.g. during shoreline surveys and oiled wildlife response). The use of vessel anchoring will be minimal and likely to occur when the impacted shoreline is inaccessible via road. Anchoring in the nearshore environment of sensitive receptor locations will have the potential to impact coral reef, seagrass beds and other benthic communities in these areas. Recovery of benthic communities from anchor damage depends on the size of anchor and frequency of anchoring. Impacts would be highly localised (restricted to the footprint of the vessel anchor and chain) and temporary, with full recovery expected.

Additional stress or injury caused to wildlife

Additional stress or injury to wildlife could be caused through the following phases of a response:

- capturing wildlife
- transporting wildlife
- stabilisation of wildlife
- cleaning and rinsing of oiled wildlife
- rehabilitation (e.g. diet, cage size, housing density)
- release of treated wildlife.

Inefficient capture techniques have the potential to cause undue stress, exhaustion or injury to wildlife, additionally pre-emptive capture could cause undue stress and impacts to wildlife when there are uncertainties in the forecast trajectory of the spill. During the transportation and stabilisation phases there is the potential for additional thermoregulation stress on captured wildlife. Additionally, during the cleaning process, it is important personnel undertaking the tasks are familiar with the relevant techniques to ensure that further injury and the removal of water proofing feathers are managed and mitigated. Finally, during the release phase it’s important that wildlife is not released back into a contaminated environment.

Waste generation

Implementing oiled wildlife response may result in the generation of the following waste streams that will require management and disposal:

- Liquids (recovered oil/water mixture), recovered from oiled wildlife response operations
- Semi-solids/solids (oily solids), collected during oiled wildlife response operations
- Debris collected during oiled wildlife response.

If not managed and disposed of correctly, wastes generated during the response have the potential for secondary contamination, impacts to wildlife through contact with or ingestion of waste materials and contamination risks if not disposed of correctly onshore.

7.4 Treatment of impacts and risks from implementing response techniques

In respect of the impacts and risks assessed the following treatment measures have been adopted. It must be recognised that this environmental assessment is seeking to identify how to maintain the level of impact and risks at levels that are ALARP and of an acceptable level rather than exploring further impact and risk reduction. It is for this reason that the treatment measures identified in this assessment will be captured in Operational Plans, Tactical Response Plans (ANNEX E: Tactical Response Plans), and/or First Strike Plans.

Vessel operations and anchoring

- If vessels are required for access, anchoring locations will be selected to minimise disturbance to benthic primary producer habitats. Where existing fixed anchoring points are not available, locations will be selected to minimise impact to nearshore benthic environments with a preference for areas of sandy seabed where they can be identified (PS 7.1, PS 14.1).
- Shallow draft vessels will be used to access remote shorelines to minimise the impacts associated with seabed disturbance on approach to the shorelines (PS 7.2, PS14.2).

Additional stress or injury caused to wildlife

- Oiled wildlife operations (including hazing) would be implemented with advice and assistance from the Oiled Wildlife Advisor from the DBCA and in accordance with the processes and methodologies described in the WA OWRP and the relevant regional plan (PS 13.3).

Waste generation

- Response teams will segregate liquid and solid wastes at the earliest opportunity (PS 15.4).

8 ALARP CONCLUSION

An analysis of alternative, additional and improved control measures has been undertaken to determine their reasonableness and practicability. The tables in **Section 6** document the considerations made in this evaluation. Where the costs of an alternative, additional, or improved control measure have been determined to be clearly disproportionate to the environmental benefit gained from its adoption it has been rejected. Where this is not considered to be the case the control measure has been adopted.

The risks from a hydrocarbon spill have been reduced to ALARP because:

- Woodside has a significant hydrocarbon spill response capability to respond to the WCCS through the control measures identified.
- New and modified impacts and risks associated with implementing response techniques have been considered and will not increase the risks associated with the activity.
- A consideration of alternative, additional, and improved control measures identified any other control measures that delivered proportionate environmental benefit compared to the cost of adoption for this activity ensuring that:
  - All known, reasonably practicable control measures have been adopted.
  - No additional, reasonably practicable alternative and/or improved control measures would provide further environmental benefit.
  - No reasonably practical additional, alternative, and/or improved control measure exists.
- A structured process for considering alternative, additional, and improved control measures was completed for each control measure.
- The evaluation was undertaken based on the outputs of the WCCS so that the capability in place is sufficient for all other scenario from this activity.
- The likelihood of the WCCS spill has been ignored in evaluating what was reasonably practicable.

9 ACCEPTABILITY CONCLUSION

Following the ALARP evaluation process, Woodside deems the hydrocarbon spill risks and impacts to have been reduced to an acceptable level by meeting all of the following criteria:

- Techniques are consistent with Woodside's processes and relevant internal requirements including policies, culture, processes, standards, structures and systems.
- Levels of risk/ impact are deemed acceptable by relevant persons (external stakeholders) and are aligned with the uniqueness of, and/or the level of protection assigned to the environment, its sensitivity to pressures introduced by the activity, and the proximity of activities to sensitive receptors, and have been aligned with Part 3 of the EPBC Act.
- Selected control measures meet requirements of legislation and conventions to which Australia is a signatory (e.g. International Convention for the Prevention of Pollution from Ships (MARPOL), the World Heritage Convention, the Ramsar Convention, and the Biodiversity Convention etc.). In addition to these, other non-legislative requirements met include:
    - Australian IUCN reserve management principles for Commonwealth marine protected areas and bioregional marine plans.
    - National Water Quality Management Strategy and supporting guidelines for marine water quality).
    - Conditions of approval set under other legislation.
    - National and international requirements for managing pollution from ships.
    - National biosecurity requirements.
- Industry standards, best practices and widely adopted standards and other published materials have been used and referenced when defining acceptable levels. Where these are inconsistent with mandatory/ legislative regulations, explanation has been provided for the proposed deviation. Any deviation produces the same or a better level of environmental performance (or outcome).

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11 GLOSSARY & ABBREVIATIONS

11.1 Glossary

Term	Description / Definition
ALARP	Demonstration through reasoned and supported arguments that there are no other practicable options that could reasonably be adopted to reduce risks further.
Availability	The availability of a control measure is the percentage of time that it is capable of performing its function (operating time plus standby time) divided by the total period (whether in service or not). In other words, it is the probability that the control has not failed or is undergoing a maintenance or repair function when it needs to be used.
Control	The means by which risk from events is eliminated or minimised.
Control effectiveness	A measure of how well the control measures perform their required function.
Control measure (risk control measure)	The features that eliminate, prevent, reduce or mitigate the risk to environment associated with PAP.
Credible spill scenario	A spill considered by Woodside as representative of maximum volume and characteristics of a spill that could occur as part of the PAP.
Dependency	The degree of reliance on other systems in order for the control measure to be able to perform its intended function.
Incident	An event where a release of energy resulted in or had (with) the potential to cause injury, ill health, damage to the environment, damage to equipment or assets or company reputation.
Major Environment Event	The events with potential environment, reputation, social or cultural consequences of category C or higher (as per Woodside's operational risk matrix) which are evaluated against credible worst-case scenarios which may occur when all controls are absent or have failed.
Performance outcome	A statement of the overall goal or outcome to be achieved by a control measure
Performance standard	The parameters against which [risk] controls are assessed to ensure they reduce risk to ALARP. A statement of the key requirements (indicators) that the control measure has to achieve in order to perform as intended in relation to its functionality, availability, reliability, survivability and dependencies.
Preparedness	Measures taken before an incident in order to improve the effectiveness of a response
Reasonably practicable	... a computation ... made by the owner, in which the quantum of risk is placed on one scale and the sacrifice involved in the measures necessary for averting the risk (whether in money, time or trouble) [showing whether or not] that there is a gross disproportion between them ... made by the owner at a point of time anterior to the accident. (Judgement: Edwards v National Coal Board [1949])
Receptors at risk	Physical, biological and social resources identified as at risk from hydrocarbon contact using oil spill modelling predictions.
Receptor areas	Geographically referenced areas such as bays, islands, coastlines and/or protected area (World Heritage Area, WHA, Commonwealth or State marine reserve or park) containing one or more receptor type.
Receptor Sensitivities	This is a classification scheme to categorise receptor sensitivity to an oil spill. The Environmental Sensitivity Index (ESI) is a numerical classification of the relative sensitivity of a particular environment (particularly different shoreline types) to an oil spill. Refer to the Woodside Oil Pollution Emergency Arrangements (Australia) for more details.
Regulator	NOPSEMA are the Environment Regulator under the Environment Regulations.
Reliability	The probability that at any point in time a control measure will operate correctly for a further specified length of time.

Term	Description / Definition
Response technique	The key priorities and objectives to be achieved by the response plan Measures taken in response to an event to reduce or prevent adverse consequences.
Survivability	Whether or not a control measure is able to survive a potentially damaging event is relevant for all control measures that are required to function after an incident has occurred.
Threshold	Hydrocarbon threshold concentrations applied to the risk assessment to evaluate hydrocarbon spills. These are defined as: surface hydrocarbon concentration – ≥10 g/m^2, dissolved – ≥100 ppb and entrained hydrocarbon concentrations – ≥500 ppb.
EMBA	The summary of quantitative modelling where the marine environment could be exposed to hydrocarbons levels exceeding hydrocarbon threshold concentrations.
Zone of Application (ZoA)	The zone in which Woodside may elect to apply dispersant. The zone is determined based on a range of considerations, such as hydrocarbon characteristics, weathering and metocean conditions. The zone is a key consideration in the Net Environmental Benefit Analysis for dispersant use.

11.2 Abbreviations

Abbreviation	Meaning
AHV	Anchor Handler Vessel
AIIMS	Australasian Inter-Service Incident Management System
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
APPEA	Australian Petroleum Production & Exploration Association
AUV	Autonomous Underwater Vehicle
BAOAC	Bonn Agreement Oil Appearance Code
BOP	Blowout Preventer
BOPE	Blowout Preventer Equipment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Condition Factor
CFD	Computational Fluid Dynamic
CICC	Corporate Incident Coordination Centre
CMT	Crisis Management Team
COP	Common Operating Picture
CS	Credible Scenario
DBCA	Department of Biodiversity, Conservation and Attractions (former Department of Parks and Wildlife)
DISC	Drilling Industry Steering Committee
DM	Duty Manager
DNA	Deoxyribonucleic Acid
DoT	Department of Transport
DP	Dynamically Positioned
EMBA	Environment that May Be Affected
EMSA	European Maritime Safety Agency
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation
EROD	ethoxyresorufin-O-deethylase
ESI	Environmental Sensitivity Index
ESD	Environmentally Sustainable Development
ESP	Environmental Services Panel
FSP	First Strike Plan
FST	Functional Support Team
GIS	Geographic Information System
GSI	Gonadosomatic Index

Abbreviation	Meaning
HSE	Health Safety and Environment
HSEQ	Health Safety Environment and Quality
HSP	Hydrocarbon Spill Preparedness
IAP	Incident Action Plan
IC	Incident Controller
ICC	Incident Coordination Centre
ICE	Internal Control Environment
ID	Identification
IGEM	Industry-Government Environmental Meta-database
IMIS	Incident Management Information System
IMS	Incident Management System
IMO	International Marine Organisation
IMT	Incident Management Team
IPIECA	International Petroleum Industry Environment Conservation Association
IR	Infrared
ISV	Infield Support Vessels
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
KBSB	King Bay Support Base
KGP	Karratha Gas Plant
LEL	Lower Explosive Limit
LOWC	Loss Of Well Control
LSI	Liver Somatic Index
MARPOL	International Convention for the Prevention of Pollution from Ships
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
MSRC	Marine Spill Response Corporation
NATA	National Association of Testing Authorities
NEBA	Net Environmental Benefit Analysis
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NRDA	Natural Resource Damage Assessment
NWBM	Non-Water Based Muds
OIE	Offset Installation Equipment
OILMAP	Oil Spill Model and Response System
OM	Operational Monitoring
OMP	Operational Monitoring Program
OPEA	Oil Pollution Emergency Arrangements

Abbreviation	Meaning
OPEP	Oil Pollution Emergency Plan
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OSPRMA	Oil Spill Preparedness and Response Mitigation Assessment
OSRL	Oil Spill Response Limited
OSRO	Oil Spill Response Organisation
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
OWRP	Oiled Wildlife Response Plan
OWROP	Oiled Wildlife Response Operational Plan
QA/QC	Quality Assurance/Quality Control
PAH	Polyaromatic Hydrocarbon
PAP	Petroleum Activities Program
PBA	Pre-emptive Baseline Areas
PPB	Parts per billion
PS	Performance Standard
ROV	Remotely Operated Vehicle(s)
RPA	Response Protection Area
S&EM	Security and Emergency Management
SCAT	Shoreline Contamination Assessment Techniques
SCERP	Source Control Emergency Response Plan
SDH	Sorbitol Dehydrogenase
SFRT	Subsea First Response Toolkit
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous Operations
SM	Scientific Monitoring
SME	Subject Matter Expert
SMP	Scientific Monitoring Program
SOPEP	Shipboard Oil Pollution Emergency Plan
SQGV	Sediment Quality Guideline Values
TOA	Testing of Arrangements
TRP	Tactical Response Plan
TRSV	Tubing Retrievable Safety Valve
TSS	Total Suspended Solids
UV	Ultraviolet
WA DoT	Western Australia Department of Transport
WBM	Water Based Muds
WCCS	Worst Case Credible Scenario
WHA	World Heritage Area

Abbreviation	Meaning
WMS	Woodside Management System
WiRCs	Woodside Integrated Risk & Compliance System
Woodside	Woodside Energy Limited
WWCI	Wild Well Control Inc
ZoA	Zone of Application

ANNEX A: NET ENVIRONMENTAL BENEFIT ANALYSIS DETAILED OUTCOMES

A NEBA has been conducted to assess the net environmental benefit of different response techniques to selected receptors in the event of an oil spill from the PAP for marine diesel (representing platform surface release during operations). The complete list of potential receptor locations within the EMBA within the PAP is included in the EP. As there were no RPAs identified, the locations utilised for the NEBA were based on receptors closest to the Scarborough well site. The detailed NEBA assessment outcomes are shown below.

Table A-1: NEBA assessment technique recommendations for a hydrocarbon release of marine diesel caused by vessel collision (CS-01)

Receptor	Monitor and Evaluate	Containment and Recovery	Dispersant application: sub-sea	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response	In situ burning	Mechanical dispersion	Source control
Open Commonwealth waters (Operational Area)	Yes	No	No	No	No	No	No	No	Potentially	No	No	Yes
Gascoyne AMP	Yes	No	No	No	No	No	No	No	Potentially	No	No	Yes

Overall assessment

Sensitive receptor (Sites identified in EP)	Monitor and Evaluate	Containment and Recovery	Dispersant application: sub-sea	Dispersant application: > 20 m water depth and > 10 km from shore/reefs	Shoreline protection	Shoreline clean-up (manual)	Shoreline clean-up (mechanical)	Shoreline clean-up (chemical)	Oiled Wildlife Response	In situ burning	Mechanical dispersion	Source control
Is this response Practicable?	Yes	No	No	No	No	No	No	No	Potentially	No	No	Yes
NEBA identifies Response potentially of Net Environmental Benefit?	Yes	No	No	No	No	No	No	No	Potentially	No	No	Yes

NEBA Impact Ranking Classification Guidance

To reduce variability between assessments, the following ranking descriptions have been devised to guide the workshop process:

			Degree of impact [6]	Potential duration of impact	Equivalent Woodside Corporate Risk Matrix Consequence Level
Positive	3P	Major	Likely to prevent: • behavioural impact to biological receptors • behavioural impact to socio-economic receptors e.g. changes to day-today business operations, public opinion/behaviours (e.g. avoidance of amenities such as beaches) or regulatory designations.	Decrease in duration of impact by > 5 years	N/A
Positive	2P	Moderate	Likely to prevent: • significant impact to a single phase of reproductive cycle of biological receptors • detectable financial impact, either directly (e.g. loss of income) or indirectly (e.g. via public perception), for socio-economic receptors.	Decrease in duration of impact by 1–5 years	N/A

Positive	1P	Minor	Likely to prevent impacts on:
			• significant proportion of population or breeding stages of biological receptors
			• socio-economic receptors such as:
			  ○ significant impact to the sensitivity of protective designation; or
			  ○ significant and long-term impact to business/industry.
				Decrease in duration of impact by several seasons (< 1 year)	N/A

	0	Non-mitigated spill impact	**No detectable difference to unmitigated spill scenario.**		
Negative	1N	Minor	Likely to result in: • behavioural impact to biological receptors • behavioural impact to socio-economic receptors e.g. changes to day-to-day business operations, public opinion/behaviours (e.g. avoidance of amenities such as beaches), or regulatory designations.	Increase in duration of impact by several seasons (< 1 year)	Increase in risk by one sub-category, without changing category (e.g. Minor (E) to Minor (D))
Negative	2N	Moderate	Likely to result in: • significant impact to a single phase of reproductive cycle for biological receptors; or • detectable financial impact, either directly (e.g. loss of income) or indirectly (e.g. via public perception), for socio-economic receptors. This level of negative impact is recoverable and unlikely to result in closure of business/industry in the region.	Increase in duration of impact by 1–5 years	Increase in risk by one category (e.g. Minor (D) to Moderate (C or B))

Negative	3N	Major	Likely to result in impacts on:
			• significant proportion of population or breeding stages of biological receptors
			• socio-economic receptors resulting in either:
			  ○ significant impact to the sensitivity of protective designation; or
			  ○ significant and long-term impact to business/industry.
				Increase in duration of impact by > 5 years or unrecoverable	Increase in risk by two categories (e.g. Minor (E) to Major (A))

[6] the maximum likely impact should be considered; for example, if a spill were to directly impact the behaviour that results in an impact to reproduction and/or the breeding population (such as fish failing to aggregate to spawn), then the score should be a 2 or 3 rather than a 1. Similarly, if a change in behaviour resulted in an increased risk of mortality of a population, then it should be scored as a 2 or 3.

ANNEX B: OPERATIONAL MONITORING ACTIVATION AND TERMINATION CRITERIA

Table B-1: Operational monitoring objectives, triggers and termination criteria

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 1 (OM01) Predictive modelling of hydrocarbons to assess resources at risk	OM01 focuses on the conditions that have prevailed since a spill commenced, as well as those that are forecasted in the short term (1–3 days ahead) and longer term. OM01 utilises computer-based forecasting methods to predict hydrocarbon spill movement and guide the management and execution of spill response operations to maximise the protection of environmental resources at risk. The objectives of OM01 are to: • Provide forecasting of the movement and weathering of spilled hydrocarbons • Identify resources that are potentially at risk of contamination • Provide simulations showing the outcome of alternative response options (booming patterns etc.) to inform on-NEBA and continually assess the efficacy of available response options in order to reduce risks to ALARP	OM01 will be triggered immediately following a level 2/3 hydrocarbon spill.	The criteria for the termination of OM01 are: • The hydrocarbon discharge has ceased • Response activities have ceased • Hydrocarbon spill modelling (as verified by OM02 surveillance observations) predicts no additional natural resources will be impacted

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 2 (OM02) Surveillance and reconnaissance to detect hydrocarbons and resources at risk	OM02 aims to provide regular, on-going hydrocarbon spill surveillance throughout a broad region, in the event of a spill. The objectives of OM02 are: • Verify spill modelling results and recalibrate spill trajectory models (OM01) • Understand the behaviour, weathering and fate of surface hydrocarbons • Identify environmental receptors and locations at risk or contaminated by hydrocarbons • Inform ongoing NEBA and continually assess the efficacy of available response options in order to reduce risks to ALARP • To aid in the subsequent assessment of the short- to long-term impacts and/or recovery of natural resources (assessed in SMPs) by ensuring that the visible cause and effect relationships between the hydrocarbon spill and its impacts to natural resources have been observed and recorded during the operational phase.	OM02 will be triggered immediately following a level 2/3 hydrocarbon spill.	The termination triggers for the OM02 are: • 72 hours has elapsed since the last confirmed observation of surface hydrocarbons • Latest hydrocarbon spill modelling results (OM01) do not predict surface exposures at visible levels
Operational Monitoring Operational Plan 3 (OM03) Monitoring of hydrocarbon presence, properties, behaviour and weathering in water	OM03 will measure surface, entrained and dissolved hydrocarbons in the water column to inform decision-making for spill response activities. The specific objectives of OM03 are as follows: • Detect and monitor for the presence, quantity, properties, behaviour and weathering of surface, entrained and dissolved hydrocarbons • Verify predictions made by OM01 and observations made by OM02 about the presence and extent of hydrocarbon contamination Data collected in OM03 will also be used for the purpose of longer-term water quality monitoring during SM01.	OM03 will be triggered immediately following a level 2/3 hydrocarbon spill.	The criteria for the termination of OM03 are as follows: • The hydrocarbon release has ceased • Response activities have ceased • Concentrations of hydrocarbons in the water are below available ANZECC/ ARMCANZ (2000) trigger values for 99% species protection.

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational Monitoring Operational Plan 4 (OM04) Pre-emptive assessment of sensitive receptors at risk	OM04 aims to undertake a rapid assessment of the presence, extent and current status of shoreline sensitive receptors prior to contact from the hydrocarbon spill, by providing categorical or semi-quantitative information on the characteristics of resources at risk. The primary objective of OM04 is to confirm understanding of the status and characteristics of environmental resources predicted by OM01 and OM02 to be at risk, to further assist in making decisions on the selection of appropriate response actions and prioritisation of resources. Indirectly, qualitative/semi-quantitative pre-contact information collected by OM04 on the status of environmental resources may also aid in the verification of environmental baseline data and provide context for the assessment of environmental impacts, as determined through subsequent SMPs.	Triggers for commencing OM04 include: • Contact of a sensitive habitat or shoreline is predicted by OM01, OM02 and/or OM03 • The pre-emptive assessment methods can be implemented before contact from hydrocarbons (once a receptor has been contacted by hydrocarbons it will be assessed under OM05)	The criteria for the termination of OM04 at any given location are: • Locations predicted to be contacted by hydrocarbons have been contacted • The location has not been contacted by hydrocarbons and is no longer predicted to be contacted by hydrocarbons (resources should be reallocated as appropriate)

Operational Monitoring Operational Plan	Objectives	Activation triggers	Termination criteria
Operational monitoring operational plan 5 (OM05) Monitoring of contaminated resources	OM05 aims to implement surveys to assess the condition of fauna and habitats contacted by hydrocarbons at sensitive habitat and shoreline locations. The primary objectives of OM05 are: • Record evidence of oiled fauna (mortalities, sub-lethal impacts, number, extent, location) and habitats (mortalities, sub-lethal impacts, type, extent of cover, area, hydrocarbon character, thickness, mass and content) throughout the response and clean-up at locations contacted by hydrocarbons to inform and prioritise clean-up efforts and resources, while minimising the potential impacts of these activities. Indirectly, the information collected by OM05 may also support the assessment of environmental impacts, as determined through subsequent SMPs.	OM05 will be triggered when a sensitive habitat or shoreline is predicted to be contacted by hydrocarbons by OM01, OM02 and/or OM03.	The criteria for the termination of OM05 at any given location are: • No additional response or clean-up of fauna or habitats is predicted • Spill response and clean-up activities have ceased OM05 survey sites established at sensitive habitat and shoreline locations will continue to be monitored during SM02. The formal transition from OM05 to SM02 will begin on cessation of spill response and clean-up activities.

ANNEX C: OIL SPILL SCIENTIFIC MONITORING PROGRAM

Oil Spill Environmental Monitoring

The following provides some further detail on Woodside's oil spill Scientific Monitoring Program and includes the following:

- the organisation, roles and responsibilities of the woodside oil spill scientific monitoring team and external resourcing
- a summary table of the ten scientific monitoring programs as per the specific focus receptor, objectives, activation triggers and termination criteria
- details on the oil spill environmental monitoring activation and termination decision-making processes
- baseline knowledge and environmental studies knowledge access via geo-spatial metadata databases
- an outline of the reporting requirements for oil spill scientific monitoring programs.

Oil Spill Scientific Monitoring – Delivery Team Roles and Responsibilities

Woodside Oil Spill Scientific Monitoring Delivery Team

The Woodside science team are responsible for the delivery of the oil spill scientific monitoring. The roles and responsibilities of the Woodside scientific monitoring delivery team are presented in Table C-1 and the organisational structure and Incident Control Centre (ICC) linkage provided in Figure C-1.

Woodside Oil Spill Scientific monitoring program - External Resourcing

In the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors, scientific monitoring personnel and scientific equipment to implement the appropriate SMPs will be provided by standby SMP contractor who hold a standby contract for SMP via the Woodside Environmental Services Panel (ESP). In the event, that additional resources are required other consultancy capacity within the Woodside ESP will be utilised (as needed and may extend to specialist contractors such as research agencies engaged in long-term marine monitoring programs). In consultation with the standby SMP contractor and/or specialist contractors, the selection, field sampling and approach of the SMPs will be determined by the nature and scale of the spill.

Table C-1: Woodside and Environmental Service Provider – Oil Spill Scientific Monitoring Program Delivery Team Key Roles and Responsibilities

Role	Location	Responsibility
Woodside Roles		
SMP Lead/Manager	Onshore (Perth)	• Approves activated the SMPs based on operational monitoring data provided by the Planning Function • Provides advice to the ICC in relation to scientific monitoring • Provides technical advice regarding the implementation of scientific monitoring • Approves detailed sampling plans prepared for SMPs • Directs liaison between statutory authorities, advisors and government agencies in relation to SMPs.
SMP Co-ordinator	Onshore (Perth)	• Activates the SMPs based on operational monitoring data provided by the Planning Function • Sits in the Planning function of the ICC. • Liaises with other ICC functions to deliver required logistics, resources and operational support from Woodside to support the Environmental Service Provider in delivering on the SMPs. Acts as the conduit for advice from the Chief Environmental Scientist to the Environmental Service Provider • Manages the Environmental Service Provider's implementation of the SMPs • Liaises with the Environmental Service Provider on delivery of the SMPs • Arranges all contractual matters, on behalf of Woodside, associated with the Environmental Service Provider's delivery of the SMPs.
Environmental Service Provider Roles		
SMP Standby Contractor – SMP Duty Manager/Project Manager (SMP Liaison Officer)	Onshore (Perth)	• Coordinates the delivery of the SMPs • Provides costings, schedule and progress updates for delivery of SMPs • Determines the structure of the Environmental Service Provider's team to necessitate delivery of the SMPs • Verifies that HSE Plans, detailed sampling plans and other relevant deliverables are developed and implemented for delivery of the SMPs • Directs field teams to deliver SMPs • Arranges all contractual matters, on behalf of Environmental Service Provider, associated with the delivery of the SMPs to Woodside • Manages sub-consultant delivery to Woodside • Provides required personnel and equipment to deliver the SMPs.
SMP Field Teams	Offshore – Monitoring Locations	• Delivers the SMPs in the field consistent with the detailed sampling plans and HSE requirements, within time and budget. • Early communication of time, budget, HSE risks associated with delivery of the SMPs to the Environmental Service Provider – Project Manager • Provides start up, progress and termination updates to the Environmental Service Provider – Project Manager (will be led in-field by a party chief).

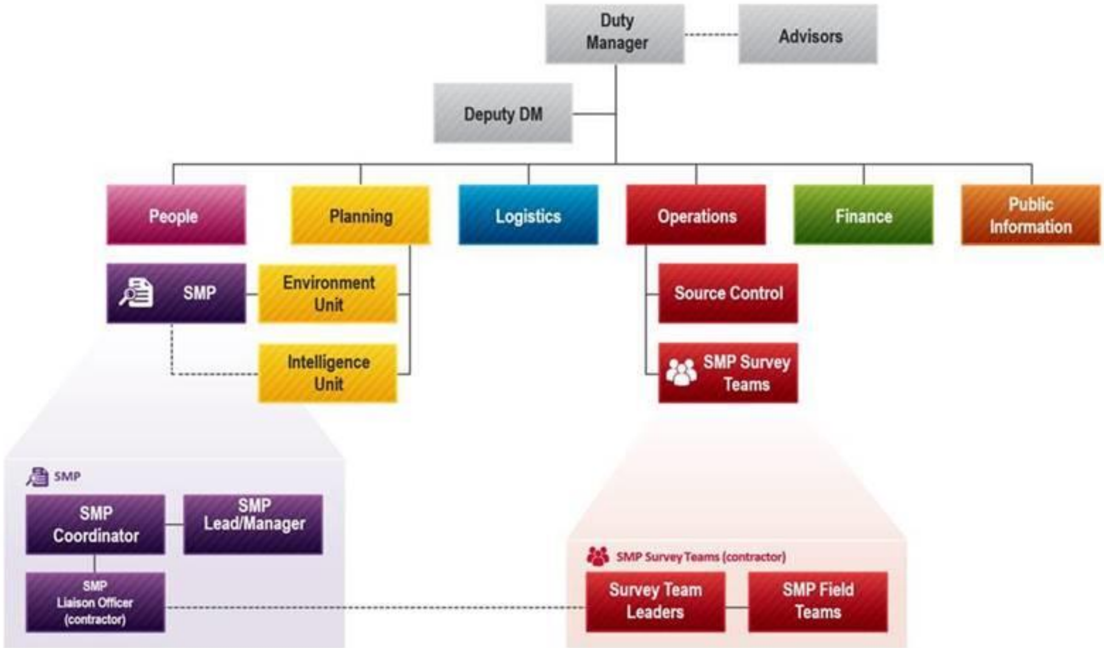

Figure C-1: Woodside Oil Spill Scientific Monitoring Program Delivery Team and linkage to Incident Control Centre (ICC) organisational structure.

Table C-2: Oil Spill Environmental Monitoring: Scientific Monitoring Program - Objectives, Activation Triggers and Termination Criteria

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
Scientific monitoring program 1 (SM01) **Assessment of Hydrocarbons in Marine Waters**	SM01 will detect and monitor the presence, extent, persistence and properties of hydrocarbons in marine waters during and post-spill and response. The specific objectives of SM01 are as follows: • Assess and document the extent, severity and persistence of hydrocarbon contamination with reference to observations made during surveillance activities and / or in-water measurements made during operational monitoring; and • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs.	SM01 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors	SM01 will be terminated when: • Operational monitoring data relating to observations and / or measurements of hydrocarbons on and in water have been compiled, analysed and reported; and • The report provides details of the extent, severity and persistence of hydrocarbons which can be used for analysis of impacts recorded for sensitive receptors monitored under other SMPs. SMP monitoring of sensitive receptor sites: • Concentrations of hydrocarbons in water samples are below NOPSEMA guidance note (2019[7]) concentrations of 1 g/m2 for floating, 10 ppb for entrained and dissolved; and • Details of the extent, severity and persistence of hydrocarbons from concentrations recorded in water have been documented at sensitive receptor sites monitored under other SMPs.
Scientific monitoring program 2 (SM02) **Assessment of the Presence, Quantity and Character of Hydrocarbons in Marine Sediments**	SM02 will detect and monitor the presence, extent, persistence and properties of hydrocarbons in marine sediments following the spill and the response. The specific objectives of SM02 are as follows: • Determine the extent, severity and persistence of hydrocarbons in marine sediments across selected sites where hydrocarbons were observed or recorded during operational monitoring; and • Provide information that may be used to interpret potential cause and effect drivers for environmental impacts recorded for sensitive receptors monitored under other SMPs.	SM02 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • Response activities have ceased; and • Operational monitoring results made during the response phase indicate that shoreline, intertidal or sub-tidal sediments have been exposed to surface, entrained or dissolved hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation).	SM02 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Concentrations of hydrocarbons in sediment samples are below ANZECC/ ARMCANZ (2013[8]) sediment quality guideline values (SQGVs) for biological disturbance; and • Details of the extent, severity and persistence of hydrocarbons from concentrations recorded in sediments have been documented.
Scientific monitoring program 3 (SM03) **Assessment of Impacts and Recovery of Subtidal and Intertidal Benthos**	The objectives of SM03 are: • Characterize the status of intertidal and subtidal benthic habitats and quantify any impacts to functional groups, abundance and density that may be a result of the spill; and • Determine the impact of the hydrocarbon spill and subsequent recovery (including impacts associated with the implementation of response options). Categories of intertidal and subtidal habitats that may be monitored include: • Coral reefs • Seagrass • Macro-algae • Filter-feeders SM03 will be supported by sediment contamination records (SM02) and characteristics of the spill derived from OMPs.	SM03 will be activated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of PBAs of receptor locations identified by time to hydrocarbon contact >10 days, to target receptors and sites where it is possible to acquire pre-hydrocarbon contact baseline; and • Operational monitoring identified shoreline potential contact of hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) for subtidal and intertidal benthic habitat.	SM03 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Overall impacts to benthic habitats from hydrocarbon exposure have been quantified. • Recovery of impacted benthic habitats has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 4 (SM04) **Assessment of Impacts and Recovery of Mangroves / Saltmarsh**	The objectives of SM04 are: • Characterize the status of mangroves (and associated salt marsh habitat) at shorelines exposed/contacted by spilled hydrocarbons; • Quantify any impacts to species (abundance and density) and mangrove/saltmarsh community structure; and • Determine and monitor the impact of the hydrocarbon spill and potential subsequent recovery (including impacts associated with the implementation of response options).	SM04 will be activated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; and	SM04 will be terminated once pre-spill condition is reached and agreed upon as per the SMP termination criteria process and include consideration of: • Impacts to mangrove and saltmarsh habitat from hydrocarbon exposure have been quantified. • Recovery of impacted mangrove/saltmarsh habitat has been evaluated.

[7] NOPSEMA (2019) Bulletin #1 – Oil spill modelling – April 2019, https://www.nopsema.gov.au/assets/Bulletins/A652993.pdf
[8] Simpson SL, Batley GB and Chariton AA (2013). Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO and Water Science Report 08/07. Land and Water, pp. 132.

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
	SM03 will be supported by sediment sampling undertaken in SM02 and characteristics of the spill derived from OMPs.	• Operational monitoring identified shoreline potential contact of hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) for mangrove/saltmarsh habitat.	• Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 5 (SM05) **Assessment of Impacts and Recovery of Seabird and Shorebird Populations**	The Objectives of SM05 are to: • Collate and quantify impacts to avian wildlife from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population level; and • Undertake monitoring to quantify and assess impacts of hydrocarbon exposure to seabirds and shorebird populations at targeted breeding colonies / staging sites / important coastal wetlands where hydrocarbon contact was recorded.	SM05 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented as follows: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Operational monitoring predicts shoreline contact of hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) at important bird colonies / staging sites / important coastal wetland locations; or • Records of dead, oiled or injured bird species made during the hydrocarbon spill or response.	SM05 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to seabird and shorebird populations from hydrocarbon exposure have been quantified. • Recovery of impacted seabird and shorebird populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 6 (SM06) **Assessment of Impacts and Recovery of Nesting Marine Turtle Populations**	The objectives of SM06 are to: • To quantify impacts of hydrocarbon exposure or contact on marine turtle nesting populations (including impacts associated with the implementation of response options); • Collate and quantify impacts to adult and hatchling marine turtles from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population levels (including impacts associated with the implementation of response options); .and • Undertake monitoring to quantify and assess impacts of hydrocarbon exposure to nesting marine turtle populations at known rookeries (including impacts associated with the implementation of response options).	SM06 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring has: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Predicted shoreline contact of hydrocarbons (at or above 0.5 g/m^2 surface, 5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) at known marine turtle rookery locations; or • Records of dead, oiled or injured marine turtle species made during the hydrocarbon spill or response.	SM06 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to nesting marine turtle populations from hydrocarbon exposure have been quantified. • Recovery of impacted nesting marine turtle populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 7 (SM07) **Assessment of Impacts to Pinniped Colonies including Haul-out Site Populations**	The objectives of SM07 are to: • Quantify impacts on pinniped colonies and haul-out sites as a result of hydrocarbon exposure/contact. • Collate and quantify impacts to pinniped populations from results recorded during OM02 and OM05 (such as mortalities, oiling, rescue and release counts) and undertake a desk-based assessment to infer potential impacts at species population levels.	SM07 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring has: • As part of a pre-emptive assessment of receptor locations identified by time to hydrocarbon contact >10 days; • Identified shoreline contact of hydrocarbons ((at or above 0.5 g/m^2 surface, ≥5 ppb for entrained/dissolved hydrocarbons and ≥1 g/m^2 for shoreline accumulation) at known pinniped colony or haul-out site(s) (i.e. most northern site is the Houtman Abrolhos Islands); or • Records of dead, oiled or injured pinniped species made during the hydrocarbon spill or response.	SM07 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Impacts to pinniped populations from hydrocarbon exposure have been quantified. • Recovery of pinniped populations has been evaluated. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 8 (SM08) **Desk-Based Assessment of Impacts to Other Non-Avian Marine Megafauna**	The objective of SM08 is to provide a desk-based assessment which collates the results of OM02 and OM05 where observations relate to the mortality, stranding or oiling of mobile marine megafauna species not addressed in SM06 or SM07, including: • Cetaceans; • Dugongs; • Whale sharks and other shark and ray populations; • Sea snakes; and	SM08 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring reports records of dead, oiled or injured non-avian marine megafauna during the spill/ response phase.	SM08 will be terminated when the results of the post-spill monitoring have quantified impacts to non-avian megafauna. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.

Scientific monitoring Program (SMP)	Objectives	Activation Triggers	Termination Criteria
	• Crocodiles. The desk-based assessment will include population analysis to infer potential impacts to marine megafauna species populations.		
Scientific monitoring program 9 (SM09) **Assessment of Impacts and Recovery of Marine Fish associated with SM03 habitats**	The objectives of SM09 are: • Characterise the status of resident fish populations associated with habitats monitored in SM03 exposed/contacted by spilled hydrocarbons; • Quantify any impacts to species (abundance, richness and density) and resident fish population structure (representative functional trophic groups); and • Determine and monitor the impact of the hydrocarbon spill and potential subsequent recovery (including impacts associated with the implementation of response options).	SM09 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented with SMO3.	SM09 will be undertaken and terminated concurrent with monitoring undertaken for SM03, as per the SMP termination criteria process • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.
Scientific monitoring program 10 (SM10) **SM10 - Assessment of physiological impacts important fish and shellfish species (fish health and seafood quality/safety) and recovery**	SM10 aims to assess any physiological impacts to important commercial fish and shellfish species (assessment of fish health) and if applicable, seafood quality/safety. Monitoring will be designed to sample key commercial fish and shellfish species and analyse tissues to identify fish health indicators and biomarkers, for example: • Liver Detoxification Enzymes (ethoxyresorufin-O-deethylase (EROD) activity) • Polyaromatic Hydrocarbon (PAH) Biliary Metabolites • Oxidative DNA Damage • Serum Sorbitol Dehydrogenase (SDH) activity • Other physiological parameters, such as condition factor (CF), liver somatic index (LSI), gonado-somatic index (GSI) and gonad histology, total weight, length, condition, parasites, egg development, testes development, abnormalities. Seafood tainting may be included (where appropriate) using applicable sensory tests to objectively assess targeted finfish and shellfish species for hydrocarbon contamination. Results will be used to make inferences on the health of commercial fisheries and the potential magnitude of impacts to fishing industries.	SM10 will be initiated in the event of a Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors and implemented if operational monitoring (OM01, OM02 and OM05) indicates the following: • The hydrocarbon spill will or has intersected with active commercial fisheries or aquaculture activities. • Commercially targeted finfish and/or shellfish mortality has been observed/recorded. • Commercial fishing or aquaculture areas have been exposed to hydrocarbons (≥0.5 g/m^2 surface and ≥5 ppb for entrained/dissolved hydrocarbons); and • Taste, odour or appearance of seafood presenting a potential human health risk is observed.	SM10 will be terminated once it is agreed that the receptor has returned to pre-spill condition. The SMP termination criteria process will be followed and include consideration of: • Physiological impacts to important commercial fish and shellfish species from hydrocarbon exposure have been quantified. • Recovery of important commercial fish and shellfish species from hydrocarbon exposure has been evaluated. • Impacts to seafood quality/safety (if applicable) have been assessed and information provided to the relevant stakeholders and regulators for the management of any impacted fisheries. • Agreement with relevant stakeholders and regulators based on the nature and scale of the hydrocarbon spill impacts and/or that observed impacts can no longer be attributed to the spill.

Activation Triggers and Termination Criteria

Scientific monitoring program activation

The Woodside oil spill scientific monitoring team will be stood up immediately with the occurrence of a hydrocarbon spill (actual or suspected) Level 2 or 3 hydrocarbon release, or any release event with the potential to contact sensitive environmental receptors via the First Strike plan for the petroleum activity programme. The presence of any level of hydrocarbons in the marine environment triggers the activation of the oil spill scientific monitoring program (SMP). This is to ensure the full range of eventualities relating to the environmental, socio-economic and health consequences of the spill are considered in the planning and execution of the SMP. The activation process also takes into consideration the management objectives, species recovery plans, conservation advices and conservations plans for any World Heritage Area (WHA), AMPs, State Marine Parks, other protected area designations (e.g., State nature reserves) and Matters of National Environmental Significance (including listed species under part 3 of the Environment Protection and Biodiversity Conservation (EPBC) Act) potentially exposed to hydrocarbons. With the first 24-48 hours of a spill event, such information will be sourced and evaluated as part of the SMP planning process guided by Appendix D (identified receptors vulnerable to hydrocarbon contact), the information presented in the Existing Environment section of the EP as well as other information sources such as the Woodside Baseline Environmental Studies Database.

The starting point for decision-making on which SMPs are activated, and the spatial extent of monitoring activities, will be based on the predictive modelling results (OM01) in the first 24-48 hours until more information is made available from other operational monitoring activities such as aerial surveillance and shoreline surveys. Pre-emptive Baseline Areas (WHA, AMPs and State Marine Parks encompassing key ecological and socio-economic values) are a key focus of the SMP activation decision-making process, particularly, in the early spill event/response phase. As the operational monitoring progresses and further situational awareness information becomes available, it will be possible to understand the nature and scale of the spill. The SMP activation and implementation decision-making will be revisited on a daily basis to account for the updates on spill information. One of the priority focus areas in the early phase of the incident will be to identify and execute pre-emptive SMP assessments at key receptor locations, as required. The SMP activation and implementation decision tree is presented in Figure C-2.

Scientific monitoring program termination

The basis of the termination process for the active SMPs (SMPs 1-10) will include quantification of impacts, evaluation of recovery for the receptor at risk and consultation with relevant authorities, persons and organisations. Termination of each SMP will not be considered until the results (as presented in annual SMP reports for the duration of each program) indicate that the target receptor has returned to pre-spill condition.

Once the SMP results indicate impacted receptor(s) have returned to pre-spill condition (as identified by Woodside) a termination decision-making process will be triggered and a number of steps will be undertaken as follows:

- Woodside will engage expert opinion on whether the receptor has returned to pre-spill condition (based on monitoring data). Subject Matter Expert (SMEs) will be engaged (via the Woodside SME scientific monitoring terms of reference) to review program outcomes, provide expert advice and recommendations for the duration of each SMP.
- Where expert opinion agrees that the receptor has returned to pre-spill condition, findings will then be presented to the relevant authorities, persons and organisations (as defined by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulation 11A). Stakeholder identification, planning and engagement will be managed by Woodside's

Reputation Functional Support Team (FST) and follow the stakeholder management FST guidelines. These guidelines outline the FST roles and responsibilities, competencies, stakeholder communications and planning processes. An assessment of the merits of any objection to termination will be documented in the SMP final report.

- Woodside will decide on termination of SMP based on expert opinion and merits of any stakeholder objections. The final report following termination will include monitoring results, expert opinion and stakeholder consultation including merits of any objections.
- Termination of SMPs will also consider applicable management objectives, species recovery plans, conservation advices and conservations plans for any World Heritage Area (WHA), AMPs, State Marine Parks, other protected area designations (e.g., State nature reserves) and Matters of National Environmental Significance (including listed species under part 3 of the EPBC Act).

The SMP termination decision-making process will be applied to each active SMP and an iterative process of decision steps continued until each SMP has been terminated (refer to decision-tree diagram for SMP termination criteria, Figure C-3).

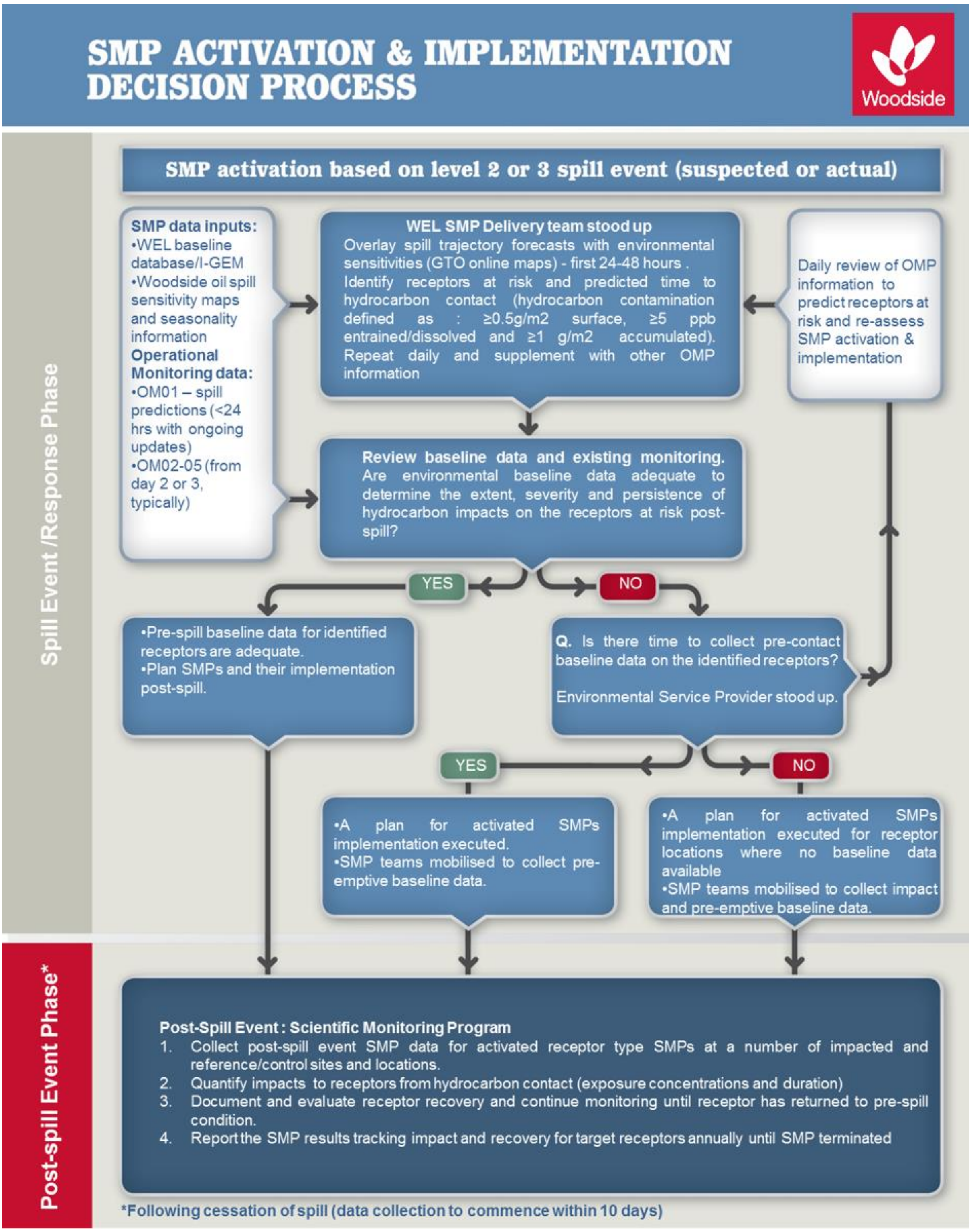

Figure C-2: Activation and Implementation Decision-tree for Oil Spill Environmental Monitoring

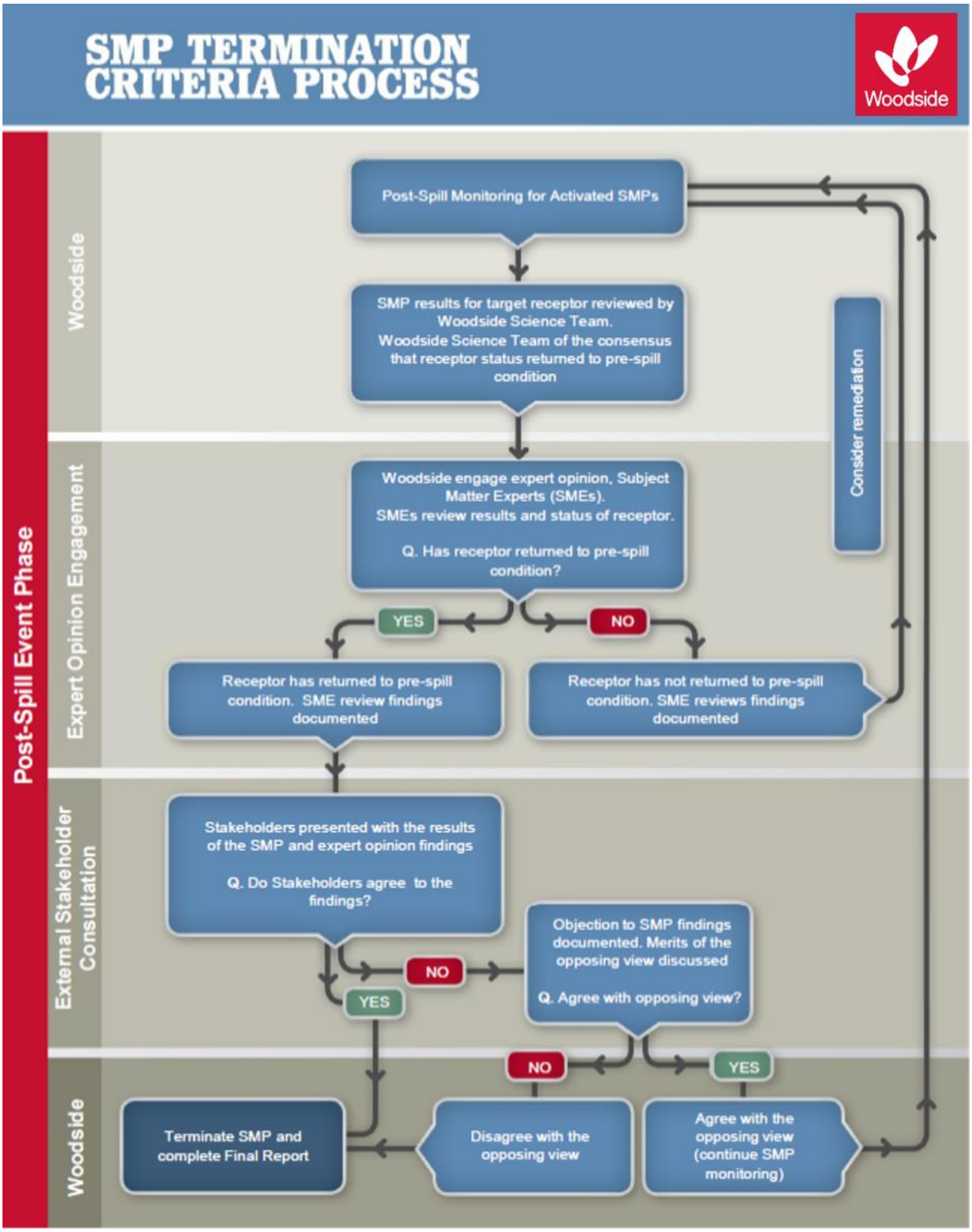

Figure C-3: Termination Criteria Decision-tree for Oil Spill Environmental Monitoring

Receptors at Risk and Baseline Knowledge

In order to assess the baseline studies available and suitability for oil spill scientific monitoring, Woodside maintains knowledge of environmental baseline studies through the upkeep and use of its Environmental Knowledge Management System.

Woodside's Environmental Knowledge Management System is a centralised platform for scientific information on the existing environment, marine biodiversity, Woodside environmental studies, key environmental impact topics, key literature and web-based resources. The system comprises a number of data directories and an environmental baseline database, as well as folders within the 'Corporate Environment' server space. The environmental baseline database was set up to support Woodside's SMP preparedness and as a SMP resource in the event of an unplanned hydrocarbon spill. The environmental baseline database is subject to updates including annual reviews completed as part of the contracted SMP standby, SMP standby contract. This database is accessed pre-PAP to identify Pre-emptive Baseline Areas (PBAs) where hydrocarbon contact is predicted to occur <10 days.

In addition to Woodside's Environmental Knowledge Management System, it is acknowledged that many relevant baseline datasets are held by other organisations (e.g. other oil and gas operators, government agencies, state and federal research institutions and non-governmental organisations). In order to understand the present status of environmental baseline studies a spatial environmental metadata database for Western Australia (Industry-Government Environmental Metadata, I-GEM) was established. IGEM is a collaboration comprising oil and gas operators (including Woodside), government and research agencies and other organisations. IGEM held data were integrated into the Department of Water and Environmental Regulation (WA) Index of Marine Surveys for Assessment (IMSA)[9] in 2020. The Index of Marine Surveys for Assessments (IMSA) is an online portal to information about marine-based environmental surveys in Western Australia. IMSA is a project of the Department of Water and Environmental Regulation for the systematic capture and sharing of marine data created as part of an environmental impact assessment (EIA). In the event of an unplanned hydrocarbon release, Woodside intends to interrogate the information on baseline studies status as held by the various databases (e.g. Woodside Environmental Knowledge Management System, IMSA and other sources of existing baseline data) to identify Pre-emptive Baseline Areas (PBAs), i.e., receptors at risk where hydrocarbon contact is predicted to be >10 days, and baseline data can be collected before hydrocarbon contact.

Reporting

For the scientific monitoring program relevant regulators will be provided with:

- Annual reports summarising the SMPs deployed and active, data collection activities and available findings; and
- Final reports for each SMP summarising the quantitative assessment of environmental impacts and recovery of the receptor once returned to pre-spill condition and termination of the monitoring program.

The reporting requirements of the scientific monitoring program will be specific to the individual SMPs deployed and terms of responsibilities, report templates, schedule, Quality Assurance/Quality Control (QA/QC) and peer-review will be agreed with the contractors engaged to conduct the SMPs. Compliance and auditing mechanisms will be incorporated into the reporting terms.

[9] https://biocollect.ala.org.au/imsa#max%3D20%26sort%3DdateCreatedSort

ANNEX D: SCIENTIFIC MONITORING PROGRAM AND BASELINE STUDIES FOR THE PETROLEUM ACTIVITIES PROGRAM

Table D-1: Oil Spill Environmental Monitoring – scientific monitoring program scope for the Petroleum Activities Program based on Spill EMBA for worse case credible spill CS-01

Note: the Commonwealth Marine Environment and Gascoyne AMP are the predicted sensitive receptors to be exposed to hydrocarbons.

Receptors to be Monitored	Applicable SMP	Receptor Areas - Potential Impact and Reference Scientific Monitoring Sites (marked X)																																							
		Kimberley AMP	Agro-Rowley Terrace AMP	Montebello AMP	Dampier AMP	Carnarvon Canyon AMP	Ningaloo AMP	Gascoyne AMP	Shark Bay Open Ocean (including AMP)	Abrolhos AMP	Jurien AMP	Two Rocks AMP	Perth Canyon AMP	Geographe AMP	South-west Corner AMP	Ashmore Reef and AMP	Seringapatam Reef	Scott Reef (North and South)	Mermaid Reef and AMP	Clerke Reef and State Marine Park	Imperieuse Reef and State Marine Park	Rankin Bank	Glomar Shoals	Rowley Shoals (including Sate Maine Park)	Fantome Shoal	Adele Island	Lacepede Islands	Montebello Islands (including State Marine Park)	Lowendal Islands (including State Nature Reserves)	Barrow Island (including State Nature Reserves, State Marine Park and Marine Management Area)	Muiron Islands (WHA, Marine Management Area)	Pilbara Islands - Southern Island Group (Serrurier, Thevenard and Bessieres Islands - State Nature Reserves)	Pilbara Islands - Northern Island Group (Sandy Island Passage Islands - State nature reserves)	Abrolhos Islands	Kimberley Coast	Dampier Peninsula	Northern Pilbara Shoreline	Ningaloo Coast (North/North West Cape, Middle and South) (WHA, and State Marine Park)	Shark Bay - Open Ocean Coast	Shark Bay (WHA, State Marine Park)	Ngari Capes State Marine Park
Habitat																																									
Water Quality	SM01	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marine Sediment Quality	SM02	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Coral Reef	SM03	X		X												X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X	X	X	X	
Seagrass / Macro-Algae	SM03	X									X					X	X	X									X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Deeper Water Filter Feeders	SM03	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X						X							X			
Mangroves and Saltmarsh	SM04																											X						X	X	X	X	X		X	
Species																																									
Sea Birds and Migratory Shorebirds (significant colonies / staging sites / coastal wetlands)	SM05	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Marine Turtles (significant nesting beaches)	SM06	X	X	X	X		X	X	X							X	X	X	X	X	X						X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Pinnipeds (significant colonies / haul-out sites)	SM07									X	X	X			X																										X
Cetaceans - Migratory Whales	SM08	X	X	X	X		X	X	X	X	X	X	X	X	X			X									X	X	X	X	X			X	X	X		X		X	X
Oceanic and Coastal Cetaceans	SM08	X	X	X	X		X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dugongs	SM08	X							X							X												X	X	X	X	X	X		X	X	X	X	X	X	
Sea Snakes	SM08	X		X	X			X	X	X						X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Whale Sharks	SM08			X			X	X										X										X	X	X	X							X			
Other Shark and Ray Populations	SM08, SM09	X	X	X	X		X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fish Assemblages	SM09	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Socio-economic																																									
Fisheries - Commercial	SM10		X	X	X	X	X	X	X	X	X	X										X	X	X	X			X	X	X		X	X	X	X	X	X	X	X	X	X
Fisheries - Traditional	SM10															X	X	X									X													X	
Tourism (incl. recreational fishing)	SM10	X		X			X	X	X		X			X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X

(dark red)	Receptor areas identified as Pre-emptive Baseline Areas (based on criteria of surface contact and/or entrained hydrocarbon contact ≤10 days (Offshore Australian Marine Parks contacted by hydrocarbons in this timeframe also noted)
(light red)	Receptor areas identified as Pre-Emptive Basline Areas in the response phase >10 days (based on criteria of surface contact and/or entrained hydrocarbon contact >10 days)
(white)	Receptor areas that may be identified as impact or reference sites in the event of major hydrocarbon release and would be identified as part of the SMP planning process

Table D-2 is not presented given the Commonwealth Marine Environment and Gascoyne AMP are the predicted sensitive receptors to be exposed to hydrocarbons no baseline studies for applicable SMPs are documented. SM01 water quality and hydrocarbon detection would be activated in the response phase of an unplanned spill event.

ANNEX E: TACTICAL RESPONSE PLANS

TACTICAL RESPONSE PLANS
Exmouth
Mangrove Bay
Turquoise Bay
Yardie Creek
Muiron Islands
Jurabi to Lighthouse Beaches Exmouth
Ningaloo Reef - Refer to Mangrove/Turquoise bay and Yardie Creek
Exmouth Gulf
Shark Bay Area 1: Carnarvon to Wooramel
Shark Bay Area 2: Wooramel to Petite Point
Shark Bay Area 3: Petite Point to Dubaut Point
Shark Bay Area 4: Dubaut Point to Herald Bight
Shark Bay Area 5: Herald Bight to Eagle Bluff
Shark Bay Area 6: Eagle Bluff to Useless Loop
Shark Bay Area 7: Useless Loop to Cape Bellefin
Shark Bay Area 8: Cape Bellefin to Steep Point
Shark Bay Area 9: Western Shores of Edel Land
Shark Bay Area 10: Dirk Hartog Island
Shark Bay Area 11: Bernier and Dorre Islands
Abrohlos Islands: Pelseart Group
Abrohlos Islands: Wallabi Group
Abrohlos Islands: Easter Group
Dampier
Rankin Bank & Glomar Shoals
Barrow and Lowendal Islands
Pilbara Islands - Southern Island Group
Montebello Is - Stephenson Channel Nth
Montebello Is Champagne Bay & Chippendale channel
Montebello Is - Claret Bay
Montebello Is - Hermite/Delta Is Channel
Montebello Is - Hock Bay
Montebello Is - North & Kelvin Channel
Montebello Is - Sherry Lagoon Entrance
Withnell Bay
Holden Bay
King Bay
No Name Bay / No Name Beach
Enderby Is -Dampier

Rosemary Island - Dampier
Legendre Is - Dampier
Karratha Gas Plant (KGP)
KGP to Whitnell Creek
KGP to Northern Shore
KGP Fire Pond & Estuary
KGP to No Name Creek
Broome
Sahul Shelf Submerged Banks and Shoals
Clerke Reef (Rowley Shoals)
Imperieuse Island (Rowley Shoals)
Mermaid Reef (Rowley Shoals)
Scott Reef
Oiled Wildlife Response
Exmouth
Dampier region
Shark Bay

APPENDIX E. NOPSEMA REPORTING FORMS

NOPSEMA Recordable Environmental Incident monthly Reporting Form
https://www.nopsema.gov.au/assets/Forms/A198750.doc

Report of an accident, dangerous occurrence or environmental incident
https://www.nopsema.gov.au/assets/Forms/N-03000-FM0831-Report-of-an-Accident-Dangerous-Occurrence-or-Environmental-Incident-Rev-8-Jan-2015-MS-Word-2010.docx

APPENDIX F. STAKEHOLDER CONSULTATION

Scarborough Drilling and Completions Environment Plan

Date: 11 October 2021

Revision: 0

TABLE OF CONTENTS

1. Consultation

1.1 Woodside Consultation Information Sheet (sent to all relevant stakeholders)

Woodside

STAKEHOLDER CONSULTATION

INFORMATION SHEET

July 2021

WA-61-L SCARBOROUGH DRILLING AND COMPLETIONS

CARNARVON BASIN, NORTH-WEST AUSTRALIA

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth). The Petroleum Activities Program is located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

The activity is planned to occur anytime within a five-year window commencing in H2 2022, pending approvals. Relevant stakeholders will be advised of the timing once determined.

The EP will cover drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells. Woodside may also need to intervene, workover or re-drill the wells. Subsea inspection, monitoring, maintenance and subsea infrastructure repair activities may also be undertaken.

Woodside is operator of the Scarborough field (within permit area WA-61-L) with a 73.5% interest. BHP Petroleum (North West Shelf) Pty Ltd holds the remaining 26.5% share in the field.

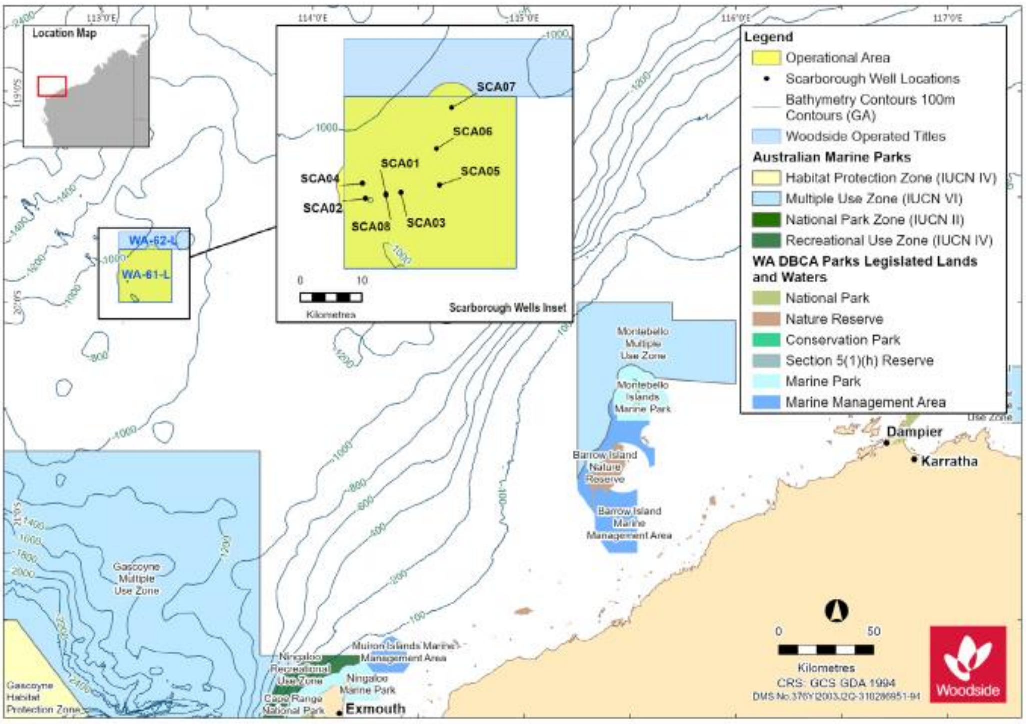

Figure 1. Proposed Scarborough Drilling and Completions Operational Area

Proposed Activity

Table 1 – Activity summary

Activity	Details
Earliest commencement date	H2 2022 pending approvals, vessel availability and weather constraints
Estimated duration	50-60 days per well
Operational Area	4,000 m for moored mobile offshore drilling unit (MODU), 500 m for dynamically positioned mobile offshore drilling unit (DPMODU)
Water depth in Operational Area	Approximately 900 m – 955 m
MODU	DPMODU with contingency for moored MODU, depending on availability and suitability for the development well locations.
Project Vessels	• Installation vessels for installing the subsea infrastructure. • Light well intervention vessel as an option for well intervention, subsea hardware installation or contingent activities. • Support vessels including installation vessel(s), anchor handling vessel(s) and general supply/support vessels.
Distance from Operational Area to nearest port/marina	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Distance from Operational Area to nearest marine park	• 83 km north of the Gascoyne Marine Park (Cwlth) • 206 km north-west of Montebello Marine Park (Cwlth) • 208 km north-northwest of Ningaloo Marine Park (Cwlth)

Drilling and completions for the development wells is expected to take approximately 50-60 days per well to complete. Subsea inspection, monitoring, maintenance and repair activities may be conducted intermittently and over short durations in the immediate vicinity of installed subsea infrastructure. Activities will be conducted 24 hours per day, seven days per week. Timing and duration of these activities is subject to change due to project schedule requirements, drill rig and vessel availability, weather and unforeseen circumstances. Technical details are outlined in Table 2.

Project vessels

Woodside is currently considering rig options for drilling of the wells, which include a moored semi-submersible MODU, a dynamically positioned drill ship or a DPMODU. Dynamic positioning is a computer-controlled system to automatically maintain a vessel or rig's position and heading by using its own propellers and thrusters. Typically, two or three vessels will support drilling activities, with at least one vessel in the vicinity to complete standby duties, if required. Supply vessels will visit the selected MODU/drill ship at regular intervals. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Communications with mariners

A petroleum safety zone of 500 m will be in place around the MODU and installation vessel for the duration of activities. The following Operational Areas will also apply:

- DPMODU/drillship – 500 m radius from each well centre
- Moored MODU – 4,000 m radius from each well centre.
- Installation vessel – 1500 m radius around subsea locations

Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.

Proposed locations

Approximate development well locations for the eight planned wells are provided in Table 2. In the event the two additional contingency wells are installed, they will be also be in WA-61-L, with all activities undertaken within the relevant Operational Area.

Implications for Stakeholders

Woodside will consult relevant stakeholders whose interests, functions, and activities may be affected by the proposed activities. We will also keep informed other stakeholders who have an identified interest in the planned activities. Woodside has undertaken an assessment to identify potential risks to the marine environment and relevant stakeholders, considering timing, duration, location and potential impacts arising from the drilling, construction and installation activities. This EP approval falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. A number of mitigation and management measures will be implemented and are summarised in Table 3. Further details will be provided in the EP.

About Scarborough

The Scarborough gas resource is located offshore, approximately 375 km west-northwest of the Burrup Peninsula and is part of the Greater Scarborough gas fields which are estimated to hold 13.0 Tcf (2C, 100%) of dry gas.

Woodside, as operator of the Scarborough Joint Venture, is proposing to develop the Scarborough gas resource through new offshore facilities connected by an approximately 430 km pipeline to a proposed expansion of the existing Pluto LNG onshore facility (Pluto Train 2).

For more information about the proposed Scarborough development, visit woodside.com.au.

Table 2 – Proposed well locations

Activity	Water Depth (Approx. m LAT)	Latitude	Longitude	Permit Area
New development wells				
SCA01 well	910	19° 53' 30.499" S	113° 08' 43.568" E	WA-61-L
SCA02 well	912	19° 53' 48.471" S	113° 06' 55.261" E	WA-61-L
SCA03 well	912	19° 53' 18.551" S	113° 10' 03.300" E	WA-61-L
SCA04 well	918	19° 52" 30.359" S	113° 06' 41.412" E	WA-61-L
SCA05 well	918	19° 52' 38.718" S	113° 13' 24.437" E	WA-61-L
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SCA08 well	909	19° 53' 27.254" S	113° 08' 43.647"E	WA-61-L
Contingent wells		Within permit area WA-61-L		

Table 3 – Summary of key risks and/or impacts and management measures.

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • Defence activities • Petroleum activities • Commercial fishing activities • Shipping activities	• Consultation with relevant petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies to inform decision making for the proposed activity and development of the EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Chemical use	• Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.
Marine fauna interactions	• Vessel masters will implement interaction management actions in accordance with the EPBC Regulations 2000.
Marine discharges	• All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable. • Drill Cuttings returned to the MODU will only be discharged if requirements relating to treatment and discharge location in the EP are met.
Seabed disturbance	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • MODU mooring analysis and anchor deployment in accordance with internal standards. • No anchoring of support and installation vessels during drilling, construction and installation activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity. • A 500 m radius petroleum safety zone will be in place around the MODU or drill ship and installation vessel for the duration of activities. • Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area around the MODU or drill ship. The Operational Area varies depending on the activity and vessel ranging from a 500 m radius for a DPMODU or 4000 m radius for a moored MODU, and a 1500 m radius around subsea installation vessel.
Waste management	• Waste generated on the vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Wastes will be managed and disposed of in a safe and environmentally responsible manner that prevents accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.

Potential Risk and/or Impact	Mitigation and/or Management Measure
Unplanned activities	

Hydrocarbon release	• Valid and appropriate Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) for all operating vessels.
	• Environment Plans and Oil Pollution Emergency Plans (OPEP) will be accepted and in place, appropriate to the credible hydrocarbon spill scenario associated with activities.
	• Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment.
	• Well Operations Management Plan accepted and in place for all wells, in accordance with the Offshore Petroleum and Greenhouse Gas Storage Act requirements, which include:
	  • Blowout Preventer (BOP) installation during drilling operations.
	  • Regular testing of BOP.

Introduction of invasive marine species	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance. • Contracted vessels comply with Australian ballast water requirements.

Providing Feedback

Our intent is to minimise environmental and social impacts associated with the proposed activities, and we are seeking any interest or comments you may have to inform our decision making. If you would like to comment on the proposed activities outlined in this information sheet, or would like additional information, please contact Woodside before 2 August 2021.

Please note that your feedback and our response will be included in our Environment Plan for the proposed activity, which will be submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

www.woodside.com.au

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan for this information to remain confidential to NOPSEMA.

Woodside Energy Ltd

E: Feedback@woodside.com.au | Toll free: 1800 442 977

Please note that stakeholder feedback will be communicated to NOPSEMA as required under legislation. Woodside will communicate any material changes to the proposed activity to affected stakeholders as they arise.

Woodside

1.2 Email sent to the following relevant stakeholders (2 July 2021)

- *DISER*
- *ABF*
- *DMIRS*
- *DoT*
- *DBCA*
- *APPEA*

Dear Stakeholder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website .

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the mobile offshore drilling unit (MODU) and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically Positioned MODU/drillship – 500 m radius from each well centre; or

- Moored MODU – 4,000 m radius from each well centre.

Subsea installation activities:

- Installation vessel – 1500 m radius around subsea locations

Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.

Vessels:

Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a dynamically positioned MODU.

A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels.

Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
New development wells				
SCA01 well	910	19° 53’ 30.499” S	113° 08’ 43.568” E	WA-61-L
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SCA08 well	909	19° 53’ 27.254” S	113° 08’ 43.647” E	WA-61-L
*Contingent wells – **located within permit area WA-61-L***				

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

Your feedback and our response will be included in our Environment Plan which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards,

Senior Corporate Affairs Adviser | Developments

1.3 Email sent to AHO (2 July 2021)

Dear Stakeholder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website . A map showing vessel density is also attached for reference.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the mobile offshore drilling unit (MODU) and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically Positioned MODU/drillship – 500 m radius from each well centre; or • Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill

ship or a Dynamically Positioned MODU.

A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels.

Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
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*Contingent wells – **located within permit area WA-61-L***				

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

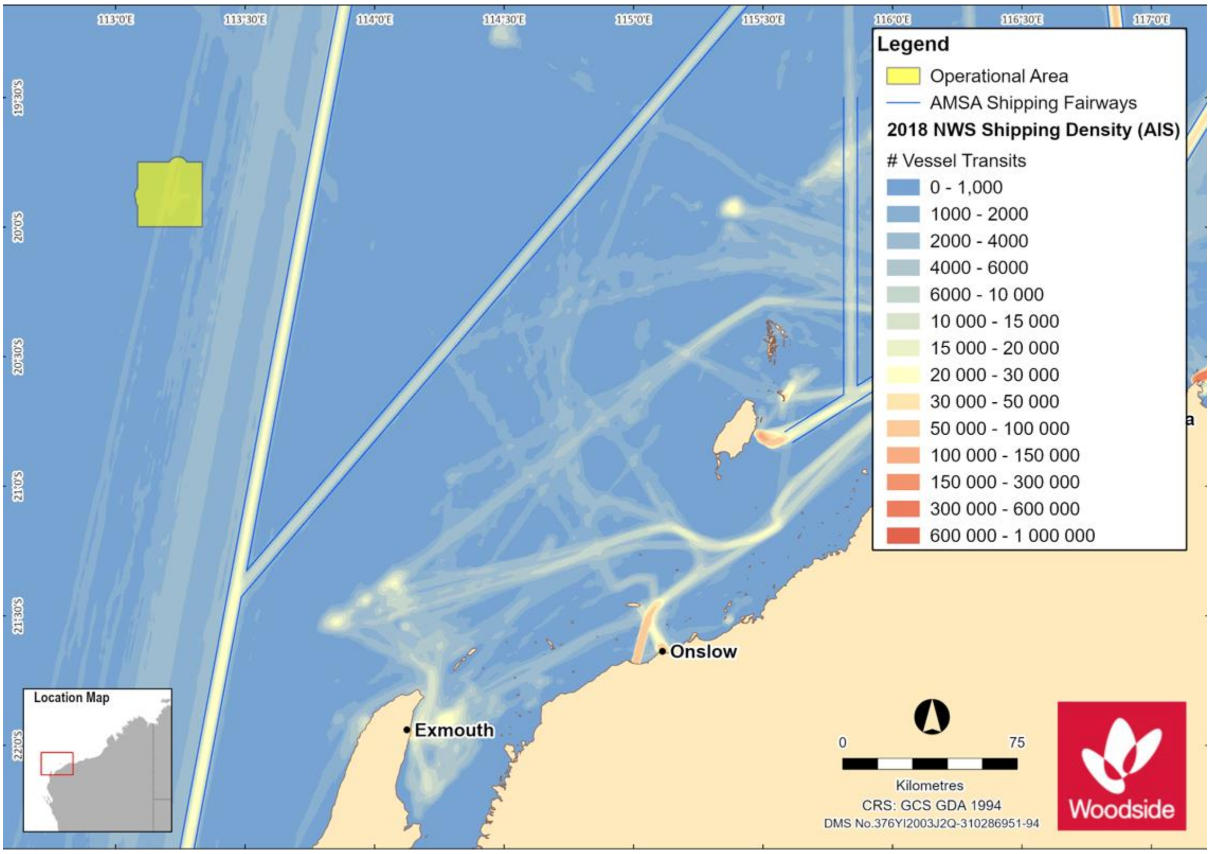
Your feedback and our response will be included in our Environment Plan which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards
Senior Corporate Affairs Adviser | Developments

1.4 Shipping lanes map sent to AHO and AMSA (2 July 2021)



1.5 Email sent to AMSA (2 July 2021)

Dear Stakeholder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

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Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the mobile offshore drilling unit (MODU) and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically Positioned MODU/drillship – 500 m radius from each well centre; or • Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a Dynamically Positioned MODU. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

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*Contingent wells – **located within permit area WA-61-L***

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

Your feedback and our response will be included in our Environment Plan which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards
Senior Corporate Affairs Adviser | Developments

1.6 Email sent to Chevron, Western Gas, ExxonMobil and Shell (2 July 2021)

Dear Stakeholder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website. A map showing the proposed activity relevant to adjacent petroleum titles is also attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here.

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Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a Dynamically Positioned MODU. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

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SCA06 well	902	19° 49’ 27.763” S	113° 13’ 08.300” E	WA-61-L
SCA07 well	907	19° 45’ 52.900” S	113° 14’ 27.449” E	WA-61-L
SCA08 well	909	19° 53’ 27.254” S	113° 08’ 43.647” E	WA-61-L
*Contingent wells – **located within permit area WA-61-L***				

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

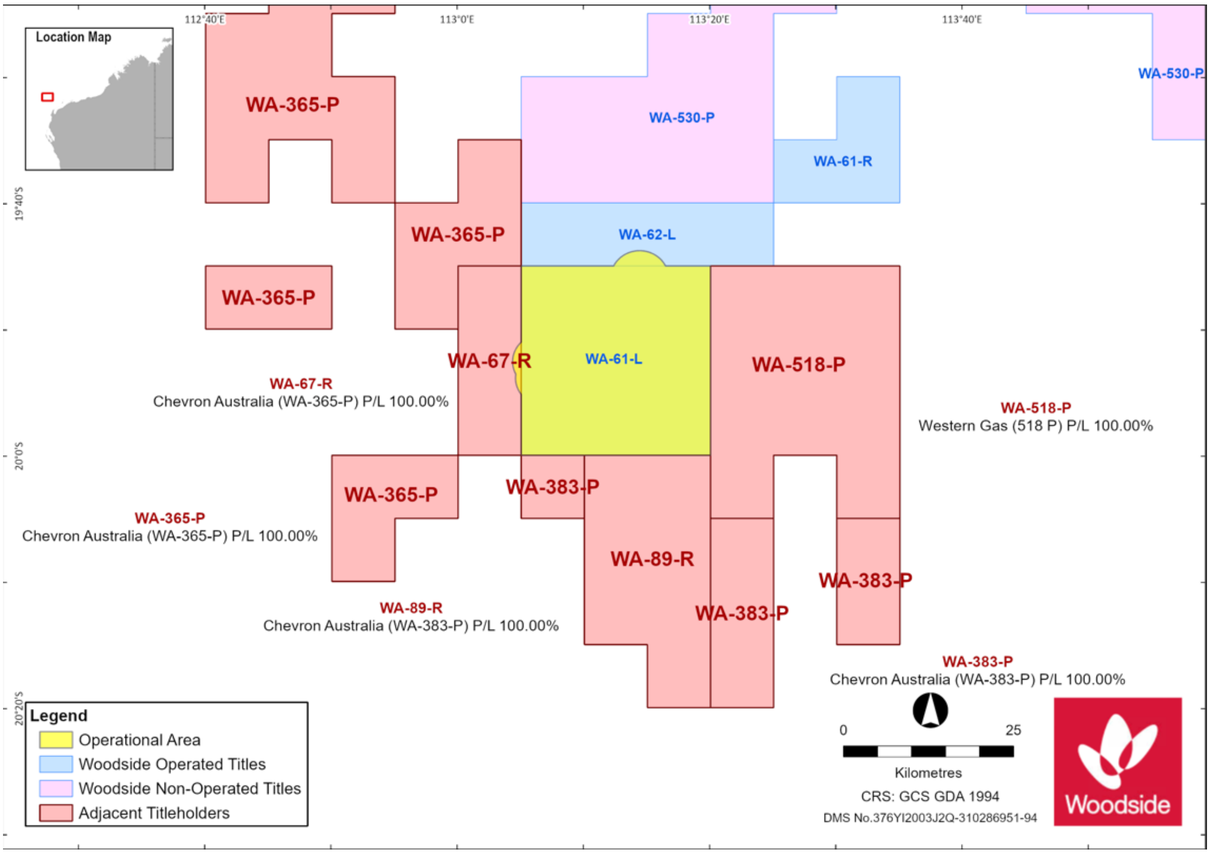
Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards
Senior Corporate Affairs Adviser | Developments

1.7 Titleholders map sent to Chevron, Western Gas, ExxonMobil, Shell (2 July 2021)



1.8 Email sent to DoD (2 July 2021)

Dear Department of Defence,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website. A map of practice and training defence areas is also attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the mobile offshore drilling unit (MODU) and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically Positioned MODU/drillship – 500 m radius from each well centre; or • Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a Dynamically Positioned MODU. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
New development wells				

SCA01 well	910	19° 53' 30.499" S	113° 08' 43.568" E	WA-61-L
SCA02 well	912	19° 53' 48.471" S	113° 06' 55.261" E	WA-61-L
SCA03 well	912	19° 53' 18.551" S	113° 10' 03.300" E	WA-61-L
SCA04 well	918	19° 52" 30.359" S	113° 06' 41.412" E	WA-61-L
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SCA08 well	909	19° 53' 27.254" S	113° 08' 43.647" E	WA-61-L
Contingent wells – ***located within permit area WA-61-L***				

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

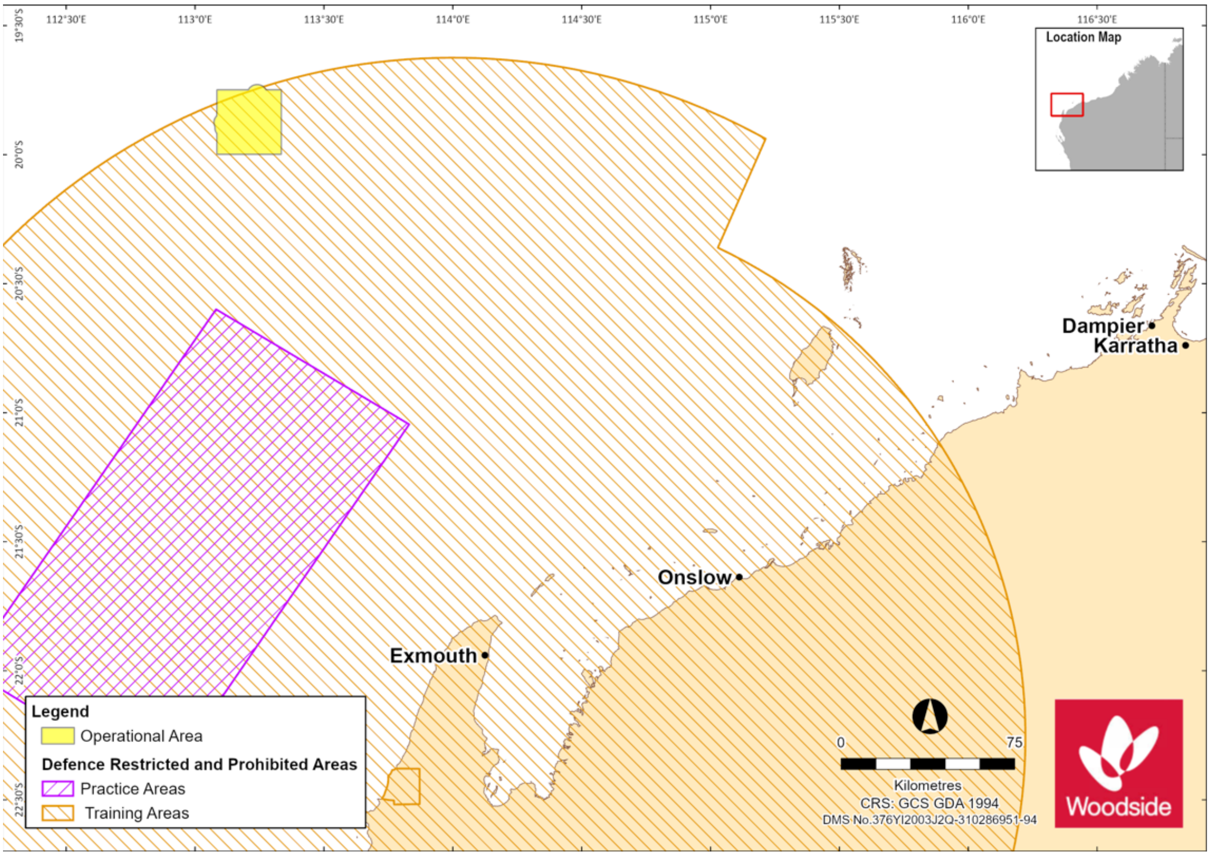
Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards
Senior Corporate Affairs Adviser | Developments

1.9 Defence map sent to DoD (2 July 2021)



1.10 Email sent to DNP (2 July 2021)

Dear Director of National Parks,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

An EP for this activity will be submitted in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

Implications for Parks Australia interests

We note Australian Government Guidance on consultation activities with respect to the proposed activities and confirm that:

- We have assessed potential impacts and risks to AMPs in the development of the proposed Environment Plan for this activity and believe that there are no credible impacts associated with planned activities that have potential to impact marine park values.
- In the unlikely event of a hydrocarbon release there is risk of hydrocarbons contacting the Abrolhos, Carnarvon Canyon, Gascoyne and Ningaloo AMPs. The worst-case credible

spill scenario assessed for this activity is a marine diesel oil spill resulting from the highly unlikely event of a vessel collision.

- A Commonwealth Government approved oil spill response plan will be in place for the duration of the activities, which includes notification to relevant agencies and organisations as to the nature and scale of the event, as soon as practicable following an occurrence. The Director of National Parks will be advised if an environmental incident occurs that may impact on the values of a marine park.

A Consultation Information Sheet about the planned activity is attached, which provides background on the activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website.

More information on the Scarborough development can be found here .

In line with Australian Government guidance on consultation with government agencies, can you please advise within 10 business days if you have any feedback on the proposed activity, noting that your feedback and our response will be included in an Environment Plan for consideration by the National Offshore Petroleum Safety and Environmental Management Authority, as is required under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

We would also be happy to meet online should you wish to discuss the proposed activity in more detail.

Regards,
Senior Corporate Affairs Adviser | Developments

1.11 Email sent to WAFIC (2 July 2021)

Dear [redacted]

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website . A map of relevant fisheries is also attached.

Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible mobile offshore drilling unit (MODU), a dynamically positioned drill ship or a Dynamically Positioned MODU.A temporary petroleum safety zone of 500 m will be in place around the MODU and installation vessel for the duration of activities. Marine users are requested to avoid this area during activity to ensure the safety of the project vessels and third-party vessels.

We have identified potential impacts to commercial fishers and the environment and have endeavoured to reduce these risks to as low as reasonably practicable. Fisheries have been identified as being relevant based on fishing area overlap with the activity area, assessment of government fishing effort data from recent years, fishing methods and water depth.

We welcome WAFIC's feedback on the activity and information provided by 2 August 2021, and subject to this feedback, we will consult individual relevant Licence Holders.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Relevant fisheries:	Commonwealth: • **Western Deepwater Trawl Fishery**
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the MODU and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically positioned MODU/drillship – 500 m radius from each well centre; or • Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a dynamically positioned MODU. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
New development wells				
SCA01 well	910	19° 53' 30.499" S	113° 08' 43.568" E	WA-61-L
SCA02 well	912	19° 53' 48.471" S	113° 06' 55.261" E	WA-61-L
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SCA08 well	909	19° 53' 27.254" S	113° 08' 43.647" E	WA-61-L
*Contingent wells – **located within permit area WA-61-L***				

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • ***Defence activities*** • ***Petroleum activities*** • ***Commercial fishing activities*** • ***Shipping activities***	• Consultation with petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies to inform decision making for the proposed activity and development of the EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Chemical use	• Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.
Marine discharges	• All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable.

	• Drill Cuttings returned to the MODU will only be discharged if requirements relating to treatment and discharge location in the EP are met.
Seabed disturbance	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • MODU mooring analysis and anchor deployment in accordance with internal standards. • No anchoring of support and installation vessels during drilling, construction and installation activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity. • A temporary 500 m radius petroleum safety zone will be in place around the MODU or drill ship and installation vessel for the duration of activities. • Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area around the MODU or drill ship. The Operational Area varies depending on the activity and vessel ranging from a 500 m radius for a DPMODU or 4000 m radius for a moored MODU, and a 1500 m radius around subsea installation vessel.
Waste management	• Waste generated on the vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Wastes will be managed and disposed of in a safe and environmentally responsible manner that prevents accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
Hydrocarbon release	• Valid and appropriate Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) for all operating vessels. • Environment Plans and Oil Pollution Emergency Plans (OPEP) will be accepted and in place, appropriate to the credible hydrocarbon spill scenario associated with activities.

	• Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment.
	• Well Operations Management Plan accepted and in place for all wells, in accordance with the Offshore Petroleum and Greenhouse Gas Storage Act requirements, which include:
	  ○ Blowout Preventer (BOP) installation during drilling operations.
	  ○ Regular testing of BOP.

Introduction of invasive marine species	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance. • Contracted vessels comply with Australian ballast water requirements.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

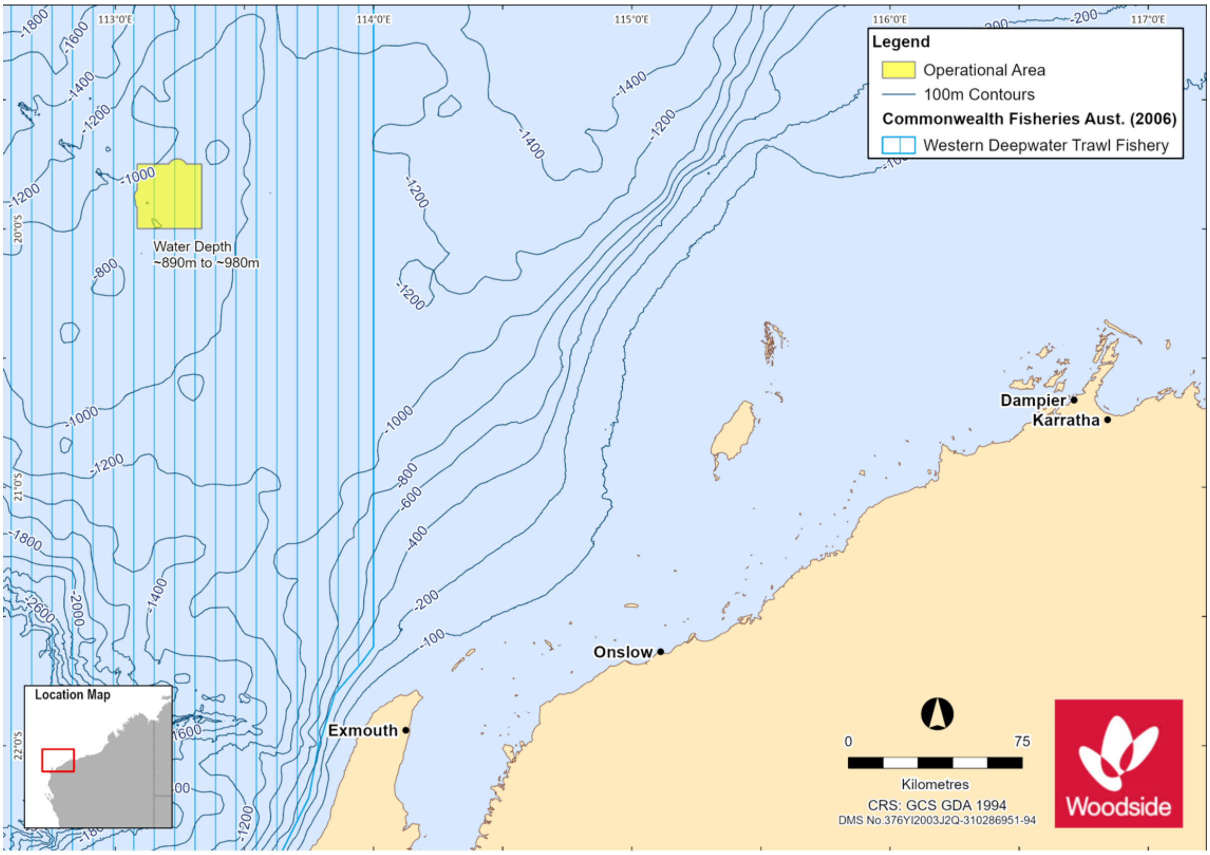
Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards
Senior Corporate Affairs Adviser | Developments

1.12 Fisheries map sent to WAFIC, AFMA, CFA, DPIRD, DAWE, PPA, Western Deepwater Trawl Licence Holders (2 July 2021)



1.13 Email sent to AFMA (2 July 2021)

Dear Stakeholder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website . A map of relevant fisheries is also attached.

Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible mobile offshore drilling unit (MODU), a dynamically positioned drill ship or a dynamically positioned MODU. A temporary petroleum safety zone of 500 m will be in place around the MODU and installation vessel for the duration of activities. Marine users are requested to avoid this area during activity to ensure the safety of the project vessels and third-party vessels.

We have identified potential impacts to commercial fishers and the environment and have endeavoured to reduce these risks to as low as reasonably practicable. Fisheries have been identified as being relevant based on fishing area overlap with the activity area, assessment of government fishing effort data from recent years, fishing methods and water depth.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Relevant fisheries:	Commonwealth: • **Western Deepwater Trawl Fishery**
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the MODU and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically positioned MODU/drillship – 500 m radius from each well centre; or • Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a dynamically positioned MODU. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
New development wells				
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SCA05 well	918	19° 52' 38.718" S	113° 13' 24.437" E	WA-61-L
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SCA08 well	909	19° 53' 27.254" S	113° 08' 43.647" E	WA-61-L
*Contingent wells – **located within permit area WA-61-L***				

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • ***Defence activities*** • ***Petroleum activities*** • ***Commercial fishing activities*** • ***Shipping activities***	• Consultation with petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies to inform decision making for the proposed activity and development of the EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Chemical use	• Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.
Marine discharges	• All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable.

	• Drill Cuttings returned to the MODU will only be discharged if requirements relating to treatment and discharge location in the EP are met.
Seabed disturbance	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • MODU mooring analysis and anchor deployment in accordance with internal standards. • No anchoring of support and installation vessels during drilling, construction and installation activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity. • A temporary 500 m radius petroleum safety zone will be in place around the MODU or drill ship and installation vessel for the duration of activities • Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area around the MODU or drill ship. The Operational Area varies depending on the activity and vessel ranging from a 500 m radius for a DPMODU or 4000 m radius for a moored MODU, and a 1500 m radius around subsea installation vessel.
Waste management	• Waste generated on the vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Wastes will be managed and disposed of in a safe and environmentally responsible manner that prevents accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
Hydrocarbon release	• Valid and appropriate Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) for all operating vessels. • Environment Plans and Oil Pollution Emergency Plans (OPEP) will be accepted and in place, appropriate to the credible hydrocarbon spill scenario associated with activities.

	• Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment.
	• Well Operations Management Plan accepted and in place for all wells, in accordance with the Offshore Petroleum and Greenhouse Gas Storage Act requirements, which include:
	  o Blowout Preventer (BOP) installation during drilling operations.
	  o Regular testing of BOP.

Introduction of invasive marine species	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance. • Contracted vessels comply with Australian ballast water requirements.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards
Senior Corporate Affairs Adviser | Developments

1.14 Email sent to CFA (2 July 2021)

Dear Stakeholder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website . A map of relevant fisheries is also attached.

Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible mobile offshore drilling unit (MODU), a dynamically positioned drill ship or a dynamically positioned MODU. A temporary petroleum safety zone of 500 m will be in place around the MODU and installation vessel for the duration of activities. Marine users are requested to avoid this area during activity to ensure the safety of the project vessels and third-party vessels.

We have identified potential impacts to commercial fishers and the environment and have endeavoured to reduce these risks to as low as reasonably practicable. Fisheries have been identified as being relevant based on fishing area overlap with the activity area, assessment of government fishing effort data from recent years, fishing methods and water depth.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Relevant fisheries:	Commonwealth: • **Western Deepwater Trawl Fishery**
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the MODU and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically positioned MODU/drillship – 500 m radius from each well centre; or • Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a

dynamically positioned drill ship or a dynamically positioned MODU.

A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels.

Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
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*Contingent wells – **located within permit area WA-61-L***				

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • ***Defence activities*** • ***Petroleum activities*** • ***Commercial fishing activities*** • ***Shipping activities***	• Consultation with petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies to inform decision making for the proposed activity and development of the EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.

Chemical use	• Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.
Marine discharges	• All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable. • Drill Cuttings returned to the MODU will only be discharged if requirements relating to treatment and discharge location in the EP are met.
Seabed disturbance	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • MODU mooring analysis and anchor deployment in accordance with internal standards. • No anchoring of support and installation vessels during drilling, construction and installation activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity. • A temporary 500 m radius petroleum safety zone will be in place around the MODU or drill ship and installation vessel for the duration of activities • Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area around the MODU or drill ship. The Operational Area varies depending on the activity and vessel ranging from a 500 m radius for a DPMODU or 4000 m radius for a moored MODU, and a 1500 m radius around subsea installation vessel.
Waste management	• Waste generated on the vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Wastes will be managed and disposed of in a safe and environmentally responsible manner that prevents accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	
Hydrocarbon release	• Valid and appropriate Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine

	Pollution Emergency Plan (SMPEP) for all operating vessels.
	
	• Environment Plans and Oil Pollution Emergency Plans (OPEP) will be accepted and in place, appropriate to the credible hydrocarbon spill scenario associated with activities.
	
	• Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment.
	
	• Well Operations Management Plan accepted and in place for all wells, in accordance with the Offshore Petroleum and Greenhouse Gas Storage Act requirements, which include:
	    ○ Blowout Preventer (BOP) installation during drilling operations.
	    ○ Regular testing of BOP.

Introduction of invasive marine species	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance. • Contracted vessels comply with Australian ballast water requirements.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards
Senior Corporate Affairs Adviser | Developments

1.15 Email sent to DPIRD (2 July 2021)

Dear Stakeholder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website . A map of relevant fisheries is also attached.

Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible mobile offshore drilling unit (MODU), a dynamically positioned drill ship or a dynamically positioned MODU. A temporary petroleum safety zone of 500 m will be in place around the MODU and installation vessel for the duration of activities. Marine users are requested to avoid this area during activity to ensure the safety of the project vessels and third-party vessels.

We have identified potential impacts to commercial fishers and the environment and have endeavoured to reduce these risks to as low as reasonably practicable. Fisheries have been identified as being relevant based on fishing area overlap with the activity area, assessment of government fishing effort data from recent years, fishing methods and water depth.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Relevant fisheries:	Commonwealth: • **Western Deepwater Trawl Fishery**
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the MODU and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically positioned MODU/drillship – 500 m radius from each well centre; or

	• Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a dynamically positioned MODU. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
New development wells				
SCA01 well	910	19° 53’ 30.499” S	113° 08’ 43.568” E	WA-61-L
SCA02 well	912	19° 53’ 48.471” S	113° 06’ 55.261” E	WA-61-L
SCA03 well	912	19° 53’ 18.551” S	113° 10’ 03.300” E	WA-61-L
SCA04 well	918	19° 52” 30.359” S	113° 06’ 41.412” E	WA-61-L
SCA05 well	918	19° 52’ 38.718” S	113° 13’ 24.437” E	WA-61-L
SCA06 well	902	19° 49’ 27.763” S	113° 13’ 08.300” E	WA-61-L
SCA07 well	907	19° 45’ 52.900” S	113° 14’ 27.449” E	WA-61-L
SCA08 well	909	19° 53’ 27.254” S	113° 08’ 43.647” E	WA-61-L
*Contingent wells – **located within permit area WA-61-L***				

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	

Interests of relevant stakeholders with respect to: • ***Defence activities*** • ***Petroleum activities*** • ***Commercial fishing activities*** • ***Shipping activities***	• Consultation with petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies to inform decision making for the proposed activity and development of the EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Chemical use	• Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.
Marine discharges	• All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable. • Drill Cuttings returned to the MODU will only be discharged if requirements relating to treatment and discharge location in the EP are met.
Seabed disturbance	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • MODU mooring analysis and anchor deployment in accordance with internal standards. • No anchoring of support and installation vessels during drilling, construction and installation activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity. • A temporary 500 m radius petroleum safety zone will be in place around the MODU or drill ship and installation vessel for the duration of activities • Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area around the MODU or drill ship. The Operational Area varies depending on the activity and vessel ranging from a 500 m radius for a DPMODU or 4000 m radius for a moored MODU, and a 1500 m radius around subsea installation vessel.

Waste management	• Waste generated on the vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Wastes will be managed and disposed of in a safe and environmentally responsible manner that prevents accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	

Hydrocarbon release	• Valid and appropriate Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) for all operating vessels.
	• Environment Plans and Oil Pollution Emergency Plans (OPEP) will be accepted and in place, appropriate to the credible hydrocarbon spill scenario associated with activities.
	• Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment.
	• Well Operations Management Plan accepted and in place for all wells, in accordance with the Offshore Petroleum and Greenhouse Gas Storage Act requirements, which include:
	    ○ Blowout Preventer (BOP) installation during drilling operations.
	    ○ Regular testing of BOP.

Introduction of invasive marine species	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance. • Contracted vessels comply with Australian ballast water requirements.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards

Senior Corporate Affairs Adviser | Developments

1.16 Email sent to DAWE (2 July 2021)

Dear DAWE,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website. A map of relevant fisheries is also attached.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Relevant fisheries:	Commonwealth: • **Western Deepwater Trawl Fishery**
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the MODU and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities:

	• Dynamically Positioned MODU/drillship – 500 m radius from each well centre; or • Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a Dynamically Positioned MODU. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
New development wells				
SCA01 well	910	19° 53’ 30.499” S	113° 08’ 43.568” E	WA-61-L
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*Contingent wells – **located within permit area WA-61-L***				

Implications for DAWE’s interests:

We have identified and assessed potential risks and impacts to active Commonwealth commercial fishers, biosecurity matters and the marine environment that overlap the proposed Operational Area in the development of the proposed Environment Plan for this activity.

Woodside has endeavoured to reduce these risks to an as low as reasonably practicable (ALARP) level.

Commercial fishing implications:

One Commonwealth-managed fishery has been identified as being relevant to the proposed Activity, this being the **Western Deepwater Trawl Fishery.**

Woodside will consult licence holders in this fishery, including the provision of a fact sheet specific to commercial fishing interests.

Fisheries were assessed for relevance on the basis of fishing licence overlap with the Operational Area, as well as consideration of government fishing effort data from recent years, fishing methods, and water depth.

Biosecurity implications:

With respect to the biosecurity matters, please note the following information below.

Potential IMS risk	***IMS mitigation management***
Introduction and establishment of IMS.	Vessels are required to comply with the Australian Biosecurity Act 2015, specifically the Australian Ballast Water Management Requirements (as defined under the Biosecurity Act 2015) (aligned with the International Convention for the Control and Management of Ships' Ballast Water and Sediments) to prevent introducing IMS. Vessels will be assessed and managed to prevent the introduction of invasive marine species in accordance with Woodside's Invasive Marine Species Management Plan. Woodside's Invasive Marine Species Management Plan includes a risk assessment process that is applied to vessels undertaking Activities. Based on the outcomes of each IMS risk assessment, Management measures commensurate with the risk (such as the treatment of internal systems, IMS inspections or cleaning) will be implemented to minimise the likelihood of IMS being introduced.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards

Senior Corporate Affairs Adviser | Developments

1.17 Email sent to PPA (2 July 2021)

Dear Stakeholder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website . A map of relevant fisheries is also attached.

Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible mobile offshore drilling unit (MODU), a dynamically positioned drill ship or a dynamically positioned MODU. A temporary petroleum safety zone of 500 m will be in place around the MODU and installation vessel for the duration of activities. Marine users are requested to avoid this area during activity to ensure the safety of the project vessels and third-party vessels.

We have identified potential impacts to commercial fishers and the environment and have endeavoured to reduce these risks to as low as reasonably practicable. Fisheries have been identified as being relevant based on fishing area overlap with the activity area, assessment of government fishing effort data from recent years, fishing methods and water depth.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints
Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Relevant fisheries:	Commonwealth: • **Western Deepwater Trawl Fishery**
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the MODU and installation vessel for the duration of activities.

The following Operational Areas will also apply:

Drilling activities:

- Dynamically positioned MODU/drillship – 500 m radius from each well centre; or
- Moored MODU – 4,000 m radius from each well centre.

Subsea installation activities:

- Installation vessel – 1500 m radius around subsea locations

Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.

Vessels:

Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a dynamically positioned MODU.

A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels.

Support vessels are also required for inspection, monitoring, maintenance and repair activities.

Scarborough Well Locations:

Subsea Wells	Water Depth (m)	Latitude	Longitude	Permit Area
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*Contingent wells – **located within permit area WA-61-L***				

Potential risks to commercial fishing and proposed mitigation

measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • ***Defence activities*** • ***Petroleum activities*** • ***Commercial fishing activities*** • ***Shipping activities***	• Consultation with petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies to inform decision making for the proposed activity and development of the EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Chemical use	• Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.
Marine discharges	• All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside's Environmental Performance Standards where applicable. • Drill Cuttings returned to the MODU will only be discharged if requirements relating to treatment and discharge location in the EP are met.
Seabed disturbance	• Infrastructure will be positioned on the seabed within design footprint to reduce seabed disturbance. • MODU mooring analysis and anchor deployment in accordance with internal standards. • No anchoring of support and installation vessels during drilling, construction and installation activities.
Vessel interaction	• Woodside will notify relevant fishery stakeholders and government maritime safety agencies of specific start and end dates, specific vessel-on-location dates and any exclusion zones prior to commencement of the activity. • A temporary 500 m radius petroleum safety zone will be in place around the MODU or drill ship and installation vessel for the duration of activities • Commercial fishers and other marine users are permitted to use but should take care when entering the Operational Area around the MODU or drill ship. The Operational Area varies depending on the activity

	and vessel ranging from a 500 m radius for a DPMODU or 4000 m radius for a moored MODU, and a 1500 m radius around subsea installation vessel.
Waste management	• Waste generated on the vessels will be managed in accordance with legislative requirements and a Waste Management Plan. • Wastes will be managed and disposed of in a safe and environmentally responsible manner that prevents accidental loss to the environment. • Wastes transported onshore will be sent to appropriate recycling or disposal facilities by a licensed waste contractor.
Unplanned activities	

Hydrocarbon release	• Valid and appropriate Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) for all operating vessels.
	• Environment Plans and Oil Pollution Emergency Plans (OPEP) will be accepted and in place, appropriate to the credible hydrocarbon spill scenario associated with activities.
	• Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment.
	• Well Operations Management Plan accepted and in place for all wells, in accordance with the Offshore Petroleum and Greenhouse Gas Storage Act requirements, which include:
	  ○ Blowout Preventer (BOP) installation during drilling operations.
	  ○ Regular testing of BOP.

Introduction of invasive marine species	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance. • Contracted vessels comply with Australian ballast water requirements.

Feedback:

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Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 2 August 2021.

Regards

Senior Corporate Affairs Adviser | Developments

1.18 Email sent to Western Deepwater Trawl Licence Holders (2 July 2021)

Dear Licence Holder,

Woodside is planning to submit an Environment Plan (EP) for Scarborough drilling and completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia.

A Consultation Information Sheet is attached, which provides background on the proposed activity, including a summary of potential key risk and associated management measures. The Information Sheet is also available on our website . A map of relevant fisheries is also attached.

Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible mobile offshore drilling unit (MODU), a dynamically positioned drill ship or a dynamically positioned MODU. A temporary petroleum safety zone of 500 m will be in place around the MODU and installation vessel for the duration of activities. Marine users are requested to avoid this area during activity to ensure the safety of the project vessels and third-party vessels.

We have identified potential impacts to commercial fishers and the environment and have endeavoured to reduce these risks to as low as reasonably practicable. Fisheries have been identified as being relevant based on fishing area overlap with the activity area, assessment of government fishing effort data from recent years, fishing methods and water depth.

This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the Scarborough development can be found here .

Activity:

Summary:	Drilling and subsea tree installation activities for eight planned development wells and the potential for a further two additional contingency wells.
Location:	244 km north-northwest of Exmouth, 374 km west-northwest of Dampier
Approx. Water Depth (m):	~ 900 m – 955 m
Schedule:	H2 2022 pending approvals, vessel availability and weather constraints

Duration:	~ 50-60 days per well. Activities will be conducted 24 hours per day, seven days per week.
Relevant fisheries:	Commonwealth: • **Western Deepwater Trawl Fishery**
Exclusionary/Cautionary Zone:	A temporary petroleum safety zone (exclusion zone) of 500 m will be in place around the MODU and installation vessel for the duration of activities. The following Operational Areas will also apply: Drilling activities: • Dynamically positioned MODU/drillship – 500 m radius from each well centre; or • Moored MODU – 4,000 m radius from each well centre. Subsea installation activities: • Installation vessel – 1500 m radius around subsea locations Marine notices will be issued prior to activity commencement to alert vessels which may be operating in waters nearby.
Vessels:	Woodside is currently considering rig options for drilling of the wells which include a moored semi-submersible MODU, a dynamically positioned drill ship or a dynamically positioned MODU. A subsea installation vessel will be used for the installation of the subsea infrastructure, with support from additional dedicated vessels. Support vessels are also required for inspection, monitoring, maintenance and repair activities.

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*Contingent wells – **located within permit area WA-61-L***				

Potential risks to commercial fishing and proposed mitigation measures:

Potential Risk and/or Impact	Mitigation and/or Management Measure
Planned activities	
Interests of relevant stakeholders with respect to: • ***Defence activities*** • ***Petroleum activities*** • ***Commercial fishing activities*** • ***Shipping activities***	• Consultation with petroleum titleholders, commercial fishers and their representative organisations, and government departments and agencies to inform decision making for the proposed activity and development of the EP. • Advice to relevant stakeholders prior to the commencement of activities. • All vessels within the Scarborough activity area will adhere to the navigation safety requirements including the Navigation Act 2012 and any subsequent Marine Orders.
Chemical use	• Chemicals will be selected with the lowest practicable environmental impacts and risks subject to technical constraints.
Marine discharges	• All routine marine discharges will be managed according to legislative and regulatory requirements and Woodside’s Environmental Performance Standards where applicable. • Drill Cuttings returned to the MODU will only be discharged if requirements relating to treatment and discharge location in the EP are met.
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	Operational Area around the MODU or drill ship. The Operational Area varies depending on the activity and vessel ranging from a 500 m radius for a DPMODU or 4000 m radius for a moored MODU, and a 1500 m radius around subsea installation vessel.
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Hydrocarbon release	• Valid and appropriate Shipboard Oil Pollution Emergency Plan (SOPEP) or Shipboard Marine Pollution Emergency Plan (SMPEP) for all operating vessels.
	• Environment Plans and Oil Pollution Emergency Plans (OPEP) will be accepted and in place, appropriate to the credible hydrocarbon spill scenario associated with activities.
	• Appropriate refuelling procedures and equipment will be used to prevent spills to the marine environment.
	• Well Operations Management Plan accepted and in place for all wells, in accordance with the Offshore Petroleum and Greenhouse Gas Storage Act requirements, which include:
	  o Blowout Preventer (BOP) installation during drilling operations.
	  o Regular testing of BOP.

Introduction of invasive marine species	• All vessels will be assessed and managed as appropriate to prevent the introduction of invasive marine species. • Compliance with Australian biosecurity requirements and guidance. • Contracted vessels comply with Australian ballast water requirements.

Feedback:

If you have any issues or concerns with these activities, any other issues relevant to this location then please respond to Woodside at:
Feedback@woodside.com.au or 1800 442 977

Your feedback and our response will be included in our Environment Plans which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your views by 12 August 2021.

Regards
Senior Corporate Affairs Adviser | Developments

1.19 Email sent to CCWA (20 August 2021)

Dear [redacted]

Thank you for your letter (*Scarborough Offshore Gas Project – Upcoming draft Environment Plans – Thursday, 12 August 2021).* Woodside consults with relevant stakeholders for all of our activities.

Woodside is planning to submit an Environment Plan (EP) for Scarborough Drilling and Completions activities located in Permit Area WA-61-L in Commonwealth waters, about 374 km west-northwest of Dampier, Western Australia. Our Consultation Information Sheet for our Scarborough Drilling and Completions activity including feedback details has been on our website since 2 July 2021 and is attached.

The Consultation Information Sheet provides background on the proposed activity, including a summary of potential key risk and associated management measures.
This EP falls under the primary environmental approval of the Scarborough Offshore Project Proposal (OPP) and will be conducted in line with relevant requirements of the OPP. Woodside is proposing four Commonwealth EPs for the Scarborough development and will consult with all relevant stakeholders ahead of each EP.

More information on the proposed Scarborough development can be found here.

If you have any comments about these activities in this location then please respond to Woodside at: Feedback@woodside.com.au or 1800 442 977.

Your feedback and our response will be included in our Environment Plan which will be submitted to submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for acceptance in accordance with the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (Cth).

Please let us know if your feedback for this activity is sensitive and we will make this known to NOPSEMA upon submission of the Environment Plan in order for this information to remain confidential to NOPSEMA.

Please provide your feedback by **20 September 2021.**

Woodside Feedback

1.20 Email sent to AMSA (6 October 2021)

Dear [redacted]

As part of Woodside's ongoing consultation for its current and planned activities, I would like to advise the Australian Maritime Safety Authority (AMSA) that Woodside is preparing the Scarborough Drilling & Completions Environment Plan, located in permit WA-61-L, and would like to offer AMSA the opportunity to review or provide comment on the attached Scarborough Drilling & Completions First Strike Plan.

Information is presented as follows:

The Scarborough Drilling & Completions First Strike Plan is attached. This will form part of the approval submission in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is available on our website here, providing information on the proposed activities.

Woodside propose to submit an EP on 1st November 2021 to support these activities.

Should you require additional information or have a comment to make about the proposed activity, please contact myself by close of business 25th October to allow us sufficient time to inform our activity planning and EP development.

Comments can be made by email, letter or by phone.

Please be aware that your feedback will be communicated to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), as is required under legislation.

We look forward to hearing from you.

Many thanks,
Hydrocarbon Spill Coordinator | Security & Emergency Management

1.21 Email sent to DoT (6 October 2021)

Dear [redacted]

As part of Woodside's ongoing consultation for its current and planned activities, I would like to advise WA Department of Transport (DoT) that Woodside is preparing the Scarborough Drilling & Completions Environment Plan, located in permit WA-61-L, and would like to offer DoT the opportunity to review or provide comment on the attached Scarborough Drilling & Completions First Strike Plan.

Information is presented as follows:

The Scarborough Drilling & Completions First Strike Plan is attached. This will form part of the approval submission in accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth).

A Consultation Information Sheet is available on our website here, providing information on the proposed activities.

In the table below, as requested in the Offshore Petroleum Industry Guidance Note (July 2020) and from recent engagement activities between DoT and Woodside, responses to the information requirements in a succinct summary and source of information.

Woodside propose to submit an EP on 1st November 2021 to support these activities.

Should you require additional information or have a comment to make about the proposed activity, please contact myself by close of business 25th October to allow us sufficient time to inform our activity planning and EP development.

Comments can be made by email, letter or by phone.

Please be aware that your feedback will be communicated to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), as is required under legislation.

We look forward to hearing from you.

Many thanks,

[redacted]

<table>
<tr><td colspan="4">[redacted]</td></tr>
<tr><td>Description of activity, including the intended schedule, location (including coordinates), distance to nearest landfall and map.</td><td colspan="3">Included in the consultation information sheet</td></tr>
<tr><td>Worst case spill volumes.</td><td colspan="3">Included in Appendix A of the First Strike Plan</td></tr>
<tr><td>Known or indicative oil type/properties.</td><td colspan="3">Included in Appendix A of the First Strike Plan</td></tr>
<tr><td>Amenability of oil to dispersants and window of opportunity for dispersant efficacy.</td><td colspan="3">Dispersant is not deemed to be suitable for marine diesel spill or dry gas release.</td></tr>
<tr><td>Description of existing environment and protection priorities.</td><td colspan="3">Included in section 4 of the First Strike Plan</td></tr>
<tr><td>Details of the environmental risk assessment related to marine oil pollution - describe the process and key outcomes around risk identification, risk analysis, risk evaluation and risk treatment. For further information see the Oil Pollution Risk Management Information Paper (NOPSEMA 2017).</td><td colspan="3">Unplanned loss of containment events from the Petroleum Activities Program have been identified during the risk assessment process (presented in Section 7 of the EP). Further descriptions of risk, impacts and mitigation measures (which are not related to hydrocarbon preparedness and response) are provided in Section 7 of the EP. One unplanned events or credible spill scenarios for the Petroleum Activities Program has been selected as representative across types, sources and incident/response levels, up to and including the WCCS.
Table 2-1 of the OSPRMA presents the credible scenarios for the Petroleum Activities Program. One worst-case credible scenario (CS-01) and one other credible scenario (CS-03) have been used for response planning purposes for the activity as all other scenarios are of a lesser scale and extent. By demonstrating capability to meet and manage an event of this size and timescale, Woodside assumes relevant scenarios that are smaller in nature and scale can also be managed by the same capability.
Response performance outcomes have been defined based on a response to the WCCS.</td></tr>
<tr><td rowspan="2">Outcomes of oil spill trajectory modelling, including predicted times to enter State waters and contact shorelines.</td><td></td><td colspan="2">[redacted]</td></tr>
<tr><td>Shoreline receptors</td><td>No contact</td><td>N/A – dry gas</td></tr>
<tr><td>Details on initial response actions and key activation timeframes.</td><td colspan="3">Included in Section 2 and 3 of the First Strike Plan</td></tr>
<tr><td>Potential Incident Control Centre arrangements.</td><td colspan="3">Included in Appendix E and F of the First Strike Plan</td></tr>
</table>

Potential staging areas / Forward Operating Base.	A Forward Operating Base can be established at Exmouth and/ or Dampier.
Details on response strategies.	Included in Section 2 and 3 of the First Strike Plan
Use of DoT equipment resources	Woodside has access to its own and contracted stockpiles of response equipment and acknowledges that potential use of DoT resources cannot be assumed and is at the discretion of DoT.
Details and diagrams on proposed IMT structure including integration of DoT arrangements as per this IGN.	Included in Appendix E and F of the First Strike Plan
Details on testing of arrangements of OPEP/OSCP.	Level 1 Response – one Level 1 First Strike drill conducted within two weeks of commencing activity and then at least every 6 month hire period thereafter. Level 2 Response – A minimum of one Emergency Management exercise per MODU per campaign [Note: must be conducted within one month of campaign commencing and at least one Level 2 exercise per 6 month hire period]. Level 3 Response – the number of CMT exercises conducted each year is determined by the Chief Executive Officer, in consultation with the Vice President of Security and Emergency Management. Testing of Oil Spill Response Arrangements There are a number of arrangements which in the event of a spill will underpin Woodside's ability to implement a response across its petroleum activities. In order to ensure each of these arrangements is adequately tested, the Hydrocarbon Spill Preparedness Capability and Competency Coordinator ensures tests are conducted in alignment with the Hydrocarbon Spill Arrangements Testing Schedule (Woodside Doc No. 10058092). Woodside's Hydrocarbon Spill Preparedness & Response Testing Schedule aligns with international good practice for spill preparedness & response management; the testing is compatible with the IPIECA Good Practice Guide and the Australian Emergency Management Institute Handbook. The Hydrocarbon Spill Arrangements Testing Schedule (Woodside Doc No. 10058092) identifies the type of test which will be conducted annually for each arrangement, and how this type will vary over a five year rolling schedule. Testing methods may include (but are not limited to): audits, drills, field exercises, functional workshops, assurance reporting, assurance monitoring and reviews of key external dependencies. Activity specific Oil Spill Pollution First Strike Plans are developed to meet the response needs of that particular activity's Worst Credible Spill Scenario (WCCS). The ability to implement these plans may rely on specific arrangements or those common to other Woodside activities. Regardless of their commonality each arrangement will be tested in at least one of the methods annually. This ensures that personnel are familiar with spill response procedures, reporting requirements, and roles/ responsibilities. At the completion of testing a report is produced to demonstrate the outcomes achieved against the tested objectives. The report will include the lessons learned, any improvement actions and a list of the participants. Alternatively, an assurance report, assurance records, or audit report may be produced. These reports record findings and include any

	recommendations for improvement. Improvement actions and their close-out are actively recorded and managed. This is over and above the emergency management exercises conducted.
Additional comments	Please note some of the links in the document are still being finalised, and as such may show a reference error in the attached version.

Hydrocarbon Spill Coordinator | Security & Emergency Management

APPENDIX G. DEPARTMENT OF ABORIGINAL AFFAIRS HERITAGE SEARCH RESULTS

Aboriginal Heritage Inquiry System

List of Registered Aboriginal Sites

Search Criteria

No Registered Aboriginal Sites in Custom search area - Polygon - 114.711346061272°E, 20.8366319386942°S (GDA94) : 113.887371451897°E, 21.6557914540822°S (GDA94) : 113.392986686272°E, 22.2569669067452°S (GDA94) : 112.821697623772°E, 22.9163008856403°S (GDA94) : 113.019451530022°E, 21.0213387070791°S (GDA94) : 114.711346061272°E, 20.8366319386942°S (GDA94)

Disclaimer

The *Aboriginal Heritage Act 1972* preserves all Aboriginal sites in Western Australia whether or not they are registered. Aboriginal sites exist that are not recorded on the Register of Aboriginal Sites, and some registered sites may no longer exist.

The information provided is made available in good faith and is predominately based on the information provided to the Department of Planning, Lands and Heritage by third parties. The information is provided solely on the basis that readers will be responsible for making their own assessment as to the accuracy of the information. If you find any errors or omissions in our records, including our maps, it would be appreciated if you email the details to the Department at AboriginalHeritage@dplh.wa.gov.au and we will make every effort to rectify it as soon as possible.

Coordinate Accuracy

Coordinates (Easting/Northing metres) are based on the GDA 94 Datum. Accuracy is shown as a code in brackets following the coordinates.

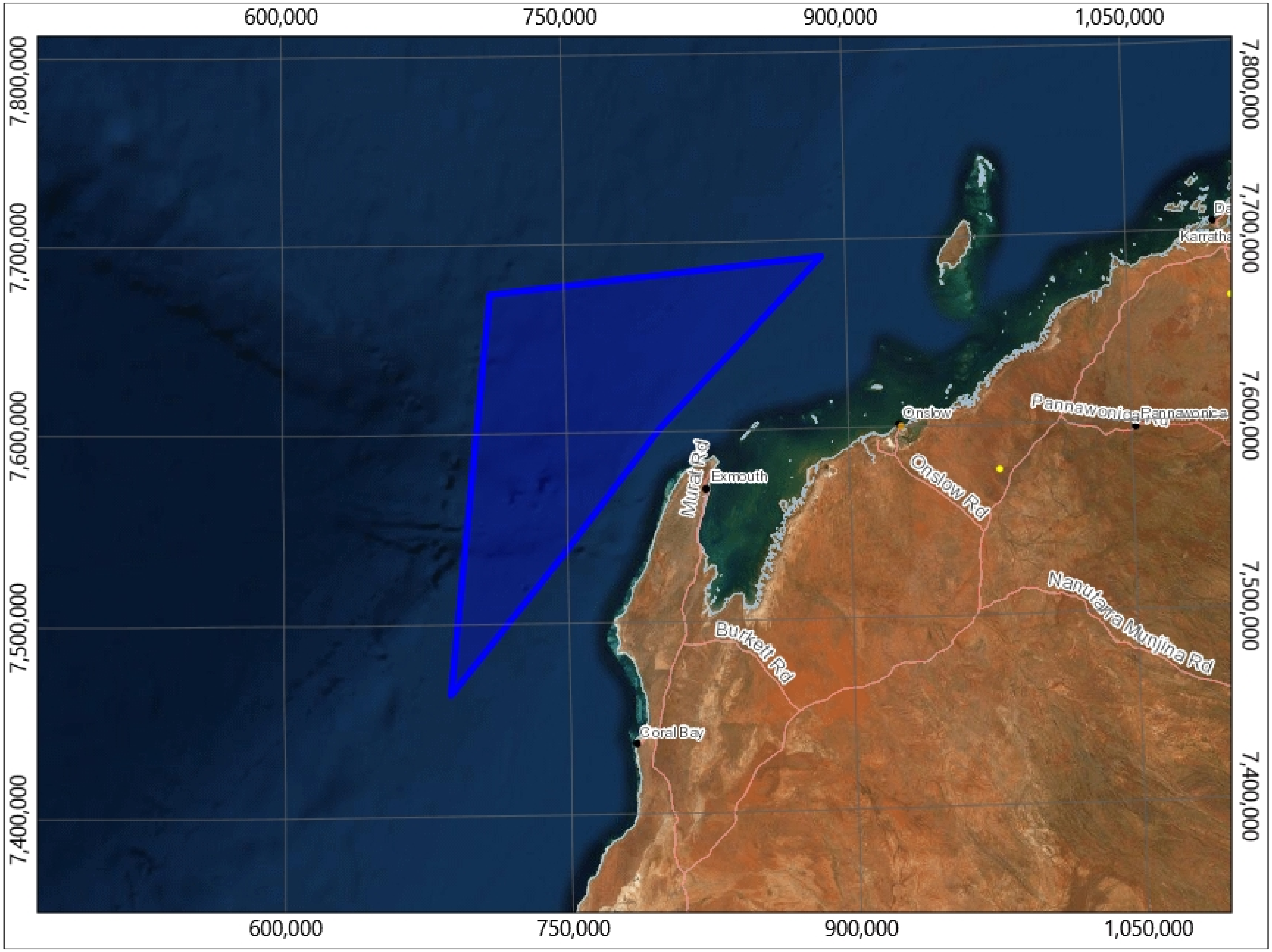
Department of Planning, Lands and Heritage

GOVERNMENT OF WESTERN AUSTRALIA

Aboriginal Heritage Inquiry System

Map of Registered Aboriginal Sites

For further important information on using this information please see the Department of Planning, Lands and Heritage's Disclaimer statement at https://www.dplh.wa.gov.au/about-this-website



Legend

- Registered Aboriginal Site
- Search Area
- Town
- Road
- River
- Local Government Authority

108.59 kilometres

Map Scale 1 : 3,290,000

MGA Zone 49 (GDA94)

APPENDIX H. OIL POLLUTION FIRST STRIKE PLAN

Scarborough Drilling and Completions Oil Pollution First Strike Plan

Security & Emergency Management
Hydrocarbon Spill Preparedness

November 2021
Revision 0

TABLE OF CONTENTS

SCARBOROUGH DRILLING & COMPLETIONS OIL POLLUTION FIRST STRIKE PLAN

SPILL FROM FACILITY INCLUDING SUBSEA INFRASTRUCTURE

LEVEL 1[1]	
CONTROL AGENCY:	**WOODSIDE**
INCIDENT CONTROLLER (IC):	Person In Charge (PIC) with support from Onshore Team Leader (OTL)
LEVEL 2 & 3	
CONTROL AGENCY:	**WOODSIDE**
INCIDENT CONTROLLER:	Corporate Incident Coordination Centre (CICC) DUTY MANAGER

SPILL FROM FACILITY ENTERING STATE WATERS

LEVEL 1	
CONTROL AGENCY:	**WOODSIDE**
INCIDENT CONTROLLER:	CICC DUTY MANAGER
LEVEL 2 & 3	
CONTROL AGENCY:	**Department of Transport (DoT)**
INCIDENT CONTROLLER:	DoT IC

SPILL FROM VESSEL

LEVEL 1	
CONTROL AGENCY:	**AMSA**
INCIDENT CONTROLLER:	VESSEL MASTER (with response assistance from Woodside)
LEVEL 2 & 3	
CONTROL AGENCY:	**Australian Marine Safety Authority (AMSA)**
INCIDENT CONTROLLER:	AMSA (with response assistance from Woodside)

[1] See Table A - 1 below for a guidance to incident characteristics of Levels 1 to 3

Guidance to Oil Spill Incident Levels

The most significant characteristic of the below guidance should be considered when determining level or escalation potential.

Table A - 1: Guidance to the characteristics of incident Levels 1 to 3

Characteristic	Level 1 Indicators	Level 2 Indicators	Level 3 Indicators
General Description	Generally able to be resolved within 24-48 hours.	Generally a response is required beyond 48 hours.	Response may extend beyond weeks.
Woodside Emergency Management (EM)/Crisis Management Team (CMT) Activation	Onsite Incident Controller (IC) activated. Use of ICC support may be required.	Handover of Control from Onsite IC Corporate Incident Coordination Center (CICC) Duty Manager (DM) in Peth.	Includes Perth based CMT activation.
Number of Agencies	First-response agency and Incident Management Team (IMT).	Multi-agency response.	Agencies from across government and industry.
Environment	Isolated impacts or with natural recovery expected within weeks.	Significant impacts and recovery may take months.	Significant area and recovery may take months to years. Remediation required.
Economy	Business level disruption (i.e. Woodside).	Business failure or 'Channel' impacts.	Disruption to a sector.
Public Affairs	Local and regional media coverage (WA).	National media coverage.	International media coverage.

For guidance on credible spill scenarios and hydrocarbon characteristics refer to Appendix A.

For Spills Entering State Waters

In the event of a spill where Woodside is the responsible party and the spill may impact State waters/shorelines, Woodside will notify the Western Australian Department of Transport (DoT). The Director General of DoT is the Hazard Management Agency (HMA) for Western Australian waters.

If the spill impacts State waters/ shorelines and is a Level 1, Woodside will remain the Control Agency. If the spill is a Level 2 or 3 then DoT will become the Control Agency/ HMA for the response in State waters/shorelines only. DoT will appoint an Incident Controller and form a separate Incident Management Team to manage the State waters/shorelines response only. The coordination structure for a concurrent hydrocarbon spill in both Commonwealth and State waters/shorelines is shown in APPENDIX E – Coordination structure for a concurrent hydrocarbon spill in both Commonwealth and State Waters/Shorelines.

Initially Woodside will be required to make available an appropriate number of suitably qualified persons to work in the DoT IMT (see Appendix G). DoT's role as the Controlling Agency/ HMA for Level 2 and 3 spills in State waters/shorelines does not negate the requirement for Woodside to have appropriate plans and resources in place to adequately respond to a Marine Hydrocarbon Spill incident in State waters/shorelines or to commence the initial response actions to a spill prior to DoT establishing incident control in line with DoT Offshore Petroleum Industry Guidance Note - Marine Oil Pollution: Response and Consultation Arrangements (July 2020):

https://www.transport.wa.gov.au/mediaFiles/marine/MAC_P_Westplan_MOP_OffshorePetroleumIndGuidance.pdf

Woodside's Incident Management Structure for a Hydrocarbon Spill, including Woodside Liaison Officer's command structure within DoT can be seen at Appendix F.

Response Process Overview

<table>
<tr><td colspan="3">Use the below to determine actions required and which parts of this plan are relevant to the incident.</td></tr>
<tr><td colspan="3">For guidance on credible scenarios and hydrocarbon characteristics, refer to Appendix A.</td></tr>
<tr><td rowspan="2">ALL INCIDENTS</td><td colspan="2">Notify the Woodside Communication Centre (WCC) on:
[redacted]
or sat phone [redacted]</td></tr>
<tr><td colspan="2">Incident Controller or delegate to make relevant notifications in Table 1-1 of this Oil Pollution First Strike Plan.</td></tr>
<tr><td rowspan="3">LEVEL 1</td><td>FACILITY INCIDENT</td><td>VESSEL INCIDENT</td></tr>
<tr><td>Coordinate pre-identified tactics in Table 2-1 of this Oil Pollution First Strike Plan.
Remember to download each Operational Plan.</td><td>Upon agreement with AMSA: Coordinate pre-identified tactics in Table 2-1 of this Oil Pollution First Strike Plan.
Remember to download each Operational Plan.</td></tr>
<tr><td colspan="2">If the spill escalates such that the site cannot manage the incident, inform the WCC on [redacted], [redacted] or sat phone [redacted] and escalate to a level 2/3 incident.</td></tr>
<tr><td rowspan="4">LEVEL 2/3</td><td>FACILITY INCIDENT</td><td>VESSEL INCIDENT</td></tr>
<tr><td>Handover control to CICC.</td><td>Handover control to AMSA and stand up CICC to assist.</td></tr>
<tr><td>Commence quick revalidation of the recommended strategies on Table 3-1 taking into consideration seasonal sensitivities and current situational awareness.

Commence validated strategies.</td><td>If requested by AMSA:
Commence quick revalidation of the recommended strategies on Table 3-1 taking into consideration seasonal sensitivities and current situational awareness.

Commence validated strategies.</td></tr>
<tr><td>Create an Incident Action Plan (IAP) for all ongoing operational periods.
<u>The content of the IAP should reflect the selected response strategies based on current situational awareness.</u>

For the full detailed pre-operational Net Environmental Benefit Analysis (NEBA) see here or Appendix A of the OSPRMA</td><td>If requested by AMSA:
Create an IAP for all ongoing operational periods.
<u>The content of the IAP should reflect the selected response strategies based on current situational awareness.</u>

For the full detailed pre-operational NEBA see here or Appendix A of the OSPRMA</td></tr>
</table>

1. NOTIFICATIONS (ALL LEVELS)

The Incident Controller or delegate must ensure the below notifications **(Table 1-1)** are completed within the designated timeframes.

For other environmental notifications required refer to the Scarborough Drilling and Completions Environmental Plan.

Table 1-1: Immediate Notifications

Notification timing	Responsibility	Authority/ Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
Notifications to be made for ALL LEVELS of spill ***(For spills from a vessel the following notifications must be undertaken by a WEL representative).***							
Immediately	Vessel Master	Woodside Communication Centre (WCC)	Duty Manager	[redacted] or Sat phone: [redacted]	Verbally notify WCC of event and estimated volume and hydrocarbon type.	Verbal	
Within 2 hours	Woodside Site Rep (WSR)	National Offshore Petroleum Safety Environmental Management Authority (NOPSEMA[1])	Incident notification office	[redacted]	Verbally notify NOPSEMA for spills >80L. Record notification using Initial Verbal Notification Form or equivalent and send to NOPSEMA as soon as practicable (cc to NOPTA and DMIRS).	App B Form 1	
Within 3 days	WSR				Provide a written NOPSEMA Incident Report Form as soon as practicable (no later than 3 days after notification) (cc to NOPTA and DMIRS) NOPSEMA: [redacted]	App B Form 2	

[1] Notification to NOPSEMA must be from a Woodside Representative.

Notification timing	Responsibility	Authority/ Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
					NOPTA: [redacted] DMIRS [redacted]		
As soon as practicable	WSR	Woodside	Environment Duty Manager	As per roster	Verbally notify Duty Environment of event and seek advice on relevant performance standards from EP	Verbal	
As soon as practicable	CICC DM or Delegate	Department of Agriculture, Water and the Environment (Director of National Parks)	Marine Park Compliance Duty Officer	[redacted]	The Marine Park Compliance Duty Officer is notified in the event of oil pollution within a marine park, or where an oil spill response action must be taken within a marine park, so far as reasonably practicable, prior to response action being taken. This notification should include: • titleholder details • time and location of the incident • proposed response arrangements and locations as per the OPEP • contact details for the response coordinator.	Verbal	
Additional notifications to be made ONLY if spill is from a vessel							
Without delay as per protection of the Sea Act, part II, section 11(1)	Vessel Master	Australian Maritime Safety Authority (AMSA)	Response Coordination Centre (RCC)	[redacted] or [redacted]	Verbally notify AMSA RCC of the hydrocarbon spill. Follow up with a written Marine Pollution Report (POLREP) as soon as practicable following verbal notification.	App B Form 3	
ADDITIONAL LEVEL 2/3 NOTIFICATIONS							
As soon as practicable	CICC DM or Delegate	AMOSC	AMOSC Duty Manager	[redacted]	Notify AMOSC that a spill has occurred and follow-up with an email from the IC/CICC DM, CMT Leader	App B Form 4	

Notification timing	Responsibility	Authority/ Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
					or Oil Spill Preparedness Manager to formally activate AMOSC. Determine what resources are required consistent with the AMOS Plan and detail in a Service Contract that will be sent to Woodside from AMOSC upon activation.		
As soon as practicable	CICC DM or Delegate	Oil Spill Response Limited (OSRL)	OSRL Duty Manager	[redacted]	Contact OSRL duty manager and request assistance from technical advisor in Perth. Send the completed notification form to OSRL as soon as practicable. For mobilisation of resources, send the Mobilisation Form to OSRL as soon as practicable. The mobilisation form requires to be signed by a nominated callout authority from Woodside.	Notification: App B Form 6a Mobilisation: App B Form 6b	
As soon as practicable or if spill is likely to extend into WA State waters.	CICC DM or Delegate	WA Department of Transport	DOT Duty Manager	[redacted]	Marine Duty Manager to verbally notify DoT that a spill has occurred and, if required, request use of equipment stored in the Karratha supply shed. Follow up with a written POLREP as soon as practicable following verbal notification. Additionally DoT to be notified if spill is likely to extend into WA State waters. Request DoT to provide Liaison to WEL IMT.	App B Form 5	

Notification timing	Responsibility	Authority/ Company	Name	Contact Number	Instruction	Form/ Template	Mark Complete (✓)
As soon as practicable if there is potential for oiled wildlife or the spill is expected to contact land or waters managed by WA Department of Biodiversity, Conservation and Attractions	CICC DM or Delegate	WA Department of Biodiversity, Conservation and Attractions (DBCA)	Duty Officer	[redacted]	Phone call notification	Verbal	
As soon as practicable	CICC DM or Delegate	Marine Spill Response Corporation (MSRC)	MSRC Response Manager	[redacted]	Activate the contract with MSRC (in full) for the provision of up to 30 personnel depending on what skills are required. Please note that provision of these personnel from MSRC are on a best endeavours basis and are not guaranteed.	Verbal	

2. LEVEL 1 RESPONSE

2.1 Mobilisation of Response Techniques

For the relevant hydrocarbon type, undertake quick revalidation of the recommended techniques and pre-identified tactics indicated with a 'Yes' in **Table 2-1.** Undertake all validated pre-identified tactics immediately. These tactics should be carried out using the associated plan identified under **Table 2-1** Operational Plan column.

All response techniques and pre-identified tactics have been identified from the pre-operational Net Environmental Benefits Analysis (NEBA) presented in the Scarborough Drilling and Completions Environment Plan Appendix D (Woodside's Oil Spill Preparedness and Response Mitigation Assessment).

Table 2-1: Level 1 Response Summary

Response Techniques	Hydrocarbon Type: Marine Diesel	Hydrocarbon Type: Dry Gas	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
Monitor and evaluate – tracking buoy (OM02)	Yes	N/A	If a vessel is on location, consider the need to deploy the oil spill tracking buoy. If no vessel is on location, consider the need to mobilise oil spill tracking buoys from the King Bay Supply Base (KBSB) Stockpile. If a surface sheen is visible from the facility, deploy the satellite tracking buoy within two hours.	Operations	**DAY 1:** Tracking buoy deployed within two hours.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02) of The Operational Monitoring Operational Plan. Deploy tracking buoy in accordance with APPENDIX D – Tracking buoy deployment instructions.
Please consider instructing the CICC DM to activate or implement any of the following Pre-Identified tactics. The following tactics will assist in answering the '7 Questions of Spill Assessment' identified in Appendix C to increase situational awareness.							
Monitor and evaluate – predictive modelling (OM01)	Yes	N/A	Marine Diesel: Undertake initial modelling using the Rapid assessment oil spill tool (Woodside Maps) and weathering fate analysis using ADIOS (or refer to the hydrocarbon information in Appendix A).	Intelligence or Environment	**DAY 1:** Marine Diesel: Initial modelling within six hours using the Rapid Assessment Tool.		Predictive Modelling of Hydrocarbons to Assess Resources at Risk (OM01 of the Operational Monitoring Operational Plan). *Planning Coordinator to download immediately and follow steps*
	Yes	N/A	Send Oil Spill Trajectory Modelling (OSTM) form APPENDIX B, Form 7 to RPS APASA response team (email [redacted]) and call [redacted]	Intelligence	**DAY 1:** Detailed modelling within four hours of APASA receiving information from Woodside.		
Monitor and evaluate – aerial surveillance (OM02)	Yes	N/A	Marine Diesel: Instruct Aviation Duty Manager to commence aerial observations in daylight hours. Aerial surveillance observer to complete log in APPENDIX B, Form 8	Logistics – Aviation	**DAY 1:** Two trained aerial observers. One aircraft available.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02 of The Operational Monitoring Operational Plan).

Response Techniques	Hydrocarbon Type		Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
	Marine Diesel	Dry Gas					
					Report made available to the IMT within two hours of landing after each sortie.		*Planning Coordinator to download immediately and follow steps*
Monitor and evaluate – satellite tracking (OM02)	Yes	N/A	Marine Diesel: The Intelligence Duty Manager should be instructed to stand up KSAT to provide satellite imagery of the spill (email [redacted] and call [redacted]).	Intelligence	**DAY 1:** Service provider will confirm availability of an initial acquisition within two hours. Data received to be uploaded into Woodside Common Operating Picture		
Monitor and evaluate – monitoring hydrocarbon s in water (OM03)	Yes	N/A	Marine Diesel: Consider the need to mobilise resources to undertake water quality monitoring (OM03).	Planning or Environment	**DAY 3:** Water quality assessment access and capability. Daily fluorometry reports will be provided to IMT.		Detecting and Monitoring for the Presence and Properties of Hydrocarbons in the Marine Environment (OM03 of The Operational Monitoring Operational Plan).
Monitor and evaluate – pre-emptive assessment of receptors at risk (OM04)	Potentially	N/A	Marine Diesel: Consider the need to mobilise resources to undertake pre-emptive assessment of sensitive receptors at risk (OM04).	Planning or Environment	In agreement with WA DoT, deployment of two specialists for each of the Response Protection Areas (RPA) within 10 days of predicted impacts.		Pre-emptive Assessment of Sensitive Receptors at Risk (OM04 of The Operational Monitoring Operational Plan).

Response Techniques	Hydrocarbon Type		Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
	Marine Diesel	Dry Gas					
Monitor and evaluate – shoreline assessment (OM05)	N/A	N/A	No shoreline impact predicted				

3. LEVEL 2/3 RESPONSE

3.1 Mobilisation of Response Techniques

For the relevant hydrocarbon type, undertake quick revalidation of the recommended techniques and pre-identified tactics indicated with a ‘Yes’ in **Table 3-1.** Undertake all validated pre-identified tactics immediately. These tactics should be carried out using the associated plan identified under **Table 3-1** Operational Plan column.

All response techniques and pre-identified tactics have been identified from the pre-operational Net Environmental Benefits Analysis (NEBA) presented in the Scarborough Drilling and Completions Environment Plan Appendix D (Woodside’s Oil Spill Preparedness and Response Mitigation Assessment).

Table 3-1: Level 2/3 Response Summary

Response Techniques	Hydrocarbon Type: Marine Diesel	Hydrocarbon Type: Dry Gas	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
Monitor and evaluate – tracking buoy (OM02)	Yes	N/A	If a vessel is on location, consider the need to deploy the oil spill tracking buoy. If no vessel is on location, consider the need to mobilise oil spill tracking buoys from the King Bay Supply Base (KBSB) Stockpile. If a surface sheen is visible from the facility, deploy the satellite tracking buoy within two hours.	Operations	**DAY 1:** Tracking buoy deployed within two hours.		Surveillance and Reconnaissance to Detect Hydrocarbons and Resources at Risk (OM02) of The Operational Monitoring Operational Plan. Deploy tracking buoy in accordance with APPENDIX D – Tracking buoy deployment instructions.
Please consider instructing the CICC DM to activate or implement any of the following Pre-Identified tactics. The following tactics will assist in answering the '7 Questions of Spill Assessment' identified in Appendix C to increase situational awareness.							
Monitor and evaluate – predictive modelling (OM01)	Yes	N/A	Marine Diesel: Undertake initial modelling using the Rapid assessment oil spill tool (Woodside Maps) and weathering fate analysis using ADIOS (or refer to the hydrocarbon information in **Appendix A**). Dry gas: if feasible, existing worst-case discharge modelling will be verified with available real-time data.	Intelligence or Environment	**DAY 1:** Marine Diesel: Initial modelling within six hours using the Rapid Assessment Tool.		Predictive Modelling of Hydrocarbons to Assess Resources at Risk (OM01 of the Operational Monitoring Operational Plan). *Planning Coordinator to download immediately and follow steps*
	Yes	N/A	Marine Diesel: Send Oil Spill Trajectory Modelling (OSTM) form APPENDIX B, Form 7 to RPS APASA response team (email [redacted]) and call [redacted]	Intelligence	**DAY 1:** Marine Diesel: Detailed modelling within four hours of APASA receiving information from Woodside.		
Monitor and evaluate – aerial	Yes	N/A	Marine diesel: Instruct Aviation Duty Manager to commence aerial observations in daylight hours.	Logistics – Aviation	**DAY 1:**		Surveillance and Reconnaissance to Detect Hydrocarbons and

Response Techniques	Hydrocarbon Type		Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
	Marine Diesel	Dry Gas					
surveillance (OM02)			Marine Diesel: Aerial surveillance observer to complete log in APPENDIX B, Form 8 Dry gas: overflights only feasible if gas detection indicates it is safe to do so.		Two trained aerial observers. One aircraft available. Report made available to the IMT within two hours of landing after each sortie.		Resources at Risk (OM02 of The Operational Monitoring Operational Plan). *Planning Coordinator to download immediately and follow steps*
Monitor and evaluate – satellite tracking (OM02)	Yes	N/A	Marine Diesel: The Intelligence Duty Manager should be instructed to stand up KSAT to provide satellite imagery of the spill (email [redacted] and call [redacted]).	Intelligence	**DAY 1:** Service provider will confirm availability of an initial acquisition within two hours. Data received to be uploaded into Woodside Common Operating Picture		
Monitor and evaluate – monitoring hydrocarbons in water (OM03)	Yes	N/A	Marine Diesel: Consider the need to mobilise resources to undertake water quality monitoring (OM03).	Planning or Environment	**DAY 3:** Water quality assessment access and capability. Daily fluorometry reports will be provided to IMT.		Detecting and Monitoring for the Presence and Properties of Hydrocarbons in the Marine Environment (OM03 of The Operational Monitoring Operational Plan).
Monitor and evaluate – pre-emptive assessment of receptors at risk (OM04)	Potentially	N/A	Marine Diesel: Consider the need to mobilise resources to undertake pre-emptive assessment of sensitive receptors at risk (OM04).	Planning or Environment	In agreement with WA DoT, deployment of two specialists for each of the Response Protection Areas		Pre-emptive Assessment of Sensitive Receptors at Risk (OM04 of The Operational Monitoring Operational Plan).

Response Techniques	Hydrocarbon Type: Marine Diesel	Hydrocarbon Type: Dry Gas	Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
					(RPA) within 10 days of predicted impacts.		
Monitor and evaluate – shoreline assessment (OM05)	N/A	N/A	No shoreline impact predicted				
Surface Dispersant	No	N/A	Not applicable for a diesel spill or dry gas release				
Mechanical Dispersion	No	N/A	Not applicable for a diesel spill or dry gas release				
Containment and Recovery	No	N/A	Not applicable for a diesel spill or dry gas release				
In-situ Burning	No	N/A	Not applicable for a diesel spill or dry gas release				
Shoreline Protection and Deflection	No	N/A	No shoreline impact predicted				
Shoreline Clean Up	No	N/A	No shoreline impact predicted				
Oiled Wildlife Response	Yes	N/A	If oiled wildlife is a potential impact, request and mobilise AMOSC oiled wildlife containers, first strike kits and relevant personnel. Refer to relevant tactical response plan for potential wildlife at risk. Consider whether additional equipment is required from local suppliers.	Logistics and Planning	**DAY 5:** Contracted capability to treat up to an additional 250 individual fauna within a five-day period. Facilities for oiled wildlife		Oiled Wildlife Response Operational Plan and relevant Tactical Response Plans

Response Techniques	Hydrocarbon Type		Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
	Marine Diesel	Dry Gas					
					rehabilitation are operational 24/7		
Scientific Monitoring (Type II)	Yes	N/A	Notify Woodside science team of spill event.	Environment			Oil Spill Scientific Monitoring Programme – Operational Plan
Well Intervention – SFRT	N/A	Yes	As per Source Control Emergency Response Plan	Operations, Logistics and Drilling and Completions (source control)	**DAY 2:** Remotely Operated Vehicle (ROV) on Mobile Offshore Drilling Unit (MODU) ready for deployment within 48 hours		Subsea First Response Toolkit (SFRT) Operational Plan Source Control Emergency Response Plan
Subsea Dispersant	N/A	N/A	Not applicable for a diesel spill or dry gas release				
Capping Stack	N/A	Yes	Conventional/vertical capping stack deployment with a heavy lift vessel will be attempted at the discretion of the vessel master on the day, giving due regard to the safety of the vessel and crew and consideration to the factors that may influence a safe deployment such as plume and environmental conditions (e.g. wind speed, wave height and current).	Operations, Logistics and Drilling and Completions (source control)	**DAY 16:** Capping stack deployed by a chartered construction vessel.		Subsea First Response Toolkit (SFRT) and Capping Stack Operational Plan Source Control Emergency Response Plan
Relief Well	N/A	Yes	As per Source Control Emergency Response Plan	Operations, Logistics and Drilling and Completions (source control)	**DAY 1:** Identify source control vessel availability within 24 hours. ROV on MODU ready for deployment within 48 hours.		Source Control Emergency Response Plan

Response Techniques	Hydrocarbon Type		Pre- Identified Tactics	Responsible	ALARP Commitment Summary	Complete ✓	Link to Operational Plans for notification numbers and actions
	Marine Diesel	Dry Gas					
					MODU mobilised to location		

4. PRIORITY RECEPTORS

Note: DoT is the Control Agency to respond to all the sites listed below in a Level 2/3 spill into State waters/shorelines.
Action: Provide DoT with all relevant Tactical Response Plans for these locations.

Based on hydrocarbon spill risk modelling results for the Marine Diesel scenario (Credible Scenario-01 (CS-01)) there are no priority protection areas that have the potential to be contacted by hydrocarbon at or above impact threshold levels within 48 hours of a spill. Please note that impact thresholds (10 g/m^2 surface hydrocarbon concentration, 100 g/m^2 shoreline accumulation, and 100 ppb entrained hydrocarbon concentration) are used to determine the Environment that May be Affected (EMBA) identified in the Environment Plan and are lower than response thresholds (**Table 4-2**).

Table 4-1: Response Thresholds

Surface Hydrocarbon (g/m^2)	Description
>10	Predicted minimum threshold for commencing operational monitoring
50	Predicted minimum floating oil threshold for containment and recovery and surface dispersant application [2]
100	Predicted optimum floating oil threshold for containment and recovery and surface dispersant application
100	Predicted minimum shoreline accumulation threshold for shoreline assessment operations
250	Predicted minimum threshold for commencing shoreline clean-up operations

Table 4-2: Receptors for Priority Protection with Potential Impact within 48 Hours (CS-01)

Receptor	Distance and Direction from Operational Area (km)	Minimum time to shoreline contact (above 100g/m^2) in days	Maximum shoreline accumulation (above 100g/m^2) in m^3	Tactical Response Plans (also available within the Data Directory DRIMS#9542566)
Open Ocean – Commonwealth Waters	0 km (open ocean)	N/A	N/A	N/A

Hydrocarbon spill modelling results indicate the sensitive receptors listed below have the potential to be contacted by hydrocarbons beyond 48 hours of a spill:

- Gascoyne AMP

Tactical Response plans can be accessed via the Oil Spill Portal - Tactical Response Plans.

Oil Spill Trajectory Modelling specific to the spill event will be required to determine the regional sensitive receptors to be contacted beyond 48 hours of a spill.

Figure 4-1 illustrates the location of regional sensitive receptors in relation to the operational area and identifies priority protection areas.

There are no assets in the vicinity of the Scarborough operational area. Modelling results show the slick from diesel will travel only 52 km from the release location. The closest asset, Santos' Ningaloo vision FPSO is approximately 196 km away.

[2] At 50 g/m^2 containment and recovery and surface dispersant application operations are not expected to be particularly effective. This threshold represents a conservative approach to planning response capability and displaying the spread of surface oil.

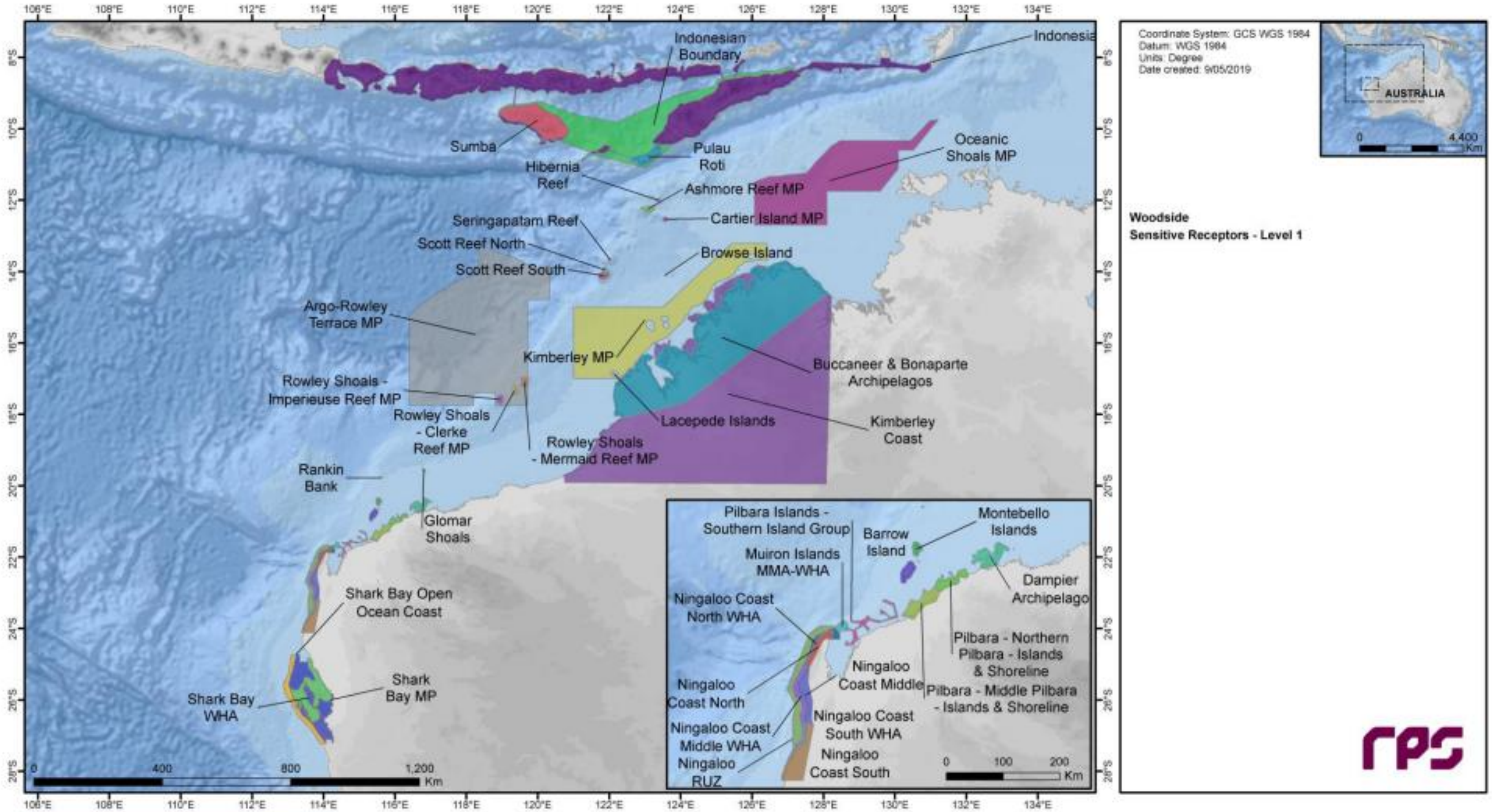


Figure 4-1: Regional Sensitive Receptors – Scarborough Drilling and Completions

5. DISPERSANT APPLICATION

Dispersant is not considered an appropriate response strategy for this activity as described in the Scarborough Drilling and Completions Environment Plan Appendix D (Woodside's Oil Spill Preparedness and Response Mitigation Assessment).

APPENDIX A – CREDIBLE SPILL SCENARIOS AND HYDROCARBON INFORMATION

For more detailed hydrocarbon information see the
[Hydrocarbon Data Directory]

Credible Spill Scenarios

Scenario	Product	Maximum Volumes	Suggested ADIOS2 Analogue*
CS-01: Unplanned hydrocarbon release caused by marine vessel collision (Project support vessel)	Marine diesel (API 37.2°)	250 m^3	Diesel Fuel Oil (API 37.2°)
CS-02: Loss of containment caused by refuelling hose failure, coupling failure or operator error	Marine diesel (API 37.2°)	8 m^3	Diesel Fuel Oil (API 37.2°)
CS-03: Loss of well control during drilling of development well	Dry gas	No liquid hydrocarbon	N/A

*Initial screening of possible ADIOS2 analogues was done by considering hydrocarbons with similar APIs. Suggested selection was based on the closest distillation cut to WEL hydrocarbon. Only hydrocarbons with distillation cuts that showed results for > 380°C were included in selection process.

Marine Diesel (Group 2 Oil)

Marine diesel is a mixture of volatile and persistent hydrocarbons, with approximately 45% by mass predicted to evaporate over the first day or two, depending upon the prevailing conditions, with further evaporation slowing over time. The heavier components of diesel have a strong tendency to entrain into the upper water column due to wind waves, but can refloat to the surface if wind waves abate.

A series of model weather tests were conducted to illustrate the potential behaviour of marine diesel when exposed to idealised and representative environmental conditions:

- A one-off release of 50 m^3 of marine diesel over 1-hour onto the water surface was modelled under calm wind conditions (constant 5 knots), assuming low seasonal water temperature (27 °C) and average air temperature (25 °C). Slick also subject to ambient tidal and drift currents **(Figure A-1**).
- A one-off release of 50 m^3 of marine diesel over 1-hour onto the water surface was modelled under variable wind conditions (4-19 knots, drawn from representative data files), assuming low seasonal water temperature (27 °C) and average air temperature (25 °C). Slick also subject to ambient tidal and drift currents (**Figure A-2**).

The first case is indicative of cumulative weathering rates under calm conditions that would not generate entrainment, while the second case may represent conditions that could cause a minor degree of entrainment. Both scenarios provide examples of potential behaviour during periods of a spill event, once the oil reaches the surface.

The mass balance forecast for the constant-wind case (**Figure A-1**) for marine diesel shows that approximately 45% of the oil is predicted to evaporate within 24 hours. Under these calm conditions the majority of the remaining oil on the water surface will weather at a slower rate due to being comprised of the longer-chain compounds with higher boiling points. Evaporation of the residual compounds will slow significantly, and they will then be subject to more gradual decay through biological and photochemical processes.

Under the variable-wind case (Figure A-2), where the winds are of greater strength, entrainment of marine diesel into the water column is indicated to be significant. Approximately 24 hours after the spill, around 45% of the oil mass is forecast to have entrained and a further 35% is forecast to have evaporated, leaving only a small proportion of the oil floating on the water surface (<1%). The residual compounds will tend to remain entrained beneath the surface under conditions that generate wind waves (approximately >6m/s).

The increased level of entrainment in the variable-wind case will result in a higher percentage of biological and photochemical degradation, where the decay of the floating slicks and oil droplets in the water column occurs at an approximate rate of 1.8% per day with an accumulated total of ~13% after 7 days, in comparison to a rate of ~0.2% per day and an accumulated total of 1.5% after 7 days in the constant-wind case. Given the large proportion of entrained oil and the tendency for it to remain mixed in the water column, the remaining hydrocarbons will decay and/or evaporate over time scales of several weeks to a few months. This long weathering duration will extend the area of potential effect, requiring the break-up and dispersion of the slicks and droplets to reduce concentrations below the thresholds.

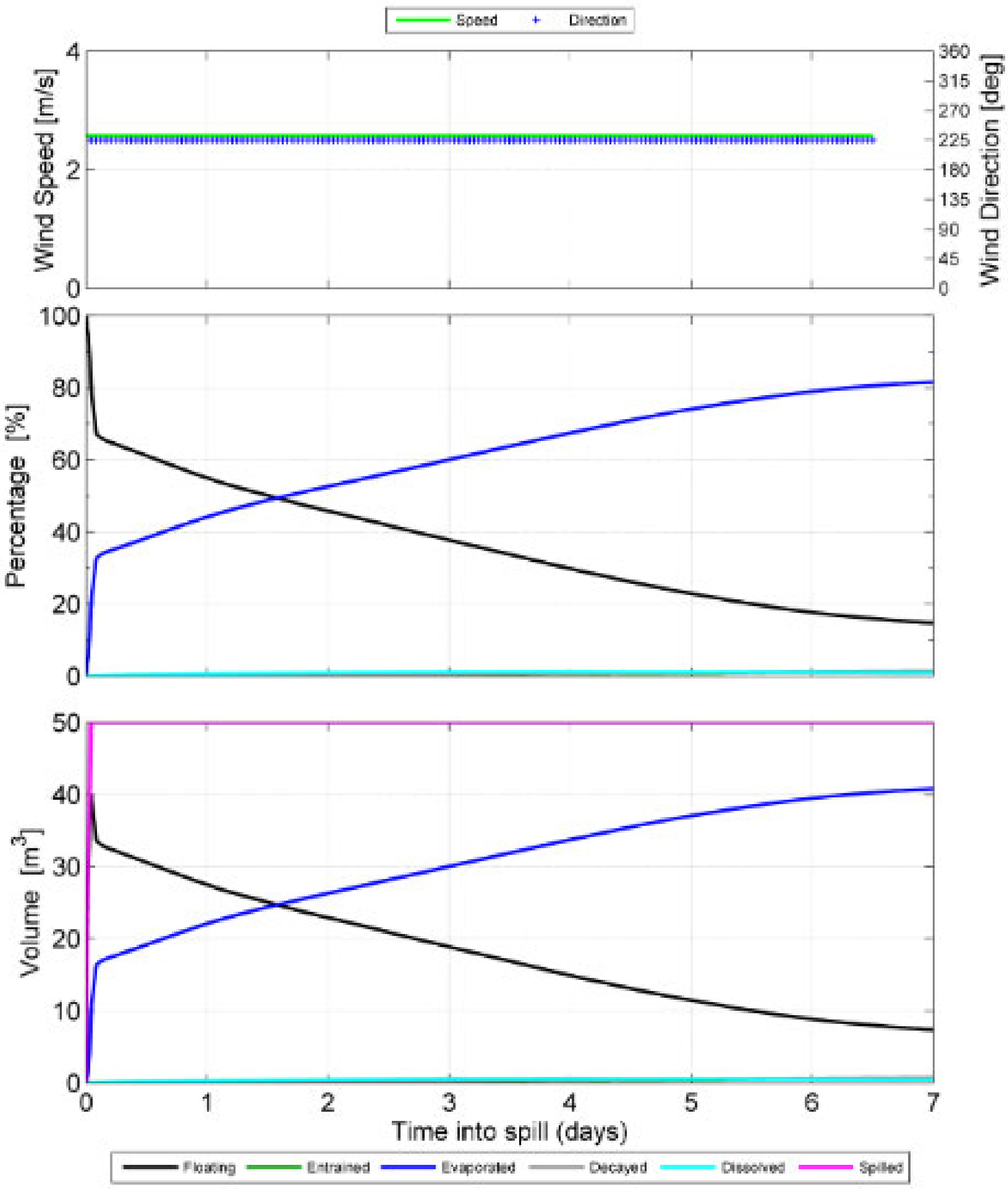


Figure A-1: Mass balance plot representing, as proportion (middle panel) and volume (bottom panel), the weathering of marine diesel spilled onto the water surface as a one-off release (50 m^3 over 1-hour) and subject to a constant 5kn (2.6 /s) wind at 27°C water temperature and 25°C air temperature.

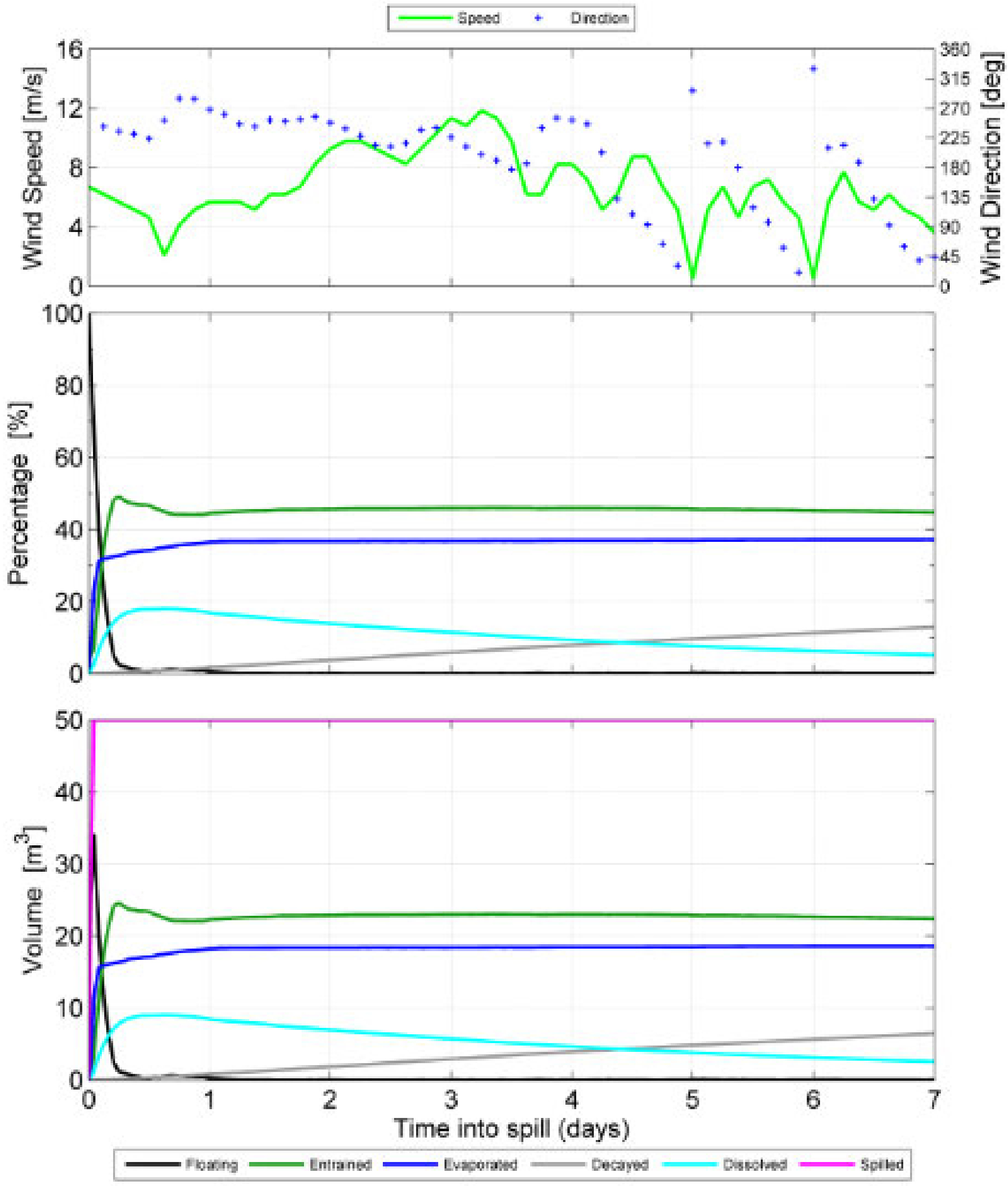


Figure A-2 Mass balance plot representing, as proportion (middle panel) and volume (bottom panel), the weathering of marine diesel spilled onto the water surface as a one-off release (50 m^3 over 1 hour) and subject to variable wind at 27°C water temperature and 25°C air temperature.

Dry gas

The Scarborough reservoir properties are dry gas, primarily methane (approximately 95%) and nitrogen (approximately 4%), with some ethane, CO_2 contents and limited heavier hydrocarbon components. No liquid hydrocarbons are expected at atmospheric conditions and, as a result, no stochastic or deterministic hydrocarbon spill modelling was undertaken for this scenario (CS-03). Furthermore, worst case discharge rate ('blowout' rate') modelling predicts that the gas plume will not breach the water's surface.

APPENDIX B – FORMS

Form No.	Form Name	Link
1	Record of Initial Verbal Notification to NOPSEMA Template	[redacted]
2	NOPSEMA Incident Report Form	[redacted]
3	Marine Pollution Report (POLREP – AMSA)	[redacted]
4	AMOSC Service Contract Note	[redacted]
5	Marine Pollution Report (POLREP – DoT)	[redacted]
6a	OSRL Initial Notification Form	[redacted]
6b	OSRL Mobilisation Activation Form	[redacted]
7	RPS Oil Spill Trajectory Modelling Request	[redacted]
8	Aerial Surveillance Observer Log	[redacted]

FORM 1

Record of initial verbal notification to NOPSEMA

(NOPSEMA ph: [redacted]

Date of call	
Time of call	
Call made by	
Call made to	

Information to be provided to NOPSEMA:

Date and Time of incident/time caller became aware of incident	
Details of incident	1. Location ____ 2. Title____ 3. Hydrocarbon source □ Platform____ □ Pipeline____ □ FPSO____ □ Exploration drilling____ □ Well____ □ Other (please specify) ____ 4. Hydrocarbon type____ 5. Estimated volume of hydrocarbon ____ 6. Has the discharge ceased?____ 7. Fire, explosion or collision? ____ 8. Environment Plan(s) ____ 9. Other Details____
Actions taken to avoid or mitigate	

environmental impacts	
Corrective actions taken or proposed to stop, control or remedy the incident	

After the initial call is made to NOPSEMA, please send this record as soon as practicable to:

1. **NOPSEMA** [redacted]
2. **NOPTA** [redacted]
3. **DMIRS** [redacted]

FORM 2

[insert NOPSEMA Notification Template when printing]

[redacted]

FORM 3

[insert Marine Pollution Report (POLREP – AMSA) when printing]

[redacted]

FORM 4

[insert AMOSC Service Contract note when printing]

[redacted]

FORM 5

[insert Marine Pollution Report (POLREP – DoT) when printing]

[redacted]

FORM 6a

[insert OSRL Initial Notification Form when printing]

[redacted]

FORM 6b

[insert OSRL Mobilisation Activation Form when printing]

[redacted]

FORM 7

[insert RPS Response Oil Spill Trajectory Modelling Request form when printing]

[redacted]

FORM 8

[insert Aerial Surveillance Observer Log when printing]

[redacted]

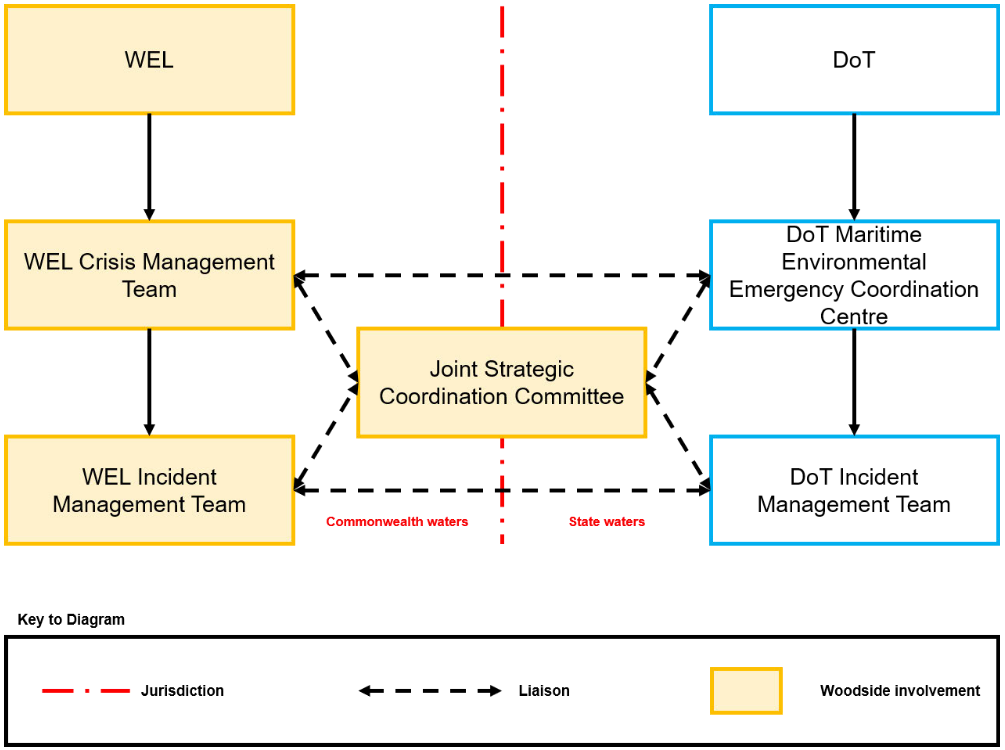
APPENDIX C – 7 QUESTIONS OF SPILL ASSESSMENT

WHAT IS IT? **Oil Type/name** **Oil properties** **Specific gravity / viscosity / pour point / asphphaltines / wax content / boiling point**	
WHERE IS IT? Lat/Long Distance and bearing	
HOW BIG IS IT? Area Volume	
WHERE IT IS GOING? Weather conditions Currents and tides	
WHAT IS IN THE WAY? Resources at risk	
WHEN WILL IT GET THERE? Weather conditions Currents and tides	
WHAT'S HAPPENING TO IT? Weathering processes	

APPENDIX D – TRACKING BUOY DEPLOYMENT INSTRUCTIONS

(Insert [redacted] when printing)

APPENDIX E – COORDINATION STRUCTURE FOR A CONCURRENT HYDROCARBON SPILL IN BOTH COMMONWEALTH AND STATE WATERS/SHORELINES[3]



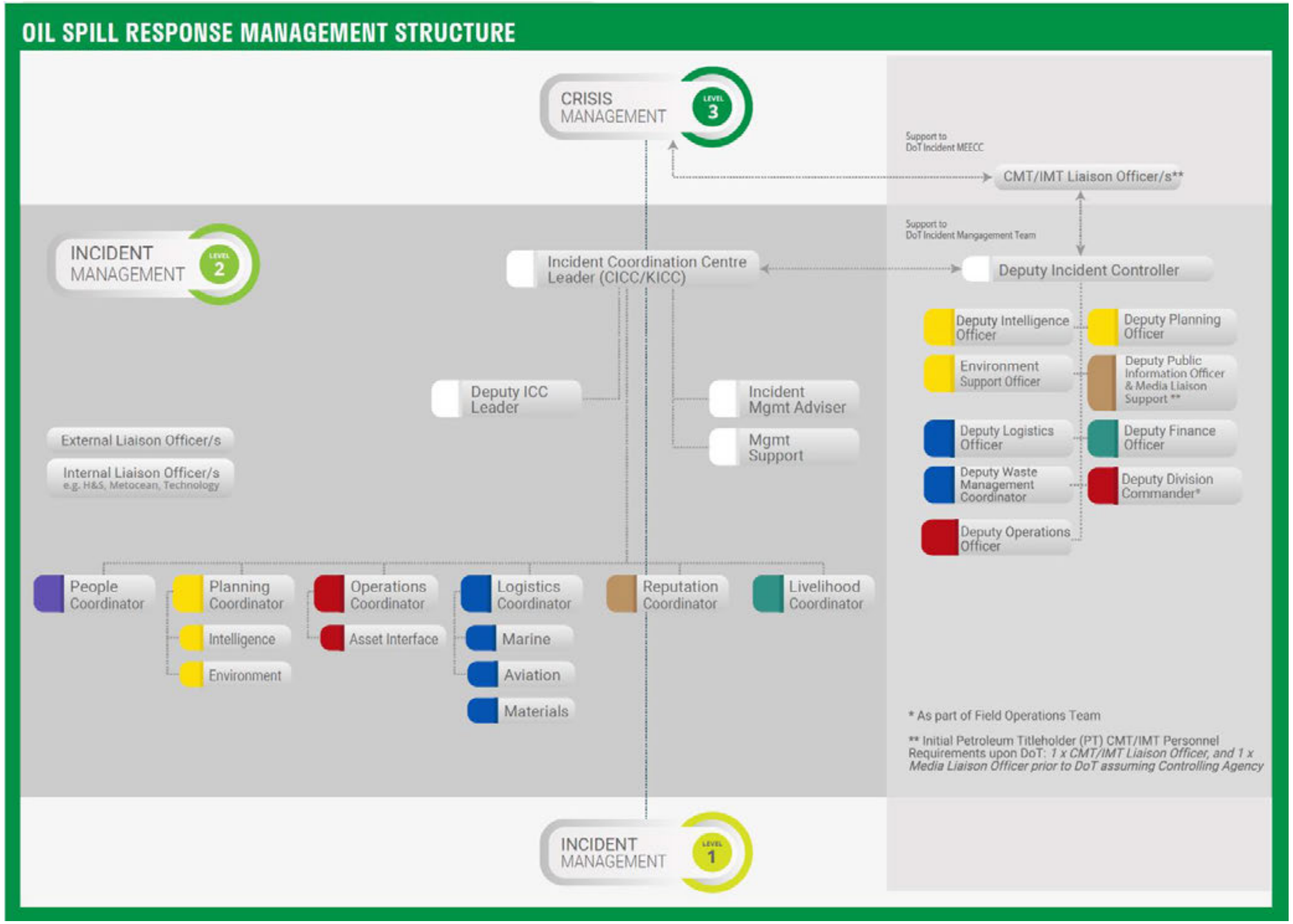
The Control Agency for a Level 1 hydrocarbon spill in Commonwealth waters resulting from an offshore petroleum activity is Woodside (the Petroleum Titleholder) (or AMSA for a vessel spill).

The Control Agency for a Level 2/3 hydrocarbon spill in State waters/shorelines resulting from an offshore petroleum activity is DoT. DoT will appoint an Incident Controller and form a separate IMT to only manage the spill within State waters/shorelines.

[3] Adapted from DoT Offshore Petroleum Industry Guidance Note, Marine Oil Pollution: Response and Consultation Arrangements July 2020. Note: For full structure up to Commonwealth Cabinet/Minister refer to Marine Oil Pollution: Response and Consultation Arrangements Section 6.5, Figure 3.

APPENDIX F – WOODSIDE INCIDENT MANAGEMENT STRUCTURE

Woodside Incident Management Structure for Hydrocarbon Spill (including Woodside Liaison Officers Command Structure within DoT IMT if required).



APPENDIX G – WOODSIDE LIASON OFFICER RESOURCES TO DOT

Once DoT activates a State waters/shorelines IMT, Woodside will make available the following roles to DoT.

Area	WEL Liaison Role	Personnel Sourced from[4]:	Key Duties	#
DoT MEECC	CMT Liaison Officer	CMT Leader Roster	• Provide a direct liaison between the CMT and the MEECC. • Facilitate effective communications and coordination between the CMT Leader and State Marine Pollution Coordinator (SMPC). • Offer advice to SMPC on matters pertaining to PT crisis management policies and procedures.	1
DoT IMT Incident Control	WEL Deputy Incident Controller	CICC Leader Reserve List Roster	• Provide a direct liaison between the PT IMT and DoT IMT. • Facilitate effective communications and coordination between the PT IC and the DoT IC. • Offer advice to the DoT IC on matters pertaining to PT incident response policies and procedures. • Offer advice to the Safety Coordinator on matters pertaining to PT safety policies and procedures, particularly as they relate to PT employees or contractors operating under the control of the DoT IMT.	1
DoT IMT Intelligence	Intelligence Support Officer/ Deputy Intelligence Officer	AMOSC Staff Member or AMOSC Core Group	• As part of the Intelligence Team, assist the Intelligence Officer in the performance of their duties in relation to situation and awareness. • Facilitate the provision of relevant modelling and predications from the PT IMT. • Assist in the interpretation of modelling and predictions originating from the PT IMT. • Facilitate the provision of relevant situation and awareness information originating from the DoT IMT to the PT IMT. • Facilitate the provision of relevant mapping from the PT IMT. • Assist in the interpretation of mapping originating from the PT IMT. • Facilitate the provision of relevant mapping originating from the DoT IMT to the PT IMT.	1
DoT IMT Intelligence – Environment	Environment Support Officer	CMT Environmental FST Duty Managers Roster	• As part of the Intelligence Team, assist the Environment Coordinator in the performance of their duties in relation to the provision of environmental support into the planning process. • Assist in the interpretation of the PT OPEP and relevant TRP plans. • Facilitate in requesting, obtaining and interpreting environmental monitoring data originating from the PT IMT. • Facilitate the provision of relevant environmental information and advice originating from the DoT IMT to the PT IMT.	1
DoT IMT	Deputy Planning Officer	AMOSC Core Group/CICC Planning	• As part of the Planning Team, assist the Planning Officer in the performance of their duties in relation to the interpretation of existing response plans and the development of incident action plans and related sub plans. • Facilitate the provision of relevant IAP and sub plans from the PT IMT.	1

[4] See [redacted]

Area	WEL Liaison Role	Personnel Sourced from[4]:	Key Duties	#
Planning-Plans/ Resources		Coordinator Reserve List and Planning Group 3	• Assist in the interpretation of the PT OPEP from the PT. • Assist in the interpretation of the PT IAP and sub plans from the PT IMT. • Facilitate the provision of relevant IAP and sub plans originating from the DoT IMT to the PT IMT. • Assist in the interpretation of the PT existing resource plans. • Facilitate the provision of relevant components of the resource sub plan originating from the DoT IMT to the PT IMT. **(Note this individual must have intimate knowledge of the relevant PT OPEP and planning processes)**	
DoT IMT Public Information-Media/ Community Engagement	Public Information Support and Media Liaison Officer/ Deputy Public Information Officer	Reputation (Media) FST Duty Manager Roster	• As part of the Public Information Team, provide a direct liaison between the PT Media team and DoT IMT Media team. • Facilitate effective communications and coordination between the PT and DoT media teams. • Assist in the release of joint media statements and conduct of joint media briefings. • Assist in the release of joint information and warnings through the DoT Information and Warnings team. • Offer advice to the DoT Media Coordinator on matters pertaining to PT media policies and procedures. • Facilitate effective communications and coordination between the PT and DoT Community Liaison teams. • Assist in the conduct of joint community briefings and events. • Offer advice to the DoT Community Liaison Coordinator on matters pertaining to the PT community liaison policies and procedures. • Facilitate the effective transfer of relevant information obtained from through the Contact Centre to the PT IMT.	1
DoT IMT Logistics	Deputy Logistic Officer	Services FST Logistics Team 2 Roster	• As part of the Logistics Team, assist the Logistics Officer in the performance of their duties in relation to the provision of supplies to sustain the response effort. • Facilitate the acquisition of appropriate supplies through the PTs existing OSRL, AMOSC and private contract arrangements. • Collects Request Forms from DoT to action via PT IMT. **(Note this individual must have intimate knowledge of the relevant PT logistics processes and contracts)**	1
DoT IMT Finance-Accounts/	Deputy Finance Officer	CICC Finance Coordinator Roster	• As part of the Finance Team, assist the Finance Officer in the performance of their duties in relation to the setting up and payment of accounts for those services acquired through the PTs existing OSRL, AMOSC and private contract arrangements. • Facilitate the communication of financial monitoring information to the PT to allow them to track the overall cost of the response.	1

Area	WEL Liaison Role	Personnel Sourced from[4]:	Key Duties	#
Financial Monitoring			• Assist the Finance Officer in the tracking of financial commitments through the response, including the supply contracts commissioned directly by DoT and to be charged back to the PT.	
DoT IMT Operations	Deputy Operations Officer	CICC Operations Coordinator Roster	• As part of the Operations Team, assist the Operations Officer in the performance of their duties in relation to the implementation and management of operational activities undertaken to resolve an incident. • Facilitate effective communications and coordination between the PT Operations Section and the DoT Operations Section. • Offer advice to the DoT Operations Officer on matters pertaining to PT incident response procedures and requirements. • Identify efficiencies and assist to resolve potential conflicts around resource allocation and simultaneous operations of PT and DoT response efforts.	1
DoT IMT Operations – Waste Management	Facilities Support Officer/ Deputy Waste Management Coordinator	Services FST Logistics Team 2 and WEL Waste Contractor Roster	• As part of the Operations Team, assist the Waste Management Coordinator in the performance of their duties in relation to the provision of the management and disposal of waste collected in State waters. • Facilitate the disposal of waste through the PT's existing private contract arrangements related to waste management and in line with legislative and regulatory requirements. • Collects Request Forms from DoT to action via PT IMT.	1
DoT FOB Operations Command	Deputy On-Scene Commander/ Deputy Division Commander	AMOSC Core Group	• As part of the Field Operations Team, assist the Division Commander in the performance of their duties in relation to the oversight and coordination of field operational activities undertaken in line with the IMT Operations Section's direction. • Provide a direct liaison between the PT FOB and DoT FOB. • Facilitate effective communications and coordination between the PT Division Commander and the DoT Division Commander. • Offer advice to the DoT Division Commander on matters pertaining to PT incident response policies and procedures. • Assist the Safety Coordinator deployed in the FOB in the performance of their duties, particularly as they relate to PT employees or contractors. • Offer advice to the Safety Coordinator deployed in the FOB on matters pertaining to PT safety policies and procedures.	1
			Total Woodside personnel initially required in DoT IMT	11

DOT LIAISON OFFICER RESOURCES TO WOODSIDE

Once DoT activates a State waters/shorelines IMT, Woodside will request DoT make available the following roles:

Area	DoT Liaison Role	Personnel Sourced from:	Key Duties	#
WEL CMT	DoT Liaison Officer (prior to DoT assuming Controlling Agency) / Deputy Incident Controller – State waters (after DoT assumes Controlling Agency)	DoT	• Facilitate effective communications between DoT's SMPC / Incident Controller and the Petroleum Titleholder's appointed CMT Leader / Incident Controller. • Provide enhanced situational awareness to DoT of the incident and the potential impact on State waters. • Assist in the provision of support from DoT to the Petroleum Titleholder. • Facilitate the provision technical advice from DoT to the Petroleum Titleholder Incident Controller as required.	1
WEL Reputation FST (Media Room)/ Public Information – Media	DoT Media Liaison Officer	DoT	• Provide a direct liaison between the PT Media team and DoT IMT Media team. • Facilitate effective communications and coordination between the PT and DoT media teams. • Assist in the release of joint media statements and conduct of joint media briefings. Assist in the release of joint information and warnings through the DoT Information and Warnings team. • Offer advice to the PT Media Coordinator on matters pertaining to DoT and wider Government media policies and procedures.	1
			Total DoT Personnel Initial Requirement to Woodside	2

APPENDIX I. MASTER EXISTING ENVIRONMENT

Description of the Existing Environment

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1. INTRODUCTION

1.1 Purpose

This document applies, where indicated in the relevant Environment Plan, to Woodside Energy Ltd. (Woodside) activities and operations.

1.2 Scope

This document describes the existing environment within the Woodside areas of activity located in Commonwealth waters off north-western Western Australia (WA), with a focus on the North-west Marine Region (NWMR) (**Figure 1-1**). This document includes details of the particular and relevant values and sensitivities of the environment as required by the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 in order to inform the impact and risk evaluation of Woodside's activities within the NWMR. Furthermore, the key values of the South-west Marine Region (SWMR) and the North Marine Region (NMR) are summarised to encompass areas outside the NWMR. This is with reference to the environment that may be affected (EMBA), as defined and described in individual EPs, for unplanned hydrocarbon spill risks. Additional information appropriate to the nature and scale of the impacts and risks of activities that may interact with the environment will be used to further inform impact and risk assessments and included in the Description of the Existing Environment of individual EPs.

This document is informed by a variety of resources that includes: a search of the Department of Agriculture, Water and the Environment (DAWE) Protected Matters Search Tool (PMST) for the marine bioregions (NWMR, SWMR and NMR) and the three PMST reports provided in **Appendix A**; State (WA)/Commonwealth Marine Park Management Plans, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Species Profile and Threats Database (SPRAT), Part 13 statutory instruments (recovery plans, conservation advices and wildlife conservation plans for listed threatened and migratory species); and peer reviewed scientific publications, as well as Woodside and Joint Venture (JV) funded studies and other titleholder funded study findings available in the public domain.

1.3 Review and Revision

The information presented in this document is reviewed and updated, where relevant, on at least an annual basis to address any relevant changes, which includes but is not limited to the status of EPBC Act listed species, Part 13 Instruments, policies and guidelines and recently published scientific literature.

1.4 Regional Context

Where relevant, the physical, biological and social environments within the areas of interest are discussed with reference to the three marine bioregions of Australia—NWMR, SWMR and NMR (**Table 1-1)**. The NWMR is the focal marine bioregion for the Description of the Existing Environment as this is currently the location of most of Woodside's activities.

Table 1-1. Description of the Marine Bioregions

Marine Bioregion	Description
North-west	The NWMR includes all Commonwealth waters (from 3 nautical mile [nm] from the Territorial Sea Baseline [TSB] to the 200 nm Exclusive Economic Zone [EEZ] boundary) extending from the WA/Northern Territory (NT) border to Kalbarri, south of Shark Bay in WA, covering an area of approximately 1.07 million square kilometres and includes extensive areas of shallower waters on the continental shelf, as well as deep areas of abyssal plain where water depths are 5000 m or greater.
South-west	The SWMR comprises Commonwealth waters from the eastern end of Kangaroo Island in SA to Shark Bay in WA. The region spans approximately 1.3 million square kilometres of temperate and subtropical waters and abuts the coastal waters of SA and WA.
North	The NMR comprises Commonwealth waters from west Cape York Peninsula to the NT/WA border). The region covers approximately 625,689 square kilometres of tropical waters in the Gulf of Carpentaria and Arafura and Timor seas, and abuts the coastal waters of Queensland and the NT.

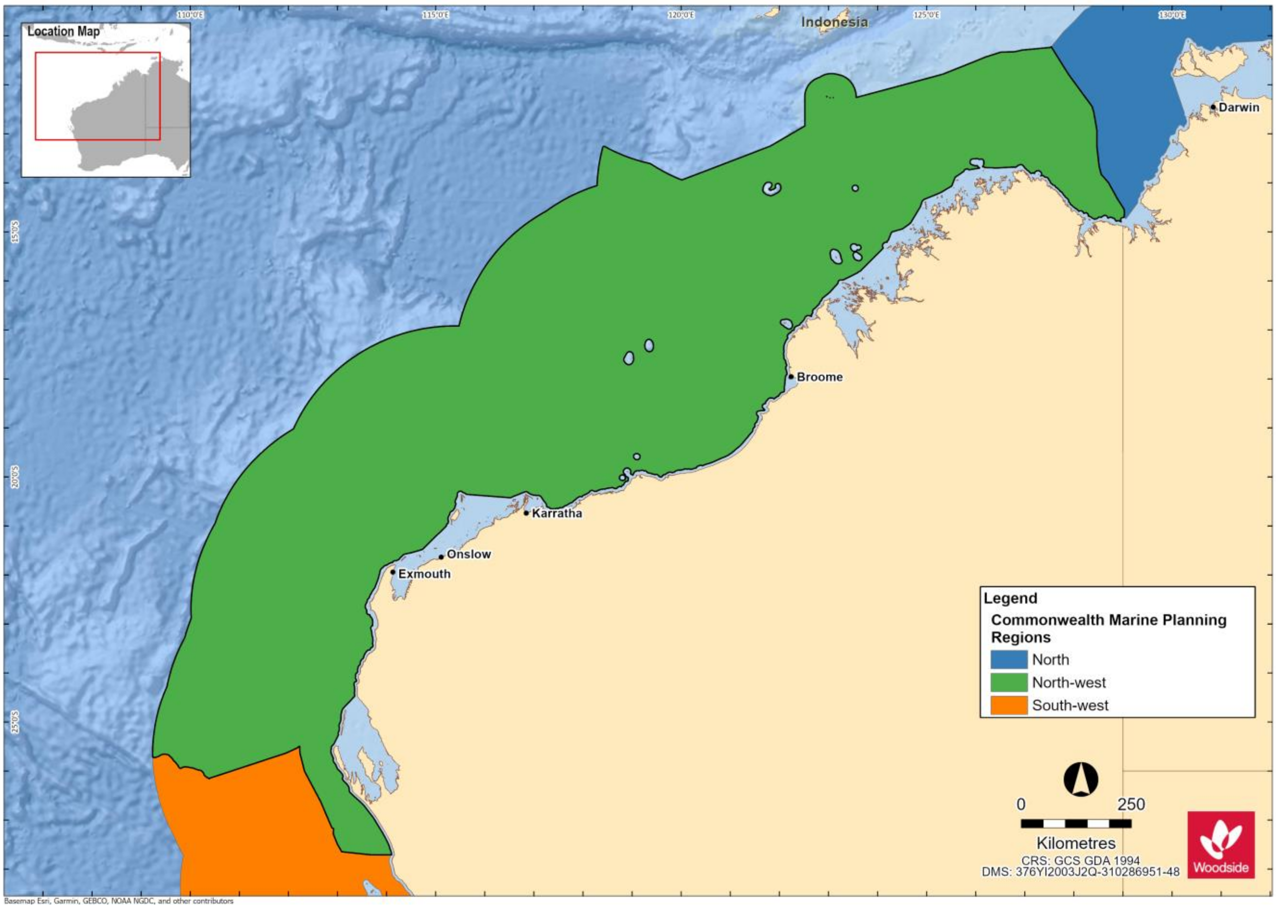


Figure 1-1. Marine Bioregions: North-west (NWMR), South-west (SWMR) and North (NMR)

2. PHYSICAL ENVIRONMENT

2.1 Regional Context

The key physical characteristics of the NWMR, SWMR and NMR are presented in **Table 2-1**.

Table 2-1 Key physical characteristics of the NWMR, SWMR and NMR

Bioregion	Key Characteristics
North-west Marine Region	The NWMR experiences a tropical monsoonal climate towards the northern extent of the region, transitioning to tropical arid and subtropical arid within the central and southern areas of the region (DSEWPAC, 2012a).
	The NWMR is part of the Indo-Australian Basin, the ocean region between the north-west coast of Australia and the Indonesian islands of Java and Sumatra. Dominant currents in the Region include: the South Equatorial Current, the Indonesian Throughflow; the Eastern Gyral Current, and the Leeuwin Current (DEWHA, 2007a).
	The seafloor of the NWMR consists of four general feature types: continental shelf; continental slope; continental rise; and abyssal plain and is distinguished by a range of topographic features including canyons, plateaus, terraces, ridges, reefs, and banks and shoals.
South-west Marine Region	The SWMR contains both subtropical and temperate climates, with overall light climatic cycles.
	The SWMR experiences complex and unusual oceanographic patterns, driven largely by the Leeuwin Current and its associated currents that have a significant influence on biodiversity distribution and abundance.
	The major seafloor features of the SWMR include a narrow continental shelf on the west coast to the waters off south-west WA, and a wide continental shelf dominated by sandy carbonate sediments of marine origin in the Great Australian Bight, the region also contains a steep, muddy continental slope, many canyons and large tracts of abyssal plains (DSEWPAC, 2012b).
North Marine Region	The NMR experiences a tropical monsoonal climate with complex weather cycles, including high temperatures and heavy seasonal yet variable rainfall and cyclones, which can be both destructive (loss of seagrass and mangroves) and constructive (mobilisation of sediment into coastal habitats).
	The NMR comprises Commonwealth waters from west Cape York Peninsula to the NT–WA border, covering tropical waters in the Gulf of Carpentaria and Arafura and Timor seas. Currents in the NMR are driven largely by strong winds and tides, with only minor influences from oceanographic currents such as the Indonesian Throughflow and the South Equatorial Current (DSEWPAC, 2012c).
	The seafloor of the NMR consists mainly of a wide continental shelf, as well as other geomorphological features such as shoals, banks, terraces, valleys, shallow canyons and limestone pinnacles.

2.2 Marine Systems of the North-west Marine Region.

The NWMR can be divided into three large scale ecological marine systems on the basis of the influence of major ocean currents, seafloor features and eco-physical processes (e.g. climate, tides, freshwater inflow) upon the Region (DSEWPAC, 2012a). The three large scale marine systems approximate the Woodside activity areas within the NWMR (**Figure 2-1**). The key characteristics of each marine system are outlined below in **Table 2-2**.

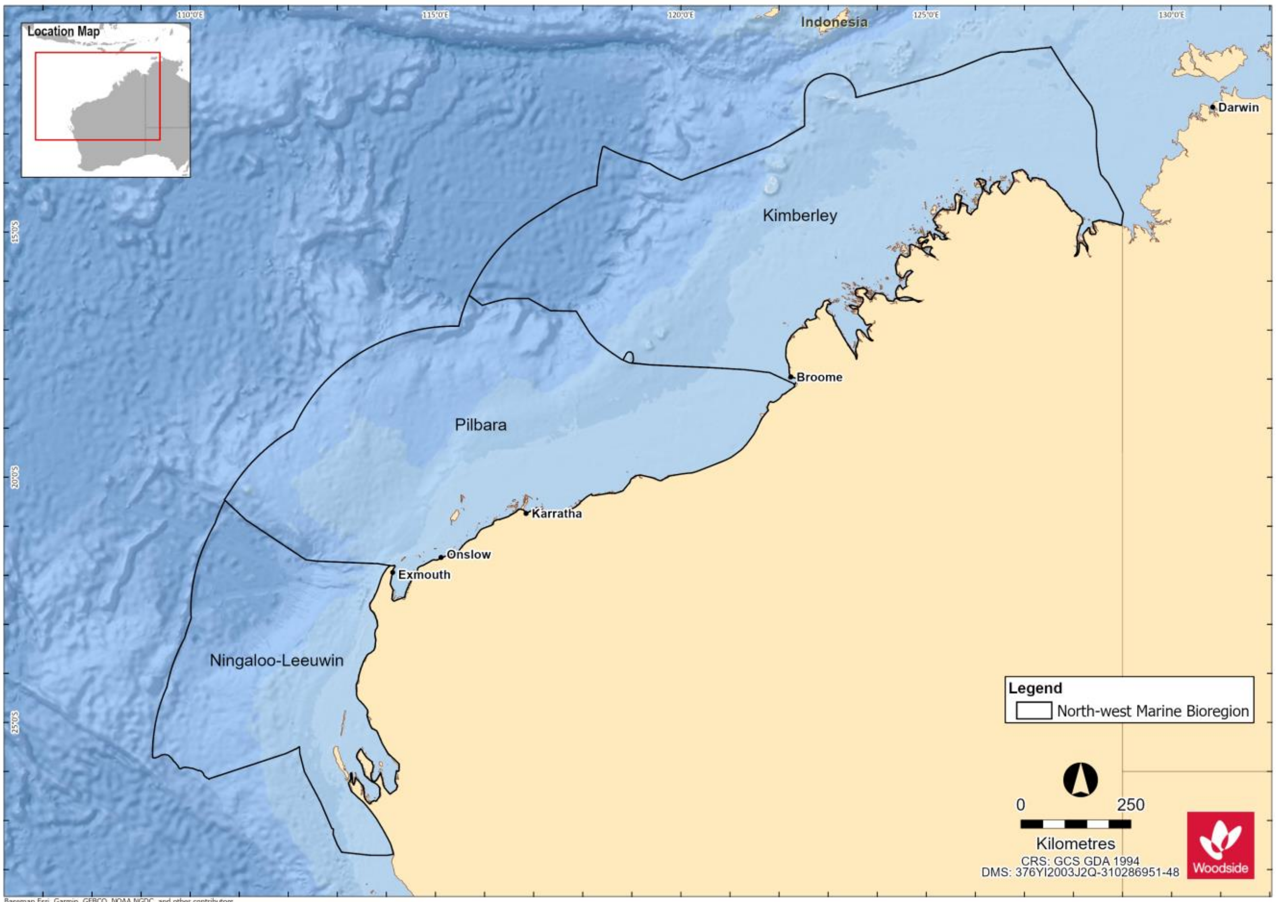


Figure 2-1. The marine systems of the North-west Marine Region (NWMR)

Table 2-2. Key characteristics of the Marine Systems of the NWMR

Note: Woodside areas align with the marine systems as described in DEWHA (2007a)

Marine System	Woodside Activity Area	Key Characteristics
Kimberley	Browse	Tropical monsoonal climate Strong influence from Indonesian Throughflow Predominantly tropical Indo-Pacific species Subject to episodic offshore cyclonic activity, rarely crossing the coast Large tidal regimes Freshwater input from terrestrial monsoonal run-off Turbid coastal waters (i.e. light limited systems) Dominated by shelf environments Predominantly hard substrates in inner to mid-shelf environments Includes a number of shelf-edge atolls (i.e. Scott Reef, Rowley Shoals)
Pilbara	North-west Shelf (NWS) / Scarborough	Tropical arid climate Transition between Indonesian Throughflow and Leeuwin Current dominated areas Predominantly tropical species High cyclone activity with frequent crossing of the coast Transitional tidal zone Internal tide activity Large areas of shelf and slope Dry coast with ephemeral freshwater inputs
Ningaloo-Leeuwin	North-west Cape	Subtropical arid climate Leeuwin Current consolidates Transitional tropical/temperate faunal area Higher water clarity in near-shore and offshore environments Narrow shelf and slope Marginal tidal range Seasonal wind forcing more dominant influence on marine environment

2.3 Meteorology and Oceanography

This section describes the general meteorological conditions and oceanography for the NWMR and provides further detail for the three Woodside activity areas. The NWMR is influenced by a complex system of ocean currents that change between seasons and between years, which generally result in its surface waters being warm and nutrient-poor, and of low salinity (DEWHA, 2007a). The mix of bathymetric features, complex topography and oceanography across the whole north-west marine environment has created and supports a globally important marine biodiversity hotspot (Wilson, 2013).

Table 2-3 NWMR climate and oceanography summary

Receptor	Description
	Meteorology
Seasonal patterns	The NWMR associated land mass of the Australian continent is characterised as a hot and humid summer climate zone. The broader NWMR experiences variations of a tropical or monsoon climate. In the far north-west (Kimberley), there is a hot summer season from December to March and a milder winter season between April and November. The Pilbara area is described as having a tropical arid climate with high cyclone activity (DEWHA, 2007a). The Pilbara and North-west Cape has a hot summer season from October to April and a milder winter season between May and September with transition periods between the summer and winter regimes.
Air temperature and rainfall	In summer (between September and March), maximum daily temperatures range from 31ºC to 33ºC. During winter (May to July), mean daily temperatures range from 18ºC to 31ºC (BOM[1]), refer to **Figure 2-2a** and **b**. Rainfall in the region typically occurs during the summer, with highest falls observed late in the season. This is often associated with the passage of tropical low-pressure systems and cyclones.
Wind	Wind patterns in north-west WA are dictated by the seasonal movement of atmospheric pressure systems. During summer, high-pressure cells produce prevailing winds from the north-west and south-west, which vary between 10 and 13 ms^{-1}. During winter, high-pressure cells over central Australia produce north-easterly to south-easterly winds with average speeds of between 6 and 8 ms^{-1}. Refer to **Figure 2-3a** and **b**.
Tropical cyclones	The NWS and Pilbara coast (within the NWMR) experiences more cyclonic activity than any other region of the Australian mainland coast (BOM, 2021a). Tropical cyclone activity typically occurs between November and April and is most frequent in the region during December to March (i.e. considered the peak period), with an average of about one cyclone per month (BOM, 2021a). Refer to **Figure 2-4**.
	Oceanography
Ocean temperature	Waters in NWMR are tropical year-round, with sea surface temperature in open shelf waters reaching ~26°C in summer and dropping to ~22°C in winter. Nearshore temperatures (as recorded for the NWS area) fluctuate more widely on an annual basis from ~17°C in winter to ~31°C in summer (Chevron Australia, 2010). Refer to **Figure 2-5a** and **b**.
Currents	The major surface currents influencing north-west WA flow towards the poles and include the Indonesian Throughflow, the Leeuwin Current, the South Equatorial Current, and the Eastern Gyral Current. The Ningaloo Current, the Holloway Current, the Shark Bay Outflow, and the Capes Current are seasonal surface currents in the region. Below these surface currents are several subsurface currents, the most important of which are the Leeuwin Undercurrent and the West Australian Current. These subsurface currents flow towards the equator in the opposite direction to surface currents (DEWHA, 2007a). Refer to **Figure 2-6**. The offshore waters of the NWMR are characterised by surface and subsurface boundary currents that flow along the continental shelf/slope and are enhanced through inflows from the ocean basins and are an important conduit for the poleward heat and mass transport along the west coast (Wijeratne *et al.*, 2018). Local physical oceanography is strongly influenced by the large-scale water movements of the Indonesian Throughflow (Liu *et al*. 2015; Sutton *et al*. 2019). Typically, a warm and well-mixed oligotrophic surface layer and a cooler and more nutrient rich, deeper water layer (Menezes *et al*. 2013).
Waves	Sea surface waves within the NWMR, generally reflect the direction of the synoptic winds and flow predominately from the south-west in the summer and east in winter (Pearce *et al.*, 2003). The NWS within the NWMR is a known area of internal wave generation. Both internal tides and internal waves are thought to be more prevalent during summer months due to the increased stratification of the water column (DEWHA, 2007a). Along the continental slope of the NWMR, strong internal waves and interaction between semi-diurnal tidal currents and seabed topographic features facilitates upwelling events and localised productivity events (Holloway, 2001).
Tides	Tides on the NWS (NWMR) increase as the water moves from deep towards the shallower coast. The highest offshore tides are experienced at the border of the Browse and Canning basins. The smallest tides are experienced at the Exmouth Plateau, near the coast. Tides of NWS (NWMR) are predominantly semi-diurnal (two highs and two lows each day), but with increasing importance of the diurnal (once per day) inequality at the southern and northern extremities of the NWS.

[1] http://www.bom.gov.au/jsp/ncc/climate_averages/temperature/index.jsp, accessed 21 January 2021.

Receptor	Description
	The tide range—represented by the Mean Spring Range (MSR)—increases northwards along the coast from 1.4 m at North-west Cape (Point Murat) to 7.7 m at Broome, before decreasing again (apart from local amplification in King Sound and Collier Bay) to about 5 m off Cape Londonderry. The MSR then increases again through Joseph Bonaparte Gulf and on up 5.5 m at Darwin (RPS, 2016).

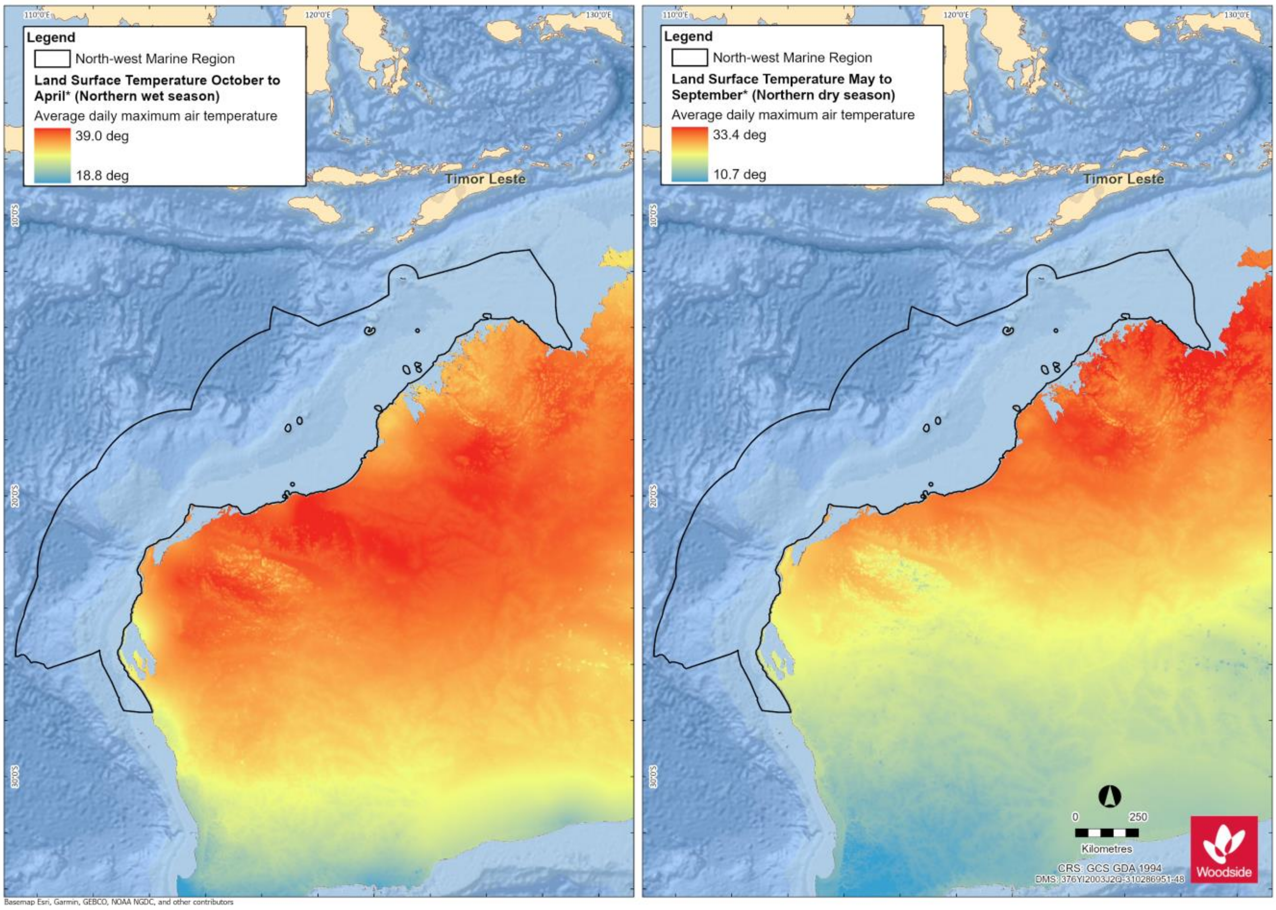


Figure 2-2. Average daily maximum air temperature for land surface adjacent to NWMR: (a) summer (northern wet season) and (b) winter (northern dry season)

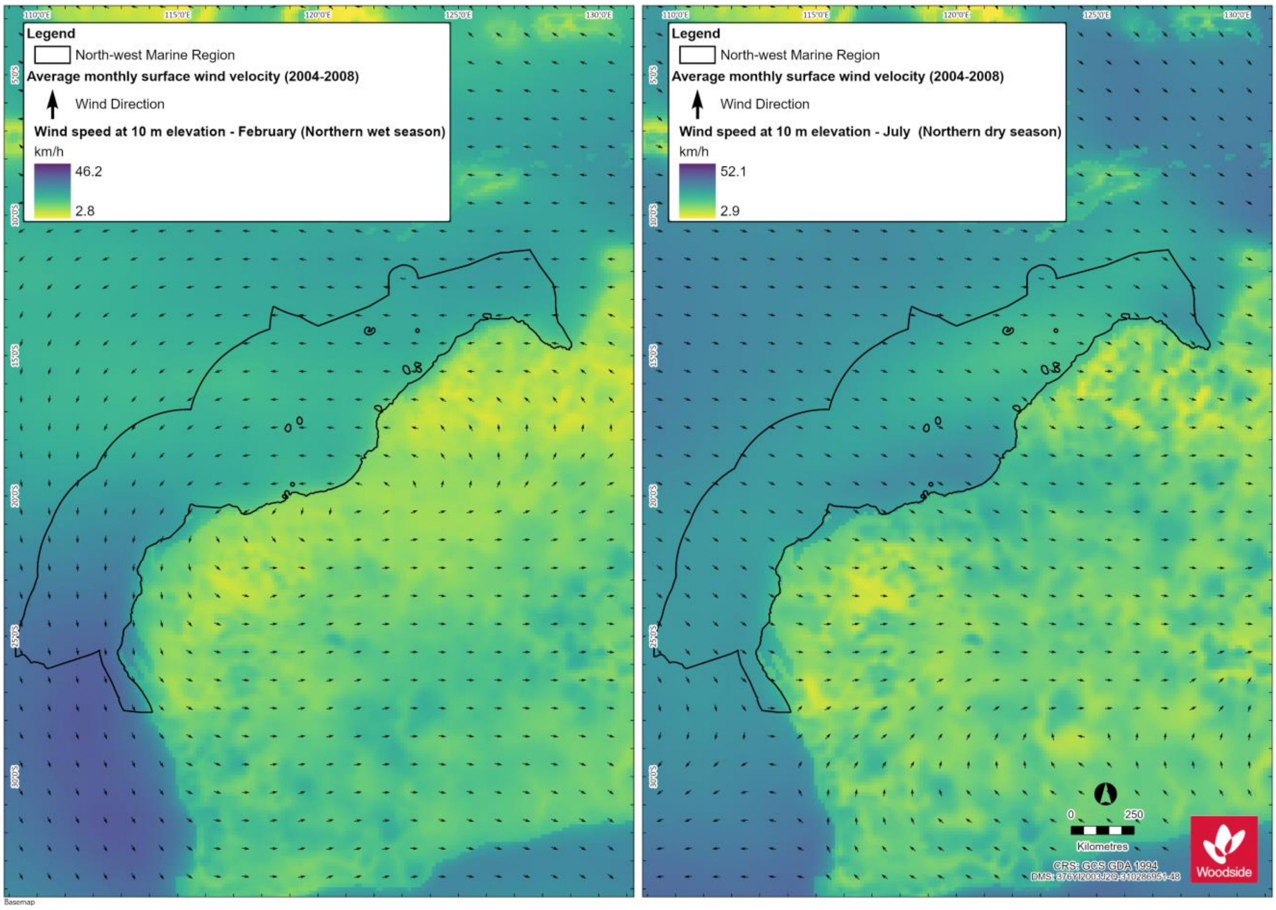


Figure 2-3. Average monthly surface wind direction and velocity for NWMR: (a) summer (February, northern wet season) and (b) winter (July, northern dry season)

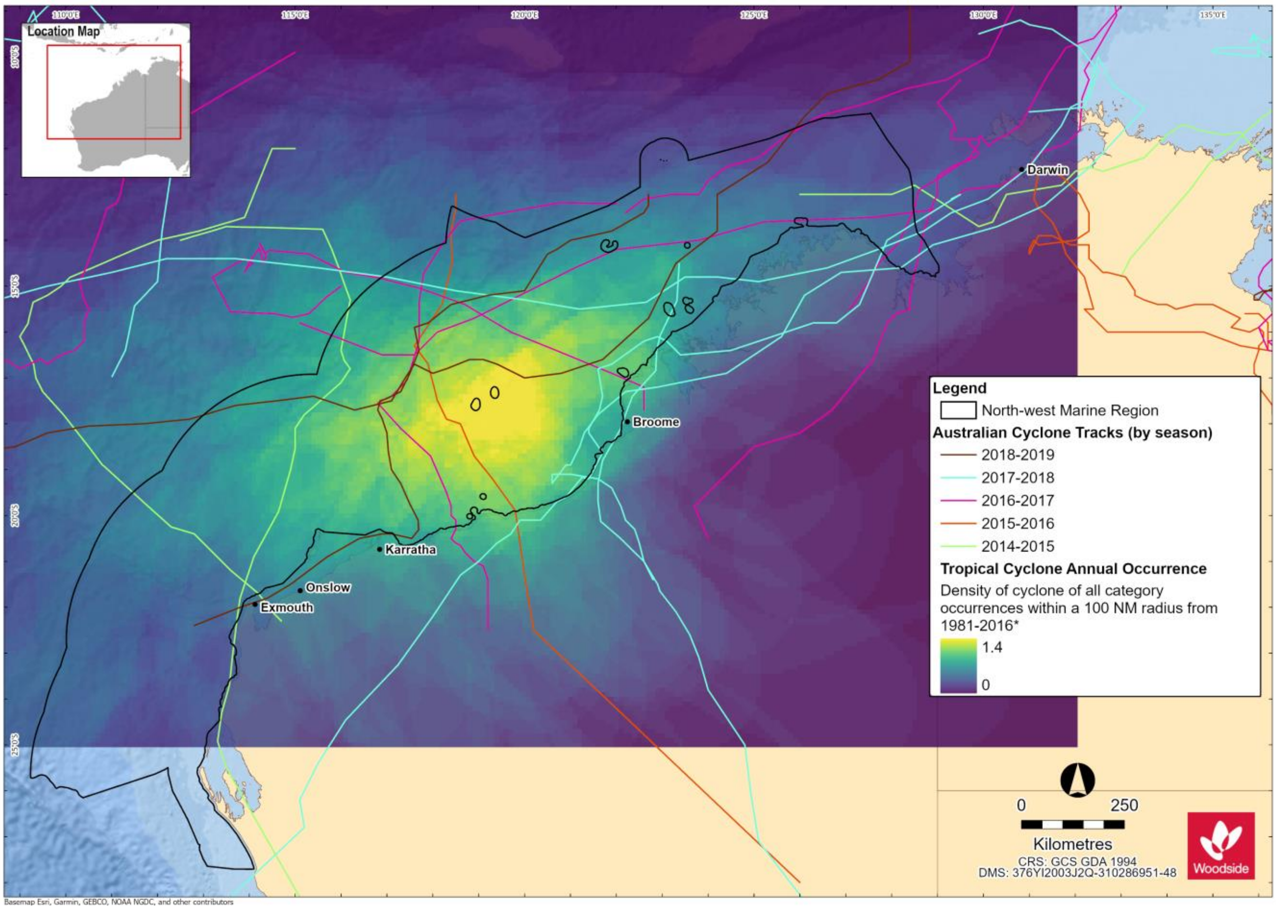


Figure 2-4. Tropical cyclone annual occurrence and cyclone tracks for NWMR

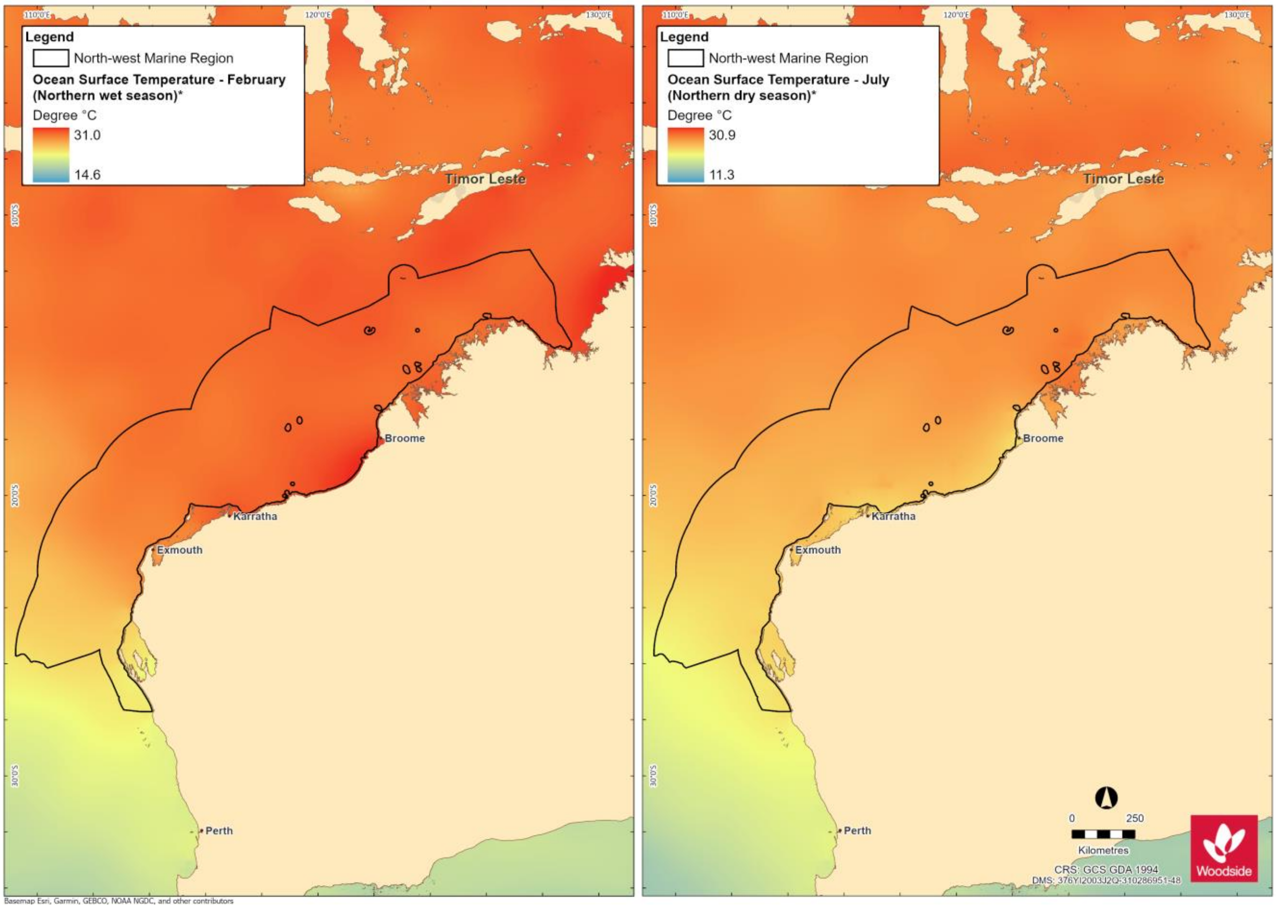
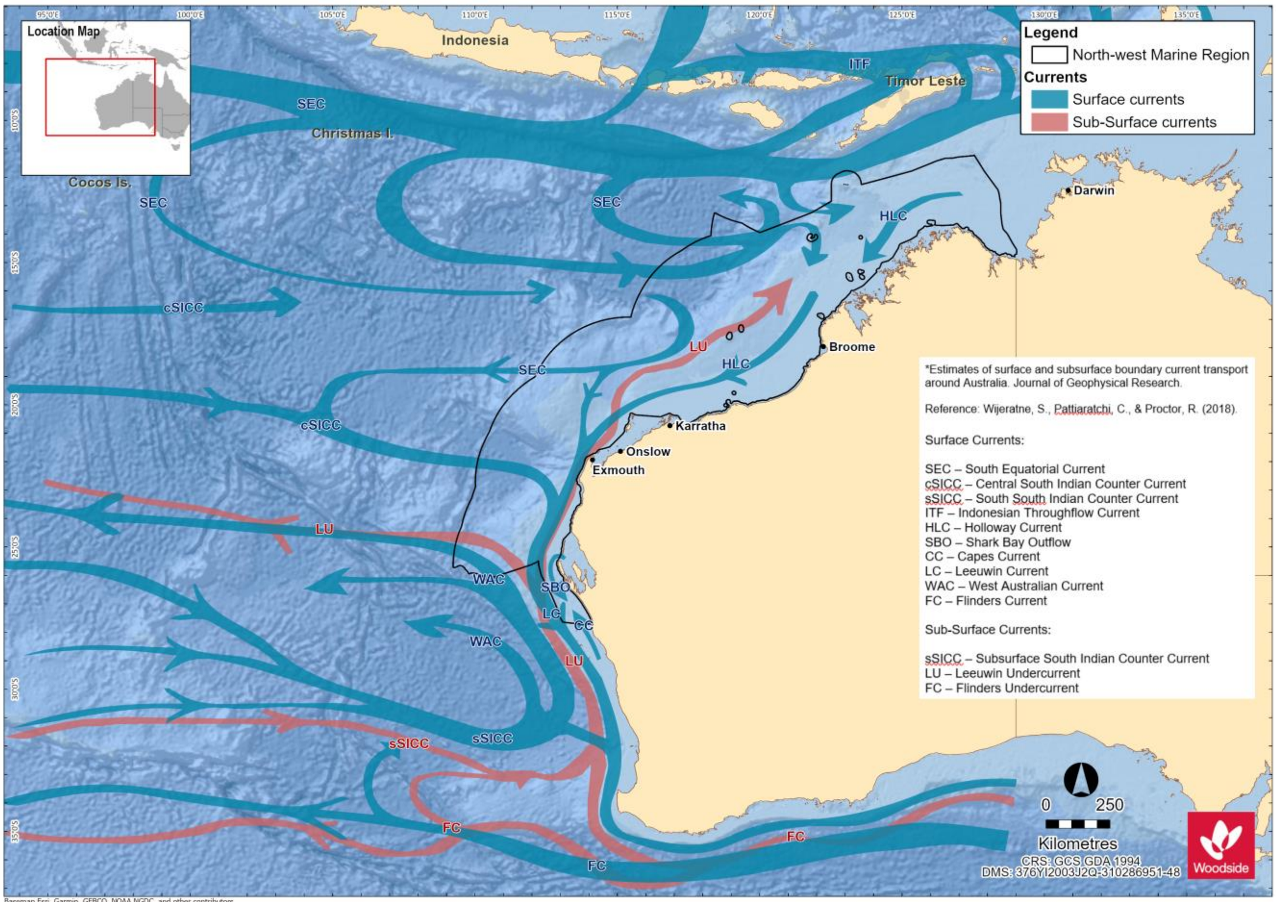


Figure 2-5. Ocean surface temperature for NWMR: (a) summer (February, northern wet season) and (b) winter (July, northern dry season)



Basemap Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 2-6. Ocean surface and sub-surface currents of the NWMR and wider region

2.3.1 Browse

Table 2-4 Summary meteorology and oceanography for Browse (refer to Appendix B for supporting metocean figures)

Receptor	Description
Meteorology	
Seasonal patterns	The Browse area overlapping the Kimberley marine system experiences tropical monsoon climate with two distinct seasons: the wet season from December to March and dry season from April to November.
Air temperature	The mean annual air temperature recorded at Troughton Island between 2010 and 2020 ranged from 30.1ºC in 2011 to 32.6ºC in 2016 and highest mean monthly air temperatures were recorded for the months of November and December (BOM, 2021b).
Rainfall	Rainfall recorded from Troughton Island in the Browse basin ranged from barely detectable (<1 mm) mean monthly level to >100 mm in December to March, with the highest rainfall recorded for January. Reflecting the wet monsoon season of the Kimberley marine system (BOM, 2021c).
Wind	The dry season experiences high pressure systems that bring east to south-easterly winds with average wind speeds during the season of approximately 16.6 km/hr and maximum wind gusts of 65 km/hr. In contrast the wet season brings predominately westerly winds with average wind speeds approximately 17 km/hr and maximum gusts exceeding 100 km/hr (generally associated with tropical cyclones (MetOcean Engineers, 2005).
Oceanography	
Currents	Surface currents exhibit seasonal directionality, with flow to the south-west during March to June and more variable outside this period (Woodside, 2019). This is consistent with the stronger Leeuwin Current flow during winter months, with more variable currents driven by local wind stress during periods of weaker Leeuwin Current flow.

2.3.2 North West Shelf / Scarborough

Table 2-5 Summary meteorology and oceanography for the North West Shelf and Scarborough (refer to Appendix B for supporting metocean figures)

Receptor	Description
Meteorology	
Seasonal patterns	The NWS and Scarborough areas experience the monsoonal climate of the wider NWMR with a distinct wet and dry seasonal regime and transitions periods between seasons.
Air temperature	Air temperatures as measured at the North Rankin A platform on NWS ranged from a maximum average of 39.5ºC in summer to a minimum average temperature of 15.6ºC in winter (Woodside, 2012).
Rainfall	Rainfall patterns annually reveal the wet season with highest rainfalls during the late summer, often associated with the passage of tropical low-pressure systems and cyclones. Rainfall in the dry season is typically extremely low. (Pearce *et al.* 2003).
Wind	Winds are typically from the southwest during the wet season (summer) and tending from the south-east during the dry season (winter). The summer south-westerly winds are driven by high pressure cells that pass from west to east over the Australian continent. During the winter period, the relative position of the high-pressure cells shifts further north, leading to prevailing south-easterly winds from the mainland (Pearce *et al.* 2003).
Oceanography	
Currents	The large-scale ocean currents of the NWMR, primarily the Indonesian Throughflow and Leeuwin Current (and Holloway Current), are the primary influence on the NWS and Scarborough areas. The ITF and Leeuwin Current are strongest during the late summer and winter and flow reversals to the north-east, typically short-lived and weak, when there are strong south-westerly winds can generate localised upwelling on the shelf edge (Holloway and Nye, 1985; James *et al.* 2004 and Condie *et al.* 2006).

2.3.3 North-west Cape

Table 2-6 Summary meteorology and oceanography for the North-west Cape (refer to Appendix B for supporting metocean figures)

Receptor	Description
Meteorology	
Seasonal patterns	The climate of the NWMR is dry tropical exhibiting a hot summer season and a mild winter season. There are often distinct transition periods between the summer and winter regimes, characterised by periods of relatively low winds.
Air temperature	Air temperatures in the North-west Cape area range from high summer temperatures (maximum average of 37.5ºC) and mild winter temperatures (minimum average of 12.2ºC).
Rainfall	Rainfall typically occurs during the summer, with highest rainfall during later summer and autumn, often associated with the passage of tropical low-pressure systems and cyclones. Rainfall is typically low in winter.
Wind	Winds vary seasonally, generally from the south-west quadrant during summer months and the south, south-east quadrant during the autumn and winter months. The summer south-westerly winds are driven by high pressure cells that pass from west to east over the Australian continent. Winds typically weaken and are more variable during the transitional period between the summer and winter seasons, generally between April to August.
Oceanography	
Currents	Surface currents exhibit seasonal directionality, with flow to the south-west during March to June and more variable outside this period (Woodside, 2016). This is consistent with the stronger Leeuwin Current flow during winter months, with more variable currents driven by local wind stress during periods of weaker Leeuwin Current flow.

2.4 Physical Environment of NWMR

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0, there are eight provincial bioregions that occur within the NWMR, which are based on patterns of demersal fish diversity, benthic habitat and oceanographic data (Commonwealth of Australia, 2006), **Figure 2-7**. Of the eight provincial bioregions that occur within the NWMR, these include four offshore (~65% of total NWMR area) and four shelf (~35% of total NWMR area) bioregions (Baker *et al.,* 2008).

The NWMR is a tropical carbonate margin that comprises an extensive area of shelf, slope and abyssal plain/deep ocean floor, as well as complex areas of bathymetry such as plateau, terraces and major canyons (Harris *et al.*, 2005). A series of reefs are located on the outer shelf/slope of the NWMR, including Ashmore, Cartier, Scott and Seringapatam reefs (Baker *et al*., 2008). The distribution of seafloor geomorphic features has been systematically mapped over much of the Australian margin and adjacent seafloor. The mapped area can be divided into 10 geomorphic regions, of which the NWMR overlays two; the Western Margin and Northern Margin (Harris *et al.*, 2005). Most of the region consists of either continental slope (61%) or continental shelf (28%) (DEWHA, 2007a) with more than 40% of the NWMR having a water depth less than 200 m. The shallow shelf is contrasted by features such as the Cuvier and Argo abyssal plains, which reach depths more than five kilometres. A unique feature of the region is the significant narrowing of the continental shelf around North-west Cape (approximately 7 km wide) from the broad continental shelf in the north of the region (approximately 400 km wide at Joseph Bonaparte Gulf) (DEWHA, 2007a), **Figure 2-8.**

The geological history of the region, as well as its geomorphology and oceanography, has influenced the composition and distribution of sediments (DEWHA, 2007a). The sedimentology of the NWMR is dominated by marine carbonates, which show a broad zoning and fining with water depth. Main trends of the NWMR sediments include a tropical carbonate shelf that is dominated by sand and gravel, an outer shelf/slope zone that is dominated by mud and a relatively homogenous rise and abyssal plain/deep ocean floor that is dominated by non-carbonate mud (Baker *et al.,* 2008), **Figure 2-9**.

The distribution and resuspension of sediments on the inner shelf is strongly influenced by the strength of tides across the continental shelf as well as episodic events such as cyclones. Further offshore, on the mid to outer shelf and on the slope itself, sediment movement is primarily influenced by ocean currents and internal tides (DEWHA, 2007a).

This variation in bathymetry and interactions with oceanographic processes provides a diversity of habitats to marine fauna and flora within the NWMR.

2.5 Air quality

The ambient air quality of all three marine regions is largely unpolluted due to the extent of the open ocean area, the activities currently carried out in each and the relative remoteness of each region.

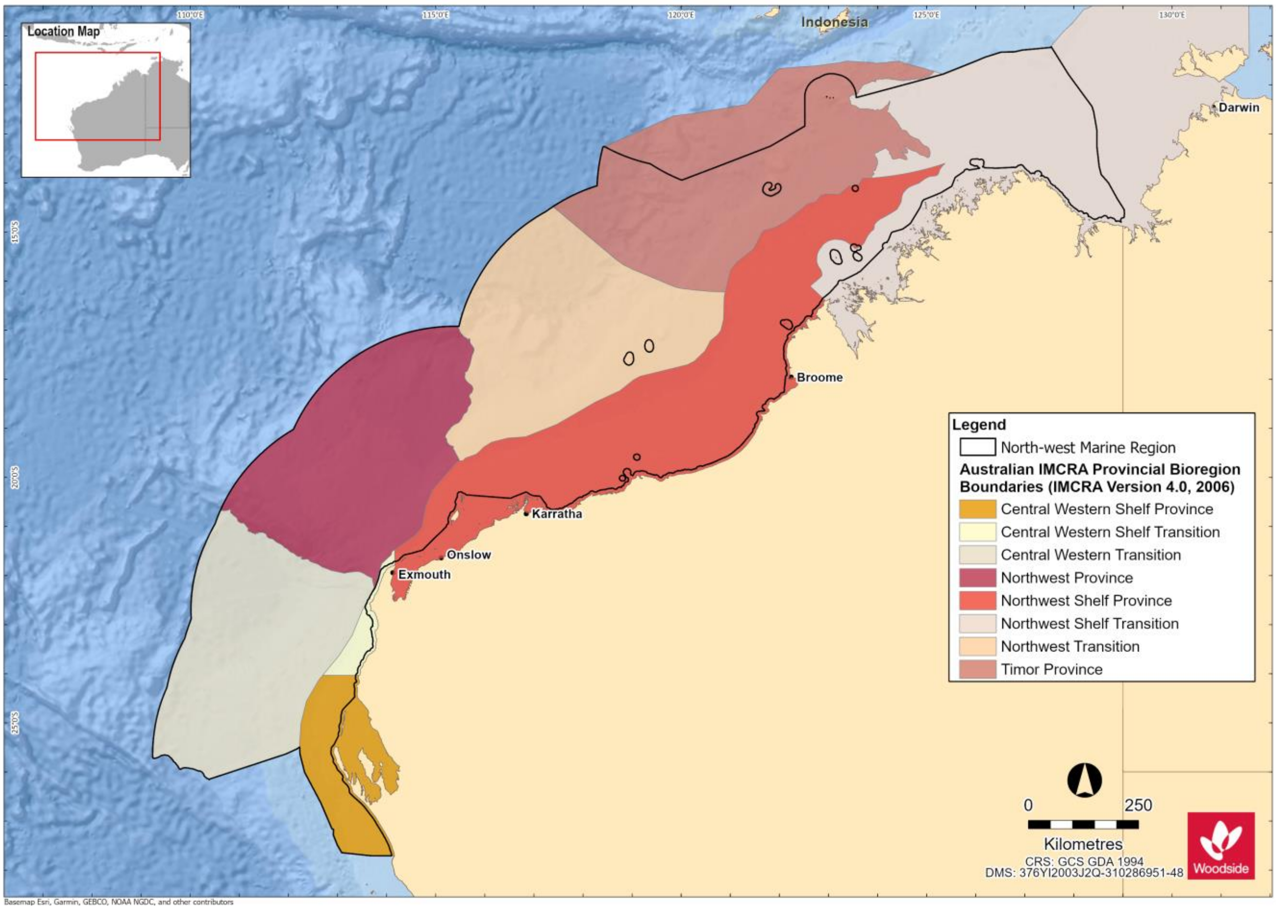


Figure 2-7. The eight provincial bioregions of the NWMR (Commonwealth of Australia, 2006)

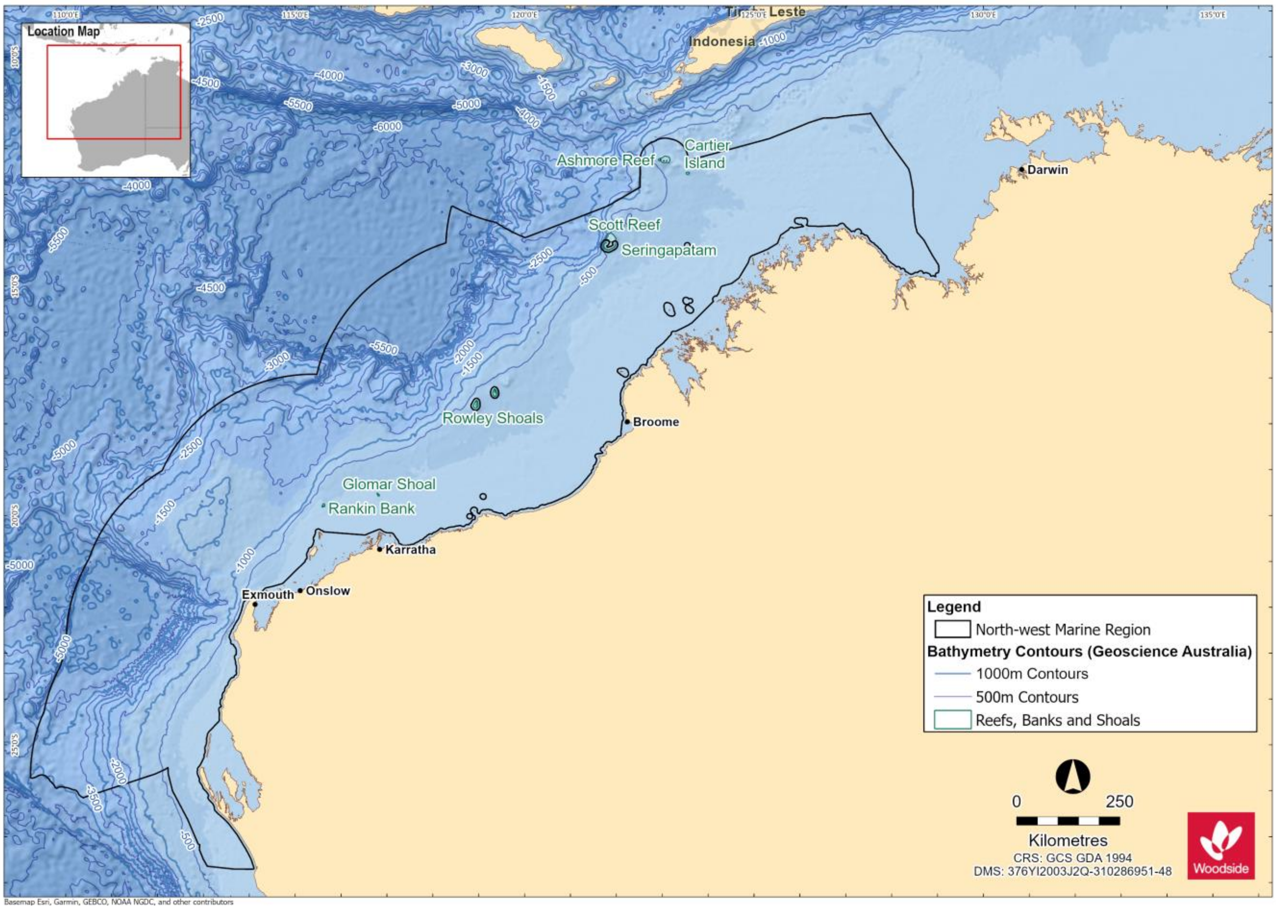


Figure 2-8. Bathymetry of the NWMR

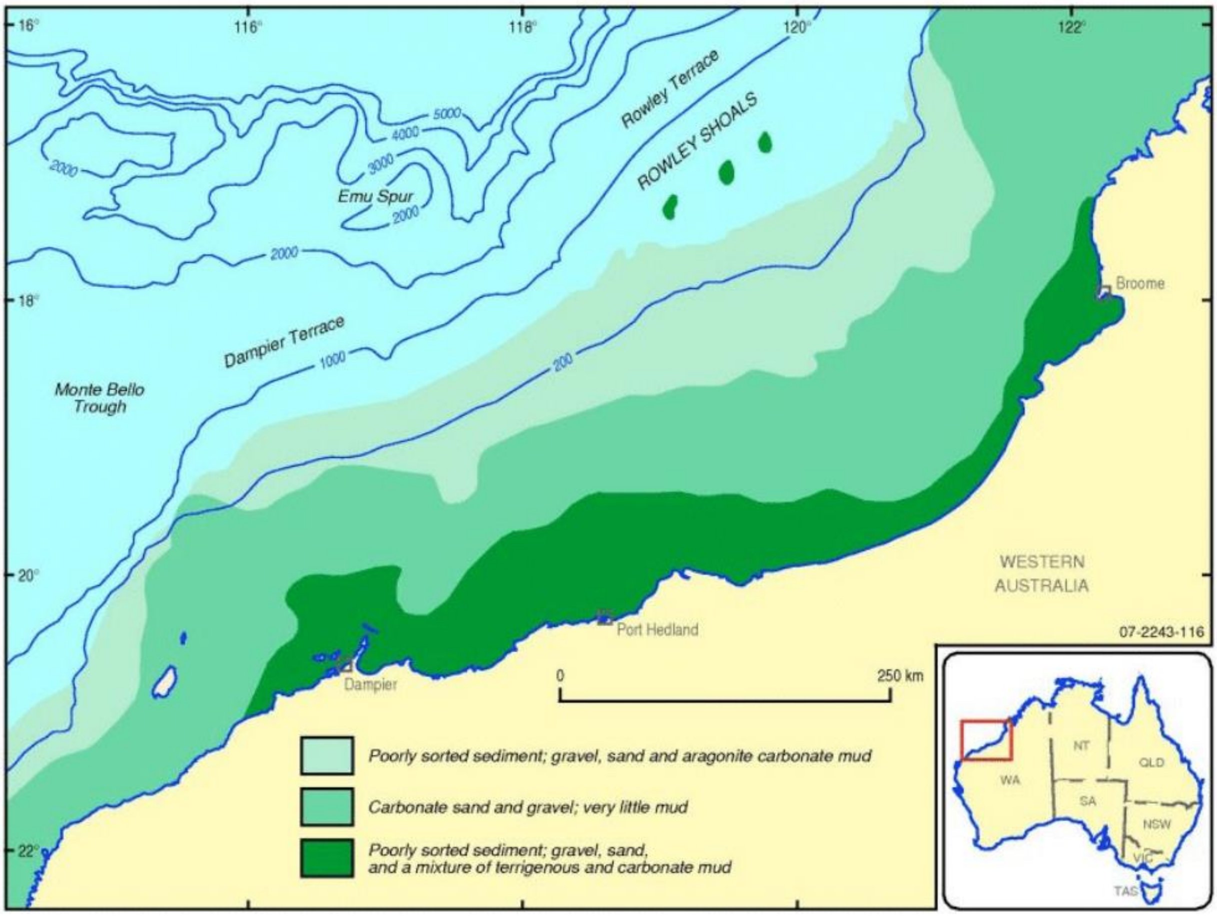


Figure 2-9. Overview of the seabed sediments of the NWMR (Baker *et al*., 2008)

3. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (EPBC ACT)

3.1 Summary of Matters of National Environmental Significance (MNES)

This section summarises the matters of national environmental significance (MNES) reported for the three bioregions; NWMR **(Table 3-1),** SWMR (**Table 3-2**) and NMR (**Table 3-3**), based on the Protected Matters search reports (**Appendix A**).

Additional information on these MNES are provided in subsequent sections (referenced below).

Table 3-1 Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the NWMR

MNES	Number	Description	Section of this Document
World Heritage Properties	2	Shark Bay The Ningaloo Coast	**Section 10**
National Heritage Places	5	Shark Bay The Ningaloo Coast The West Kimberley The Dampier Archipelago (including Burrup Peninsula) Dirk Hartog Landing Site 1616	**Section 10**
Wetlands of International Importance (Ramsar)	3	Ashmore Reef National Nature Reserve Eighty Mile Beach Roebuck Bay[1]	**Section 10**
Commonwealth Marine Area	2	EEZ and Territorial Sea Key Ecological Features (KEFs) Australian Marine Parks (AMPs) Australian Whale Sanctuary Extended Continental Shelf	**Section 9** **Section 10**
Listed Threatened Ecological Communities	1	Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Terrestrial community and not considered further
Listed Threatened Species	70	Refer NWMR PMST report (**Appendix A**)	**Section 5 – Section 8**
Listed Migratory Species	84	Refer NWMR PMST report (**Appendix A**)	**Section 5 – Section 8**

[1] *Roebuck Bay is a designated Wetland of International Importance (Ramsar site), which was not included in the PMST Report (**Appendix A**).*

Table 3-2 Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the SWMR

MNES	Number	Description	Section of this Document
World Heritage Properties	0	N/A	N/A
National Heritage Places	3	Cheetup Rock Shelter Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos HMAS Sydney II and HSK Kormoran Shipwreck Sites	**Section 10**
Wetlands of International Importance (Ramsar)	4	Becher Point Wetlands Forrestdale and Thomsons Lakes Peel-Yalgorup System Vasse-Wonnerup System	**Section 10**
Commonwealth Marine Area	2	EEZ and Territorial Sea KEFs AMPs Australian Whale Sanctuary Extended Continental Shelf	**Section 9** **Section 10**
Listed Threatened Ecological Communities	3	Banksia Woodlands of the Swan Coastal Plain ecological community Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community	Terrestrial communities and not considered further
Listed Threatened Species	65	Refer SWMR PMST report (**Appendix A**)	N/A
Listed Migratory Species	67	Refer SWMR PMST report (**Appendix A**)	N/A

Table 3-3 Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) as potentially occurring within the NMR

MNES	Number	Description	Section of this Document
World Heritage Properties	0	N/A	N/A
National Heritage Places	0	N/A	N/A
Wetlands of International Importance (Ramsar)	0	N/A	N/A
Commonwealth Marine Area	2	EEZ and Territorial Sea KEFs AMPs Australian Whale Sanctuary Extended Continental Shelf	**Section 9** **Section 10**
Listed Threatened Ecological Communities	0	N/A	N/A
Listed Threatened Species	33	Refer NMR PMST report (**Appendix A**)	N/A
Listed Migratory Species	70	Refer NMR PMST report (**Appendix A**)	N/A

3.2 Part 13 Statutory Instruments for EPBC Act Listed Threatened and Migratory Species in the NWMR, SWMR and NMR

A screening process was conducted to identify which EPBC Act listed threatened and migratory species, and associated Part 13 statutory instruments, are relevant in the context of the assessment of impacts and risks associated with petroleum activities in each of the Woodside activity areas, using the following criteria:

- overlap between the Woodside activity areas with habitat critical for the survival of marine turtles, and with BIAs (overlapping the marine environment) for any listed threatened species as reported in the PMST searches;
- published literature, unpublished reports and/or credible anecdotal information (e.g. feedback from stakeholders) indicating species presence/occurrence within the Woodside activity areas;
- temporal overlap between the likely timing of petroleum activities and peak periods for key behaviours (e.g. breeding, nesting, calving, resting, foraging, migration); and
- environmental aspects associated with petroleum activities have been identified as a key threat to a species in a Part 13 statutory instrument (e.g. anthropogenic noise, light emissions, marine debris).

Relevant EPBC Act threatened and migratory species and their Part 13 statutory instruments are listed in **Table 3-4**. For the full list of EPBCA Act listed species for each marine bioregion refer to the PMST reports (**Appendix A**).

Table 3-4 Summary of MNES identified by the EPBC Act Protected Matters Search Tool (PMST) to be considered for impact or risk evaluation for Woodside operations

Species	EPBC Act Part 13 Statutory Instrument
All vertebrate marine fauna	Threat Abatement Plan for the impacts of marine debris on vertebrate marine life (Commonwealth of Australia, 2018)
Marine Mammals	
Blue whale	Conservation Management Plan for the Blue Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015–2025 (Commonwealth of Australia, 2015a)
Southern right whale	Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011–2021 (DSEWPAC, 2012d)
Sei whale	Conservation Advice *Balaenoptera borealis* sei whale (Threatened Species Scientific Committee, 2015a)
Humpback whale	Conservation Advice *Megaptera novaeangliae* humpback whale (Threatened Species Scientific Committee, 2015b)
Fin whale	Conservation Advice *Balaenoptera physalus* fin whale (Threatened Species Scientific Committee, 2015c)
Australian sea lion	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) 2013 (DSEWPAC, 2013a) (due to expire in October 2023) Conservation Advice *Neophoca cinerea* Australian Sea Lion (Threatened Species Scientific Committee, 2020a) (in effect under the EPBC Act from 23-Dec-2020)
Marine Reptiles	
All marine turtle species (loggerhead, green, leatherback, hawksbill, flatback, olive ridley)	Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)
Short-nosed sea snake	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (DSEWPAC, 2011a)
Leaf-scaled sea snake	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (DSEWPAC, 2011b)
Fishes, Sharks, Rays and Sawfishes	
Grey nurse shark (west coast population)	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) 2014 (DOE, 2014)
White shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) 2013 (DSEWPAC, 2013b)
Whale shark	Conservation Advice *Rhincodon typus* whale shark (Threatened Species Scientific Committee, 2015d)
All sawfishes (largetooth, green, dwarf, speartooth, narrow)	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015b)

Species	EPBC Act Part 13 Statutory Instrument
Seabirds	
Migratory seabird species	Draft Wildlife Conservation Plan for Migratory Seabirds (Commonwealth of Australia, 2019)
Southern giant petrel	National recovery plan for threatened albatrosses and giant petrels 2011–2016 (DSEWPAC, 2011c)
Indian yellow-nosed albatross	National recovery plan for threatened albatrosses and giant petrels 2011–2016 (DSEWPAC, 2011c)
Abbott's booby	Conservation Advice for the Abbott's booby - *Papasula abbotti* (Threatened Species Scientific Committee, 2020b)
Australian fairy tern	Approved Conservation Advice for *Sterna nereis nereis* (Fairy Tern) (DSEWPAC, 2011d)
Australian lesser noddy	Conservation Advice *Anous tenuirostris melanops* Australian lesser noddy (Threatened Species Scientific Committee, 2015e)
Soft-plumaged petrel	Conservation Advice *Pterodroma mollis* soft-plumaged petrel (Threatened Species Scientific Committee, 2015f)
Shorebirds	
Migratory shorebird species	Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2015c)
Eastern curlew, far eastern curlew	Conservation Advice *Numenius madagascariensis* eastern curlew (DOE, 2015a)
Curlew sandpiper	Conservation Advice *Calidris ferruginea* curlew sandpiper (DOE, 2015b)
Great knot	Conservation Advice *Calidris tenuirostris* Great knot (Threatened Species Scientific Committee, 2016a)
Red knot, knot	Conservation Advice *Calidris canutus* Red knot (Threatened Species Scientific Committee, 2016b)
Bar-tailed godwit (*menzbieri*)	Conservation Advice *Limosa lapponica menzbieri* Bar-tailed godwit (northern Siberia) (Threatened Species Scientific Committee, 2016c)
Greater sand plover	Conservation Advice *Charadrius leschenaultii* Greater sand plover (Threatened Species Scientific Committee, 2016d)
Lesser sand plover	Conservation Advice *Charadrius mongolus* Lesser sand plover (Threatened Species Scientific Committee, 2016e)

4. HABITAT AND BIOLOGICAL COMMUNITIES

4.1 Regional context

The NWMR habitats range from nearshore benthic primary producer habitats such as seagrass beds, coral communities and mangrove forests, to offshore soft sediment seabed habitats and submerged and emergent reef systems. These habitats support biological communities that range from low density sessile and mobile benthos, such as sponges, molluscs and echinoids (with noted areas of sponge hotspot diversity) in offshore soft sediment habitat (DSEWPAC, 2012a) to complex, diverse, remote coral reef systems.

Benthic primary producer habitats, such as seagrass beds, coral communities and mangrove forests within the SWMR, are described as a mixture of tropical and temperate species, due to the seasonal influences of the tropical waters carried south by the Leeuwin Current and the temperate waters carried north by the Capes Current (DSEWPAC, 2012b).

The NMR shares similar habitat types to the NWMR. The predominant habitat of the region includes soft muddy sediments on relatively flat terrain. Other habitat types include seagrasses, reefs, shoals and coastal habitats such as mangroves and coastal wetlands (Rochester *et al.*, 2007).

The summary of key habitats and biological communities provided in the following sub-sections is focused on the primary features of relevance to the activity areas within the NWMR – primarily the offshore habitats of the continental shelf and slope, submerged shoals and banks, and remote oceanic reef systems of recognised conservation value.

4.2 Biological Productivity of NWMR

Primary productivity of the NWMR is generally low and appears to be largely driven by offshore influences (Brewer *et al.*, 2007), with periodic upwelling events and cyclonic influences driving coastal productivity with nutrient recycling and advection. Seasonal weather patterns also influence the delivery of nutrients from deep-water to shallow water. Cyclones and north-westerly winds during the North-west monsoon (approximately November–March) and the strong offshore winds of the South-east monsoon (approximately April–September) facilitate the upwelling and mixing of nutrients from deep-water to shallow water environments (Brewer *et al.*, 2007).

The Indonesian Throughflow (ITF) has an important effect on productivity in the northern areas of the Region. Generally, its deep, warm and low nutrient waters suppress upwelling of deeper comparatively nutrient-rich waters, thereby forcing the highest rates of primary productivity to occur at depths associated with the thermocline. When the ITF is weaker, the thermocline lifts bringing deeper, more nutrient-rich waters into the photic zone and hence resulting in conditions favourable to increased productivity (DEWHA, 2007a). Similarly, the Leeuwin Current has a significant role in determining primary productivity in the southern areas of the NWMR. As with the ITF, the overlying warm oligotrophic waters of the Leeuwin Current suppress upwelling. A subsurface chlorophyll maximum is therefore formed at a depth in the water column where nutrients and light are sufficient for photosynthesis to proceed. Seasonal changes in the strength of the Leeuwin Current influence primary productivity levels and seasonal interactions between the Leeuwin and Ningaloo currents in the south of the NWMR are believed to be particularly important (DEWHA, 2007a).

Internal tides (defined as internal waves generated by the barotropic tide) are a striking characteristic of many parts of the NWMR and are associated with highly stratified water columns. Internal waves (solitons), which can raise cooler, generally more nutrient rich water higher in the water column, are generated between water depths of 400 m and 1000 m where bottom topography results in a significant change in water depth over a relatively short distance. Cyclones are episodic events in the NWMR that contribute to spikes in productivity through enrichment of surface water layers due to enhanced vertical mixing of the water column. Temporary increases in primary productivity as a result of cyclones generally last between one and two weeks, and it is believed that the impacts of cyclones are generally limited to waters less than 100 m deep and affect benthic communities more substantially than pelagic systems (DEWHA, 2007a).

Water depth also has a significant overriding influence over productivity in the marine environment, due to its influence on light availability. This is reflected by distinct onshore and offshore assemblages of major pelagic groups of phytoplankton, microzooplankton, mesoplankton and ichthyoplankton. Productivity booms are thought to be triggered by seasonal changes to physical drivers or episodic events, as detailed above, which result in rapid increases in primary production over short periods, followed by extended periods of lower primary production. The trophic systems in the NWMR are able to take advantage of blooms in primary production, enabling nutrients generated to be used by different groups of consumers over long periods (DEWHA, 2007a).

Little detailed information is available about the trophic systems in the NWMR. The utilisation of available nutrients is thought to differ between pelagic and benthic environments, influenced by water depth and vertical migration of some species groups in the water column. In the pelagic system, it is thought that approximately half of the nutrients available are utilised by microzooplankton (e.g. protozoa) with the remainder going to macro/meso-zooplankton (e.g. copepods). As primary and secondary consumers, gelatinous zooplankton (e.g. salps, coelenterates) and jellyfish are thought to play an important role in the food web, contributing a significant proportion of biomass in the marine system during and for periods after booms in primary productivity. Salps are semi-transparent, barrel-shaped marine animals that can reproduce quickly in response to bursts in primary productivity and provide a food source for many pelagic fish species (DEWHA, 2007a).

4.3 Planktonic Communities in the NWMR

The NWMR has two distinct phytoplankton assemblages; a tropical oceanic community in offshore waters and a tropical shelf community confined to the NWS (Hallegraeff, 1995). MODIS (Moderate Resolution Imaging Spectrometer) satellite datasets from the NWMR indicates that chlorophyll (and thus phytoplankton) levels are low in summer months (December to March) and higher in the winter months (Schroeder *et al.*, 2009). Low chlorophyll levels during summer months may be a result of lower plankton productivity during the wet season or lower nutrient inputs from warm surface waters dominant during summer. However, it is likely that much of the primary production is taking place below the surface, where the MODIS imagery does not penetrate (Schroeder *et al.*, 2009). The winter months are relatively cloud free and surface chlorophyll is high throughout most of the region.

Zooplankton and may include organisms that complete their lifecycle as plankton (e.g. copepods, euphausiids) as well as larval stages of other taxa such as fishes, corals and molluscs. Peaks in zooplankton such as mass coral spawning events (typically in March and April) (Rosser and Gilmour, 2008) and fish larvae abundance (CALM, 2005a) can occur throughout the year. Spatial and temporal patterns in the distribution and abundance of macro-zooplankton on the North-west Shelf are influenced by sporadic climatic and oceanographic events, with large inter-annual changes in assemblages (Wilson *et al.*, 2003). Amphipods, euphausiids, copepods, mysids and cumaceans are among the most common components of the zooplankton in the region (Wilson *et al.*, 2003).

4.3.1 Browse

Phytoplankton within the Browse activity area is expected to reflect the conditions of the NWMR. There is a tendency for offshore phytoplankton communities in the NWMR to be characterised by smaller taxa (e.g. bacteria), whereas shelf waters are dominated by larger taxa such as diatoms (Hanson *et al.*, 2007).

Zooplankton within the activity area may include organisms that complete their lifecycle as plankton (e.g. copepods, euphausiids) as well as larval stages of other taxa such as fishes, corals and molluscs. Peaks in zooplankton such as mass coral spawning events (typically in March and April) (Rosser and Gilmour, 2008; Simpson *et al.*, 1993) and fish larvae abundance (CALM, 2005a) can occur throughout the year.

The influence of the Indonesian Throughflow restricts upwelling across the Kimberley System (approximately equates to the Browse activity area). However, small-scale topographically associated current movements and upwellings are thought to occur, which inject nutrients into specific locations within the system and result in ‘productivity hot-spots’. Similarly, internal waves, generated at the shelf break (e.g. west of Browse Island and around submerged cliffs) play a role in making nutrients available in the photic zone. Productivity within shallow nearshore waters is driven primarily by tidal movement and terrestrial runoff whereby nutrients are mixed by tidal action and new inputs of organic matter come from the land.

4.3.2 North-west Shelf / Scarborough

Plankton communities within the NWS / Scarborough activity area are expected to reflect conditions of the NWMR. Within the Pilbara system of the NWMR (approximately equates to the NWS / Scarborough activity area). Internal tides along the NWS and Exmouth Plateau result in the drawing of deeper cooler waters into the photic zone, stirring up nutrients and triggering primary productivity. Broadly the greatest productivity within this sub-system is found around the 200 m isobath associated with the shelf break.

4.3.3 North-west Cape

Waters of the North-west Cape experience a relatively high diversity of phytoplankton groups including diatoms, coccolithophorids and dinoflagellates. During the warmer months blooms of *Trichodesmium* occur in the region, these have been observed particularly on the frontal systems around Point Murat (Heyward *et al*., 2000).

Average Leeuwin Current phytoplankton biomass is characteristic of low productivity oceanic waters like the Indian, Pacific and Atlantic Oceans (Hanson *et al.*, 2005). However, the Canyons linking the Cuvier Abyssal Plain and Cape Range Peninsula KEF are connected to the Commonwealth waters adjacent to Ningaloo Reef, and may also have connections to Exmouth Plateau. The canyons are thought to interact with the Leeuwin Current to produce eddies inside the heads of the canyons, resulting in waters from the Antarctic intermediate water mass being drawn into shallower depths and onto the shelf (Brewer *et al.* 2007). These waters are cooler and richer in nutrients and strong internal tides may also aid upwelling at the canyon heads (Brewer *et al.* 2007). The narrow shelf width (about 10 kilometres) near the canyons facilitates nutrient upwelling and relatively high productivity. This high primary productivity leads to high densities of primary consumers, such as micro and macro-zooplankton, such as amphipods, copepods, mysids, cumaceans, euphausiids (Brewer *et al.*, 2007).

4.4 Habitats and Biological Communities in the NWMR

4.4.1 Offshore Habitats and Biological communities

The NWMR has a large area of continental shelf and continental slope, with a range of bathymetric features such as canyons, plateaus, terraces, ridges, reefs, banks and shoals. The marine environment in this region is typified by tropical to sub-tropical marine ecosystems with diverse habitats from soft sediments, canyons, remote coral reefs and limestone pavement.

The key habitats and biological communities representative of the broader NWMR are summarised in **Table 4-1**.

The key habitats and biological communities representative of the broader SWMR and NMR are summarised in **Table 4-2** and **Table 4-3**.

4.4.2 Shoreline habitats and biological communities

The NWMR encompasses offshore and coastal waters, islands and mainland shoreline habitats typified by mangroves, tidal flats, saltmarshes, sandy beaches, and smaller areas of rocky shores. Each of these shoreline types has the potential to support different flora and fauna assemblages due to the different physical factors (e.g. waves, tides, light, etc.) influencing the habitat.

The key shoreline habitats representative of the broader NWMR are summarised in **Table 4-1**.

The key shoreline habitats representative of the broader SWMR and NMR are summarised in **Table 4-2** and **Table 4-3**.

Table 4-1 Habitats and biological communities within the NWMR

Habitat/Community	Browse	NWS / Scarborough	North-west Cape	Reference
Offshore habitats and biological communities				
Soft sediment with infauna	The offshore environment of the NWMR comprises predominately of seabed habitats dominated by soft sediments (sandy and muddy substrata with occasional patches of coarser sediments) and sparse benthic biota. The benthic communities inhabiting the predominantly soft, fine sediments of the offshore habitats are characterised by infauna such as polychaetes, and sessile and mobile epifauna such as crustacea (shrimp, crabs and squat lobsters) and echinoderms (starfish, cucumbers).The density of benthic fauna is typically lower in deep-sea sediment habitats (greater than 200 m) than in shallower coastal sediment habitats, but the diversity of communities may be similar.			
Soft sediment with hard substrate outcropping	A unique seafloor feature combining both soft sediment and hard substrates, including outcrops, terraces, continental slope, and escarpments. This habitat is found in offshore areas of the NWMR, often associated with key ecological features such as the Ancient coastline at 125 m depth contour KEF.			**Section 9**
	Ancient Coastline at 125 m Depth Contour KEF Continental Slope Demersal Fish Communities KEF	Ancient Coastline at 125 m Depth Contour KEF Continental Slope Demersal Fish Communities KEF	Ancient Coastline at 125 m Depth Contour KEF Continental Slope Demersal Fish Communities KEF	**Section 9**
Coral Reef	Coral reef habitats within the NWMR have a high species diversity that includes corals, and associated reef species such as fishes, crustaceans, invertebrates, and algae. Coral reef habitats of the offshore environment of the NWMR include remote oceanic reef systems, large platform reefs, submerged banks and shoals.			
	Browse Island Scott Reef Seringapatam Reef Ashmore Reef Cartier Island Hibernia Reef	Rowley Shoals (including Mermaid Reef, Clerke Reef, Imperieuse Reef) Glomar Shoal Rankin Bank	-	**Section 10**
Seagrass and Macroalgae communities	Seagrass beds and benthic macroalgae reefs are a main food source for many marine species and also provide key habitats and nursery grounds (Heck Jr. *et al.*, 2003; Wilson *et al.*, 2010). In the northern half of Western Australia, these habitats are restricted to sheltered and shallow waters, including around offshore reef systems, due to large tidal movement, high turbidity, large seasonal freshwater run-off and cyclones.			
	Scott Reef Seringapatam Reef Ashmore Reef	Rowley Shoals (including; Mermaid Reef, Clerke Reef, Imperieuse Reef)		**Section 10**
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWHA, 2008). Filter feeders generally live in areas that have strong currents and hard substratum, often associated with deeper environments of the shoals and banks in the offshore NWMR.			
	Lower outer reef slopes of the oceanic reef	Glomar Shoal Rankin Bank	Cape Range canyon system	**Section 10**

Habitat/Community	Browse	NWS / Scarborough	North-west Cape	Reference
	systems such as Scott Reef	Ancient coastline at 125 m depth contour KEF		
Sandy Beaches	Sandy beaches are dynamic environments, naturally fluctuating in response to external forcing factors (e.g. waves, currents, etc). Sandy beaches vary in length, width and gradient, and in sediment type, composition, and grain size throughout the NWMR, being found around islands and reefs in the offshore areas of the region.			
	Browse Island Scott Reef (Sandy Islet) Ashmore Reef Cartier Island	Montebello Islands Lowendal Islands Barrow Island	Muiron Islands	**Section 10**
Nearshore/coastal habitats and biological communities				
Coral Reef	Coral reef habitats typically found in nearshore regions of the NWMR include the fringing reefs around coastal islands and the mainland shore.			
	Kimberley East Holothuria and Long reefs Bonaparte and Buccaneer Archipelagos Montgomery Reef Adele complex (Beagle, Mavis, Albert, Churchill reefs, Adele Island)	Dampier Archipelago Montebello, Lowendal and Barrow Island Groups	Ningaloo Reef Exmouth Gulf Shark Bay	**Section 10**
Seagrass and Macroalgae communities	Seagrass beds and benthic macroalgae reefs are a main food source for many marine species and also provide key habitats and nursery grounds (Heck Jr. *et al.*, 2003; Wilson *et al.*, 2010). In the nearshore areas of the NWMR, these habitats are restricted to sheltered and shallow waters due to large tidal movement, high turbidity, large seasonal freshwater run-off and cyclones. These areas include in bays and sounds and around reef and island groups.			
	King Sound	Roebuck Bay Dampier Archipelago Montebello, Lowendal and Barrow Island Groups	Ningaloo Reef Exmouth Gulf Shark Bay	**Section 10**
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWHA, 2007a). Filter feeders generally live in areas that have strong currents and hard substratum. Conversely, higher diversity infauna are mainly associated with soft unconsolidated sediment and infauna communities are considered widespread and well represented along the continental shelf and upper slopes of the NWMR. In nearshore areas of the NWMR, these species are generally found around reef systems.			
	-	Deeper habitats of Rankin Bank and Glomar Shoal	Deeper habitats of Ningaloo Reef and the protected sponge zone in the south	

Habitat/Community	Browse	NWS / Scarborough	North-west Cape	Reference
Mangroves	Mangroves grow in intertidal mud and sand, with specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie *et al.*, 2006). Mangrove forests can help stabilise coastal sediments, provide a nursery ground for many species of fish and crustacean, and provide shelter or nesting areas for seabirds (McClatchie *et al.*, 2006). Mangroves are confined to shoreline habitats, in nearshore areas of the NWMR.			
	Dampier Peninsula (including Carnot Bay, Beagle Bay and Pender Bay)	Pilbara Coastline (including; Ashburton River Delta, Coolgra Point, Robe River Delta, Yardie Landing, Yammadery Island and the Mangrove Islands) Montebello, Lowendal and Barrow Island Groups Roebuck Bay	Shark Bay Mangrove Bay, Cape Range Peninsula Exmouth Gulf	
Saltmarshes	Saltmarshes communities are confined to shoreline habitats and are typically dominated by dense stands of halophytic plants such as herbs, grasses, and low shrubs. The diversity of saltmarsh plant species increases with increasing latitude (in contrast to mangroves). The vegetation in these environments is essential to the stability of the saltmarsh, as they trap and bind sediments. The sediments are generally sandy silts and clays and can often have high organic material content.			
	-	Eighty Mile Beach Roebuck Bay	Shark Bay	
Sandy Beaches	Sandy beaches are dynamic environments, naturally fluctuating in response to external forcing factors (e.g. waves, currents, etc). Sandy beaches vary in length, width and gradient, and in sediment type, composition, and grain size throughout the NWMR. Sandy beaches are important for both resident and migratory seabirds and shorebirds and can also provide an important habitat for turtle nesting and breeding. They are located along many coastlines of the nearshore environments of the NWMR.			
	Cape Domett Lacrosse Island	Eighty Mile Beach Eco Beach Dampier Archipelago Inshore Pilbara Islands (Northern, Middle, and Southern)	Ningaloo coast Muiron Islands Exmouth Gulf	

Table 4-2 Habitats within the SWMR

Habitat/Community	Location
Offshore	
Soft sediment with infauna	Most of the SWMR seafloor is composed of soft unconsolidated sediments, but due to large variations in bathymetry there are marked differences in sedimentary composition and benthic assemblage structure across the region. Despite the prevalence of these habitats in the SWMR, very little is known about the composition or distribution of the region’s sedimentary infauna (DEWHA, 2008b)
Soft sediment with hard substrate outcropping	A unique seafloor feature combining both soft sediment and hard substrates, including outcrops, terraces, continental slope, and escarpments.
	Perth Canyon Marine Park Ancient coastline at 90-120 m depth contour KEF Diamantina Fracture Zone Naturaliste Plateau
Coral Reef	To date, studies and understanding of the corals within the SWMR have concentrated on the shallow water areas in State Waters. Within the deeper Commonwealth waters of the SWMR little is known of the distribution of corals.
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWR, 2007). Filter feeders generally inhabit deeper habitat (below the photic zone) that have strong currents and hard substratum
	Ancient coastline at 90-120 m depth Diamantina Fracture Zone Naturaliste Plateau Perth Canyon Marine Park South-west Corner Marine Park
Nearshore	
Coral Reef	The northern extent of the SWMR coincides loosely with the disappearance of abundant and diverse coral from coastal habitats. To the south of Shark Bay, abundant corals occur predominantly around offshore islands, with corals at inshore sites occurring in very isolated patches of non-reef coral communities, usually of reduced species richness.
	Houtman Abrolhos Islands Rottnest Island
Seagrass and Macroalgae communities	Within the SWMR, macroalgae and seagrass communities are noted for their extent, species richness and endemism. The clear waters of the region allow light to reach greater depths, with some species found at much greater depths than usual (down to 120 m) (DEWR, 2007). Of the known species there are more than 1000 species of macro-algae and 22 species of seagrass consisting of tropical and temperate species. Seagrass and macro-algae occur in areas with sheltered bays and in the inter-reef lagoons along exposed sections of the coast.
	Houtman Abrolhos Islands Jurien Marine Park Shoalwater Islands Marine Park Geographe Marine Park Cockburn Sound Rottnest Island

Habitat/Community	Location
	Commonwealth marine environment within and adjacent to the west-coast inshore lagoons KEF Commonwealth marine environment within and adjacent to Geographe Bay KEF Commonwealth marine environment surrounding the Recherche Archipelago KEF
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWR, 2007). Filter feeders generally live in areas that have strong currents and hard substratum.
	Houtman Abrolhos Islands Recherche Archipelago
Mangroves	Mangroves grow in intertidal mud and sand, with specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie *et al.*, 2006). Mangrove forests can help stabilise coastal sediments, provide a nursery ground for many species of fish and crustacean, and provide shelter or nesting areas for seabirds (McClatchie *et al.*, 2006). Mangroves are confined to shoreline habitats, in nearshore areas of the SWMR.
	Houtman Abrolhos Islands
Sandy Beaches	Sandy beaches within the SWMR are important for both resident and migratory seabirds and shorebirds and can also host breeding populations of the Australian sea lion. They are found along many coastlines of the nearshore environments of the SWMR. In addition to this, beaches in the SWMR provide a variety of socio-economic values including tourism, commercial and recreational fishing, and support other recreational activities.
	Houtman Abrolhos Islands Marmion Marine Park Ngari Capes Marine Park Walpole and Nornalup Inlets Marine Park

Table 4-3 Habitats and Biological Communities within the NMR

Habitat/Community	Location
Offshore habitats and biological communities	
Soft sediment with infauna	Most of the offshore environment of the NMR is characterised by relatively flat expanses of soft sediment seabed. The soft sediments of the region are characterised by moderately abundant and diverse communities of infauna and mobile epifauna dominated by polychaetes, crustaceans, molluscs, and echinoderms.
Soft sediment with hard substrate outcropping	A unique seafloor feature combining both soft sediment and hard substrates, including outcrops, terraces, continental slope, and escarpments. The variability in substrate composition may contribute to the presence of unique ecosystems. Species present include sponges, soft corals and other sessile filter feeders associated with hard substrate sediments.
	Carbonate bank and terrace system of the Van Diemen Rise KEF Pinnacles of the Bonaparte Basin KEF
Coral Reef	Offshore coral reefs within the NMR is generally associated with a series of submerged shoals and banks. The shoals/banks in the region support tropical marine biota consistent with that found on emergent reef systems of the Indo West Pacific region such as Ashmore Reef, Cartier Island, Seringapatam Reef and Scott Reef (Heyward *et al.,* 1997)
	Pinnacles of the Bonaparte Basin KEF Evans Shoal Tassie Shoal Blackwood Shoal
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWHA, 2007b). Filter feeders generally live in areas that have strong currents and hard substratum and typically associated with the deeper habitats of the submerged shoals and banks, and canyon features.
	Carbonate bank and terrace system of the Van Diemen Rise KEF Pinnacles of the Bonaparte Basin KEF Tributary Canyons of the Arafura Depression KEF Evans Shoal Tassie Shoal Goodrich Bank
Nearshore	
Coral Reef	Within the NMR corals occur both as reefs and in non-reef coral communities. Nearshore reefs include patch reefs and fringing reefs sparsely distributed within the region. Coral reefs within the NMR provides breeding and aggregation areas for many fish species including mackerel and snapper and offer refuges for sea snakes and apex predators such as sharks.
	Submerged coral reefs of the Gulf of Carpentaria KEF Darwin Harbour
Seagrass and Macroalgae communities	Seagrasses provide key habitats in the NMR. They stabilise coastal sediments and trap and recycle nutrients. They provide nursery grounds for commercially harvested fish and prawns and provide feeding grounds for dugongs and green turtles. Seagrass distribution in the region is largely associated with sheltered small bays and inlets including shallow waters surrounding inshore islands.
	Field Island The mainland coastline adjacent to Kakadu National Park

Habitat/Community	Location
Filter Feeders/ heterotrophic	Filter feeder epifauna such as sponges, ascidians, soft corals, and gorgonians are animals that feed by actively filtering suspended matter and food particles from water, by passing the water over specialised filtration structures (DEWHA, 2007b). Filter feeders generally live in areas that have strong currents and hard substratum.
	Cape Helveticus
Mangroves	Mangroves grow in intertidal mud and sand, with specially adapted aerial roots (pneumatophores) that provide for gas exchange during low tide (McClatchie *et al.*, 2006). Mangroves provide habitat for waterbirds and support many commercially and recreationally important fish and crustacean species for parts of their life cycles. They buffer the coast from large tidal movements, storm surges and flooding.
	Tiwi Islands Darwin Harbour The mainland coastline adjacent to the Daly River
Sandy Beaches	Sandy beaches vary in length, width and gradient, and in sediment type, composition, and grain size throughout the NMR and are important for both resident and migratory seabirds and shorebirds. Sandy beaches can also provide an important habitat for turtle nesting. They are located along many coastlines of the nearshore environments of the islands and mainland shores of the NMR.
	Tiwi Islands Cobourg Peninsula Joseph Bonaparte Gulf

5. FISHES, SHARKS AND RAYS

5.1 Regional Context

Western Australian waters provide important habitat for listed fishes, sharks, and rays including areas that support key life stages such as breeding, foraging, and migration routes for fish species. Pelagic and demersal fishes occupy a range of habitats throughout each of the regions, from coral reefs to open offshore waters, and are an extremely important component of ecosystems, providing a link between primary production and higher predators, with many species being of conservation value and important for commercial and recreational fishing.

The fish fauna in the NWMR is diverse. Of the approximately 500 shark species found worldwide, 94 are found in the region (DEWHA, 2008). Approximately 54 species of syngnathids (seahorses, seadragons, pipehorses and pipefishes) and one species of solenostomids (ghostpipefishes) are also known to occur in the NWMR or adjacent State waters (DSEWPAC, 2012a).

The fish fauna of the SWMR includes more than 900 species occupying a large variety of habitats. However, only three species of bony fishes known to occur in the region are listed under the EPBC Act as threatened or marine species, and seven listed species of shark (DSEWPAC, 2012b).

The NMR is considered an important area for the sawfish and river shark species group, with five species of sawfishes and river sharks listed under the EPBC Act known to occur in the region (DSEWPAC, 2012c). Approximately 28 species of syngnathids and two species of solenostomids are listed marine and known to occur in the NMR, however there is a paucity of knowledge on the distribution, relative abundance and habitats of these species in the region (DEWHA, 2008).

The following sections focus on the fish species (including sharks and rays) listed as threatened or migratory that are known to occur within the NWMR. In addition, listed, conservation dependent fish and shark species for the NWMR are described. A detailed account of commercial and recreational fisheries that operate in the region is provided in **Section 11**.

Table 5-1 outlines the threatened and migratory fish species that may occur within the NWMR, with their conservation status and relevant recovery plans and/or conservation advice. **Table 5-2** provides information for species of fish that are listed as conservation dependent that may occur within the NWMR, NMR and SWMR. Note that currently there are no approved Conservation Advices in place for any of these five species.

Table 5-1 Fish species (including sharks and rays) identified by the EPBC Act PMST for the NWMR

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Rhincodon typus	Whale shark	Vulnerable	Migratory	Marine	Other specially protected fauna	Conservation Advice *Rhincodon typus* whale shark. (Threatened Species Scientific Committee, 2015d)
Carcharias taurus	Grey nurse shark (west coast population)	Vulnerable	N/A	Marine	Vulnerable	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (DOE, 2014a)
Carcharodon carcharias	White shark	Vulnerable	Migratory	Marine	Vulnerable	Recovery Plan for the White Shark (*Carcharodon carcharias*) (DSEWPAC, 2013b)
Isurus oxyrinchus	Shortfin mako	N/A	Migratory	Marine	N/A	N/A
Isurus paucus	Longfin mako	N/A	Migratory	Marine	N/A	N/A
Lamna nasus	Porbeagle shark Mackerel shark	N/A	Migratory	Marine	N/A	N/A
Carcharhinus longimanus	Oceanic whitetip shark	N/A	Migratory	Marine	N/A	N/A
Anoxypristis cuspidata	Narrow sawfish	N/A	Migratory	Marine	N/A	N/A
Pristis clavata	Dwarf sawfish	Vulnerable	Migratory	Marine	Priority	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015b)
Pristis pristis	Largetooth (Freshwater) sawfish	Vulnerable	Migratory	Marine	Priority	
Pristis zijsron	Green sawfish	Vulnerable	Migratory	Marine	Vulnerable	
Glyphis garricki	Northern river shark	Endangered	N/A	Marine	Priority	
Manta alfredi	Reef manta ray	N/A	Migratory	Marine	N/A	N/A
Manta birostris	Giant manta ray	N/A	Migratory	Marine	N/A	N/A

Table 5-2 EPBC Act listed Conservation Dependent species of fishes and sharks that may occur in the NWMR, NMR and SWMR

Species Name	Common Name	Likely Occurrence / Distribution	Listing Advice
Hoplostethus atlanticus	Orange roughy, Deep-sea perch, Red roughy	SWMR	No conservation listing advice for this species. Refer to the Marine bioregional plan for the SWMR (DSEWPAC, 2012b) for further information
Thunnus maccoyii	Southern bluefin tuna	NWMR and SWMR	Threatened Species Scientific Committee (2010)
Sphyrna lewini	Scalloped hammerhead	NWMR, NMR and SWMR	Threatened Species Scientific Committee (2018)
Centrophorus zeehaani	Southern dogfish, Endeavour dogfish, Little gulper shark	SWMR	Threatened Species Scientific Committee (2013)
Galeorhinus galeus	School shark, Eastern school shark, Snapper shark, Tope, Soupfin shark	SWMR	Threatened Species Scientific Committee (2009)

5.2 Protected Sharks, Sawfishes and Rays in the NWMR

The EPBC Act Protected Matters search (**Appendix A**) identified seven species of shark and five species of river shark or sawfish listed as threatened and/or migratory within the NWMR. In addition, two species of ray (the reef manta ray and giant manta ray) are listed as migratory within the region (refer **Table 5-2**).

5.2.1 Sharks and Sawfishes

The shark species known to occur within the NWMR include: the whale shark, grey nurse shark*,* white shark*,* shortfin mako, and longfin mako (**Table 5-2**)*.*

Five species of river shark or sawfish known to occur in the NWMR and include: the narrow sawfish, northern river shark*,* freshwater sawfish, green sawfish and dwarf sawfish (**Table 5-2**)*.*

There are identified BIAs within the NWMR for the whale shark, freshwater sawfish, green sawfish, and dwarf sawfish (refer **Section 5.3.2**).

Table 5-2 Information on the threatened shark and sawfish species within the NWMR

Species	Preferred Habitat and Diet	Habitat Location
Whale shark	Preferred habitat: They have a widespread distribution in tropical and warm temperate seas, both oceanic and coastal (Last and Stevens, 2009). The species is widely distributed in Australian waters. Diet: Whale sharks are planktivorous sharks and feed on a variety of planktonic organisms including krill, jellyfish, and crab larvae (Last and Stevens, 2009).	Ningaloo Reef is the main known aggregation site for whale sharks in Australian waters and has the largest density of whale sharks per kilometre in the world (Martin, 2007). Refer **Table 5-3** for the BIA summary for the whale shark.
Grey nurse shark (west coast population)	Preferred habitat: Most commonly found in temperate waters on, or close to, the bottom of the continental shelf, from close inshore to depths of about 200 m (McAuley, 2004). Diet: A variety of teleost and elasmobranch fishes and some cephalopods (Gelsleichter *et al.*, 1999; Smale, 2005).	Details of movement patterns of the western sub-population are unclear (McAuley, 2004) and key aggregation sites have not been formally identified within the NWMR (Chidlow *et al.*, 2006). The NWMR represents the northern limit of the west coast population.

Species	Preferred Habitat and Diet	Habitat Location
White shark	Preferred habitat: The species typically occurs in temperate coastal waters between the shore and the 100 m depth contour; however, adults and juveniles have been recorded diving to depths of 1000 m (Bruce *et al.*, 2006; Bruce, 2008). Diet: Smaller white sharks (less than 3 m in length) feed primarily on teleost and elasmobranch fishes, broadening their diet as larger sharks to include marine mammals (Last and Stevens, 2009).	There are no known aggregation sites for white sharks in the NWMR, and this species is most often found south of North-west Cape, in low densities (DSEWPAC, 2012a). Given the migratory nature of the species, most likely has a broad distribution within the NWMR. No BIAs identified for NWMR.
Shortfin mako	Preferred habitat: The shortfin mako shark is a pelagic species with a circumglobal, wide-ranging oceanic distribution in tropical and temperate seas (Mollet *et al.*, 2000). Tagging studies indicate shortfin makos spend most of their time in water less than 50 m deep but with occasional dives up to 880 m (Abascal *et al.*, 2011; Stevens *et al.*, 2010). Diet: Feeds on a variety of prey, such as teleost fishes, other sharks, marine mammals, and marine turtles (Campana *et al.*, 2005).	Given the migratory nature of the species, most likely has a broad distribution within the NWMR. No BIAs identified for NWMR.
Longfin mako	Preferred habitat: A pelagic species with a wide-ranging oceanic distribution in tropical and temperate seas (Mollet *et al.*, 2000). Diet: Primarily teleost fishes and cephalopods (primarily squid) (Last and Stevens, 2009).	Records on longfin mako sharks are sporadic and their complete geographic range is not well known (Reardon *et al.*, 2006). Given the migratory nature of the species, most likely has a broad distribution within the NWMR. No BIAs identified for NWMR.
Mackerel/Porbeagle shark	Preferred habitat: The porbeagle shark primarily inhabits offshore waters around the edge of the continental shelf. They occasionally move into coastal waters, but these movements are temporary (Campana and Joyce, 2004; Francis *et al.*, 2002). The porbeagle shark is known to dive to depths exceeding 1300 m (Campana *et al.*, 2010; Saunders *et al.*, 2011). Diet: Primarily teleost fish, elasmobranchs, and cephalopods (primarily squid) (Joyce *et al.*, 2002; Last and Stevens, 2009).	In Australia, the species occurs in waters from southern Queensland to south-west Australia (Last and Stevens, 2009). Distribution within the NWMR is unknown, but there are several records for this species on the NWS in the Atlas of Living Australia (ALA).
Oceanic whitetip shark	Preferred habitat: The oceanic whitetip shark is globally distributed in warm-temperate and tropical oceans (Andrzejaczek *et al.*, 2018). The species may occur in tropical and sub-tropical offshore and coastal waters around Australia. They primarily occupy pelagic waters in the upper 200 m of the water column; however, they have been observed diving to depths of around 1000 m, potentially associated with foraging behaviour (Howey-Jordan *et al.*, 2013; D'Alberto *et al.*, 2017). The species is highly migratory, travelling large distances between shallow reef habitats in coastal waters and oceanic waters (Howey-Jordan *et al.*, 2013). The species does exhibit a strong preference for warm and shallow waters above 120 m. Diet: Opportunistic feeders and generally target a variety of finfishes and pelagic squid, depending on habitat. Target pelagics such as tuna in open ocean as noted by the large bycatch numbers in the long line fisheries.	Given the migratory nature of the species, most likely has a broad distribution within the NWMR. No BIAs identified for NWMR.

Species	Preferred Habitat and Diet	Habitat Location
Narrow sawfish	Preferred habitat[1]: Shallow coastal, estuarine, and riverine habitats, however it may occur in waters up to 40 m deep (D'Anastasi *et al.*, 2013). Diet: Shoaling fishes, such as mullet, as well as molluscs and small crustaceans (Cliff and Wilson, 1994).	Shallow coastal waters of the Pilbara and Kimberly coasts (Last and Stevens, 2009).
Northern river shark	Preferred habitat[1]: Rivers, tidal sections of large tropical estuarine systems and macrotidal embayments, as well as inshore and offshore marine habitats (Pillans *et al.*, 2009; Thorburn and Morgan, 2004). Adults have been recorded only in marine environments. Juveniles and sub-adults have been recorded in freshwater, estuarine and marine environments (Pillans *et al.*, 2009). Diet: Variety of fish and crustaceans (Stevens *et al.*, 2005)	Within the NWMR records have come from both the west and east Kimberley, including King Sound, the Ord and King rivers, West Arm of Cambridge Gulf and also from Joseph Bonaparte Gulf (Thorburn and Morgan, 2004; Stevens *et al.*, 2005; Thorburn, 2006; Field *et al.*, 2008; Pillans *et al.*, 2008, Whitty *et al.*, 2008; Wynen *et al.*, 2008).
Largetooth (Freshwater) sawfish	Preferred habitat: Sandy or muddy bottoms of shallow coastal waters, estuaries, river mouths and freshwater rivers, and isolated water holes. Diet: Shoaling fishes, such as mullet, as well as molluscs and small crustaceans (Cliff and Wilson, 1994).	Refer **Table 5-3** for the BIA summary for the freshwater sawfish.
Green sawfish	Preferred habitat[1]: Inshore coastal environments including estuaries, river mouths, embayments, and along sandy and muddy beaches, as well as offshore marine habitat (Stevens *et al.*, 2005; Thorburn *et al.*, 2003). Diet: Schools of baitfish and prawns (Poganoski *et al.*, 2002), molluscs and small crustaceans (Cliff and Wilson, 1994).	Refer **Table 5-3** for the BIA summary for the green sawfish.
Dwarf sawfish	Preferred habitat[1]: Shallow (2 to 3 m) silty coastal waters and estuarine habitats, occupying relatively restricted areas and moving only small distances (Stevens *et al.*, 2008) Diet: Shoaling fish such as mullet, molluscs, and small crustaceans (Cliff and Wilson, 1994).	Refer **Table 5-3** for the BIA summary for the dwarf sawfish.

1 Preferred habitat as described within the Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia, 2015b).

5.2.2 Rays

Rays are commonly found in the NWMR. Two listed and migratory species of ray known to occur within the NWMR: the reef manta ray and giant manta ray.

No BIAs for either the reef or giant manta ray species have been identified in the NWMR.

Table 5-3 Information on migratory ray species within the NWMR

Species	Preferred Habitat and Diet	Habitat Location
Reef manta ray	Preferred habitat: The reef manta ray is commonly sighted within productive nearshore environments, such as island groups, atolls or continental coastlines. However, the species has also been recorded at offshore coral reefs, rocky reefs, and seamounts (Marshall *et al.*, 2009). Diet: Feed on planktonic organisms including krill and crab larvae.	A resident population of reef manta rays has been recorded at Ningaloo Reef. No BIAs identified for NWMR.
Giant manta ray	Preferred habitat: The species primarily inhabits near-shore environments along productive coastlines with regular upwelling, but they appear	The Ningaloo Coast is an important area for giant manta rays from March to August (Preen *et al.*, 1997).

Species	Preferred Habitat and Diet	Habitat Location
	to be seasonal visitors to coastal or offshore sites including offshore island groups, offshore pinnacles and seamounts (Marshall *et al.*, 2011). Diet: Feed on planktonic organisms including krill and crab larvae.	No BIAs identified for NWMR.

5.3 Fish, Shark and Sawfish Biological Important Areas in the NWMR

A review of the National Conservation Values Atlas identified Biologically Important Areas (BIAs) for four species of shark and sawfish (whale shark, freshwater sawfish, green sawfish and dwarf sawfish) within the NWMR. The BIAs for the whale shark and the sawfish species include foraging, nursing and pupping areas. These are described in **Table 5-4**.

Table 5-4 Fish, whale shark and sawfish BIAs within the NWMR

Species	Woodside Activity Area			BIAs		
	Browse	NWS/S	NWC	Pupping	Nursing	Foraging
Whale shark	✓	✓	✓	No pupping BIA identified within the NWMR	No nursing BIA identified within the NWMR	Foraging (high density) in Ningaloo Marine Park and adjacent Commonwealth waters (March–July) Foraging northward from Ningaloo along the 200 m isobath (July – Nov).
Green sawfish	✓	✓	-	Pupping in Cape Keraudren (pupping occurs in summer in a narrow area adjacent to shoreline) Pupping in Willie Creek Pupping in Roebuck Bay Pupping in Cape Leveque Pupping in waters adjacent to Eighty Mile Beach Pupping (likely) in Camden Sound.	Nursing in Cape Keraudren Nursing in waters adjacent to Eighty Mile Beach	Foraging in Cape Keraudren Foraging in Roebuck Bay Foraging in Cape Leveque Foraging in Camden Sound
Largetooth (freshwater) sawfish	✓	✓	-	Pupping in the mouth of the Fitzroy River (January to May) Roebuck Bay (Jan – May) Pupping likely in waters adjacent to Eighty Mile Beach	Nursing (likely) in King Sound Roebuck Bay (Jan – May)	Foraging in the mouth of the Fitzroy River (January to May) Foraging in King Sound Roebuck Bay (Jan – May) Foraging in waters adjacent to Eighty Mile Beach
Dwarf sawfish	✓	✓	-	Pupping in King Sound Pupping in waters adjacent to Eighty Mile Beach	Nursing in King Sound Nursing waters adjacent to Eighty Mile Beach	Foraging in King Sound Foraging in Camden Sound Foraging in waters adjacent to Eighty Mile Beach

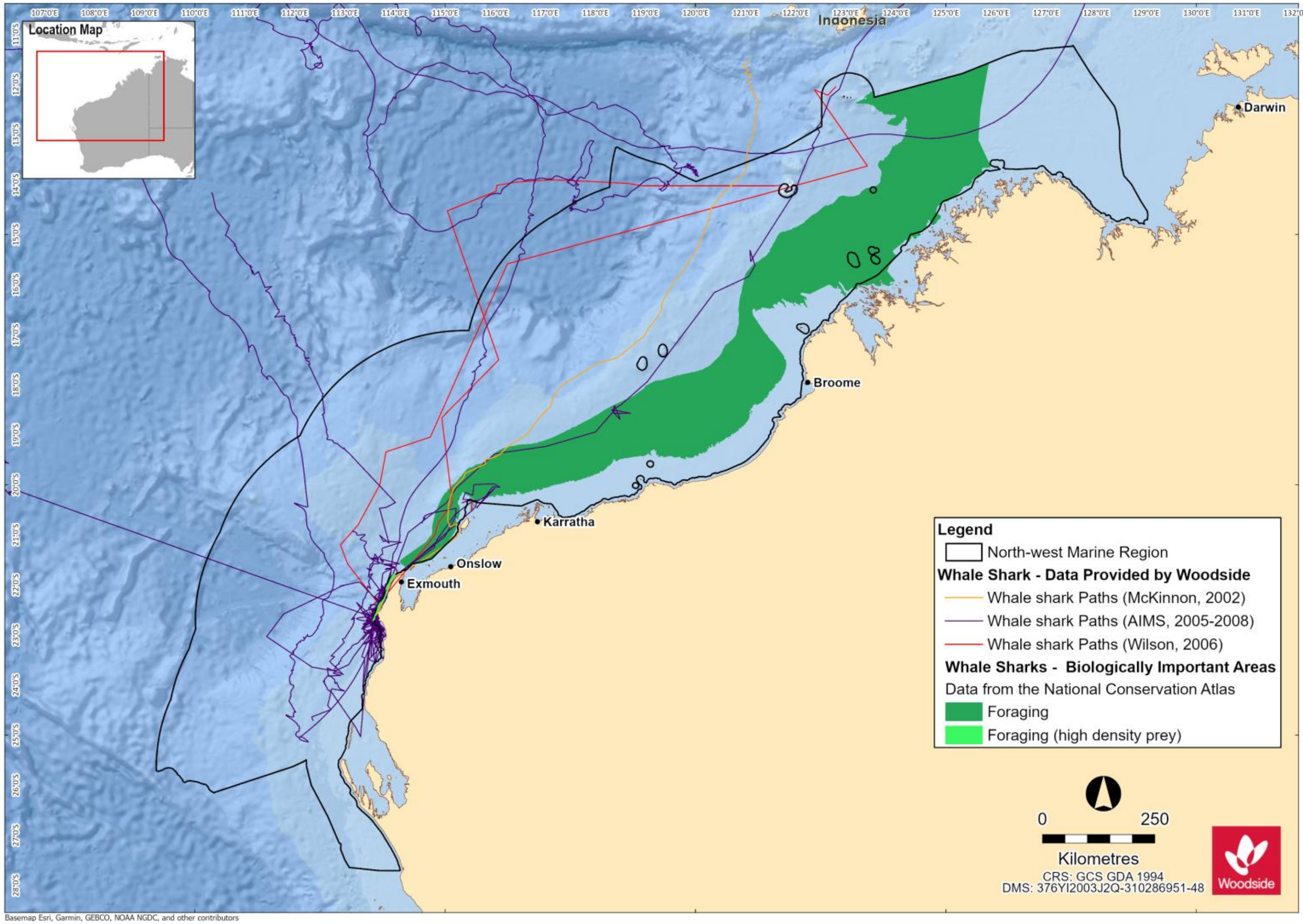


Figure 5-1 Whale shark BIAs for the NWMR and tagged whale shark tracks

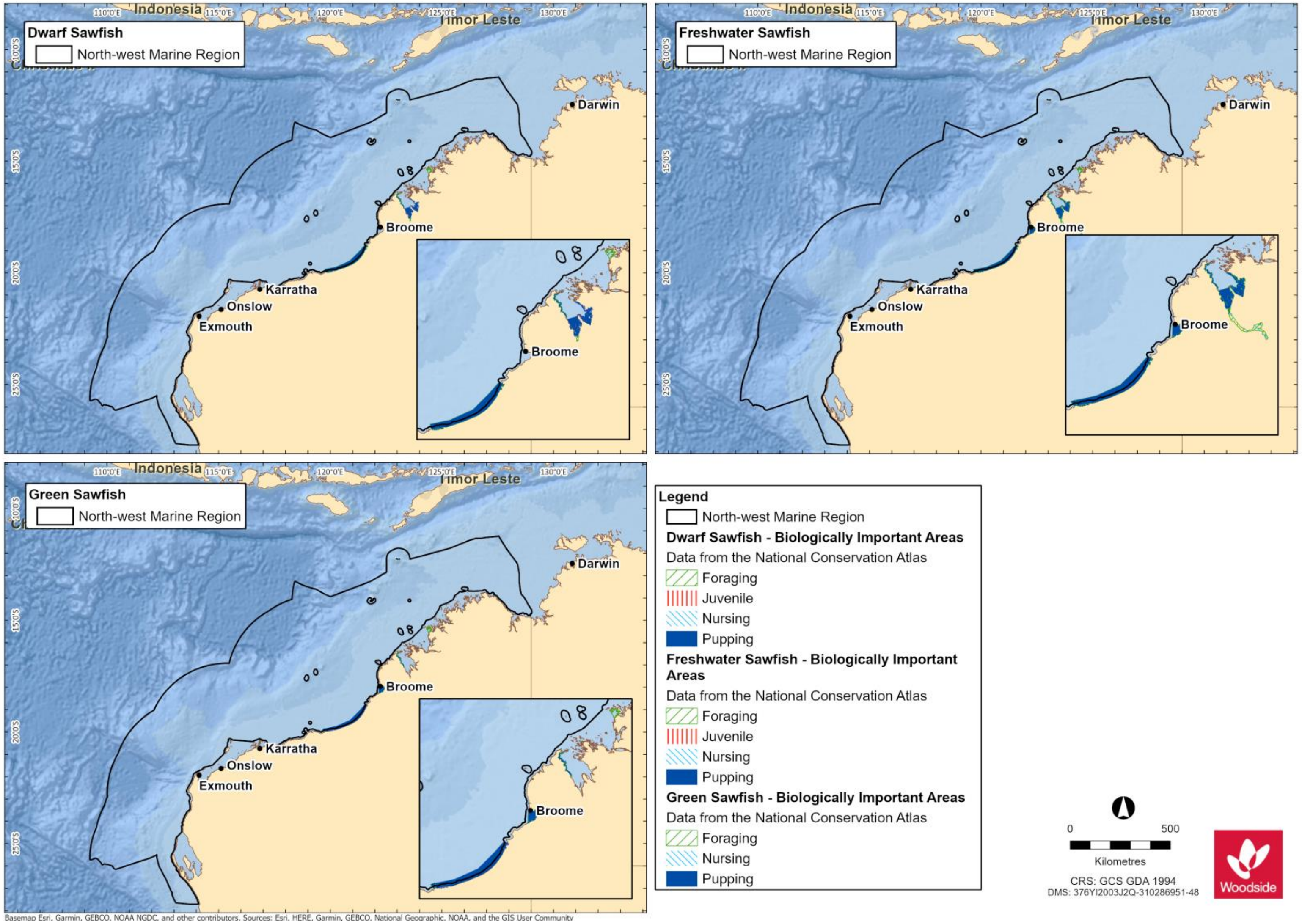


Figure 5-2 Sawfish BIAs for the NWMR

5.4 Fish Assemblages of the NWMR

5.4.1 Regional Context for Fish Assemblages of NWMR

The NWMR contains a diverse range of fishes of tropical Indo-west Pacific affinity (Allen *et al.*, 1988). The region is characterised by the highest level of endemism and species diversity compared with other areas of the Australian continental slope. Last *et al.* (2005) recorded 1431 species from the three bioregions encompassing the continental slope, whilst also acknowledging some information gaps.

The NWMR is known for its demersal slope fish assemblages; the continental slope of the Timor Province and the North-west Transition supports more than 418 and 505 species of demersal fishes respectively, of which 64 are considered to be endemic. This is the second richest area for demersal fish species across the entire Australian continental slope. Conversely, the broad Southern Province, which covers most of southern Australia, supports 463 species, only 26 possibly being endemic. The continental slope demersal fish assemblages of the NWMR have been identified as a KEF (DEWHA, 2008), as described in **Section 9**.

The NWMR also features a diversity of pelagic fishes (those living in the pelagic zone) and bentho-pelagic fishes, including tuna, billfish, bramids, lutjanids, serranids and some sharks (DEWHA, 2007a). These species feed on salps and jellyfish, and more often on secondary consumers such as squid and bait fish. Water depth provides an indication of the level of interaction between pelagic and benthic communities within the NWMR; in waters deeper than 1000 m, for instance, the trophic system is pelagically-driven and benthic communities rely on particulates that fall to the seafloor (DEWHA, 2007a).

Pelagic fishes play an important ecological role within the NWMR; small pelagic fishes, such as lantern fish, inhabit a range of marine environments, including inshore and continental shelf waters and form a vital link in and between many of the region's trophic systems, feeding on pelagic phytoplankton and zooplankton and providing a food source for a wide variety of predators including large pelagic fishes, sharks, seabirds and marine mammals (Bulman, 2006; Mackie *et al.*, 2007). Large pelagic fishes, such as tuna, mackerel, swordfish, sailfish and marlin, are found mainly in oceanic waters and occasionally on the continental shelf (Brewer *et al.*, 2007). Both juvenile and adult phases of the large pelagic species are highly mobile and have a wide geographic distribution, although the juveniles more frequently inhabit warmer or coastal waters (DEWHA, 2008).

5.4.2 Listed Fish Species in the NWMR

The family Syngnathidae is a group of bony fishes that includes seahorses, pipefishes, pipehorses and seadragons. Along with syngnathids, members of the related Solenostomidae family (ghost pipefishes) are also found in the NWMR (DSEWPAC, 2012a).

There are 44 solenostomid and syngnathid species that are listed marine species that may occur within the NWMR, although no species is currently listed as threatened or migratory, according to the PMST report (**Appendix A**).

Syngnathids live in nearshore and inner shelf habitats, usually in shallow coastal waters, among seagrasses, mangroves, coral reefs, macroalgae dominated reefs, and sand or rubble habitats (Dawson, 1985; Lourie *et al.*, 1999, Lourie *et al.*, 2004; Vincent, 1996). Two species, the winged seahorse (*Hippocampus alatus*) and western pipehorse (*Solegnathus sp. 2*) have been identified in deeper waters of the NWMR (up to 200 m) (DSEWPAC, 2012a), however, these species were not identified by the Protected Matters search of the NWMR.

Knowledge about the distribution, abundance and ecology of both syngnathids and solenostomids in the NWMR is limited. No BIAs for syngnathids and solenostomids have been identified in the NWMR.

5.4.3 Browse

The proposed Browse activity area includes biologically important habitat for the whale shark and three sawfish species:

- whale shark (foraging northward from Ningaloo along the 200 m isobath (July – Nov),
- freshwater sawfish (pupping, nursing and foraging areas),
- green sawfish (pupping, nursing and foraging areas); and
- dwarf sawfish (pupping, nursing and foraging areas).

BIAs for the shark and sawfish species are outlined in **Table 5-4** and **Figure 5-1**.

The proposed Browse activity area has partial overlap with the Continental slope demersal fish communities KEF.

5.4.4 NWS / Scarborough

The NWS / Scarborough activity area includes biologically important habitat for the whale shark and three sawfish species:

- whale shark (foraging northward from Ningaloo along the 200 m isobath (July – Nov),
- freshwater sawfish (pupping, nursing and foraging areas),
- green sawfish (pupping, nursing and foraging areas); and
- dwarf sawfish (pupping, nursing and foraging areas).

BIAs for the whale shark and sawfish species are outlined in **Table 5-4** and **Figure 5-1**.

The NWS / Scarborough activity area has partial overlap with the Continental slope demersal fish communities KEF. The continental slope between North-west Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in Australia (Last *et al.*, 2005).

5.4.5 North-west Cape

The North-west Cape activity area includes biologically important foraging habitat for the whale shark:

- whale shark, including:
  - Foraging (high density) in Ningaloo Marine Park and adjacent Commonwealth waters (March–July); and
  - Foraging northward from Ningaloo along the 200 m isobath (July – Nov).

BIAs for the whale shark are outlined in **Table 5-4** and **Figure 5-1**.

The North-west Cape activity area coincides with part of the Continental slope demersal fish communities KEF.

6. MARINE REPTILES

6.1 Regional Context for Marine Reptiles

The NWMR contains important habitat for listed marine reptiles, including areas that support key life stages such as nesting, internesting, migration and foraging for marine turtle species, and habitats supporting resident sea snake and crocodile populations.

Six of the seven marine turtle species occur in Australian waters, and all six (the green turtle, hawksbill turtle, loggerhead turtle, flatback turtle, leatherback turtle and olive ridley turtle) occur in the NWMR and NMR.

There are 25 listed species of sea snake reported within or adjacent to the NWMR (Guinea, 2007a; Udyawer *et al*., 2016), of which four are endemic to reef habitats in the remote parts of the region. Nineteen (19) listed sea snake species are known to occur in the NMR, as reported in the Protected Matters search (**Appendix A**).

There are significantly fewer marine reptile species that frequently occur within the SWMR and presently include three species of listed marine turtle and one sea snake species. Other species of sea snake may occur because of the southward-flowing Leeuwin Current, as vagrants in the region (DSEWPAC, 2012b).

The following sections focus on the listed marine reptile species known to occur within the NWMR.

Table 6-1 outlines the threatened and migratory marine reptile species that occur within the NWMR, with their conservation status and relevant recovery plans and/or conservation advice.

Table 6-1 Marine reptile species identified by the EPBC Act PMST as potentially occurring within or utilising habitats in the NWMR for key life cycle stages

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Caretta caretta	Loggerhead turtle	Endangered	Migratory	Marine	Endangered	Recovery Plan for Marine Turtles in Australia 2017-2027 (Commonwealth of Australia, 2017)
Chelonia mydas	Green turtle	Vulnerable	Migratory	Marine	Vulnerable	
Dermochelys coriacea	Leatherback turtle	Endangered	Migratory	Marine	Vulnerable	
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	Migratory	Marine	Vulnerable	
Natator depressus	Flatback turtle	Vulnerable	Migratory	Marine	Vulnerable	
Lepidochelys olivacea	Olive ridley turtle	Endangered	Migratory	Marine	Vulnerable	
Aipysurus apraefrontalis	Short-nosed sea snake	Critically endangered	N/A	Marine	Critically endangered	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (DSEWPAC, 2011a)
Aipysurus foliosquama	Leaf-scaled sea snake	Critically endangered	N/A	Marine	Critically endangered	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (DSEWPAC, 2011b)
Crocodylus porosus	Salt-water crocodile	N/A	Migratory	Marine	Other protected fauna	N/A

6.2 Marine Turtles in the NWMR

According to the Protected Matters search (**Appendix A**) six species of marine turtle known to occur within the NWMR are listed as threatened and migratory (three Vulnerable and three Endangered) under the EPBC Act—the green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), flatback (*Natator depressus*), loggerhead (*Caretta caretta*), leatherback (*Dermochelys coriacea*) and olive ridley (*Lepidochelys olivacea*) turtle (DSEWPAC, 2012a) (refer **Table 6-1**).

The NWMR supports globally significant breeding populations of four marine turtle species: the green, hawksbill, flatback and loggerhead turtle. Olive ridley turtles are known to forage within the NWMR, but there are only occasional records of the species nesting in the region. Leatherback turtles regularly forage over Australian continental shelf waters within the NWMR but there are also no records of the species nesting in the region (DSEWPAC, 2012a).

The six marine turtle species reported for the NWMR also occur within the NMR.

Three marine turtle species; the green, loggerhead, and leatherback turtle, have presumed feeding areas within the SWMR; however, no known nesting areas exist within the region (DSEWPAC, 2012b).

Discrete genetic stocks have evolved within each marine turtle species. This is the result of marine turtles returning to the location where they hatched. These genetically distinct stocks are defined by the presence of regional breeding aggregations. Stocks are composed of multiple rookeries in a region and are delineated by where there is little or no migration of individuals between nesting areas. Turtles from different stocks typically overlap at feeding grounds (Commonwealth of Australia, 2017). There are 17 genetic stocks across both the NWMR and NMR (nine in the NWMR, six in the NMR, and two overlapping both regions). Of these 17 genetic stocks, nine are known to occur within Woodside's three areas of activity (**Table 6-2**).

6.2.1 Life Cycle Stages

Marine turtles are highly migratory during non-reproductive life phases and have high site fidelity during breeding and nesting life phases. Majority of their lives are spent in the ocean, but the adult female marine turtles will come ashore to lay eggs in the sand above the high water mark on natal beaches (Commonwealth of Australia, 2017). **Figure 6-1** summarises the generalised life cycle of marine turtles. Species-specific life cycle information is outlined within the Recovery Plan for Marine Turtles of Australia (Commonwealth of Australia, 2017).

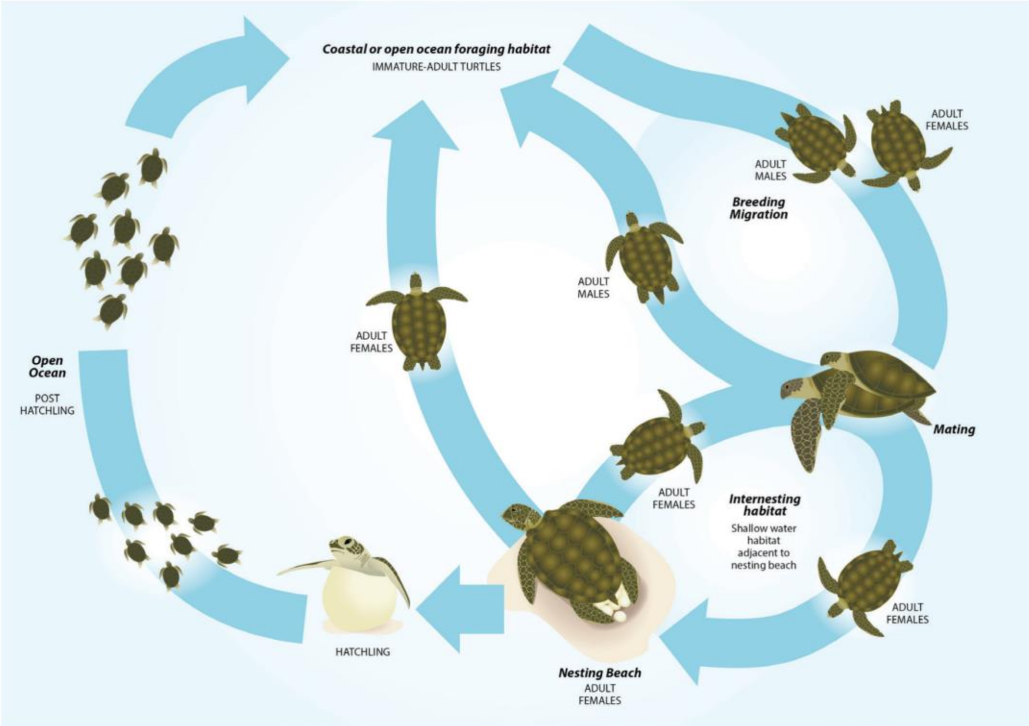


Figure 6-1 Generalised life cycle of marine turtles (Commonwealth of Australia, 2017)

6.2.2 Habitat Critical to Survival for Marine Turtles in the NWMR

The Recovery Plan for Marine Turtles of Australia (Commonwealth of Australia, 2017) identifies habitat critical to the survival of a species for marine turtle stocks under the EPBC Act. Habitat critical to survival is defined by the EPBC Act *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* as areas necessary:

- for activities such as foraging, breeding or dispersal;
- for the long-term maintenance of the species (including the maintenance of species essential to the survival of the species);
- to maintain genetic diversity and long term evolutionary development; and
- for the reintroduction of populations or recovery of the species.

The Recovery Plan for Marine Turtles of Australia (Commonwealth of Australia, 2017) has identified nesting locations and associated internesting areas as habitat critical to survival for four marine turtle species within the NWMR and these are identified, described and mapped in **Table 6-2** and **Figure 6-2**. No habitat critical to survival has been identified within the NWMR for olive ridley or leatherback turtles.

Table 6-2 outlines the relevant genetic stock, habitat critical to survival and key life cycle stage seasonality of the four species of marine turtles within the NWMR.

Table 6-2 Genetic stock, habitat critical to survival and key life cycle stage seasonality of the four species of marine turtles within the NWMR

Species	Woodside Activity Area			Habitat Critical to Survival			
	Browse	NWS/S	NWC	Nesting (* Major Rookery[1])	Internesting Buffer	Seasonality-Nesting	Preferred Habitat[2]
Green Turtle							
NWS Stock (G-NWS)	✓	✓	✓	Adele Island Maret Island Cassini Island Lacepede Islands* Barrow Island* Montebello Islands (all with sandy beaches)* Serrurier Island Dampier Archipelago Thevenard Island Northwest Cape* Ningaloo coast	20 km radius	Nov-Mar	Nearshore reef habitats in the photic zone.
Ashmore Reef Stock (G-AR)	✓	-	-	Ashmore Reef* Cartier Reef*		All year (peak: Dec-Jan)	
Scott Reef-Browse Island Stock (G-ScBr)	✓	-	-	Scott Reef (Sandy Islet)* Browse Island*		Nov-Mar	
Hawksbill Turtle							
Western Australia Stock (H-WA)	-	✓	-	Dampier Archipelago (including Rosemary Island and Delambre Island)* Montebello Islands (including Ah Chong Island, South East Island and Trimouille Island)* Lowendal Islands (including Varanus Island, Beacon Island and Bridled Island) Sholl Island	20 km radius	Oct-Feb	Nearshore and offshore reef habitats.

Species	Woodside Activity Area			Habitat Critical to Survival			
	Browse	NWS/S	NWC	Nesting (* Major Rookery[1])	Internesting Buffer	Seasonality-Nesting	Preferred Habitat[2]
Flatback Turtle							
Cape Domett Stock (F-CD)	✓	-	-	Cape Domett* Lacrosse Island	60 km radius	All year (peak: Jul-Sep)	Nearshore and offshore sub-tidal and soft bottomed habitats of offshore islands.
South-west Kimberley Stock (F-swKim)	-	✓	-	Eighty Mile Beach* Eco Beach* Lacepede Islands		Oct-Mar	
Pilbara Stock (F-Pil)	-	✓	-	Montebello Islands Mundabullangana Beach* Barrow Island* Cemetery Beach Dampier Archipelago (including Delambre Island* and Huay Island) Coastal islands from Cape Preston to Locker Island		Oct-Mar	
Unknown genetic stock Kimberley, Western Australia	✓	✓	-	Maret Islands Montilivet Islands Cassini Island Coronation Islands (includes Lamarck Island) Napier-Broome Bay Islands (West Governor Island, Sir Graham Moore Island – near Kalumbaru) Champagny, Darcy and Augustus Islands (Camden Sound)		May-July	

Species	Woodside Activity Area			Habitat Critical to Survival			
	Browse	NWS/S	NWC	Nesting (* Major Rookery[1])	Internesting Buffer	Seasonality-Nesting	Preferred Habitat[2]
Loggerhead Turtle							
Western Australia Stock (LH-WA)	-	-	✓	Dirk Hartog Island* Muiron Islands* Gnaraloo Bay* Ningaloo coast	20 km radius	Nov-May	Nearshore and island coral reefs, bays and estuaries in tropical and warm temperate latitudes.

[1] *Major rookeries as outlined in the Recovery Plan (Commonwealth of Australia, 2017)*

[2] *Preferred habitat as outlined in the Recovery Plan (Commonwealth of Australia, 2017)*

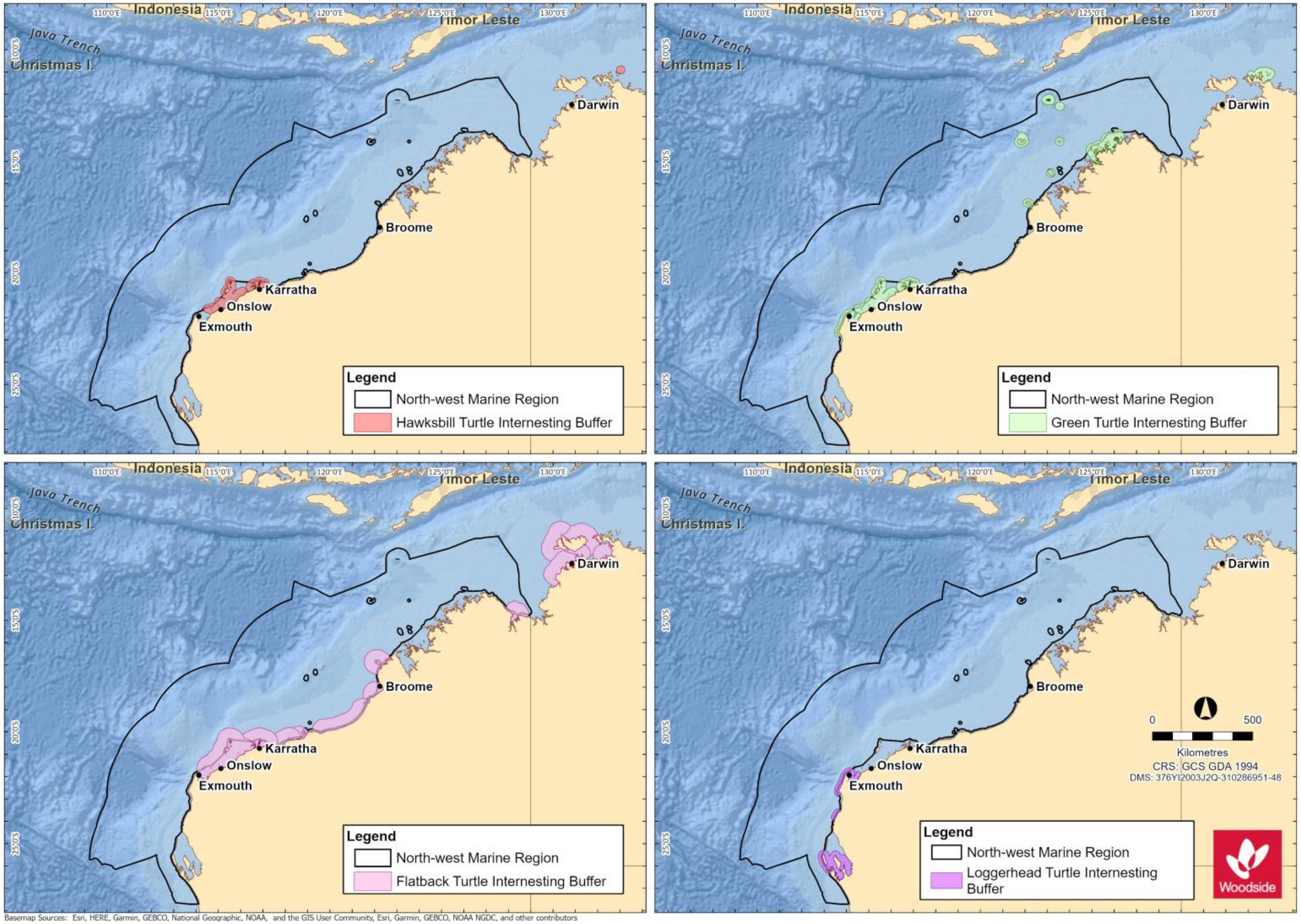


Figure 6-2 Marine turtle species habitat critical to survival (nesting beaches and internesting buffers) for the NWMR

6.3 Marine Turtle Biological Important Areas in the NWMR

A review of the National Conservation Values Atlas (DAWE, 2020[2]) identified BIAs for the four marine turtle species that occur within the NWMR. These are described in **Table 6-3**. Note that nesting and internesting BIAs are not listed in **Table 6-3** as they are defined as in the Recovery Plan as habitat critical to survival for marine turtles nesting beaches and internesting areas (refer **Table 6-2**).

[2] http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf

Table 6-3 Marine turtle BIAs within the NWMR

Species	Woodside Activity Area			BIAs		
	Browse	NWS/S	NWC	Mating	Foraging	Migration[3]
Green turtle	✓	✓	✓	No mating BIA identified within the NWMR.	Foraging inshore areas of Barrow Island Foraging at Montgomery Reef Foraging at Montebello Islands Foraging at Dixon Island Foraging around Ashmore Reef Foraging at Seringapatam Reef and Scott Reef Foraging in the De Grey River area to Bedout Island Foraging around the Islands between Cape Preston and Onslow and inshore of Barrow Island Foraging around Dampier Archipelago (islands to the west of the Burrup Peninsula) Foraging at Legendre Island and Huay Island Foraging around Delambre Island Foraging in the Joseph Bonaparte Gulf Foraging in waters adjacent to James Price Point	Green turtles can migrate more than 2600 km between their feeding and nesting grounds. Individual turtles foraging in the same area do not necessarily take the same migration route (Limpus *et al.*, 1992). Ferreira et al. (2021) broadly identified two migratory corridors, one used by the NWS stock-Pilbara and another used by the NWS stock-Kimberley and the Scott-Browse stock with some overlap at the northern and southern extents respectively. This study showed that the foraging distribution of green turtles from two stocks in WA expands throughout north-west and northern Australian coastal waters, including the NT and Queensland.
Hawksbill turtle	✓	✓	✓	No mating BIA identified within the NWMR.	Foraging around the Lowendal Island group Foraging at Delambre Island Foraging around Dixon Island Foraging in the De Grey River area to Bedout Island Foraging around the islands between Cape Preston and	Individuals may migrate up to 2400 km between their nesting and foraging grounds (DSEWPAC, 2012a).

[3] Migration BIA does not exist for Marine Turtles – general information provided.

Species	Woodside Activity Area			BIAs		
	Browse	NWS/S	NWC	Mating	Foraging	Migration[3]
					Onslow and inshore of Barrow Island Foraging around the islands of the Dampier Archipelago (to the west of the Burrup Peninsula) Foraging at Ashmore Reef	
Flatback turtle	✓	✓	-	Lacepede Islands Mating at Montebello Islands Mating at Dampier Archipelago (islands to the west of the Burrup Peninsula) Mating at Barrow Island A year-round internesting buffer biologically important area (BIA) of 80 km is located north and north-west of the Montebello Islands, extending 20 km further than the habitat critical to survival. However, use level for this BIA has been defined as very low (Commonwealth of Australia, 2017) and the habitat critical to survival internesting buffer is the legally recognised area of protection under the EPBC Act *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* Refer to the Marine Bioregional Plan for the North-west Marine Region (DSEWPAC, 2012a) for locations of seasonal 80 km internesting buffer BIAs for flatback turtles	Foraging at the islands between Cape Preston and Onslow and inshore of Barrow Island. Foraging at Montebello Islands Foraging at Dampier Archipelago (islands to the west of the Burrup Peninsula) Foraging at Legendre Island and Huay Island Foraging at Delambre Island Foraging in the Joseph Bonaparte Depression Foraging in waters adjacent to James Price Point	There is evidence that some flatback turtles undertake long-distance migrations between breeding and feeding grounds (Limpus *et al.*, 1983). However, flatback turtles generally do not have a pelagic phase to their lifecycle. Instead, hatchlings grow to maturity in shallow coastal waters thought to be close to their natal beaches (DSEWPAC, 2012a).

Species	Woodside Activity Area			BIAs		
	Browse	NWS/S	NWC	Mating	Foraging	Migration[3]
Loggerhead turtle	✓	✓	-	No mating BIA identified within the NWMR	Foraging in the De Grey River area to Bedout Island Foraging on the Western Joseph Bonaparte Depression Foraging in the waters adjacent to James Price Point	Adult loggerhead turtles dispersing from Dirk Hartog Island beaches (near Shark Bay) have remained within WA waters from southern WA to the Kimberley. Turtles dispersing from the North-west Cape–Muiron Islands nesting area have ranged north as far as the Java Sea and the north-western Gulf of Carpentaria, and to south-west WA (DSEWPAC, 2012).
Olive ridley turtle	✓	✓	-	No mating BIA identified within the NWMR	Foraging in the Western Joseph Bonaparte Depression and Gulf Foraging in the Dampier Archipelago (islands to the west of the Burrup Peninsula)	Migration routes and distances between nesting beaches and foraging areas are not known for Australian olive ridley turtles.

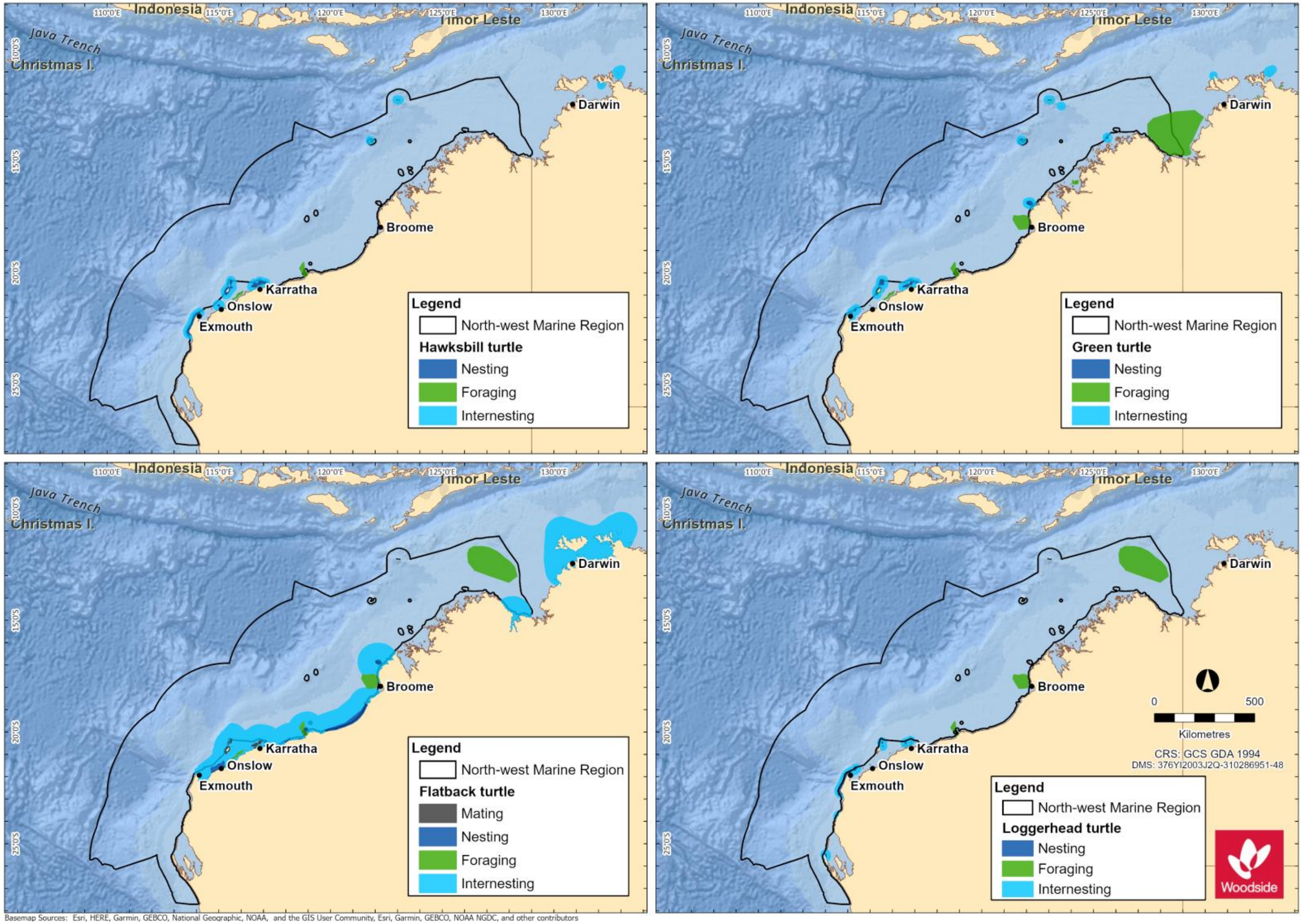


Figure 6-3 Marine turtle species BIAs within the NWMR

6.4 Marine Turtle Summary for NWMR

Six of the seven marine turtle species occur within the Woodside activity areas. Across all three areas, globally significant breeding populations of four marine turtle species; the green, hawksbill, flatback and loggerhead turtle, have been recorded.

However, offshore waters do not represent biologically important habitat for marine turtles in any of the three Woodside activity areas. Isolated records of transient individuals (on post-nesting migration) are expected, but there is no evidence of important habitat or behaviours for marine turtles in offshore, open water environment of the NWS, in general.

6.4.1 Browse

The proposed Browse activity area includes major nesting areas that support globally significant breeding populations of two marine turtle species:

- the green turtle, including two distinct genetic stocks (Ashmore Reef and Scott Reef-Browse Island); and
- the flatback turtle, Cape Domett genetic stock.

Locations of habitat critical for each of the two species are outlined in **Table 6-2** and **Figure 6-2**.

BIAs for the green and flatback turtle are outlined in **Table 6-3** and **Figure 6-3**.

Table 6-4 Marine turtle key information for Browse activity area

Species / Genetic Stock	Key Information
Green Turtle	
Ashmore Reef Stock (G-AR)	The G-AR stock nests in a localised area of the Indian Ocean in the Ashmore Reef and Cartier Island AMP areas. Population estimates are not available for Ashmore Reef, although annual breeding numbers are thought to be in the low hundreds (Whiting, 2000). Designated habitat critical for the G-AR stock are the nesting locations of Ashmore Reef and Cartier Reef, and an internesting buffer of 20 km radius around these rookeries, year-round with peak internesting activity occurring December to January (refer Table 6 of the Recovery Plan). Juvenile and adult turtles forage within the tidal/sub-tidal habitats of offshore islands and coastal waters with coral reef, mangrove, sand, rocky reefs, and mudflats where there are algal turfs or seagrass meadows present (Commonwealth of Australia, 2017).
Scott Reef-Browse Island Stock (G-ScBr)	The G-ScBr stock is a discrete unit known to nest at only two locations within the north-east Indian Ocean—Sandy Islet and Browse Island. There is currently very limited data available for the G-ScBr stock, therefore population numbers are not known. Designated habitat critical for the G-ScBr stock are the nesting locations of Sandy Islet and Browse Island, and an internesting buffer of 20 km radius around these rookeries, for the period November to March (refer Table 6 of the Recovery Plan). Surveys conducted at Scott Reef in 2006, 2008 and 2009 indicate that the summer months from late November to February are the preferred breeding season for green turtles at Sandy Islet (Guinea, 2009). Satellite tagging studies (Pendoley, 2005; Guinea, 2011) have provided an indication of the behaviour and migratory routes of adult green turtles leaving Scott Reef. Most animals appear to swim through South Reef lagoon and disperse toward the Western Australian mainland via two distinct post-nesting migration pathways; travelling east and north toward the Bonaparte Archipelago and then north along the coast to foraging areas in NT waters, or travelling south to Cape Leveque and then south along the coast to the Turtle Islands off the mouth of the De Grey River in the Pilbara region (Ferreira *et al*., 2021).

Species / Genetic Stock	Key Information
Flatback Turtle	
Cape Domett Stock (F-CD)	Cape Domett is an important high density nesting area. Combined with a smaller site at Lacrosse Island, the F-CD stock is one of the largest flatback turtle stocks in Australia. Average nesting abundance at Cape Domett is estimated at 3250 females per year (Whiting *et al.*, 2008). Designated habitat critical for the F-CD stock are the nesting locations of Cape Domett and Lacrosse Island, and an internesting buffer of 60 km radius around these rookeries, year-round with peak internesting activity occurring July to September. Extending further than the habitat critical internesting buffer, an internesting buffer BIA of 80 km is located at Cape Domett and Lacrosse Island.

6.4.2 North-west Shelf / Scarborough

The NWS / Scarborough activity area includes major nesting areas that support globally significant breeding populations of three marine turtle species, representing four discreet genetic stocks:

- the green turtle, NWS genetic stock;
- the hawksbill turtle, WA genetic stock; and
- the flatback turtle, South-west Kimberley stock and Pilbara genetic stocks.

Locations of habitat critical for each of the four species are outlined in **Table 6-2** and **Figure 6-2**.

BIAs for the green, hawksbill, and flatback are outlined in **Table 6-3** and **Figure 6-3**.

Table 6-5 Marine turtle key information for NWS / Scarborough activity area

Species / Genetic Stock	Key Information
Green Turtle	
NWS Stock (G-NWS)	The G-NWS stock is one of the largest green turtle stocks in the world and the largest in the Indian Ocean. The G-NWS stock is estimated at approximately 20,000 individuals (DSEWPAC, 2012a) and the trend for the stock is reported as stable (Commonwealth of Australia, 2017). Major rookeries of the G-NWS stock within the NWS / Scarborough activity area are located at Barrow Island and the Montebello Islands. These areas are designated habitat critical for the stock and include an internesting buffer of 20 km radius around these rookeries, November to March.
Hawksbill Turtle	
Western Australia Stock (H-WA)	The H-WA stock is the largest in the Indian Ocean. The majority of the nesting for this stock is located in the Pilbara. The Dampier Archipelago has the largest nesting aggregation recorded. In particular, Rosemary Island supports the most significant hawksbill turtle rookery in the WA region and one of the largest in the Indian Ocean; approximately 500-1000 females nest on the island annually, more than at any other WA rookery (Pendoley, 2005; Pendoley *et al.*, 2016). Major rookeries of the H-WA stock within the NWS / Scarborough activity area are located at Rosemary Island, Delambre Island and the Montebello Islands. These areas are designated habitat critical for the stock and include an internesting buffer of 20 km radius around these rookeries, October to February.
Flatback Turtle	
South-west Kimberley Stock (F-swKim)	The genetic relationship between this nesting aggregation and the Cape Domett and Pilbara stocks is currently under review. Population numbers of the F-swKim stock are unknown. Major rookeries of the F-swKim stock are located at Eighty Mile Beach and Eco Beach. These areas are designated habitat critical for the stock and include an internesting buffer of 60 km radius around these rookeries, October to March.

Species / Genetic Stock	Key Information
Pilbara Stock (F-Pil)	The extent of genetic relatedness of flatback turtles along the WA coast is currently under review. Population numbers of the F-Pil stock are unknown. This stock nests on many islands in the Pilbara and southern Kimberley, with major rookeries at Mundabullangana Beach, Delambre Island and Barrow Island. These areas are designated habitat critical for the F-Pil stock and include an internesting buffer of 60 km radius around these rookeries, October to March. Extending further than the habitat critical internesting buffer, a year-round internesting buffer BIA of 80 km is located north and north-west of the Montebello Islands. However, use level for this BIA has been defined as very low (Commonwealth of Australia, 2017) and the habitat critical internesting buffer is the legally recognised area of protection under the EPBC Act *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance*. Post-nesting satellite tracking indicates foraging occurs along the WA coast in water shallower than 130 m and within 315 km of shore (Commonwealth of Australia, 2017).

6.4.3 North-west Cape

The North-west Cape activity area includes major nesting areas that support globally significant breeding populations of two marine turtle species, representing two discreet genetic stocks:

- the green turtle, NWS genetic stock; and
- the loggerhead turtle, Western Australia genetic stock.

Locations of habitat critical for each of the two species are outlined in **Table 6-2** and **Figure 6-2**.

BIAs for the green and loggerhead turtles are outlined in **Table 6-3** and **Figure 6-3**.

A 2018 survey, including on-beach monitoring of the Muiron Islands and Ningaloo Coast from North-west Cape to Bungelup (Rob *et al.*, 2019), supports the concept that North-west Cape and the Muiron Islands are major important nesting areas for green and loggerhead turtles, as identified in the Recovery Plan (Commonwealth of Australia, 2017).

Table 6-6 Marine turtle key information for North-west Cape activity area

Species / Genetic Stock	Key Information
Green Turtle	
NWS Stock (G-NWS)	The G-NWS stock is one of the largest green turtle stocks in the world and the largest in the Indian Ocean. The G-NWS stock is estimated at approximately 20,000 individuals (DSEWPAC, 2012a) and the trend for the stock is reported as stable (Commonwealth of Australia, 2017). There is one major rookery of the G-NWS stock located within the North-west Cape activity area. Located on the mainland coast of the North-west Cape, this area is designated habitat critical for the stock and includes an internesting buffer of 20 km radius around the rookery, November to March.
Loggerhead Turtle	
Western Australia Stock (LH-WA)	The LH-WA stock is one of the largest in the world (Limpus, 2009). The trend for the stock is reported as stable (Commonwealth of Australia, 2017). Major rookeries of the LH-WA stock are located at Dirk Hartog Island, Muiron Islands and Gnaraloo Bay. These areas are designated habitat critical for the stock and include an internesting buffer of 20 km radius around these rookeries, November to May. Dirk Hartog Island in the Shark Bay Marine Park, with an average of 122 nests per day over 2.1 km (Reinhold and Whiting, 2014), is recognised as the most important loggerhead turtle rookery in WA (Commonwealth of Australia, 2016; as cited in Rob *et al.*, 2019).

6.5 Sea Snakes

Sea snakes are commonly found in the NWMR and NMR, but less so in the SWMR, and occupy three broad habitat types: shallow water coral reef and seagrass habitats, deepwater soft bottom habitats away from reefs, and surface water pelagic habitats (Guinea, 2007a).

There are 25 listed species of sea snake reported within or adjacent to the NWMR (Guinea, 2007a; Udyawer *et al*., 2016), of which four are endemic to reef habitats in the remote parts of the region:

- dusky sea snake (*Aipysurus fuscus*);
- large headed sea snake (*Hydrophis pacificus*);
- short-nosed sea snake (*Aipysurus apraefrontalis*); and
- leaf-scaled sea snake (*Aipysurus foliosquama*).

The short-nosed sea snake and the leaf-scaled sea snake are listed threatened species (Critically Endangered) under the EPBC Act **(Table 6-7**).

There is currently limited knowledge about the ranges and distribution patterns of sea snake species in the NWMR, in addition to a lack of understanding of population status and threats. Recent findings of *A. apraefrontalis* and *A. foliosquama* in locations outside of their previously defined ranges have highlighted the lack of information on species distributions in the NWMR (Udyawer *et al.*, 2016). Udyawer *et al.* (2020) used a correlative modelling approach to understand habitat associations and identify suitable habitats for five sea snake species (*A. apraefrontalis, A. foliosquama, A. fuscus, A. l. pooleorum* and *A. tenuis*). Species-specific habitat suitability was modelled across 804,244 km^2 of coastal waters along the NWS, and the resulting habitat suitability maps enabled the identification of key locations of suitable habitat for these five species (refer **Table 6-6**).

No habitat critical to survival or BIAs for sea snake species have been identified in the NWMR. While the Ashmore Reef and Cartier Island AMPs have been recognised for their high diversity and density of sea snakes (DSEWPAC, 2012a), surveys have revealed a steep decline in sea snake numbers at Ashmore Reef (Guinea, 2007b; Lukoschek *et al.*, 2013). Leaf-scaled and short-nosed sea snakes have been absent from surveys at Ashmore Reef since 2001, despite an increase in survey intensity (Guinea, 2006, 2007b; Guinea and Whiting, 2005; Lukoschek *et al.*, 2013). The reason for the decline is unknown.

Table 6-7 Information on the two threatened sea snake species within the NWMR

Species	Preferred Habitat and Diet	Habitat Location
Short-nosed sea snake	Preferred habitat: Primarily on the reef flats or in shallow waters of the outer reef edges to depths of 10 m (Minton *et al*., 1975). Typically, movement is restricted to within 50 m of reef flat habitat (Guinea and Whiting, 2005). Diet: Primarily fishes and eels.	The short-nosed sea snake has been recorded from Exmouth Gulf to the reefs of the Sahul Shelf, although most records come from Ashmore and Hibernia reefs (Guinea and Whiting, 2005). Key locations of suitable habitat: Ashmore Reef, Exmouth Gulf, Muiron Islands, Montebello Islands (Udyawer *et al.*, 2020).
Leaf-scaled sea snake	Preferred habitat: The leaf-scaled sea snake occurs in shallow protected areas of reef flats, typically in water depth less than 10 m. Diet: Primarily shallow water coral-associated wrasse, gudgeons, clinids and eels (McCosker, 1975; Voris, 1972; Voris and Voris, 1983)	The leaf-scaled sea snake has only been recorded at Ashmore and Hibernia reefs (Guinea and Whiting, 2005), indicating it has a very limited distribution. Key locations of suitable habitat: Ashmore Reef, Shark Bay, Exmouth Gulf, Barrow Island and Montebello Islands (Udyawer *et al.*, 2020).

6.6 Crocodiles

The salt-water crocodile (*Crocodylus porosus*) is a listed migratory species under the EPBC Act known to occur within the NWMR. The species is found in most major river systems of the Kimberley, including the Ord, Patrick, Forrest, Durack, King, Pentecost, Prince Regent, Lawley, Mitchell, Hunter, Roe and Glenelg rivers. The largest populations occur in the rivers draining into the Cambridge Gulf and the Prince Regent River and Roe River systems. There have also been isolated records in rivers of the Pilbara region, around Derby near Broome and as far south as Carnarvon on the mid-west coast.

No BIAs for salt-water crocodile have been identified in the NWMR.

7. MARINE MAMMALS

7.1 Regional Context

The offshore waters of WA include important habitat for marine mammals, including areas that support key life stages such as breeding, foraging, and migration. Of the 45 species of cetacean occurring in Australian waters, 27 species occur regularly in the waters of the NWMR, nine species in the waters of the NMR and 33 species in the SWMR. The waters of the NWMR and the NMR also support significant populations of dugong (DSEWPAC, 2012a, c).

The NWMR is an important migratory pathway between feeding grounds in the Southern Ocean and breeding grounds in tropical waters of the NWMR for several cetacean species (DSEWPAC, 2012a). Numerous large mysticetes (baleen whale) species, in particular the humpback whale, are known to utilise the region for migration and calving, and the pygmy blue whale for foraging and as a migration pathway between southern feeding and northern breeding/feeding areas, north of the equator.

The SWMR is an important area for numerous marine mammal species including pinniped species, large, migratory whale species and resident coastal whale and dolphin species (DSEWPAC, 2012b).

The NMR and adjacent areas are important for several species of cetacean, particularly inshore dolphin species. These species, and other marine mammals, rely on the waters of the NMR and adjacent coastal areas for breeding and foraging. However, there is little knowledge of the seasonal movements, migrations and breeding seasonality for many of the marine mammal species in the NMR due to lack of extensive surveys (DSEWPAC, 2012c).

Table 7-1 outlines the threatened and migratory marine mammal species that may occur within the NWMR, with their conservation status and relevant recovery plans and/or conservation advice.

Table 7-1 Marine mammal species identified by the EPBC Act PMST as occurring within the NWMR

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Cetaceans - Mysticeti						
Balaenoptera musculus	Blue whale	Endangered	Migratory	Cetacean	Endangered	Conservation Management Plan for the Blue Whale - A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2015-2025 (Commonwealth of Australia, 2015a)
Eubalaena australis	Southern right whale	Endangered	Migratory	Cetacean	Vulnerable	Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011-2021 (DSEWPAC, 2012d)
Balaenoptera borealis	Sei whale	Vulnerable	Migratory	Cetacean	Endangered	Conservation Advice *Balaenoptera borealis* sei whale (Threatened Species Scientific Committee, 2015a)
Megaptera novaeangliae	Humpback whale	Vulnerable	Migratory	Cetacean	Conservation dependent	Conservation Advice *Megaptera novaeangliae* humpback whale (Threatened Species Scientific Committee, 2015b)
Balaenoptera physalus	Fin whale	Vulnerable	Migratory	Cetacean	Endangered	Conservation Advice *Balaenoptera physalus* fin whale (Threatened Species Scientific Committee, 2015c)
Balaenoptera edeni	Bryde's whale	N/A	Migratory	Cetacean	N/A	N/A
Balaenoptera bonaerensis	Antarctic minke whale	N/A	Migratory	Cetacean	N/A	N/A
Cetaceans - Odontoceti						
Physeter macrocephalus	Sperm whale	N/A	Migratory	Cetacean	Vulnerable	N/A
Orcinus orca	Killer whale	N/A	Migratory	Cetacean	N/A	N/A
Orcaella heinsohni	Australian snubfin dolphin	N/A	Migratory	Cetacean	Priority	N/A
Sousa chinensis	Indo-Pacific humpback dolphin	N/A	Migratory	Cetacean	Priority	N/A

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Tursiops aduncus	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	N/A	Migratory	Cetacean	N/A	N/A
Sirenians and Pinnipeds						
Dugong dugon	Dugong	N/A	Migratory	Marine	Other protected fauna	N/A
Neophoca cinerea	Australian sea lion	Endangered	N/A	Marine	Vulnerable	Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*) 2013 (DSEWPAC, 2013a) Conservation Advice *Neophoca cinerea* Australian Sea Lion (Threatened Species Scientific Committee, 2020a) (in effect under the EPBC Act from 23-Dec-2020)

7.2 Cetaceans in the NWMR

Cetaceans are generally widely distributed and highly mobile. In general, distribution patterns reflect seasonal feeding areas, characterised by high productivity, and migration routes associated with reproductive patterns. The NWMR is thought to be an important migratory pathway between feeding grounds in the Southern Ocean and breeding grounds in tropical waters for several cetacean species (DSEWPAC, 2012a).

From the Protected Matters search, 34 EPBC Act listed species were recorded as potentially occurring or having habitat within the NWMR (**Appendix A**). Of those, 12 cetacean species are listed as threatened and/or migratory, including baleen whales, toothed whales and dolphins that occur within the NWMR (**Table 7-2**).

7.3 Dugongs in the NWMR

The dugong is listed as migratory under the EPBC Act. Dugongs inhabit seagrass meadows in coastal waters, estuarine creeks and streams, and reef systems (DSEWPAC, 2012a).

Some of the coastal waters adjacent to the NWMR support significant populations of dugongs, including Shark Bay, Exmouth Gulf, in and adjacent to Ningaloo Reef, in coastal waters along the Kimberley coast, and on the edge of the continental shelf at Ashmore Reef (DEWHA, 2008).

Although the patterns of dugong movement in WA are not well understood, it is thought that dugongs move in response to availability of seagrass (Marsh *et al.*, 1994; Preen *et al.*, 1997) and water temperature.

There are a number of BIAs for dugong within and adjacent to waters of the NWMR (refer **Section 7.5**).

7.4 Pinnipeds in the NWMR

The Australian sea lion is listed as a species that may occur, or may have habitat within the NWMR (Protected Matters search - **Appendix A**). It is included here as the Australian sea lion is the only pinniped endemic to Australia (Strahan, 1983) and has been recorded within the southern extent of the NWMR at Shark Bay, WA (Kirkwood *et al.*, 1992). The most northern known breeding colony is at the Houtman Abrolhos Islands in the SWMR. The Australian sea lion's breeding range extends from the Houtman Abrolhos Islands, WA to The Pages Island, east of Kangaroo Island, SA. The Australian sea lion was listed as endangered in 2020 (Threatened Species Scientific Committee, 2020a). An assessment of the status and trends in abundance of this endemic, coastal pinniped species (Goldsworthy *et al.* 2021) documented an overall reduction in pup abundance over three generations, providing strong evidence that the species meets IUCN endangered criteria.

There are no BIAs for the Australian sea lion in the NWMR.

Table 7-2 Information on the threatened/migratory marine mammal species within the NWMR

Species	Key Information
	Baleen whales (Mysticeti)
Humpback whale	In Australian waters two genetically distinct populations migrate annually along the west (Group IV) and east coasts (Group V) between May and November. In WA, the migration pathway for the Group IV population (also known as Breeding Stock D) extends from Albany to the Kimberley coastline, passing through the NWMR (Threatened Species Scientific Committee, 2015b). Since the 1982 moratorium on commercial whaling population numbers have recovered significantly; from approximately 2000 to 3000 individuals in 1991, to between 19,200–33,850 individuals in 2008 (Bannister and Hedley, 2001; Bejder *et al.*, 2019; Hedley *et al.*, 2011). Aerial surveys off the WA coast undertaken between 2000 and 2008 produced a population estimate for the Group IV population of 26,100 individuals (CI 20,152–33,272) in 2008 (Salgado Kent *et al.*, 2012). Current population growth for the Group IV population is estimated to be between 9.7 and 13% per annum (Threatened Species Scientific Committee, 2015b). Using the Salago-Kent *et al.* (2012) estimate of 26,100 individuals and an annual population growth rate of ~10%, current population size could be in excess of 75,000 individuals (Woodside, 2019). The Group IV population migrates northward from their Antarctic feeding grounds around May each year, reaching the NWMR around early June. The southward migration subsequently starts in mid-September, around the time of breeding and calving (typically August to September) (Threatened Species Scientific Committee, 2015b). Within the NWMR there are key calving areas between Broome and the northern end of Camden Sound, and resting areas in the southern Kimberley region, Exmouth Gulf and Shark Bay. In particular, high numbers of humpback whales are observed in Camden Sound and Pender Bay from June to September each year (Threatened Species Scientific Committee, 2015b). There are reports of neonates further south, suggesting that the calving areas may be poorly defined. Aerial photogrammetric surveys in 2013 and 2015 recorded large numbers of humpback whale calves along North-west Cape, with estimated minimum relative calf abundance of 463–603 in 2013 and 557–725 in 2015 (Irvine *et al.*, 2018). The majority of calves sighted in both years (85% in 2013; 94% in 2015) were neonates, and these observations indicate that a minimum of approximately 20% of the expected number of calves of this population are born near, or south of, North-west Cape. Thus, the calving grounds for the Group IV population extend south from Camden Sound to at least North-west Cape, 1000 km south-west of the currently recognized calving area (Irvine *et al.*, 2018). There are BIAs for migration and breeding and calving for the humpback whale along the WA coast and within the NWMR (refer **Table 7-3** and **Figure 7-1**).
Blue whale	There are two recognised sub-species of blue whale in the Southern Hemisphere, both of which are recorded in Australian waters. These are the southern (or 'true') blue whale (*Balaenoptera musculus*) and the 'pygmy' blue whale (*Balaenoptera musculus brevicauda*) (Commonwealth of Australia, 2015a). In general, southern blue whales occur in waters south of 60°S and pygmy blue whales occur in waters north of 55°S (i.e. not in the Antarctic). On this basis, nearly all blue whales sighted in the NWMR are likely to be pygmy blue whales. The East Indian Ocean (EIO) pygmy blue whale population is seasonally distributed from Indonesia (a potential breeding ground) to south-west of Australia and east across the Great Australian Bight and Bonney Upwelling to beyond the Bass Strait (Blue Planet Marine, 2020). Migration seems to be variable, with some individuals appearing as resident to areas of high productivity and others undertaking migrations across long distances (Commonwealth of Australia, 2015a). McCauley *et al.* (2018) describe three migratory stages around Australia for the EIO pygmy blue whale population: a 'southbound migratory stage' where whales travel southwards from Indonesian waters offshore from the WA coastline, mostly from October to December but possibly into January of the following year; a protracted 'southern Australian stage' (January to June) where animals spread across southern waters of the Indian Ocean and south of Australia; and a 'northbound migratory stage' (April to August) where animals travel north back to Indonesia again. There are currently insufficient data to accurately estimate population numbers of the pygmy blue whale in Australian waters (Blue Planet Marine, 2020; Commonwealth of Australia, 2015a). There are, however, two estimates of population size of the EIO pygmy blue whale for WA. McCauley and Jenner (2010) calculated the population to be between 662 and 1559 individuals in 2004 based on passive acoustics (whale vocalisations), and Jenner *et al.* (2008) (based on photographic mark and recapture) calculated between 712 and 1754 individuals, but both estimates did not account for animals

Species	Key Information
	travelling further west into the Indian Ocean (McCauley *et al.*, 2018). More recent passive acoustic data estimates a 4.3% growth rate that applies to the proportion of EIO pygmy blue whales seasonally present in offshore water of the south-eastern Australia and may not reflect the full population but does imply an increasing population (McCauley *et al.*, 2018). The pygmy blue whale is typically present in the Perth Canyon from November to June, with an observed peak between March and May (Commonwealth of Australia, 2015a; Blue Planet Marine, 2020). The pygmy blue whale feeds in the Perth Canyon at depths of 200 to 300 m, which overlaps the typical distribution of krill (200–500 m water depth (day) to surface (night) (McCauley *et al.*, 2004; Commonwealth of Australia, 2015a). Other possible feeding grounds off the WA coast include the wider area around the Perth Canyon, and possible foraging areas off the Ningaloo Coast and at Scott Reef (Commonwealth of Australia, 2015a). Refer **Table 7-3** and **Figure 7-2** for the location and type of BIAs for blue whales in the NWMR. There is a migratory BIA for the pygmy blue whale within WA waters, which extends for most of the length of the NWMR within offshore waters.
Bryde's whale	The Bryde's whale is the least migratory of its genus and is restricted geographically from the equator to approximately 40°N and S, or the 20° isotherm (Bannister *et al.*, 1996). The species is known to exhibit inshore and offshore forms in other international locations that vary in morphology and migratory behaviours (Bannister *et al.*, 1996). This appears to also be the case within Australian waters. Bryde's whales have been identified as occurring in both oceanic and inshore waters, with the only key localities recognised in WA being in the Houtman Abrolhos Islands and north of Shark Bay (Bannister *et al.*, 1996). Data suggests offshore whales migrate seasonally, heading towards warmer tropical waters during the winter; however, information about migration within the NWMR is not well known (McCauley and Duncan, 2011). McCauley (2011) detected Bryde's whales using acoustic loggers deployed in and around Scott Reef from 2006 to 2009. Other acoustic logger data of Bryde's whale vocalisations recorded between Ningaloo and north of Darwin showed no apparent trends or seasonality (McCauley, 2011). There are no identified BIAs for this species in the National Conservation Values Atlas.
Southern right whale	The southern right whale occurs primarily in waters between about 20°S and 60°S and moves from high latitude feeding grounds in summer to warmer, low latitude, coastal locations in winter (Bannister *et al.*, 1996). Southern right whales aggregate in calving areas along the south coast of WA outside of the NWMR. However, there have been sightings in waters of the NWMR as far north as Ningaloo (Bannister and Hedley, 2001), and a stranding record exists for the far north Kimberley coast (ALA, 2020). Southern right whale calving grounds are found at mid to lower latitudes and are occupied during the austral winter and early-mid spring. They are regularly present on the southern Australian coast from about mid-May to mid-November, and peak periods for mating are from mid-July through August. Mating occurs within these breeding grounds as evidenced by many observations of intromission and mating behaviours. Southern right whales in south-western Australia appear to be increasing at the maximum biological rate but there is limited evidence of increase in south-eastern Australian waters (DSEWPAC, 2012d). There are no identified BIAs for this species in the NWMR.
Antarctic minke whale	The Antarctic minke whale is distributed worldwide and has been recorded off all Australian states (but not in the NT), feeding in cold waters and migrating to warmer waters to breed. It is thought that the Antarctic minke whale migrates up the WA coast to about 20°S to feed and possibly breed (Bannister *et al.*, 1996); however, detailed information about timing and location of migrations and breeding grounds within the NWMR is not well known. In the high latitudinal winter breeding grounds in other regions, the species appears to be distributed off the continental shelf edge. No population estimates are available for Antarctic minke whales in Australian waters. There are no identified BIAs for this species in the National Conservation Values Atlas.
Sei whale	The sei whale is a baleen whale with a worldwide oceanic distribution and is expected to seasonally migrate between low latitude wintering areas and high latitude summer feeding grounds (Bannister *et al.*, 1996; Prieto *et al.*, 2012). There are no known mating or calving areas in Australian waters. The species has a preference for deep waters, typically occurs in oceanic basins and continental slopes (Prieto *et al.*, 2012), and exhibits a migration pathway influenced by seasonal feeding and breeding patterns. Sei whales have been infrequently recorded in Australian waters (Bannister *et al.*, 1996). Reliable estimates of the sei whale population size in Australian waters are currently not possible due to a lack of dedicated surveys and their elusive characteristics. Similarly, the extent of occurrence and area of occupancy of sei whales in Australian waters cannot be calculated due to the

Species	Key Information
	rarity of sighting records. They will typically travel in small pods of three to five individuals, with some segregation by age, sex and reproductive status. Calving grounds are presumed to exist in low latitudes with mating and calving potentially occurring during winter months (Threatened Species Scientific Committee, 2015a). There are no known mating or calving areas in Australian waters, and there are no identified BIAs for this species in the National Conservation Values Atlas.
Fin whale	The fin whale is a large baleen whale distributed worldwide. Fin whales migrate annually between high latitude summer feeding grounds and lower latitude over-wintering areas (Bannister *et al.*, 1996) and follow oceanic migration paths. The species is uncommonly encountered in coastal or continental shelf waters. Australian Antarctic waters are important feeding grounds for fin whales but there are no known mating or calving areas in Australian waters (Morrice *et al.*, 2004). The species has been observed in groups of six to 10 individuals, as well as in pairs and alone (Threatened Species Scientific Committee, 2015c). Accurate distribution patterns are not known within Australian waters and the majority of data are from stranding events. Fin whales have been recorded vocalising off the Perth Canyon, WA, between January and April 2000 (McCauley *et al.*, 2000). It is currently not possible to accurately estimate the population size of fin whales in Australian waters predominantly due to the species' behaviour and local ecology, as the proportion of time they spend at the surface varies greatly depending on these factors. In addition, natural fluctuations of fin whales in Australian waters are unknown; however, long-range movements do appear to be prey-related. A recent study by Aulich *et al.* (2019) used passive acoustic monitoring as a tool to identify the migratory movements of fin whales in Australian waters. On the west coast, the earliest arrival of these animals occurred at Cape Leeuwin in April, and between May and October they migrated along the WA coastline to the Perth Canyon, which likely acts as a way-station for feeding (Aulich *et al.*, 2019). Some whales were found to continue migrating as far north as Dampier (Aulich *et al.*, 2019). There are no identified BIAs for this species in the National Conservation Values Atlas.
Toothed whales (Odontoceti)	
Sperm whale	Sperm whales are the largest of the toothed whales and are distributed worldwide in deep waters (greater than 200 m) off continental shelves and sometimes near shelf edges (Bannister *et al.*, 1996). The species tends to inhabit offshore areas at depths of 600 m or more and is uncommon in waters less than 300 m deep (Ceccarelli *et al.*, 2011). There is limited information about sperm whale distribution in Australian waters, however, they are usually found in deep offshore waters, with more dense populations close to continental shelves and canyons. In the open ocean, there is a generalised movement of sperm whales southwards in summer, and corresponding movement northwards in winter, particularly for males. Detailed information about the distribution and migration patterns of sperm whales off the WA coast is not available. Females with young may reside within the NWMR all year round, males may migrate through the region and the species may be associated with canyon habitats (Ceccarelli *et al.*, 2011). Sperm whales have been recorded in deep waters off North-west Cape and appear to occasionally venture into shallower waters in other areas. Twenty-three (23) sightings of sperm whales (variable pod sizes, ranging from one to six animals) were recorded by marine mammal observers (MMOs) during the North West Cape MC3D marine seismic survey (December 2016 to April 2017) (Woodside, 2020). These animals were observed in deep, continental slope waters of the Montebello Saddle (maximum distance of approximately 90 km from North-west Cape), and the waters overlying the Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula KEF. The deep waters above the gully/saddle on the inner edge of the plateau (the Montebello Saddle) are thought to be important for sperm whales that may feed in the region (based on 19th Century whaling records; Townsend, 1935). There are no identified BIAs for this species in the NWMR.
Killer whale	The preferred habitat of killer whales includes oceanic, pelagic and neritic (relatively shallow waters over the continental shelf) regions, in both warm and cold waters. Killer whales appear to be more common in cold, deep waters; however, they have been observed along the continental slope and shelf, particularly near seal colonies, as well as in shallow coastal areas of WA (Bannister *et al.*, 1996; Thiele and Gill, 1999). The total number of killer whales in Australian waters is unknown, however, it may be that the total number of mature animals within waters around the continent is less than 10,000. Killer whales are known to make seasonal movements, and probably follow regular migratory routes, but no information is available for the

Species	Key Information
	species in Australian waters. Killer whales are top-level carnivores, and there are reports from around Australia of attacks on dolphins, juvenile humpback whales, blue whales, sperm whales, dugongs and Australian sea lions (Bannister *et al.*, 1996). Killer whales are known to target humpback whales, particularly calves, off Ningaloo Reef during the humpback southern migration season (Pitman *et al.*, 2015). Overall, observations suggest that humpback calves are a predictable, plentiful, and readily taken prey source for killer whales off Ningaloo Reef for at least five months of the year. Additionally, there are records of killer whales attacking dugongs in Shark Bay (Anderson and Prince, 1985). However, there are no recognised key localities or important habitats for killer whales within the NWMR (DSEWPAC, 2012a). There are no identified BIAs for this species in the NWMR.
Australian snubfin dolphin	Stranding and museum specimen records indicate that Australian snubfin dolphins occur only in waters off northern Australia, from approximately Broome on the west coast to the Brisbane River on the east coast (Parra *et al.*, 2002). Aerial and boat-based surveys indicate that Australian snubfin dolphins occur mostly in protected shallow waters close to the coast, and close to river and creek mouths (Parra, 2006; Parra *et al.*, 2006; Parra *et al.*, 2002). Within the NWMR, species has been found in the shallow coastal waters and estuaries along the Kimberley coast. Beagle and Pender bays on the Dampier Peninsula, and tidal creeks around Yampi Sound and between Kuri Bay and Cape Londonderry are important areas for Australian snubfin dolphins (DEWHA, 2008). Roebuck Bay has generally been considered the south-western limit of snubfin dolphin distribution across northern Australia, but the species has been recorded in Port Hedland harbour, the Dampier Archipelago, Montebello Islands, Exmouth Gulf and off North-west Cape (Allen *et al.*, 2012). A first comprehensive catalogue of snubfin dolphin sightings has been compiled for the Kimberley, north-west Western Australia (Bouchet *et al.* 2021) and documented that snubfin dolphins are consistently encountered in shallow water (<21 m depth) close to (<15 km) freshwater inputs with high detection rates in known hotspots such as Roebuck Bay and Cygnet Bay as well as suitable coastal habitat in the wider Kimberley region. Refer **Table 7-3** and **Figure 7-3** for the location and type of BIAs for Australian snubfin dolphins in the NWMR.
Indo-Pacific humpback dolphin (Australian humpback dolphin)	Previously included with *Sousa chinensis*, the Australian humpback dolphin (*S. sahulensis*) was elevated to a species in 2014. *S. chinensis* is now applied for humpback dolphins in the eastern Indian and western Pacific Oceans and *S. sahulensis* for humpback dolphins in the waters of the Sahul Shelf from northern Australia to southern New Guinea (Jefferson and Rosenbaum, 2014). The Australian humpback dolphin is listed as *S. chinensis* under EPBC Act. The Australian humpback dolphin (referred to as 'humpback dolphin' hereafter) inhabits the tropical/subtropical waters of the Sahul Shelf across northern Australia and southern Papua New Guinea (Jefferson and Rosenbaum, 2014). Based on historical stranding data, museum specimens and opportunistic sightings collected during aerial and boat-based surveys for other fauna it has been inferred that humpback dolphins occur from the WA/NT border south-west to Shark Bay (Hanf *et al.*, 2016). Allen *et al.* (2012) suggested that humpback dolphins use a range of inshore habitats, including both clear and turbid coastal waters across northern WA. The waters surrounding North-west Cape are an important area for the species. Boat-based surveys up to 5 km out from the coast (Brown *et al.*, 2012) recorded humpback dolphins from 0.3 to 4.5 km away from shore and in depths ranging from 1.2 to 20 m, with a mean of ~8 m. Other studies around North-west Cape, surveying waters up to 5 km from the coast, recorded humpback dolphins in water depths of up to 40 m (Hanf *et al.*, 2016). Based on density, site fidelity and residence patterns, North-west Cape is clearly an important habitat toward the south-western limit of this species' range (Hunt *et al.*, 2017). Aerial surveys targeting dugongs over the western Pilbara have recorded humpback dolphins more than 60 km from the mainland in shallow shelf waters (i.e. <30 m deep) near Barrow Island and the western Lowendal Islands (Hanf, 2015). The species has also been recorded in fringing coral reef and shallow, sheltered sandy lagoons at the Montebello Islands (Raudino *et al.*, 2018). Over the past ten years a number of studies have focused on populations of humpback dolphins along the Kimberley coast, including Roebuck Bay, the Dampier Peninsula, Cone Bay, Yampi Sound, Prince Regent River and the Cambridge Gulf (Brown *et al.*, 2016). Refer Table **Table 7-3** and **Figure 7-4** for the location and type of BIAs for Indo-Pacific humpback dolphins in the NWMR.
Indo-Pacific bottlenose dolphin (Spotted bottlenose dolphin)	There are four known sub-populations of spotted bottlenose dolphins, of which the Arafura/Timor Sea populations were identified as potentially occurring within the NWMR. The species is restricted to inshore areas such as bays and estuaries, nearshore waters, open coast environments, and shallow offshore waters including coastal areas around oceanic islands, from Shark Bay to the western edge of the Gulf of Carpentaria. The species

Species	Key Information
	forages in a range of habitats but is generally restricted to water depths of less than 200 m (DSEWPAC, 2012a). Important foraging/breeding areas include the shallow coastal waters and estuaries along the Kimberley coast and Roebuck Bay. Refer **Table 7-3** the location and type of BIAs for spotted bottlenose dolphins in the NWMR.
Sirenians	
Dugong	Dugongs are distributed along the WA coast throughout the Gascoyne, Pilbara and Kimberley. Specific areas supporting dugong populations include: Shark Bay; Ningaloo and Exmouth Gulf; the Pilbara coast (Exmouth Gulf to De Grey River [Marsh *et al.*, 2002]); and Eighty Mile Beach and the Kimberley coast, including Roebuck Bay (Brown *et al.*, 2014). Dugong distribution is correlated with the seagrass habitats upon which it feeds, although water temperature has also been correlated with dugong movements and distribution (Preen *et al.*, 1997; Preen, 2004). Dugongs are known to migrate between seagrass habitats (hundreds of kilometres) (Sheppard *et al.*, 2006), and in Shark Bay they exhibit seasonal movements as a behavioural thermoregulatory response to winter water temperatures (Holley *et al.*, 2006; Marsh *et al.*, 2011). Aerial surveys since the mid-1980s indicate that dugong populations are now stable at a regional scale in Shark Bay and in the Exmouth/Ningaloo Reef. Refer **Table 7-3** and **Figure 7-5** for the location and type of BIAs for dugong in the NWMR.
Pinnipeds	
Australian sea lion	The Australian sea lion is the only endemic pinniped (true seals, fur seals and sea lions) in Australian waters. It is a member of the Otariidae (eared seals) family. The birth interval in Australian sea lions is around 17–18 months. The Australian sea lion is unique among pinnipeds in being the only species that has a non-annual breeding cycle that is also temporally asynchronous across its range (DSEWPAC, 2013a; Threatened Species Scientific Committee, 2020a). This means the breeding period (copulation and birthing) in one colony will occur at different times to breeding in another colony. The Australian sea lion is considered to be a specialised benthic forager—that is, it feeds primarily on the sea floor. Studies have shown that the species will eat a range of prey, including fish, cephalopods (squid, cuttlefish and octopus), sharks, rays, rock lobsters and penguins (DSEWPAC, 2013a; Threatened Species Scientific Committee, 2020a). The Australian sea lion feeds on the continental shelf, most commonly in depths of 20–100 m, and they typically travel up to about 60 km from their colony on each foraging trip, with a maximum distance of around 190 km when over shelf waters. The current breeding distribution of the Australian sea lion extends from the Houtman Abrolhos Islands on the west coast of WA to the Pages Islands in SA. Sites for the 58 breeding colonies occurring in WA and SA are designated as habitat critical to the survival of the species under the Recovery Plan for the Australian sea lion (DSEWPAC, 2013a). Of these, four are located in the SWMR along the west coast of WA: Abrolhos Islands (Easter Group), Beagle Island, North Fisherman Island and Buller Island. There are also a number of foraging BIAs for both males and females along the west coast, extending from the Abrolhos Islands south to Rockingham. There is no designated habitat critical to survival or identified BIAs for this species in the NWMR. **Figure 7-6** shows the foraging BIAs for the Australian sea lion to the south of the NWMR.

7.5 Biological Important Areas in the NWMR

BIAs representing important life cycle stages and behaviours for six species of marine mammal in the NWMR: the humpback whale, the pygmy blue whale, Australian snubfin dolphin, Australian humpback dolphin, spotted bottlenose dolphin and dugong, are presented in **Table 7-3**.

Table 7-3 Marine mammal BIAs within the NWMR

Species	Woodside Activity Area			BIAs				
	Browse	NWS/S	NWC	Resting	Foraging	Breeding	Calving	Migration
Humpback whale[1]	✓	✓	✓	Shark Bay Exmouth Gulf (north migration – early June) (south migration – late Aug to Oct) Southern Kimberley region	No foraging BIA identified within the NWMR	Kimberley coast from the Lacepede Islands to north of Camden Sound (mid Aug – early Sept)	Core calving in waters off the Kimberley coast from the Lacepede Islands to north of Camden Sound (mid Aug – early Sept)	Southern border of the NWMR to north of the Kimberley (arrive June)
Blue whale and Pygmy blue whale [1 2]	✓	✓	✓	No resting BIA identified within the NWMR	Possible foraging areas off Ningaloo and Scott Reef	No breeding BIA identified within the NWMR	No calving BIA identified within the NWMR	Augusta to Derby. Along the shelf edge at depths of 500 m to 1000 m; appear close to Ningaloo coast Montebello Islands area on southern migration (north: April – Aug) (south: Oct – late Dec)
Australian snubfin dolphin [1]	✓	✓	-	No resting BIA identified within the NWMR	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound Talbot Bay Maret Islands Bigge Island Admiralty Gulf Parry Harbour Bougainville Peninsula Vansittart Bay Anjo Peninsula Napier	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound Talbot Bay Maret Islands Bigge Island Admiralty Gulf Parry Harbour Bougainville Peninsula Vansittart Bay, Anjo Peninsula Napier Broome Bay Deep Bay Prince Regent River King George River Cape Londonderry	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound Talbot Bay Maret Islands Bigge Island Admiralty Gulf Parry Harbour Bougainville Peninsula Vansittart Bay Anjo Peninsula Napier Broome Bay Deep Bay Prince Regent River	No migration BIA identified within the NWMR

Species	Woodside Activity Area			BIAs				
	Browse	NWS/S	NWC	Resting	Foraging	Breeding	Calving	Migration
					Broome Bay Deep Bay Prince Regent River King George River Cape Londonderry Ord River	Ord River	King George River Cape Londonderry Ord River	
Indo-Pacific humpback dolphin	✓	✓	-	No resting BIA identified within the NWMR	Roebuck Bay Willie Creek Prince Regent River King Sound (north) Yampi Sound Talbot Bay Walcott Inlet Doubtful Bay Deception Bay Augustus Island Maret Islands Bigge Island King Sound, southern sector Vansittart Bay, Anjo Peninsula	Roebuck Bay Willie Creek Prince Regent River King Sound (north) Yampi Sound Talbot Bay Walcott Inlet Doubtful Bay Deception Bay Augustus Island	Roebuck Bay Willie Creek Prince Regent River	No migration BIA identified within the NWMR
Spotted bottlenose dolphin	✓	✓	✓	No resting BIA identified within the NWMR	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound	Roebuck Bay Cambridge Gulf Camden Sound area King Sound (south) King Sound (north) Yampi Sound	No calving BIA identified within the NWMR	No migration BIA identified within the NWMR

Species	Woodside Activity Area			BIAs				
	Browse	NWS/S	NWC	Resting	Foraging	Breeding	Calving	Migration
Dugong[1]	✓	✓	✓	No resting BIA identified within the NWMR	Exmouth Gulf Ningaloo Reef Shark Bay Roebuck Bay Dampier Peninsula	No breeding BIA identified within the NWMR	Exmouth Gulf Ningaloo Reef Shark Bay	Not listed as a migratory species

[1.] *DSEWPAC (2012a)*

[2.] *Commonwealth of Australia (2015a)*

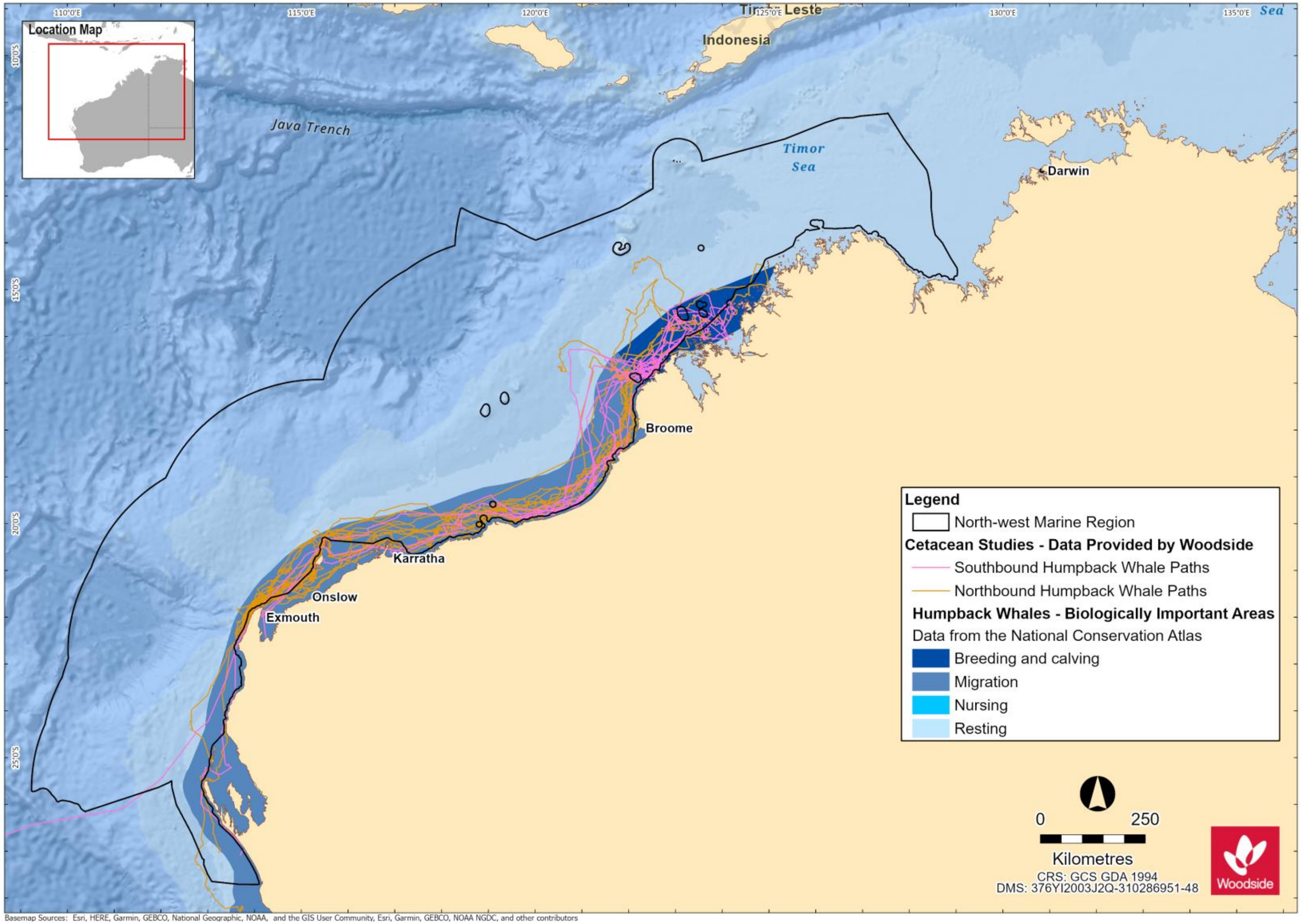


Figure 7-1 Humpback whale BIAs for the NWMR and tagged tracks for north and south bound migrations

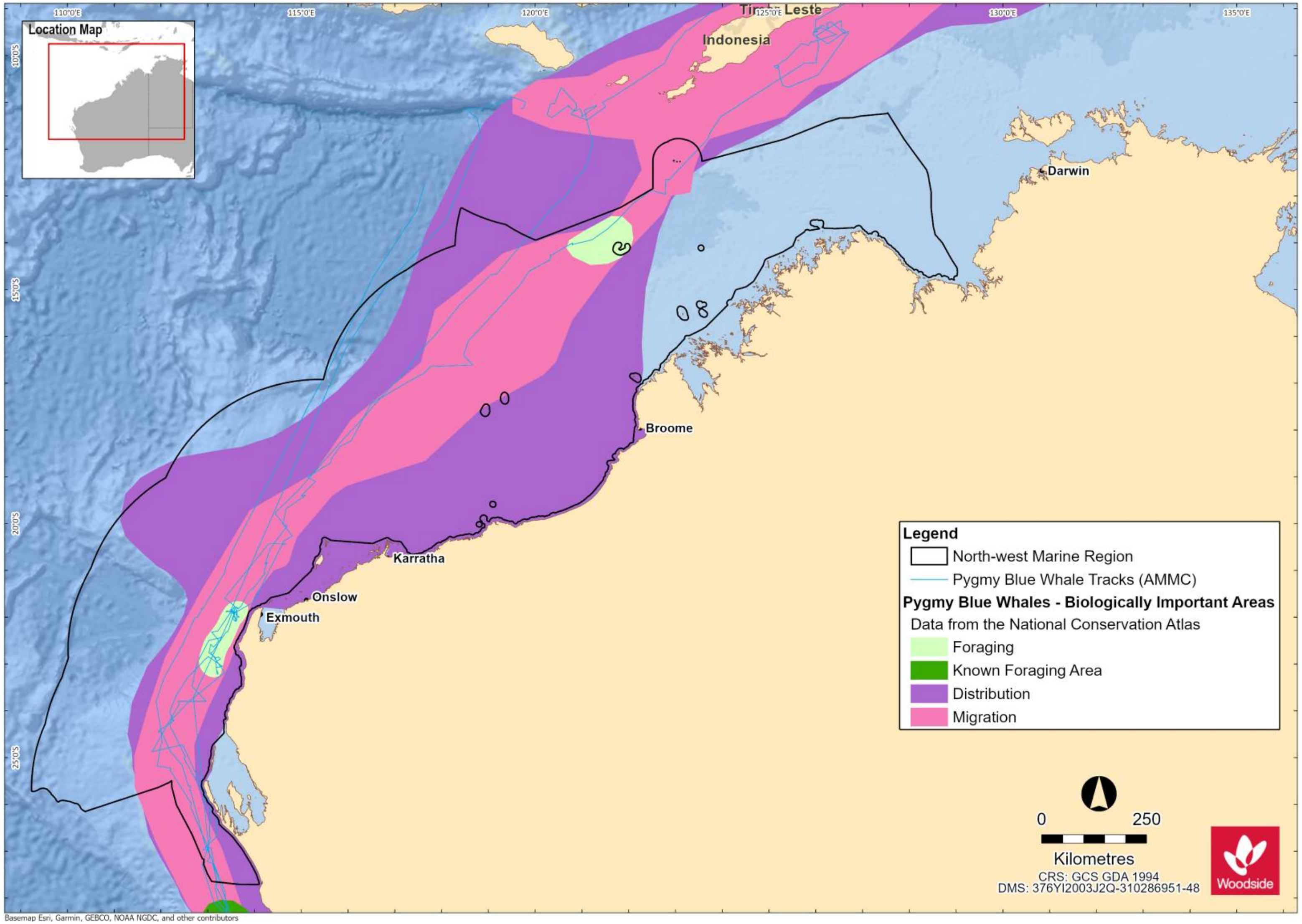


Figure 7-2 Pygmy blue whale BIAs for the NWMR and tagged whale tracks for northbound migration

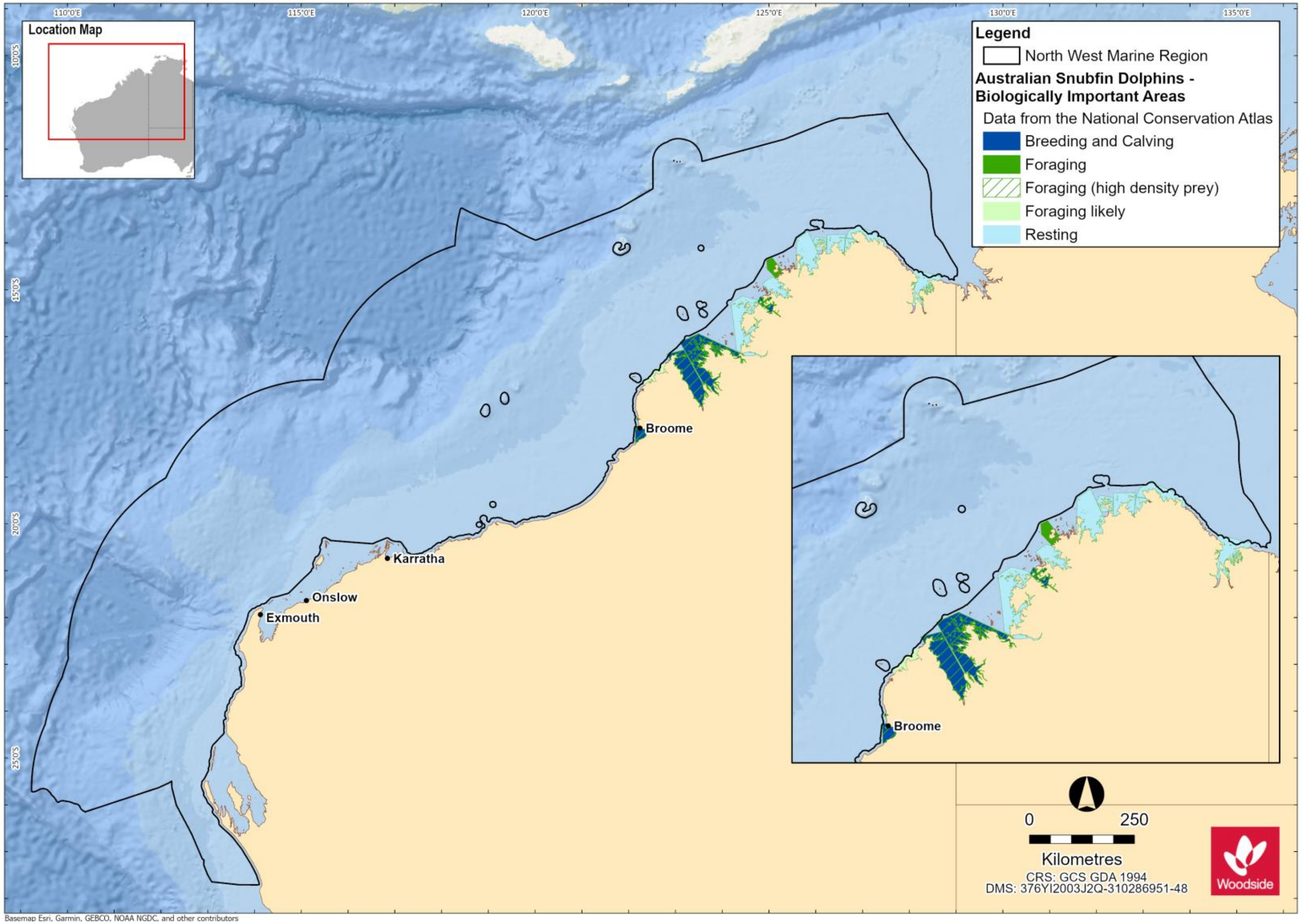


Figure 7-3 Australian snubfin dolphin BIAs for the NWMR

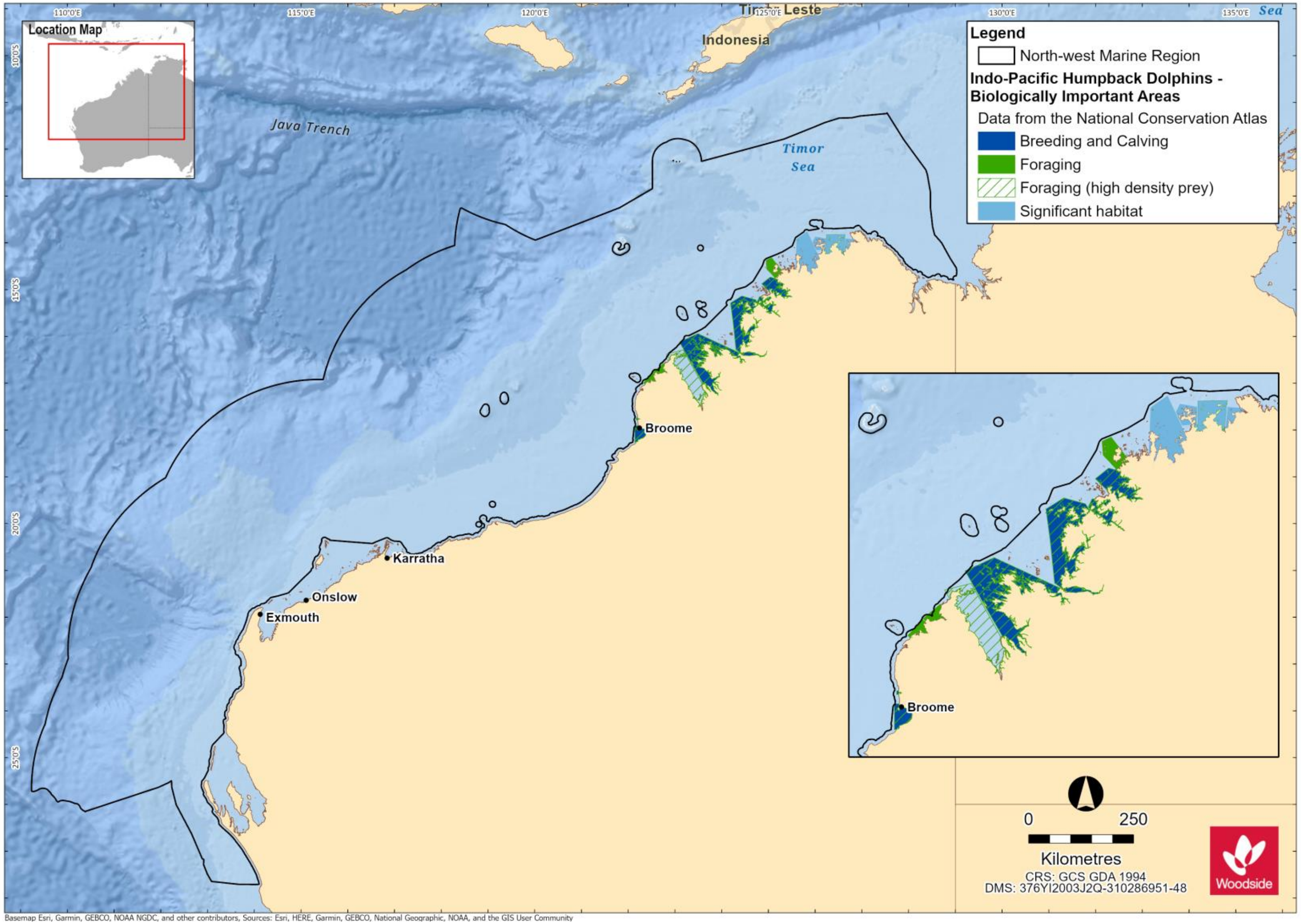


Figure 7-4 Indo-Pacific humpback dolphin BIAs for the NWMR

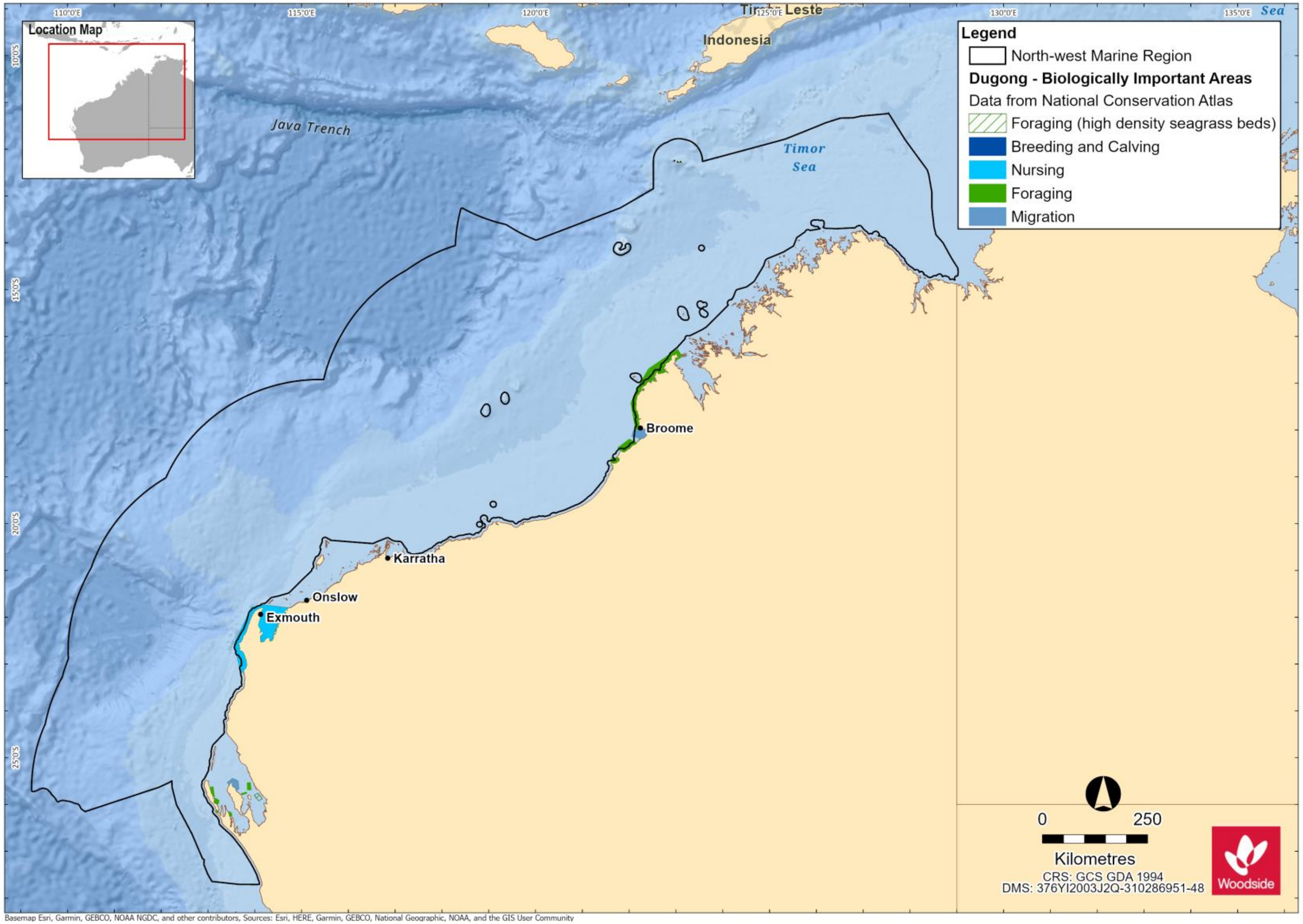


Figure 7-5 Dugong BIAs for the NWMR

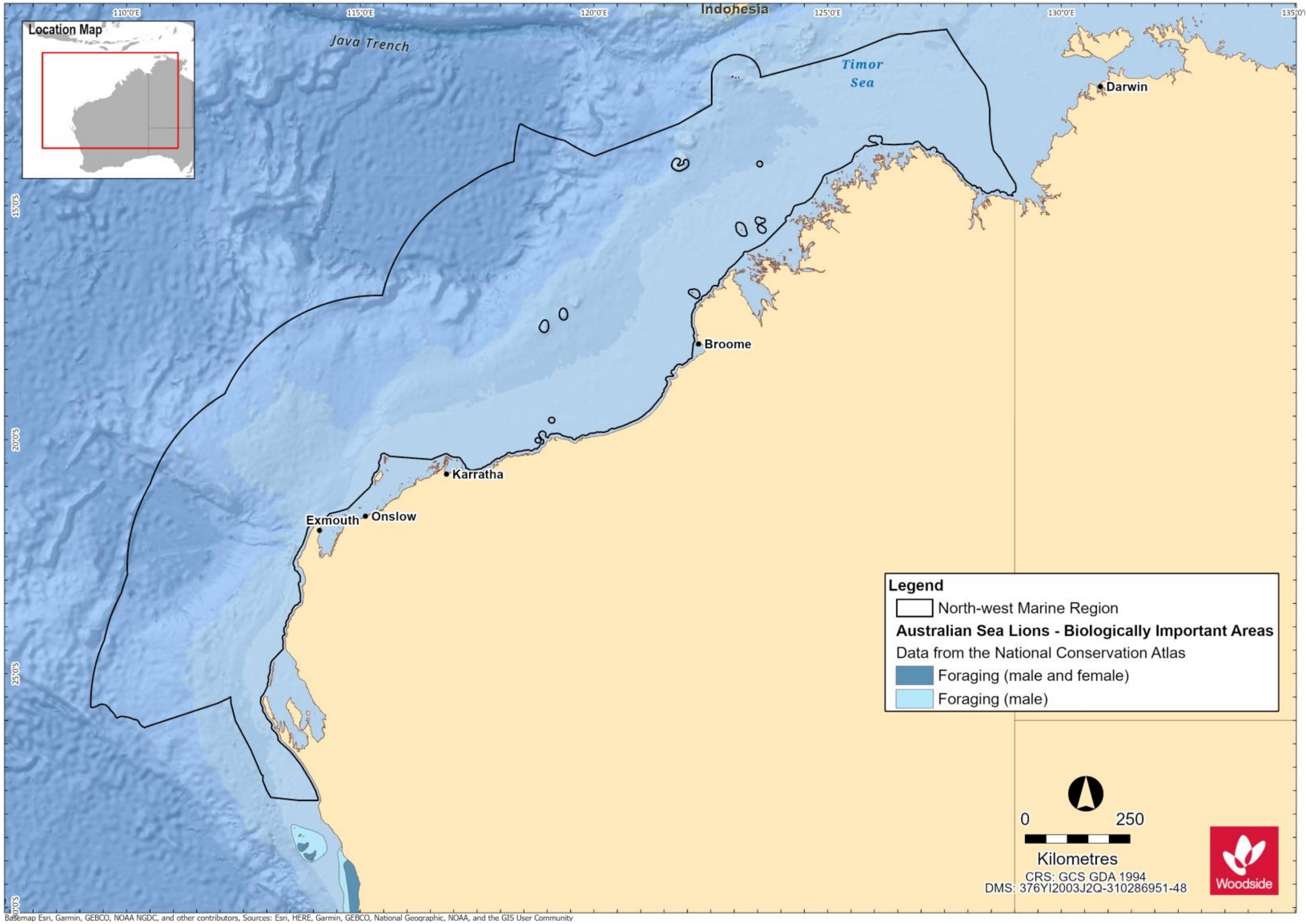


Figure 7-6 Australian sea lion BIAs in the northern extent of the SWMR closest to the NWMR

7.6 Marine Mammal Summary for the NWMR

7.6.1 Browse

The Browse activity area includes biologically important habitat for five threatened and/or migratory marine mammal species:

- blue whale and pygmy blue whale (foraging and migration areas);
- humpback whale (breeding, calving and migration areas);
- Indo-Pacific humpback dolphin (foraging, breeding and calving areas);
- Australian snubfin dolphin (foraging, breeding and calving areas); and
- dugong (foraging).

BIAs for the marine mammal species are outlined in **Table 7-3**.

7.6.2 North-west Shelf / Scarborough

The NWS / Scarborough activity area includes biologically important habitat for five threatened and/or migratory marine mammal species:

- blue whale and pygmy blue whale (foraging and migration areas);
- humpback whale (resting and migration areas);
- Indo-Pacific humpback dolphin (foraging, breeding and calving areas);
- Australian snubfin dolphin (foraging, breeding and calving areas); and
- dugong (foraging and calving areas).

BIAs for the marine mammal species are outlined in **Table 7-3**.

7.6.3 North-west Cape

The North-west Cape activity area includes biologically important habitat for three threatened and/or migratory marine mammal species:

- blue whale and pygmy blue whale (foraging and migration areas);
- humpback whale (resting and migration areas); and
- dugong (foraging and calving areas).

BIAs for the marine mammal species are outlined in **Table 7-3**.

8. SEABIRDS AND MIGRATORY SHOREBIRDS OF THE NWMR

8.1 Regional Context

The NWMR supports high numbers and species diversity of seabirds and migratory shorebirds including many that are EPBC Act listed, threatened and migratory. The NWMR marine bioregional plan reported 34 seabird species (listed as threatened, migratory and/or marine) that are known to occur, and 30 of 37 species of migratory shorebird species that regularly occur in Australia, are recorded at Ashmore Reef in the NWMR (DSEWPAC, 2012e). The NWMR marine bioregional plan also noted that Roebuck Bay and Eighty Mile Beach are internationally significant and recognised migratory shorebird locations.

Many migratory seabirds and shorebirds are protected through bilateral agreements between Australia and Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA), recognising the migratory route and important stopover and resting habitats of the East Asian-Australasian Flyway (EAAF). Important migratory bird habitats are also recognised as part of protected wetlands of the internationally significance under the Ramsar Convention. Important Bird Areas (IBAs) for the NWMR, which are also recognised as global Key Biodiversity Areas (KBAs) (BirdLife Australia[4]), include:

- Roebuck Bay KBA (and Ramsar site): Internationally significant migratory shorebird species.
- Mandora Marsh and Anna Plains KBA (adjacent to Eighty Mile Beach, Ramsar site): Internationally significant migratory shorebird species.
- Dampier Saltworks KBA: Internationally significant migratory shorebird species.
- Montebello Islands KBA: Shorebird and seabird species.
- Barrow Island KBA: Shorebird and seabird species.
- Exmouth Gulf Mangroves KBA: Internationally significant migratory shorebird species.

Table 8-1 presents a list of the threatened and migratory seabird and shorebird species that occur within the NWMR, with their conservation status and relevant recovery plans and/or conservation advice.

4 https://www.birdlife.org.au/projects/KBA#:~:text=The%20Key%20Biodiversity%20Areas%20(KBAs,of%20advocacy%20for%20protected%20areas. Accessed April, 2021.

Table 8-1. Bird species (threatened/migratory) identified by the EPBC Act PMST and other sources of information as potentially occurring within the NWMR

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Seabirds						
Macronectes giganteus	Southern giant petrel	Endangered	Migratory	Marine	Migratory	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPAC, 2011c)
Papasula abbotti	Abbott's booby	Endangered	N/A	Marine	N/A	Conservation Advice for the Abbott's booby - *Papasula abbotti* (Threatened Species Scientific Committee, 2020b)
Pterodroma mollis	Soft-plumaged petrel	Vulnerable	N/A	Marine	N/A	Conservation Advice *Pterodroma mollis* soft-plumaged petrel (Threatened Species Scientific Committee, 2015f)
Sternula nereis nereis	Australian fairy tern	Vulnerable	N/A	N/A	Vulnerable	Conservation Advice for *Sternula nereis nereis* (Fairy Tern) (DSEWPAC, 2011d)
Anous tenuirostris melanops	Australian lesser noddy	Vulnerable	N/A	Marine	Endangered	Conservation Advice *Anous tenuirostris melanops* Australian lesser noddy (Threatened Species Scientific Committee, 2015e)
Thalassarche carteri	Indian yellow-nosed albatross	Vulnerable	Migratory	Marine	Endangered	National recovery plan for threatened albatrosses and giant petrels 2011-2016 (DSEWPAC, 2011c)
Anous stolidus	Common noddy	N/A	Migratory	Marine	Migratory	Draft Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2019)
Fregata ariel	Lesser frigatebird	N/A	Migratory	Marine	Migratory	
Fregata minor	Great frigatebird	N/A	Migratory	Marine	Migratory	
Sula leucogaster	Brown booby	N/A	Migratory	Marine	Migratory	
Sula sula	Red-footed booby	N/A	Migratory	Marine	Migratory	

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Onychiprion anaethetus (listed as *Sterna anaethetus)*	Bridled tern	N/A	Migratory	Marine	Migratory	
Thalasseus bergii	Greater crested tern	N/A	Migratory	Marine	Migratory	
Sternula albifrons	Little tern	N/A	Migratory	Marine	Migratory	
Sterna dougallii	Roseate tern	N/A	Migratory	Marine	Migratory	
Onychoprion fuscata	Sooty tern	N/A	N/A	Marine	N/A	
Hydroprogne caspia	Caspian tern	N/A	Migratory	Marine	Migratory	
Ardenna pacifica	Wedge-tailed shearwater	N/A	Migratory	Marine	Migratory	
Puffinus assimillis	Little shearwater	N/A	N/A	Marine	N/A	
Ardenna carneipes	Flesh-footed shearwater	N/A	Migratory	Marine	Vulnerable	
Calonectris leucomelas	Streaked shearwater	N/A	Migratory	Marine	Migratory	
Phaethon lepturus	White-tailed tropicbird	N/A	Migratory	Marine	Migratory	
Chroicocephalus novaehollandiase	Silver gull	N/A	N/A	Marine	N/A	
Migratory shorebirds						
Numenius madagascariensis	Eastern curlew, Far Eastern curlew	Critically endangered	Migratory	Marine	Critically endangered	Conservation Advice *Numenius madagascariensis* eastern curlew (DOE, 2015a)
Calidris ferruginea	Curlew sandpiper	Critically endangered	Migratory	Marine	Critically endangered	Conservation Advice *Calidris ferruginea* curlew sandpiper (DOE, 2015b)
Calidris tenuirostris	Great knot	Critically endangered	Migratory	Marine	Critically endangered	Conservation Advice *Calidris tenuirostris* Great knot (Threatened Species Scientific Committee, 2016a)
Limosa lapponica menzbieri	Bar-tailed godwit (*menzbieri*)	Critically endangered	Migratory	Marine	Critically endangered	Conservation Advice *Limosa lapponica menzbieri* Bar-tailed godwit (northern Siberia). (Threatened Species Scientific Committee, 2016c)

Species Name	Common Name	*Environment Protection and Biodiversity Conservation Act 1999*			WA *Biodiversity Conservation Act 2016*	EPBC Act Part 13 Statutory Instrument
		Threatened Status	Migratory Status	Listed	Conservation Status	
Calidris canutus	Red knot	Endangered	Migratory	Marine	Endangered	Conservation Advice *Calidris canutus* Red knot (Threatened Species Scientific Committee, 2016b)
Charadrius mongolus	Lesser sand plover	Endangered	Migratory	Marine	Endangered	Conservation Advice *Charadrius mongolus* Lesser sand plover (Threatened Species Scientific Committee, 2016e)
Charadrius leschenaultii	Greater sand plover	Vulnerable	Migratory	Marine	Vulnerable	Conservation Advice *Charadrius leschenaultia* Greater sand plover (Threatened Species Scientific Committee, 2016d)
All migratory shorebird species	Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2015c).					

8.2 Seabirds in the NWMR

Seabirds are birds that are adapted to life within the marine environment (oceanic and coastal) and are generally long-lived, have delayed breeding and have fewer young than other bird species (Commonwealth of Australia, 2019). At least 34 seabird species listed as threatened, migratory and/or marine under the EPBC Act are known to occur regularly in the NWMR and include a variety of species of terns, noddies, petrels, shearwaters, frigatebirds, and boobies. Many of these species spend most of their lives at sea (predominately pelagic species), ranging over large distances to forage. These pelagic species only come onshore to breed and raise chicks at natal or high-fidelity breeding colonies on remote, offshore island locations in and adjacent to the NWMR. Many species are ecologically significant to the NWMR, as they are endemic to the region, can be present in large numbers in breeding seasons and non-breeding seasons, and many exhibit extensive annual migrations that include marine areas outside the Australian EEZ (DSEWPAC, 2012e).

The presence of seabirds within the NWMR is influenced by seabird species that migrate and forage in the area during the non-breeding season and this includes many seabird species that breed on the Houtman Abrolhos in the SWMR. Pelagic seabirds have been documented foraging at current boundaries and seasonal upwellings within the NWMR (refer to Sutton *et al*., 2019). The Houtman Abrolhos Islands National Park located in the SWMR, is one of the most significant seabird breeding locations in the eastern Indian Ocean. Sixteen (16) species of seabirds breed there. Eighty percent of common (brown) noddies, 40% of sooty terns and all the lesser noddies found in Australia nest at the Houtman Abrolhos (Surman, 2019). Important seabird areas in the NWMR are as identified by the KBAs (refer to **Section 8.1**) and the information on a select number of seabird species documented for the NWMR (based on the screening criteria presented in **Section 3**), as presented in **Table 8-2**.

Table 8-2 Information on threatened/migratory seabird species of the NWMR

Species	Key Information
Seabirds	
Southern giant petrel	This species is included in the National recovery plan for threatened albatrosses and giant petrels. Habitat critical to survival is defined for breeding and foraging. There are six known breeding localities under Australian jurisdiction (for all species giant petrels) and all are located in the Southern Ocean including islands off Tasmania and within the Australian Antarctic Territory (DSEWPAC, 2011c). Habitat critical to survival identified for foraging is defined as waters south of 25 degrees latitude. The giant petrel species distribution is mainly within the Southern Ocean but this species does migrate into subtropical waters during the winter and its distribution includes the southern extent of the NWMR. No BIAs for this species are located in the NWMR.
Abbott's booby	The Abbott's booby is a large, long-lived seabird known to nest only at Christmas Island. The recovery of this species is strongly dependent on the protection of breeding habitat defined habitat critical to the survival of this species on Christmas Island (Threatened Species Scientific Committee, 2020b). This species spends much of its time at sea and known to forage over large distances offshore when nesting and its range includes off the coast of Java, near the Chagos and in the Banda Sea, and may possibly extend into the north-western extent of the NWMR. No BIAs for this species are located in the NWMR.
Soft-plumaged petrel	This petrel species breeds only at two locations in Australian waters within the Southern Ocean (one off Tasmania and Macquarie Island) (Threatened Species Scientific Committee, 2015f). As a mainly sub-Antarctic species they are usually distributed in cooler seas but distribution extents into subtropical waters and its known distribution includes the southern extent of the NWMR. No BIAs for this species are located in the NWMR.
Australian fairy tern	The Australian fairy tern is listed as Vulnerable for the sub-species only recorded for WA. It has a coastal distribution from Sydney, south to Tasmania and around southern WA up to the Dampier Archipelago and out on the offshore island groups of Barrow, Montebello and the Lowendals (DSEWPAC, 2011d). The Australian fairy tern feeds on small baitfish and roosts and nests on sandy beaches below vegetation. These behaviours, generally, occur in inshore waters of island archipelagos and on the Australian mainland shores and adjacent wetlands. Fairy terns breed from August to February. The Australian fairy tern is unlikely to be present

Species	Key Information
	within the offshore environment of the NWMR. The largest breeding colony in Western Australia for this species is in the Houtman Abrolhos Islands, SWMR (Surman, 2019). For the description and location of BIAs in the NWMR, refer to **Table 8-3** and **Figure 8-2.**
Australian lesser noddy	The Houtman Abrolhos, WA is an important breeding habitat for the Australian lesser noddy in the eastern Indian Ocean. This species exhibits nesting habitat specialisation (white mangrove stands) and has a limited foraging range during the breeding season. Furthermore, the lesser noddy forages over shelf waters and appears not to disperse over their non-breeding period as they remain largely in the general vicinity or slightly to the south of the colony in the non-breeding season (February to September; Surman *et al*., 2018). No BIAs for this species are located in the NWMR.
Indian yellow-nosed albatross	This species is included in the National recovery plan for threatened albatrosses and giant petrels. Habitat critical to survival is defined for breeding and foraging. There are six known breeding localities under Australian jurisdiction (for all species of albatrosses) and all are located in the Southern Ocean including islands off Tasmania and within the Australian Antarctic Territory (DSEWPAC, 2011c). Habitat critical to survival identified for foraging is defined as waters south of 25 degrees latitude. All albatross species distribution (including the Indian yellow-nose albatross) is mainly within the Southern Ocean but this species does migrate into subtropical waters during the winter and its distribution includes the southern extent of the NWMR. No BIAs for this species are located in the NWMR.
Common noddy	This species is listed as migratory and marine. The common (or brown) noddy is the largest species of noddy found in Australian waters. The species is widespread in tropical and subtropical areas beyond Australia. This seabird species is gregarious and normally occurs in flocks, up to hundreds of individuals, when feeding or roosting. The Houtman Abrolhos, WA is the primary breeding habitat for the common noddy in the Eastern Indian Ocean. This species spends their non-breeding season (March to August) in the NWS area, around 950 km north from the breeding colony (Surman *et al*. 2018). The species occurs within NWMR waters, particularly around offshore islands such as the Montebello Island group. This species is recorded on unmanned oil and gas platforms within the NWS. No BIAs for this species are located in the NWMR.
Lesser frigatebird **Great frigatebird**	Both species of frigatebird are listed as migratory and marine. Within the NWMR, the lesser frigatebird is known to breed on Adele, Bedout and West Lacepede islands, Ashmore Reef and Cartier Island (Commonwealth of Australia, 2019). The lesser frigatebird feeds mostly on fish and sometimes cephalopods, and all food is taken while the bird is in flight. Lesser frigatebirds generally forage close to breeding colonies. Breeding/foraging BIAs for the lesser frigatebird are located in the NWMR; refer to **Table 8-3**.
Brown booby	The brown booby is the most common booby, occurring throughout all tropical oceans bounded by latitudes 30º N and 30º S. There are large colonies on offshore islands within the NWMR such as the Lacepede Islands (one of the largest colonies in the world), Ashmore Reef, and other offshore Kimberley islands. This seabird species is a specialised plunge diver, mostly eating fish and some cephalopods (Commonwealth of Australia, 2019). Breeding/foraging BIAs for the brown booby are located in the NWMR; refer to **Table 8-3** and **Figure 8-3**.
Red-footed booby	Within the NWMR, its known breeding sites for this species include Ashmore Reef and Cartier Island. It is a pelagic species and generally occurs away from land. It mainly eats flying fish and squid. Prey abundance is reliant on the high productivity in slope areas off remote islands where the birds breed (Commonwealth of Australia, 2019). Breeding/foraging BIAs for the red-footed booby are located in the NWMR; refer to **Table 8-3** and **Figure 8-3**.
Greater crested tern	The greater crested tern has a widespread distribution recorded on islands and coastlines of tropical and subtropical areas, ranging from the Atlantic coast of South Africa, Indian Ocean and through south-east Asia and Australia. Outside the breeding season it can be found at sea throughout its range, with the exception of the central Indian Ocean (Commonwealth of Australia, 2019). The largest breeding colony in WA for this species is the Houtman Abrolhos Islands, SWMR (Surman, 2019). No BIAs for this species are located in the NWMR.
Little tern	There are three sub-populations of this species in Australia and two of these occur in the NWMR: northern Australian breeding sub-population occurring around Broome and extending across in to the NMR, and an east Asian breeding sub-population, with the terns present from Shark Bay to south-eastern Queensland during the austral summer. Little terns

Species	Key Information
	usually forage close to breeding colonies in the shallow water of estuaries (Commonwealth of Australia, 2019). For the description and location of BIAs in the NWMR, refer to **Table 8-3** and **Figure 8-2**.
Roseate tern	This species is generally tropical in distribution and there are many breeding populations in the NWMR, including Ashmore Reef, Napier Broome Bay, Bonaparte Archipelago, Lacepede Islands, Dampier Archipelago and the Lowendal Islands. A large number of non-breeding roseate terns have been observed at several remote locations in the Kimberley and there are high numbers also recorded for Eighty Mile Beach Ramsar site. The Kimberley colonies are likely to be another sub-species that breeds in east Asia. Roseate terns predominately eat small pelagic fish (Commonwealth of Australia, 2019). The largest breeding colony in Western Australia for this species is in the Houtman Abrolhos Islands, SWMR (Surman, 2019). For the description and location of BIAs in the NWMR, refer to **Table 8-3** and **Figure 8-2**.
Wedge-tailed shearwater	The wedge-tailed shearwater is a pelagic, marine seabird known from tropical and subtropical waters. Its distribution is widespread across the Indian and Pacific oceans. It is known to breed on the east and west coasts (and offshore islands) of Australia. This species is known to consume fish, cephalopods, and other biota primarily via contact-dipping. Wedge-tailed shearwaters are now understood to undertake extensive foraging trips (over thousands of kilometres over periods of days when chicking and provisioning young) and much longer and extensive pelagic travels over the north-west Indian Ocean during the non-breeding season, targeting current boundaries and upwellings. The species breeds throughout its range, mainly on vegetated islands, atolls and cays and excavates burrows in the ground where chicks are raised (Commonwealth of Australia, 2019). Large breeding colonies of the wedge-tailed shearwater are located on the Houtman Abrolhos islands (SWMR) (Surman *et al*., 2018) and several locations in the NWMR including: Muiron Islands (North-west Cape), Varanus Island and the Dampier Archipelago in the Pilbara where burrow numbers were estimated to several hundred thousand to half a million such as on the Muiron Islands, though it is not known if all burrows are utilised on an annual basis (Birdlife Australia, 2018; Surman *et al.*, 2018). Cannell *et al* (2019) satellite tracked adult wedge-tailed shearwaters during egg incubation and chick rearing on the Muiron Islands in January 2018. For the incubation trips, there was a strong consistency for the birds to travel towards seamounts, typically located north-west of the Muiron Islands, between Australia and Indonesia. One bird however remained south-west of the islands, in the Cape Range Canyon. A similar pattern to utilise areas associated with sea mounts was also observed for the long foraging trips during chick rearing, though some of the foraging was concentrated in deeper waters. A bimodal foraging strategy during chick-rearing was observed, with adults undertaking long foraging trips after a series of shorter foraging trips within the NWMR. Surman *et al*. (2018) reported most wedge-tailed shearwaters from the breeding colonies on the Houtman Abrolhos undertook extensive non-breeding migrations. This seabird species occupied waters adjacent or to the north of their nesting sites or migrated 4200 km north-west into the equatorial central Indian Ocean near the Ninety East Ridge during the non-breeding season (later April to mid-November). For the description and location of BIAs in the NWMR, refer to **Table 8-3** and **Figure 8-1**.
Flesh-footed shearwater	The species mainly occurs in the subtropics, over continental shelves and slopes and occasionally inshore waters, with individual birds pass through the tropics and over deeper waters during migration to the North Pacific and Indian oceans (Commonwealth of Australia, 2019). They are a common visitor to the waters off southern Australia, from south-western WA to south-eastern Queensland. The fleshy-footed shearwater is a trans-equatorial migrant, breeding from late September to May off south-western Australia, and migrating north by early May, across the southern Indian and possibly Indonesia to the northern Pacific Ocean. No BIAs for the flesh-footed shearwater are located in the NWMR.
Streaked shearwater	The streaked shearwater has a broad distribution in the western Pacific Ocean, breeding on the coast and offshore islands of Japan, Russia, China and the Korean Peninsula. During winter months (non-breeding season), the species undertakes trans-equatorial migration to the coasts of Vietnam, New Guinea, the Philippines, Australia, southern India and Sri Lanka. The streaked shearwater feeds mainly on fish and squid that it catches by surface-seizing and shallow plunges (Commonwealth of Australia, 2019). No BIAs for the streaked shearwater are located in the NWMR.
White-tailed tropicbird	Tropicbirds are predominately pelagic species and the white-tailed tropicbird forages in warm waters and over long distances (pan-tropical). The species is most common off north-west Australia. In the NWMR, this species is considered a sub-species and are limited in number and distribution. Nesting sites are known for Clerke Reef (Rowley Shoals) and Ashmore

Species	Key Information
	Reef. Christmas Island is also a known nesting site and the species can disperse several thousand kilometres during foraging trips. This species feeds mainly on fish and cephalopods, captured by deep plunge diving (Commonwealth of Australia, 2019). There are breeding BIAs at the Rowley Shoals and Ashmore Reef within the NWMR for the white-tailed tropicbird; refer to **Table 8-3**.
Silver gull	The silver gull is typically described as an inshore and coastal foraging seabird and has an Australian-wide distribution including locations within the NWMR. It is noted as it has been recorded on unmanned oil and gas platforms located within the NWS.

8.2.1 Biologically Important Areas in the NWMR

BIAs representing important life cycle stages and behaviours for eight species of seabird in the NWMR are presented in **Table 8-3**.

Table 8-3 Seabird BIAs within the NWMR

Seabird Species	Woodside Activity Area			BIAs			
	Browse	NWS/S	NWC	Breeding/foraging	Foraging	Breeding	Resting
Australia fairy tern	-	✓	✓	-	No foraging BIAs in the NWMR Foraging in high numbers: the BIA is located in the SWMR including the Houtman Abrolhos Islands	Dampier Archipelago, Montebello, Lowendal and Barrow Island Groups, south Ningaloo and barrier island of Shark Bay	-
Wedge-tailed shearwater	✓	✓	✓	Widespread area of the NWMR offshore and inshore waters	Foraging in high numbers: the BIA is located in the SWMR including the Houtman Abrolhos Islands	-	-
Great frigatebird	✓	-	-	Ashmore Reef, Adele Island	-	-	-
Lesser frigatebird	✓	✓	-	Off Eighty Mile Beach, Lacepedes, Adele Island, North Kimberley and Ashmore Reef	-	-	-
Brown booby	✓	✓	-	Off Eighty Mile Beach, Lacepedes, Adele Island, North Kimberley and Ashmore Reef	-	-	-
Red-footed booby	✓	-	-	Adele Island, Ashmore Reef	-	-	-
Little tern	✓	✓	-	Rowley Shoals, Adele Island	-	-	-
Roseate tern	✓	✓	✓	-	No foraging BIAs in the NWMR Foraging (provisioning young) and foraging BIAs located in the SWMR – Houtman Abrolhos Islands the	Dampier Archipelago, Montebello, Lowendal and Barrow Island Groups, south Ningaloo and barrier island of Shark Bay	Eighty Mile Beach

Seabird Species	Woodside Activity Area			BIAs			
	Browse	NWS/S	NWC	Breeding/foraging	Foraging	Breeding	Resting
					nearest BIA to the NWMR		
White-tailed tropicbird	✓	-	-			Rowley Shoals Ashmore Reef	

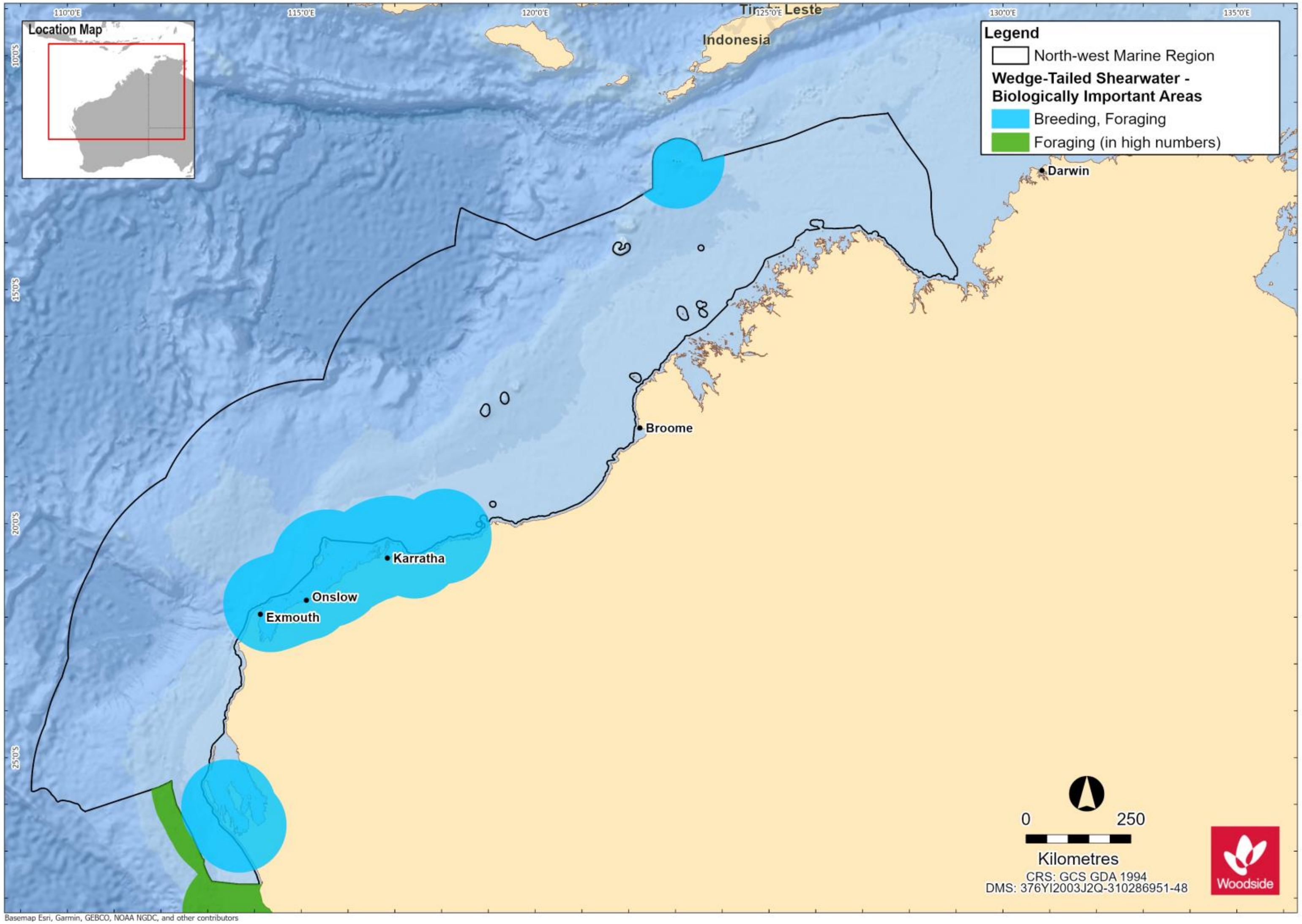


Figure 8-1 Wedge-tailed shearwater BIAs for the NWMR

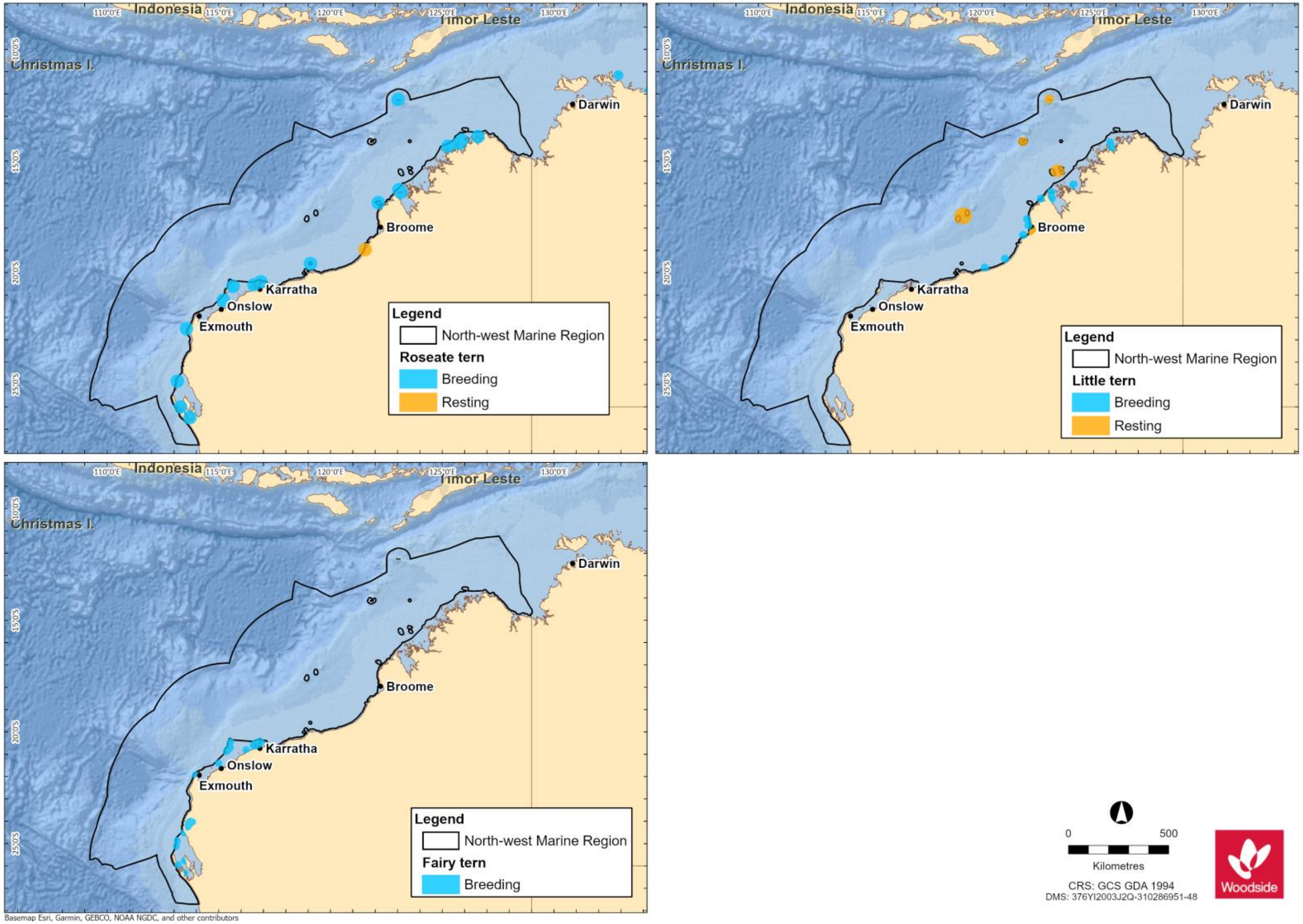


Figure 8-2 Tern species BIAs for the NWMR

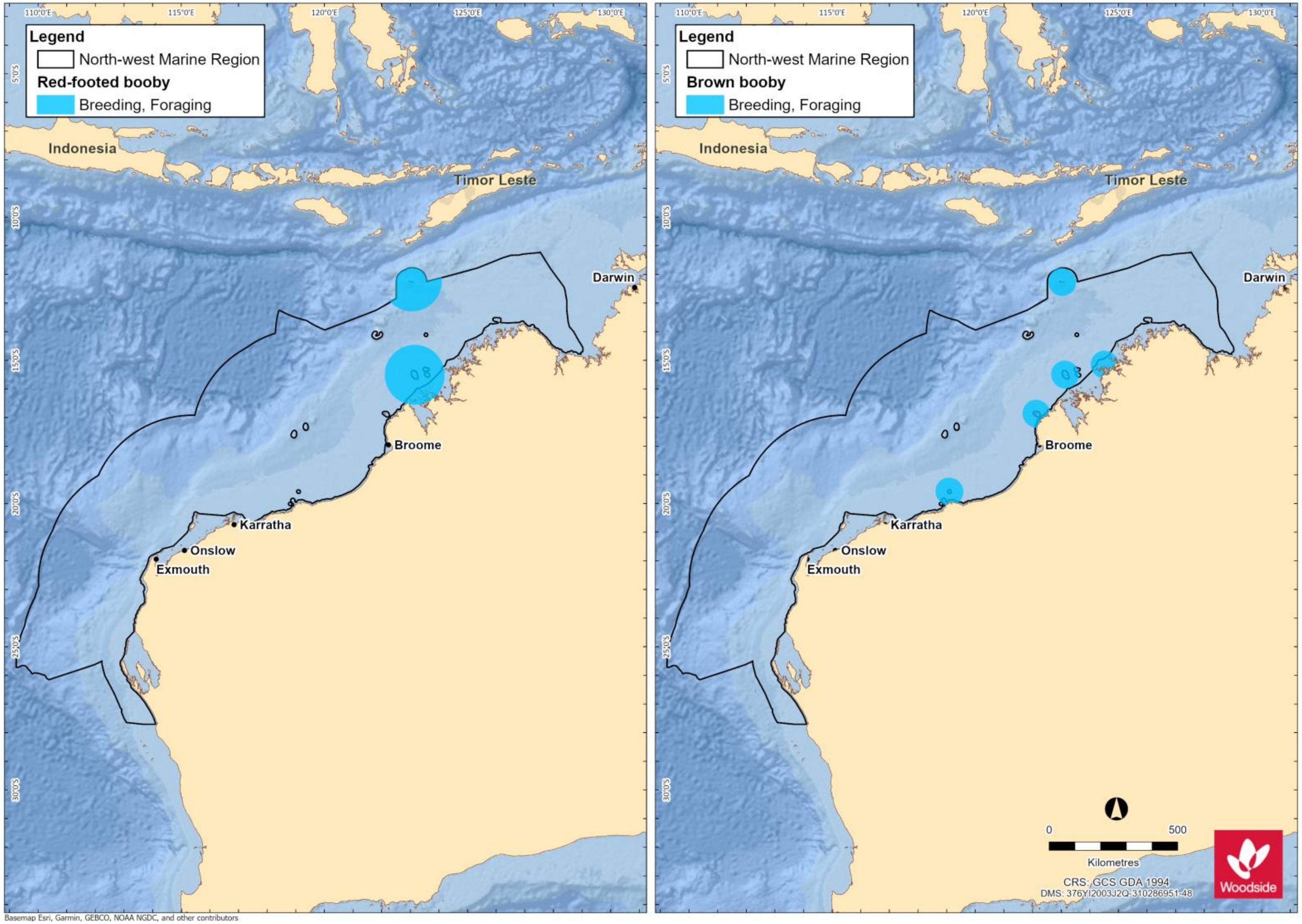


Figure 8-3 Red-footed and brown booby BIAs for the NWMR

8.2.2 Seabird Summary for NWMR

8.2.2.1 Browse

The Browse activity area includes biologically important habitat for seven threatened and/or migratory seabird species:

- wedge-tailed shearwater (breeding/foraging);
- great and lesser frigatebirds (breeding/foraging);
- brown booby (breeding/foraging);
- red-footed booby (breeding/foraging);
- little tern (breeding/foraging);
- roseate tern (breeding and resting); and,
- white-tailed tropicbird (breeding).

BIAs for the seabird species are outlined in **Table 8-3**.

8.2.2.2 NWS / Scarborough

The NWS / Scarborough activity area includes biologically important habitat for five threatened and/or migratory seabird species:

- wedge-tailed shearwater (breeding/foraging);
- lesser frigatebird (breeding/foraging);
- brown booby (breeding/foraging);
- little tern (breeding/foraging); and
- roseate tern (breeding and resting).

BIAs for the seabird species are outlined in **Table 8-3**.

8.2.2.3 North-west Cape

The North-west Cape activity area includes biologically important habitat for five threatened and/or migratory seabird species:

- Australian fairy tern (breeding);
- wedge-tailed shearwater (breeding/foraging); and
- roseate tern (breeding and resting).

BIAs for the seabird species are outlined in **Table 8-3**.

8.3 Shorebirds

Shorebirds (migratory and resident species) are generally associated with wetland or coastal environments, and the NWMR hosts a large number of many shorebird species, particularly in the Austral summer (refer to **Appendix A** for the EPBC Act PMST reports on listed species of shorebirds). Shorebirds may use coastal environments for feeding, nesting or migratory stopovers. In coastal environments, shorebirds generally feed during low tide on exposed intertidal mud and sand flats, and roost in suitable habitat above the high water mark. Many shorebird species undergo annual migrations, typically breeding at high latitudes of the Northern Hemisphere and migrating south for the non-breeding season and Australia is part of the East Asian-Australasian Flyway (EAAF). The EAAF extends from breeding grounds in the Russian tundra, Mongolia and Alaska southwards through east and south-east Asia, to non-breeding areas of Indonesia, Papua New Guinea, Australia and New Zealand (Weller and Lee, 2017). The EAAF is of most relevance to the NWMR. There are 37 species of shorebird which annually migrate to Australia via the EAAF and 36 of these species spend the austral summer (non-breeding season) foraging and roosting in coastal and wetland habitats (Commonwealth of Australia, 2015c; Weller and Lee, 2017).

Ashmore Reef is documented as a BIA for migratory shorebirds in the NWMR (DSEWPAC, 2012a).

Table 8-4. Information on threatened/migratory shorebird species of the NWMR

Species	Key Information
	Shorebirds
Eastern curlew, Far eastern curlew	This species is the largest, migratory shorebird in the world, with a long neck, long legs and a very long downcurved bill and is a long-haul flyer. The eastern curlew is a coastal species with a continuous distribution north from Barrow Island to the Kimberley region. The species is endemic to the EAAF and is a non-breeding visitor to Australia from August to March, primarily foraging on crabs and molluscs in intertidal mudflats. During the non-breeding season in Australia, this species is most associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (DOE, 2015a).
Curlew sandpiper	The curlew sandpiper breeds in northern Siberia but has a non-breeding range that extends from western Africa to Australia, with small numbers reaching New Zealand (Bamford *et al*., 2008). In Australia, curlew sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states and the NT during the non-breeding period, and also during the breeding season when many non-breeding one-year old birds remain in Australia rather than migrating north along the EAAF. The species preferred habitat for foraging is mudflats and nearby shallow waters in sheltered coastal areas such as estuaries, bay, inlets and lagoons (DOE, 2015b).
Great knot	The great knot breeds in the Northern Hemisphere and undertakes biannual migrations along the EAAF to non-breeding habitat in Australia. The great knot winters in Australia and has been recorded around the entirety of the Australian coast the greatest numbers are found in northern Western Australia (Pilbara (Dampier Archipelago) and Kimberley and the Northern Territory. In Australia, this species prefers sheltered, coastal habitat with large intertidal mudflats or sandflats (inkling inlets, bays, harbours, estuaries and lagoons). High numbers (exceeding several thousand birds are regularly recorded from Roebuck Bay. The great knot feeds on a variety of invertebrates by pecking at or just below the surface of moist mud or sand (Threatened Species Scientific Committee, 2016a).
Bar-tailed godwit (*menzbieri*)	The bar-tailed godwit is a large, migratory shorebird and there are two sub-species in the EAAF (*Limosa lapponica baueri* and *L. l. menzbieri*). The sub-species *L. l. menzbieri* breeds in northern Siberia and spends its non-breeding period mostly in the north of WA but also in South-east Asia. The bar-tailed godwit (*menzbieri*) usually forages near the water in shallow water, mainly in tidal estuaries and harbours with a preference for exposed sandy or soft mud substrates on intertidal flats, banks and beaches (Threatened Species Scientific Committee, 2016c).
Red knot (*piersmai*)	This species is a small to medium migratory shorebird. There are two sub-species that cannot be distinguished from each other in nonbreeding plumage, however, *Calidris canutus piersmai* tend to overwinter almost exclusively in north-west Australia. The red knot migrates long distances from breeding grounds in high northern latitudes, where it breeds during the boreal summer, to the Southern Hemisphere during the austral summer with migration along the EAAF. Very large numbers are recorded for the north-west Australia and is common in all suitable habitats around the coast, including inland clay pans near Roebuck Bay (where the species roosts). The red knot usually forages in soft substrate along the waters edge on intertidal mudflats, sandflats and sandy beaches of sheltered coasts (Threatened Species Scientific Committee, 2016b).
Lesser sand plover	The lesser sand plover is a small to medium shorebird and one of 36 migratory shorebirds that breed in the Northern Hemisphere during the boreal summer and are known to annually migrate to the non-breeding grounds of Australia along the EAAF for the austral summer. There are five different sub-species and it is most likely the non-breeding ranges of the sub-species *Charadrius m. mongolus* overlaps with the NWMR. This species is widespread in coastal regions, preferring sandy beaches, mudflats of coastal bays and estuaries (Threatened Species Scientific Committee, 2016e).
Greater sand plover	The greater sand plover is a small to medium shorebird and in its non-breeding plumage is difficult to distinguish from the lesser sand plover. This species breeds in the Northern

Species	Key Information
	Hemisphere and undertakes annual migrations to and from Southern Hemisphere feeding grounds in the austral summer along the EAAF. The species distribution in Australia during the non-breeding season is widespread, in WA the greater sand plover is widespread between Northwest Cape and Roebuck Bay (Threatened Species Scientific Committee, 2016d).

9. KEY ECOLOGICAL FEATURES

Key ecological features (KEFs) are elements of the Commonwealth marine environment that are considered to be important for a marine region's biodiversity or ecosystem function and integrity. KEFs have been identified by the Australian Government based on advice from scientists about the ecological processes and characteristics of the area.

KEFs meet one or more of the following criteria:

- a species, group of species, or a community with a regionally important ecological role (e.g. a predator, prey that affects a large biomass or number of other marine species),
- a species, group of species or a community that is nationally or regionally important for biodiversity,
- an area or habitat that is nationally or regionally important for:
  - enhanced or high productivity (such as predictable upwellings – an upwelling occurs when cold nutrient-rich waters from the bottom of the ocean rise to the surface),
  - aggregations of marine life (such as feeding, resting, breeding or nursery areas), or
  - biodiversity and endemism (species which only occur in a specific area),
- a unique seafloor feature, with known or presumed ecological properties of regional significance.

Thirteen KEFs are designated within the NWMR, twelve KEFs within the SWMR and eight KEFs within the NMR. These KEFs have been identified in the Protected Matters search (**Appendix A**) and outlined in **Table 9-1, Table 9-2** and **Table 9-3,** and **Figure 9-1, Figure 9-2** and **Figure 9-3**.

Table 9-1 Key Ecological Features (KEF) within the NWMR

KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
Carbonate bank and terrace system of the Sahul Shelf	✓	-	-	Unique seafloor feature with ecological properties of regional significance Regionally important because of their role in enhancing biodiversity and local productivity relative to their surrounds. The carbonate banks and terraces provide areas of hard substrate in an otherwise soft sediment environment which are important for sessile species	The Carbonate banks and terrace system of the Sahul Shelf are located in the western Joseph Bonaparte Gulf and to the north of Cape Bougainville and Cape Londonderry. The carbonate banks and terraces are part of a larger complex of banks and terraces that occurs on the Van Diemen Rise in the adjacent NMR. The bank and terrace system of the Van Diemen Rise covers approximately 31,278 km^2 and forms part of the larger system associated with the Sahul Banks to the north and Londonderry Rise to the east. The feature is characterised by terrace, banks, channels and valleys (DSEWPAC, 2012c). The banks, ridges and terraces of the Van Diemen Rise are raised geomorphic features with relatively high proportions of hard substrate that support sponge and octocoral gardens. These, in turn, provide habitat to other epifauna, by providing structure in an otherwise flat environment (Przeslawski *et al.*, 2011). Plains and valleys are characterised by scattered epifauna and infauna that include polychaetes and ascidians. These epibenthic communities support higher order species such as olive ridley turtles, sea snakes and sharks (DSEWPAC, 2012c)
Pinnacles of the Bonaparte Basin	✓	-	-	Unique seafloor feature with ecological properties of regional significance Provide areas of hard substrate in an otherwise soft sediment environment and so are important for sessile species Recognised as a biodiversity hotspot for sponges The Pinnacles of the Bonaparte Basin KEF is located within both the NWMR and NMR (refer **Table 9-3**)	The Pinnacles of the Bonaparte Basin provide areas of hard substrate in an otherwise relatively featureless environment, the pinnacles are likely to support a high number of species, although a better understanding of the species richness and diversity associated with these structures is required (DSEWPAC, 2012a, 2012c). Covering >520 km^2 within the Bonaparte Basin, this feature contains the largest concentration of pinnacles along the Australian margin. The Pinnacles of the Bonaparte Basin are thought to be the eroded remnants of underlying strata; it is likely that the vertical walls generate local upwelling of nutrient-rich water, leading to phytoplankton productivity that attracts aggregations of planktivorous and predatory fish, seabirds, and foraging turtles (DSEWPAC, 2012a, 2012c).
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	✓	-	-	High productivity, biodiversity and aggregation of marine life that apply to both the benthic and pelagic habitats within the feature	Ashmore Reef is the largest of only three emergent oceanic reefs present in the north-eastern Indian Ocean and is the only oceanic reef in the region with vegetated islands. Ashmore contains a large reef shelf, two large lagoons, several channelled carbonate sand flats, shifting sand cays, an extensive reef flat, three vegetated islands—East, Middle and West islands—and

KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
					surrounding waters. Rising from a depth of more than 100 m, the reef platform is at the edge of the NWS and covers an area of 239 km². Ashmore Reef and Cartier Island and the surrounding Commonwealth waters are regionally important for feeding and breeding aggregations of birds and other marine life; they are areas of enhanced primary productivity in an otherwise low-nutrient environment (DSEWPAC, 2012a). Ashmore Reef supports the highest number of coral species of any reef off the WA coast.
Seringapatam Reef and the Commonwealth waters in the Scott Reef complex	✓	-	-	Support diverse aggregations of marine life, have high primary productivity relative to other parts of the region, are relatively pristine and have high species richness, which apply to both the benthic and pelagic habitats within the feature	Seringapatam Reef and the Commonwealth waters in the Scott Reef complex are regionally important in supporting the diverse aggregations of marine life, high primary productivity, and high species richness associated with the reefs themselves. As two of the few offshore reefs in the north-west, they provide an important biophysical environment in the region (DSEWPAC, 2012a).
Continental slope demersal fish communities	✓	✓	✓	High biodiversity of demersal fish assemblages, including high levels of endemism	The diversity of demersal fish assemblages on the continental slope in the Timor Province, the Northwest Transition and the North-west Province is high compared to elsewhere along the Australian continental slope (DSEWPAC, 2012a). The continental slope between North-west Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in Australia (Last *et al.*, 2005). The slope of the Timor Province and the Northwest Transition also contains more than 500 species of demersal fishes of which 64 are considered endemic (Last *et al.*, 2005), making it the second richest area for demersal fishes throughout the whole continental slope. Demersal fish species occupy two distinct demersal biomes associated with the upper slope (225–500 m water depths) and the mid-slope (750–1000 m). Although poorly known, it is suggested that the demersal slope communities rely on bacteria and detritus-based systems comprised of infauna and epifauna, which in turn become prey for a range of teleost fishes, molluscs and crustaceans (Brewer *et al.*, 2007). Higher-order consumers may include carnivorous fishes, deepwater sharks, large squid, and toothed whales (Brewer *et al.*, 2007). Pelagic production is phytoplankton-based, with hot spots around oceanic reefs and islands (Brewer *et al.*, 2007).

KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
Ancient coastline at 125 m depth contour	✓	✓	✓	Unique seafloor feature with ecological properties of regional significance Provides areas of hard substrate and therefore may provide sites for higher diversity and enhanced species richness relative to surrounding areas of predominantly soft sediment	Several steps and terraces as a result of Holocene sea level changes occur in the region, with the most prominent of these features occurring as an escarpment along the NWMR and Sahul Shelf at a water depth of 125 m. The Ancient Coastline is not continuous throughout the NWMR and coincides with a well-documented eustatic stillstand at about 130 m worldwide (Falkner *et al.*, 2009). Where the Ancient Coastline provides areas of hard substrate, it may contribute to higher diversity and enhanced species richness relative to soft sediment habitat (Falkner *et al.*, 2009). Parts of the Ancient Coastline, represented as rocky escarpment, are considered to provide biologically important habitat in an area predominantly made up of soft sediment. The escarpment type features may also potentially facilitate mixing within the water column due to upwelling, providing a nutrient-rich environment. Although the Ancient Coastline adds additional habitat types to a representative system, the habitat types are not unique to the coastline as they are widespread on the upper shelf (Falkner *et al.*, 2009)
Canyons linking the Argo Abyssal Plain and Scott Plateau	-	✓	-	Facilitates nutrient upwelling, creating enhanced productivity and encouraging diverse aggregations of marine life	Interactions with the Leeuwin Current and strong internal tides are thought to result in upwelling at the canyon heads, thus creating conditions for enhanced productivity in the region (Brewer *et al.*, 2007). As a result, aggregations of whale sharks, manta rays, humpback whales, sea snakes, sharks, predatory fishes and seabirds are known to occur in the area due to its enhanced productivity (Sleeman *et al.*, 2007).
Glomar Shoal	-	✓	-	An area of high productivity and aggregations of marine life including commercial and recreational fish species	Glomar Shoal is a submerged littoral feature located about 150 km north of Dampier on the Rowley shelf at depths of 33–77 m (Falkner *et al.*, 2009). Studies by Abdul Wahab *et al.* (2018) found a number of hard coral and sponge species in water depths less than 40 m. One hundred and seventy (170) different species of fishes were detected with greatest species richness and abundance in shallow habitats (Abdul Wahab *et al.*, 2018). Fish species present include a number of commercial and recreational species such as Rankin cod, brown striped snapper, red emperor, crimson snapper, bream and yellow-spotted triggerfish (Falkner *et al.*, 2009; Fletcher and Santoro, 2009). These species have recorded high catch rates associated with Glomar Shoal, indicating that the shoal is likely to be an area of high productivity.

KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	-	✓	-	Regionally important in supporting high species richness, higher productivity and aggregations of marine life	The Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals KEF and is adjacent to the three nautical mile State waters limit surrounding Clerke and Imperieuse reefs, and include the Mermaid Reef Marine Park as described in **Section 10**. The reefs provide a distinctive biophysical environment in the region. They have steep and distinct reef slopes and associated fish communities. In evolutionary terms, the reefs may play a role in supplying coral and fish larvae to reefs further south via the southward flowing Indonesian Throughflow. Both coral communities and fish assemblages differ from similar habitats in eastern Australia (Done *et al.*, 1994).
Exmouth Plateau	-	✓	✓	Unique seafloor feature with ecological properties of regional significance, which apply to both benthic and pelagic habitats Likely to be an important area of biodiversity as it provides an extended area offshore for communities adapted to depths of approximately 1000 m	The Exmouth Plateau is a large, mid-slope, continental margin plateau that lies off the northwest coast of Australia. It ranges in depth from about 500 to more than 5000 m and is a major structural element of the Carnarvon Basin (Miyazaki and Stagg, 2013). The large size of the Exmouth Plateau and its expansive surface may modify deep water flow and be associated with the generation of internal tides; both of which may subsequently contribute to the upwelling of deeper, nutrient-rich waters closer to the surface (Brewer *et al.*, 2007). Satellite observations suggest that productivity is enhanced along the northern and southern boundaries of the plateau (Brewer *et al.*, 2007). Sediments on the plateau suggest that biological communities include scavengers, benthic filter feeders and epifauna (DSEWPAC, 2012a). Fauna in the pelagic waters above the plateau are likely to include small pelagic species and nekton attracted to seasonal upwellings, as well as larger predators such as billfishes, sharks and dolphins (Brewer *et al.*, 2007). Protected and migratory species are also known to pass through the region, including whale sharks and cetaceans.
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	-	-	✓	Unique seafloor feature with ecological properties of regional significance The feature is an area of moderately enhanced productivity, attracting aggregations of fish and higher-order consumers such as large predatory	The canyons are associated with upwelling as they channel deep water from the Cuvier Abyssal Plain up onto the slope. This nutrient-rich water interacts with the Leeuwin Current at the canyon heads (DSEWPAC, 2012a). Aggregations of whale sharks, manta rays, sea snakes, sharks, large predatory fish, and seabirds are known to occur in this area.

KEF Name	Woodside Activity Area			Values[1]	Description
	Browse	NWS/S	NW Cape		
				fish, sharks, toothed whales and dolphins Likely to be important due to their historical association with sperm whale aggregations	
Commonwealth waters adjacent to Ningaloo Reef	-	-	✓	High productivity and diverse aggregations of marine life The Commonwealth waters adjacent to Ningaloo Reef and associated canyons and plateau are interconnected and support the high productivity and species richness of Ningaloo Reef, globally significant as the only extensive coral reef in the world that fringes the west coast of a continent	The Leeuwin and Ningaloo currents interact, leading to areas of enhanced productivity in the Commonwealth waters adjacent to Ningaloo Reef. Aggregations of whale sharks, manta rays, humpback whales, sea snakes, sharks, large predatory fish, and seabirds are known to occur in this area (DSEWPAC, 2012a). The spatial boundary of this KEF, as defined in the NCVA, is defined as the waters contained in the existing Ningaloo AMP provided in **Section 10**.
Wallaby Saddle	-	-	✓	High productivity and aggregations of marine life: Representing almost the entire area of this type of geomorphic feature in the NWMR. It is a unique habitat that neither occurs anywhere else nearby (within hundreds of kilometres) nor with as large an area (Falkner *et al.* 2009)	The Wallaby Saddle may be an area of enhanced productivity. Historical whaling records provide evidence of sperm whale aggregations in the area of the Wallaby Saddle, possibly due to the enhanced productivity of the area and aggregations of baitfish (DSEWPAC, 2012a).

[1.] *Values description sourced from Marine bioregional plan for the North-west Marine Region (DSEWPAC, 2012a) and the Department of Agriculture, Water and the Environment (DAWE) SPRAT database.*

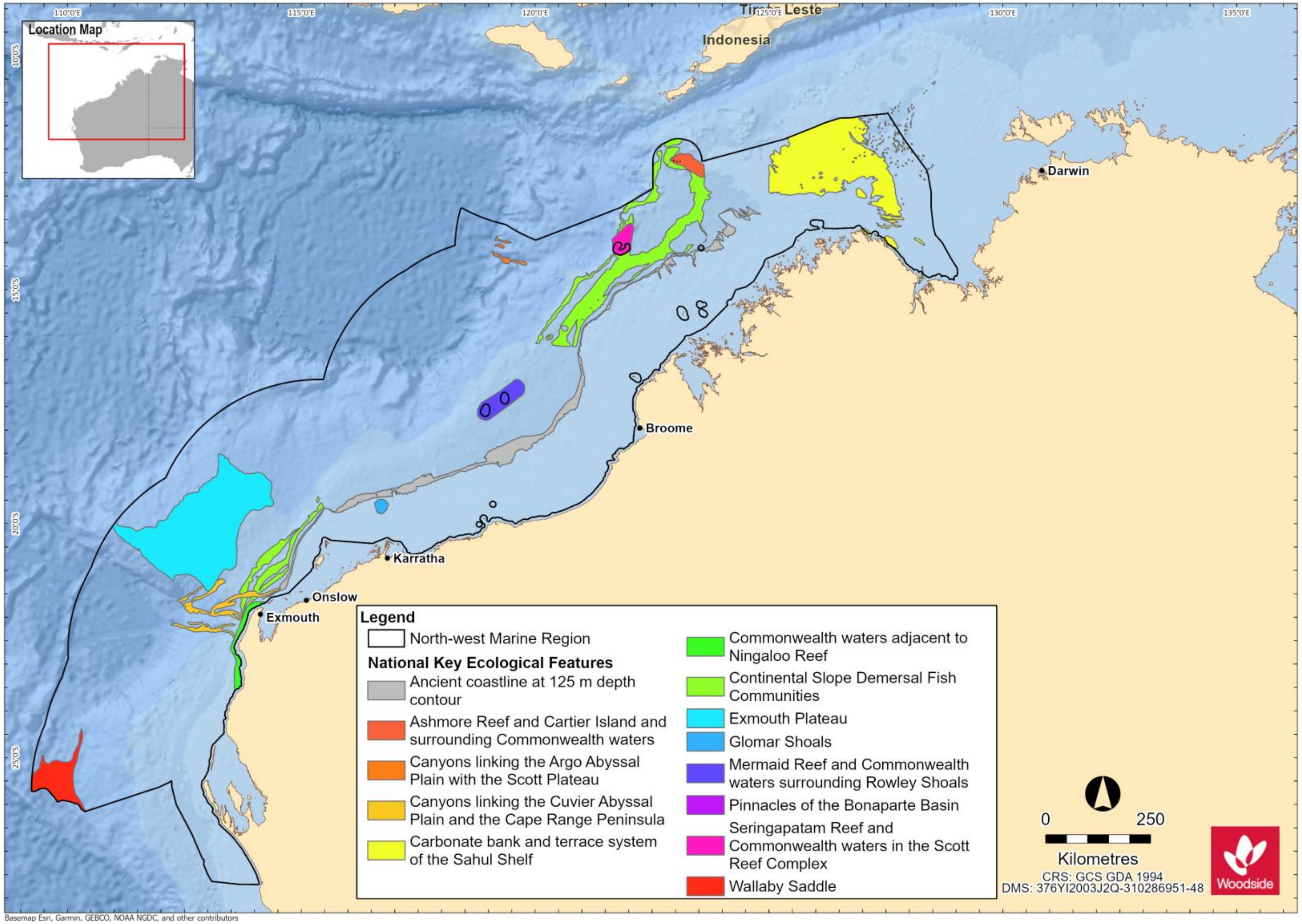


Figure 9-1 Key Ecological Features (KEFs) within the NWMR.

Table 9-2 Key Ecological Features (KEF) within the SWMR

KEF Name	Values[1]	Description
Albany Canyons group and adjacent shelf break	High productivity and aggregations of marine life, and unique seafloor feature with ecological properties of regional significance Both benthic and demersal habitats within the feature are of conservation value	The Albany Canyons group is thought to be associated with small, periodic subsurface upwelling events, which may drive localised regions of high productivity. The canyons are known to be a feeding area for sperm whale and sites of orange roughy aggregations. Anecdotal evidence also indicates that this area supports fish aggregations that attract large predatory fish and sharks.
Ancient coastline at 90-120 m depth	Relatively high productivity and aggregations of marine life, and high levels of biodiversity and endemism The feature creates topographic complexity, that may facilitate benthic biodiversity and enhanced biological productivity	Benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment, such as in the western Great Australian Bight, where the sea floor is dominated by sponge communities of significant biodiversity and structural complexity.
Cape Mentelle upwelling	Facilitates nutrient upwelling, supporting high productivity and diverse aggregations of marine life	The Cape Mentelle upwelling draws relatively nutrient-rich water from the base of the Leeuwin Current, up the continental slope and onto the inner continental shelf, where it results in phytoplankton blooms at the surface. The phytoplankton blooms provide the basis for an extended food chain characterised by feeding aggregations of small pelagic fish, larger predatory fish, seabirds, dolphins and sharks.
Commonwealth marine environment surrounding the Houtman Abrolhos Islands (and adjacent shelf break)	High levels of biodiversity and endemism within benthic and pelagic habitats	The Houtman Abrolhos Islands and surrounding reefs support a unique mix of temperate and tropical species, resulting from the southward transport of species by the Leeuwin Current over thousands of years. The Houtman Abrolhos Islands are the largest seabird breeding station in the eastern Indian Ocean. They support more than one million pairs of breeding seabirds.

KEF Name	Values[1]	Description
Commonwealth marine environment surrounding the Recherche Archipelago	Aggregations of marine life and high levels of biodiversity and endemism within benthic and demersal communities	The Recherche Archipelago is the most extensive area of reef in the SWMR. Its reef and seagrass habitat supports a high species diversity of warm temperate species, including 263 known species of fish, 347 known species of molluscs, 300 known species of sponges, and 242 known species of macroalgae. The islands also provide haul-out (resting areas) and breeding sites for Australian sea lions and New Zealand fur seals.
Commonwealth marine environment within and adjacent to the west-coast inshore lagoons	High productivity and aggregations of marine life within benthic and pelagic habitats Important for benthic productivity and recruitment for a range of marine species	These lagoons are important for benthic productivity, including macroalgae and seagrass communities, and breeding and nursery aggregations for many temperate and tropical marine species. They are important areas for the recruitment of commercially and recreationally important fish species. Extensive schools of migratory fish visit the area annually, including herring, garfish, tailor and Australian salmon.
Commonwealth marine environment within and adjacent to Geographe Bay	High productivity and aggregations of marine life, and high levels of biodiversity, recruitment within benthic and pelagic communities	Geographe Bay is known for its extensive beds of tropical and temperate seagrass that support a diversity of species, many of them not found anywhere else. The bay provides important nursery habitat for many species. Juvenile dusky whaler sharks use the shallow seagrass habitat as nursery grounds for several years, before ranging out to adult feeding grounds along the shelf break. The seagrass also provides valuable habitat for fish and invertebrates (Carruthers *et al.*, 2007). It is also an important resting area for migratory humpback whales.
Diamantina Fracture Zone	Unique seafloor feature with ecological properties of regional significance which apply to its benthic and demersal habitats	The Diamantina Fracture Zone is a rugged, deep- water environment of seamounts and numerous closely spaced troughs and ridges. Very little is known about the ecology of this remote, deep- water feature, but marine experts suggest that its size and physical complexity mean that it is likely to support deep-water communities characterised by high species diversity, with many species found nowhere else.
Naturaliste Plateau	Unique seafloor feature with ecological properties of regional significance including high species diversity and endemism which apply to its benthic and demersal habitats	The Naturaliste Plateau is Australia's deepest temperate marginal plateau. The combination of its structural complexity, mixed water dynamics and relative isolation indicate that it supports deep- water communities with high species diversity and endemism.
Perth Canyon and adjacent shelf break, and other west-coast canyons	An area of higher productivity that attracts feeding aggregations of deep-diving mammals and large predatory fish. It is also recognised as a unique seafloor feature with ecological properties of regional significance	The Perth Canyon is the largest known undersea canyon in Australian waters. Deep ocean currents rise to the surface, creating a nutrient-rich cold- water habitat attracting feeding aggregations of deep-diving mammals, such as pygmy blue whales and large predatory fish that feed on aggregations of small fish, krill and squid.

KEF Name	Values[1]	Description
Western demersal slope and associated fish communities of the Central Western Province	Provides important habitat for demersal fish communities and supports species groups that are nationally or regionally important to biodiversity	The western demersal slope provides important habitat for demersal fish communities, with a high level of diversity and endemism. A diverse assemblage of demersal fish species below a depth of 400 m is dominated by relatively small benthic species such as grenadiers, dogfish and cucumber fish. Unlike other slope fish communities in Australia, many of these species display unique physical adaptations to feed on the sea floor (such as a mouth position adapted to bottom feeding), and many do not appear to migrate vertically in their daily feeding habits.
Western rock lobster	A species that plays a regionally important ecological role	This species is the dominant large benthic invertebrate in the region. The lobster plays an important trophic role in many of the inshore ecosystems of the SWMR. Western rock lobsters are an important part of the food web on the inner shelf, particularly as juveniles.

1. Values description sourced from Marine bioregional plan for the South-west Marine Region (DSEWPAC, 2012b) and the Department of Agriculture, Water and the Environment (DAWE) SPRAT database

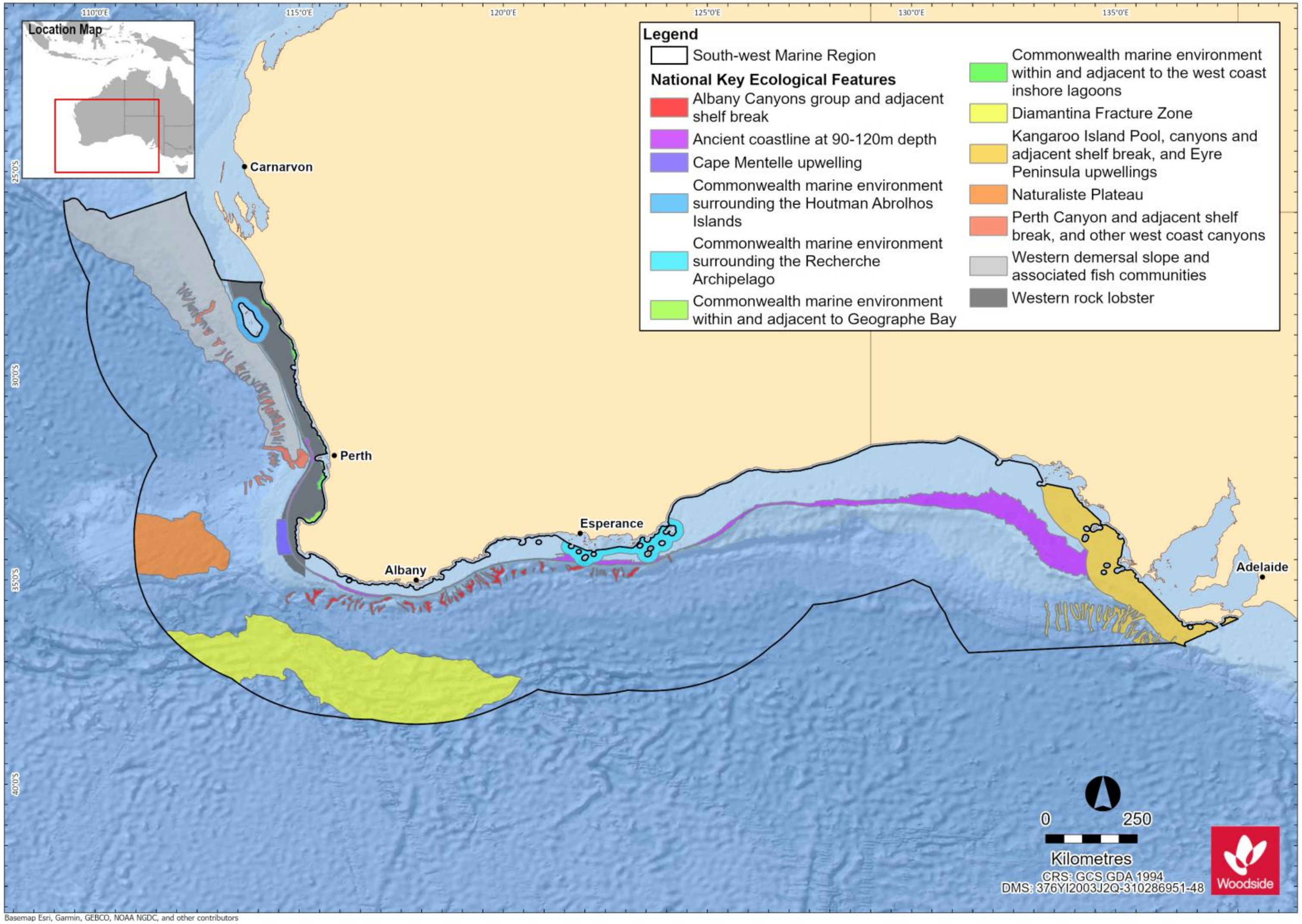


Figure 9-2. Key Ecological Features (KEFs) within the SWMR

Table 9-3 Key Ecological Features (KEF) within the NMR

KEF Name	Values[1]	Description
Carbonate bank and terrace system of the Van Diemen Rise	Important for its role in enhancing biodiversity and local productivity relative to its surrounds and for supporting relatively high species diversity The feature has been identified as a sponge biodiversity hotspot (Przeslawski *et al.* 2014)	The bank and terrace system of the Van Diemen Rise is part of the larger system associated with the Sahul Banks to the north and Londonderry Rise to the east; it is characterised by terrace, banks, channels and valleys. The variability in water depth and substrate composition may contribute to the presence of unique ecosystems in the channels. Species present include sponges, soft corals and other sessile filter feeders associated with hard substrate sediments of the deep channels; epifauna and infauna include polychaetes and ascidians. Olive ridley turtles, sea snakes and sharks are also found associated with this feature.
Gulf of Carpentaria basin	Regional importance for biodiversity, endemism and aggregations of marine life relevant to benthic and pelagic habitats	The Gulf of Carpentaria basin is one of the few remaining near-pristine marine environments in the world. Primary productivity in the Gulf of Carpentaria basin is mainly driven by cyanobacteria that fix nitrogen but is also strongly influenced by seasonal processes. The soft sediments of the basin are characterised by moderately abundant and diverse communities of infauna and mobile epifauna dominated by polychaetes, crustaceans, molluscs, and echinoderms. The basin also supports assemblages of pelagic fish species including planktivorous and schooling fish, with top predators such as shark, snapper, tuna, and mackerel.
Gulf of Carpentaria coastal zone	High productivity, aggregations of marine life (including several endemic species) and high biodiversity compared to broader region	Nutrient inflow from rivers adjacent to the NMR generates higher productivity and more diverse and abundant biota within the Gulf of Carpentaria coastal zone than elsewhere in the region. The coastal zone is near pristine and supports many protected species such as marine turtles, dugongs, and sawfishes. Ecosystem processes and connectivity remain intact; river flows are mostly uninterrupted by artificial barriers and healthy, diverse estuarine and coastal ecosystems support many species that move between freshwater and saltwater environments.
Pinnacles of the Bonaparte Basin	Unique seafloor feature with ecological properties of regional significance Provide areas of hard substrate in an otherwise soft sediment environment and so are important for sessile species Recognised as a biodiversity hotspot for sponges The Pinnacles of the Bonaparte Basin KEF is located within both the NWMR and NMR (refer **Table 9-1**)	Covering more than 520 km^2 within the Bonaparte Basin, this feature contains the largest concentration of pinnacles along the Australian margin. The Pinnacles of the Bonaparte Basin are thought to be the eroded remnants of underlying strata; it is likely that the vertical walls generate local upwelling of nutrient-rich water, leading to phytoplankton productivity that attracts aggregations of planktivorous and predatory fish, seabirds and foraging turtles.

KEF Name	Values[1]	Description
Plateaux and saddle north-west of the Wellesley Islands	High species abundance, diversity and endemism of marine life	Abundance and species density are high in the plateaux and saddle as a result of increased biological productivity associated with habitats rather than currents. Submerged reefs support corals that are typical of northern Australia, including corals that have bleach-resistant zooxanthellae; and particular reef fish species that are different to those found elsewhere in the Gulf of Carpentaria. Species present include marine turtles and reef fish such as coral trout, cod, mackerel, and shark. Seabirds frequent the plateaux and saddle, most likely due to the presence of predictable food resources for feeding offspring.
Shelf break and slope of the Arafura Shelf	The Shelf break and slope of the Arafura Shelf is defined as a key ecological feature for its ecological significance associated with productivity emanating from the slope It also forms part of a unique biogeographic province (Last *et al.*, 2005)	The shelf break and slope of the Arafura Shelf is characterised by continental slope and patch reefs and hard substrate pinnacles. The ecosystem processes of the feature are largely unknown in the region; however, the Indonesian Throughflow and surface wind-driven circulation are likely to influence nutrients, pelagic dispersal and species and biological productivity in the region. Biota associated with the feature is largely of Timor–Indonesian Malay affinity.
Submerged coral reefs of the Gulf of Carpentaria	High aggregations of marine life, biodiversity and endemism Twenty per cent of the reefs found in the NMR are situated within this KEF (Harris *et al.*, 2007)	The submerged coral reefs of the Gulf of Carpentaria are characterised by submerged patch, platform and barrier reefs that form a broken margin around the perimeter of the Gulf of Carpentaria basin, rising from the sea floor at depths of 30–50 m. These reefs provide breeding and aggregation areas for many fish species including mackerel and snapper and offer refuges for sea snakes and apex predators such as sharks. Coral trout species that inhabit the submerged reefs are smaller than those found in the Great Barrier Reef and may prove to be an endemic sub-species.
Tributary Canyons of the Arafura Depression	High productivity and high levels of species diversity and endemism of marine life within the benthic and pelagic habitats of the feature	The tributary canyons are approximately 80–100 m deep and 20 km wide. The largest of the canyons extend some 400 km from Cape Wessel into the Arafura Depression, and are the remnants of a drowned river system that existed during the Pleistocene era. Sediments in this feature are mainly calcium-carbonate rich, although sediment type varies from sandy substrate to soft muddy sediments and hard, rocky substrate. Marine turtles, deep sea sponges, barnacles and stalked crinoids have all been identified in the area.

1. Values description sourced from Marine bioregional plan for the North Marine Region (DSEWPAC, 2012c) and Department of Agriculture, Water and the Environment (DAWE) SPRAT database.

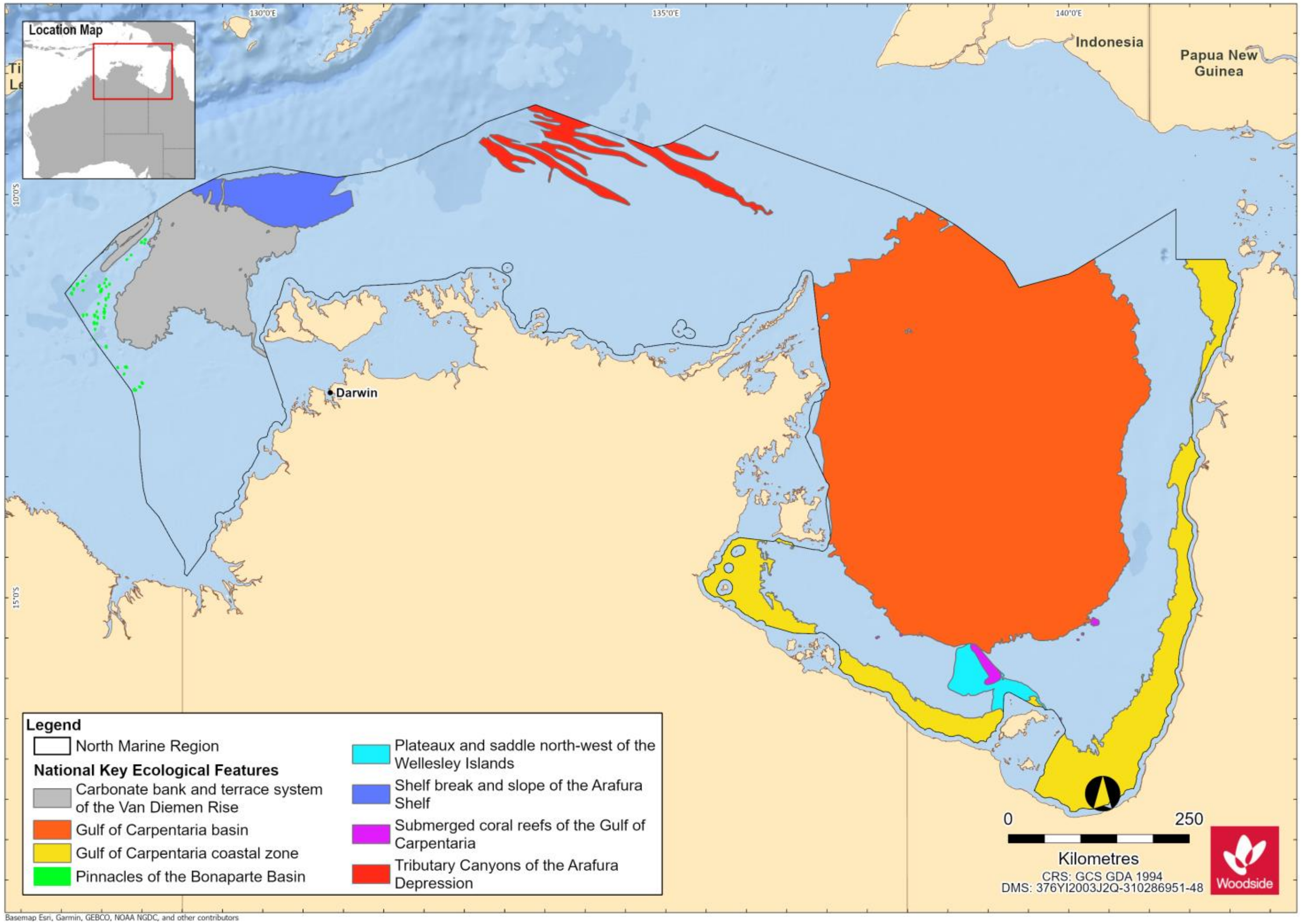


Figure 9-3. Key Ecological Features (KEFs) within the NMR

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10. PROTECTED AREAS

10.1 Regional Context

Protected areas included World Heritage Properties, National Heritage Places, Wetlands of International Importance, Australian Marine Parks, State Marine Parks and Reserves, Threatened Ecological Communities and the Australian Whale Sanctuary. The PMST Reports (**Appendix A**) shows that there are twenty-nine protected areas found in the NWMR, eighteen in the SWMR and nine in the NMR.

Table 10-1, Table 10-2 and **Table 10-3** outline the protected areas of each of the marine regions NWMR, SWMR and NMR, respectively.

10.2 World Heritage Properties

Properties nominated for World Heritage listing are inscribed on the list only after they have been carefully assessed as representing the best examples of the world's cultural and natural heritage. Only World Heritage listings classed as natural are discussed in this section. World Heritage sites classed as cultural are discussed in **Section 11**.

The list of Australia's World Heritage Properties and the PMST Reports (**Appendix A**) show two World Heritage Properties within the NWMR (**Table 10-1**), no World Heritage Properties within the SWMR (**Table 10-2),** and though not reported in the NMR PMST Report, Kakadu National Park and World Heritage Area is included in **Table 10-3**.

10.3 National and Commonwealth Heritage Places - Natural

The National Heritage List is Australia's list of natural, historic, and Indigenous places of outstanding significance to the nation. The National Heritage List Spatial Database describes the place name, class (Indigenous, natural, historic), and status. Commonwealth Heritage Places are a collection of sites recognised for their Indigenous, historical and/or natural values which are owned or controlled by the Australian Government.

Only National and Commonwealth Heritage Places classed as natural are discussed in this section. Heritage Places classed as indigenous or historic are discussed in **Section 11**.

A search of the National Heritage List Spatial Database and the PMST Reports (**Appendix A**) identified three natural National Heritage Places in the NWMR (**Table 10-1**), three in the SWMR (**Table 10-2**) and for the NMR, Kakadu National Park (not included in the PMST report) is included in **Table 10-3**.

A search of the Commonwealth Heritage List identified four natural commonwealth heritage places within the NWMR (**Table 10-1**).

10.4 Wetlands of International Importance (listed under the Ramsar Convention)

Australia has 65 Ramsar wetlands that cover >8.3 million ha. Ramsar wetlands are those that are representative, rare, or unique wetlands, or that are important for conserving biological diversity.

The List of Wetlands of International Importance held under the Ramsar Convention and the PMST Reports (**Appendix A**) identified four Ramsar Sites with coastal features within the NWMR (**Table 10-1**), four in the SWMR (**Table 10-2**) and two for the New Territory, included for the NMR (**Table 10-3**).

10.5 Australian Marine Parks

Australian Marine Parks (AMPs), proclaimed under the EPBC Act in 2007 and 2013, are located in Commonwealth waters that start at the outer edge of State and Territory waters, generally three nautical miles (~5.5 km) from the shore, and extend to the outer boundary of Australia's EEZ, 200 nm (~370 km) from the shore.

PMST Reports (**Appendix A**) show sixteen AMPs within the NWMR (**Table 10-1**), ten within the SWMR (**Table 10-2**) and eight within the NMR (**Table 10-3**).

10.6 Threatened Ecological Communities

No Threatened Ecological Communities (TECs) as listed under the EPBC Act are known to occur within the marine waters of the NWMR, SWMR or NMR as indicated by the PMST Reports (**Appendix A**).

10.7 Australian Whale Sanctuary

The Australian Whale Sanctuary has been established to protect all whales and dolphins found in Australian waters. Under the EPBC Act all cetaceans (whales, dolphins and porpoises) are protected in Australian waters.

The Australian Whale Sanctuary includes all Commonwealth waters from the three nautical mile State/Territory waters limit out to the boundary of the EEZ (i.e. out to 200 nm and further in some places). Within the Sanctuary it is an offence to kill, injure or interfere with a cetacean. Severe penalties apply to anyone convicted of such offences.

10.8 State Marine Parks and Reserves

State Marine Parks and Reserves, proclaimed under the *Conservation and Land Management Act 1984* (CALM Act), are located in State waters and vested in the WA Conservation and Parks Commission. State Marine Parks and Reserves of Western Australia have been considered, with 14 occurring in the NWMR (**Table 10-1**) and six occurring in the SWMR (**Table 10-2**).

10.9 Summary of Protected Areas within the NWMR

Table 10-1 Protected Areas within the NWMR

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
World Heritage Properties						
Shark Bay World Heritage Property	-	-	✓		The Shark Bay World Heritage Property is adjacent to the Shark Bay AMP and was included on the World Heritage List in 1991.	Universal values of the Shark Bay World Heritage Property include large and diverse seagrass beds, stromatolites and populations of dugong and threatened species. Inscribed under Natural Criteria vii, viii, ix and x.
The Ningaloo Coast World Heritage Property	-	-	✓		The Ningaloo Coast World Heritage Property lies within the Ningaloo AMP and was included on the World Heritage List in 2011.	Universal values of the Ningaloo Coast World Heritage Property include high marine species diversity and abundance; in particular, Ningaloo Reef supports both tropical and temperate marine reptiles and mammals. Inscribed under Natural Criteria vii and x.
National Heritage Places - Natural						
Shark Bay	-	-	✓		The Shark Bay National Heritage Place consists of the same area included in the Shark Bay World Heritage Property (refer above) and was established on the National Heritage List in 2007.	The national heritage place has a number of exceptional natural features, including one of the largest and most diverse seagrass beds in the world, colonies of stromatolites and rich marine life including a large population of dugongs, and also provides a refuge for a number of other globally threatened species. Shark Bay meets the national heritage listing criteria a, b, c, d, e, f, g, h and i.
The Ningaloo Coast	-	-	✓		The Ningaloo Coast National Heritage Place consists of the same area included in the Ningaloo	The Ningaloo Coast contains one of the best developed near-shore reefs in the world, being home to rugged limestone peninsulas, spectacular coral and sponge gardens and the whale shark.

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					Coast World Heritage Property (refer above) and was established on the National Heritage List in 2010.	The Ningaloo Coast meets the national heritage listing criteria a, b, c, d, and f.
The West Kimberley	✓	✓	-		The West Kimberley National Heritage Place covers an area of around 192,000 km^2 located in the north-west of Australia from Broome to Wyndham, and was established on the National Heritage List in 2011.	The Kimberley plateau, north-western coastline and northern rivers of the West Kimberley provide a vital refuge for many native plants and animals that are found nowhere else or which have disappeared from much of the rest of Australia. In addition, Roebuck Bay is internationally recognised as one of Australia's most significant sites for migratory wading birds. The national heritage place also contains a remarkable history of Aboriginal occupation, with many places of indigenous sacred value. The West Kimberley meets the national heritage listing criteria a, b, c, d, e, f, g, h and i.
Commonwealth Heritage Places - Natural						
Mermaid Reef – Rowley Shoals	-	✓	-	N/A	The Mermaid Reef – Rowley Shoals Commonwealth Heritage Place is located within the boundary of the Mermaid Reef Marine National Nature Reserve. The site was listed as a Commonwealth Heritage Place in 2004.	The Mermaid Reef-Rowley Shoals Commonwealth Heritage Place is regionally important for the diversity of its fauna and together with Clerke and Imperieuse reefs, has biogeographical significance due to the presence of species which are at, or close to, the limits of their geographic ranges, including fishes known previously only from Indonesian waters. Rowley Shoals is important for benchmark studies as one of the few places off the north-west coast of Western Australia which have been the site of major biological collection trips by the WA Museum.

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
Ashmore Reef National Nature Reserve	✓	-	-		The Ashmore Reef Commonwealth Heritage Place is located within the boundary of the Ashmore Reef Marine Park (refer AMPs below). The site was listed as a Commonwealth Heritage Place in 2004.	Ashmore Reef has major significance as a staging point for wading birds migrating between Australia and the Northern Hemisphere and supports high concentrations of breeding seabirds, many of which are nomadic and typically breed on small isolated islands. Ashmore Reef is an important scientific reference area for migratory seabirds, sea snakes and marine invertebrates. The Ashmore Reef Commonwealth Heritage Place is significant for its history of human occupation and use. The island is believed to have been visited by Indonesian fisherman since the early eighteenth century. The islands were used both for fishing and as a staging point for voyages to the southern reefs off Australia's coast.
Scott Reef and Surrounds – Commonwealth Area	✓	-	-		Scott Reef and Surrounds Commonwealth Heritage Place is located within the Western Australian Coastal Waters surrounding North and South Scott Reef. The site was listed as a Commonwealth Heritage Place in 2004.	The Scott Reef and Surrounds Commonwealth Heritage Place is regionally important for the diversity of its fauna and has biogeographical significance due to the presence of species which are at, or close to, the limits of their geographic ranges, including fish known previously only from Indonesian waters. Scott Reef is recognised as important for scientific research and benchmark studies due to its age, the extensive documentation of its geophysical and physical environmental characteristics and its use as a site of major biological collection trips and surveys by the WA Museum and the Australian Institute of Marine Science.

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
Ningaloo Marine Area – Commonwealth Waters	-	-	✓		The Ningaloo Marine Area Commonwealth Heritage Place is located within the Commonwealth waters of the Ningaloo Marine Park (refer AMPs below). The site was listed as a Commonwealth Heritage Place in 2004.	The Ningaloo Marine Area Commonwealth Heritage Place provides a migratory pathway for humpback whales and foraging habitat for whale sharks. The place is an important breeding area for billfish and manta ray. The Ningaloo Marine Area provides opportunities for scientific research relating to aspects of the area's unique features including tourism (marine ecology, whales, turtles, whale sharks, fish and oceanography.
Wetlands of International Importance (Ramsar)						
Ashmore Reef National Nature Reserve	✓	-	-	Ramsar	The Ashmore Reef Ramsar site is located within the boundary of the Ashmore Reef Marine Park (refer AMPs below). The site was listed under the Ramsar Convention in 2002.	Ashmore Reef Ramsar site supports internationally significant populations of seabirds and shorebirds, is important for turtles (green, hawksbill and loggerhead) and dugong, and has the highest diversity of hermatypic (reef-building) corals on the WA coast. It is known for its abundance and diversity of sea snakes. However, since 1998 populations of sea snakes at Ashmore Reef have been in decline.
Eighty Mile Beach	-	✓	-	Ramsar	The Eighty Mile Beach Ramsar site covers an area of 1250 km^2, located along a long section of the Western Australian coastline adjacent to the Eighty Mile Beach AMP (refer below).	The Eighty Mile Beach Ramsar site includes saltmarsh and a raised peat bog more than 7000 years old. The site contains the most important wetland for waders in north-western Australia, supporting up to 336,000 birds, and is especially important as a land fall for waders migrating south for the austral summer.
Roebuck Bay	-	✓	-	Ramsar	The Roebuck Bay Ramsar site covers an area of 550	The Roebuck Bay Ramsar site is recognised as one of the most important areas for migratory shorebirds in Australia.

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					km^2, located south of Broome and adjacent to the Roebuck AMP (refer below).	The site regularly supports over 100,000 waterbirds, with numbers being highest in the austral spring when migrant species breeding in the Palearctic stop to feed during migration.
Ord River Floodplain	✓			Ramsar	The Ord River Floodplain Ramsar Site is in the East Kimberley region and encompasses an extensive system of river, seasonal creek, tidal mudflat, and floodplain wetlands. The Ramsar Site is a nursery, feeding and/or breeding ground for migratory birds, waterbirds, fish, crabs, prawns, and crocodiles.	The site represents the best example of wetlands associated with the floodplain and estuary of a tropical river system in the Tanami-Timor Sea Coast Bioregion in the Kimberley. In addition, the False Mouths of the Ord are the most extensive mudflat and tidal waterway complex in Western Australia.
Wetlands of National Importance (DAWE, 2019)						
Ashmore Reef	✓	-	-		Ashmore Reef is a shelf-edge platform reef located among the Sahul Banks of north-western Australia. It covers an area of 583 km^2 and consists of three islets surrounded by intertidal reef and sand flats.	These islets are major seabird nesting sites with 20 breeding species recorded to date. The total bird population has been estimated to exceed 100,000 during the peak breeding season. The marine reserve also has the highest diversity of marine fauna of the reefs on the NWS and differs from other reefs and coastal areas in the region. The area meets criteria 1, 3, 4 and 5 for inclusion on the Directory of Important Wetlands in Australia.
Mermaid Reef	-	✓	-		Mermaid Reef Marine Park covers an area of around 540 km^2, located ~280 km west north-west of Broome, and is the most north-easterly atoll of the Rowley Shoals.	The reefs of the Mermaid Reef Marine Park have biogeographic value due to the presence of species that are at or close to the limit of their distribution. The coral communities are one of the special values of Mermaid Reef. The area meets criteria 1, 2 and 3 for inclusion on the Directory of Important Wetlands in Australia.

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
Exmouth Gulf East	-	-	✓		Exmouth Gulf East covers an area of 800 km^2 and includes wetlands in the eastern part of Exmouth Gulf, from Giralia Bay; to Urala Creek, Locker Point.	The Exmouth Gulf East is an outstanding example of tidal wetland systems of low coast of north-west Australia, with well- developed tidal creeks, extensive mangrove swamps and broad saline coastal flats. The site is one of the major population centres for dugong in WA and its seagrass beds and extensive mangroves provide nursery and feeding areas for marine fishes and crustaceans in the Gulf. The area meets criteria 1, 2 and 3 for inclusion on the Directory of Important Wetlands in Australia.
Hamelin Pool	-	-	✓		Hamelin Pool covers an area of 900 km^2 in the far south-east part of Shark Bay.	Hamelin Pool is an outstanding example of a hypersaline marine embayment and supports extensive microbialite (subtidal stromatolite) formations, which are the most abundant and diverse examples of growing marine microbialites in the world. The area meets criteria 1 and 6 for inclusion on the Directory of Important Wetlands in Australia.
Shark Bay East	-	-	✓		Shark Bay East covers a 250 km area of coastline comprising tidal wetlands, and marine waters less than 6 m deep at low tide, in the east arm of Shark Bay.	The site is an outstanding example of a very large, shallow marine embayment, with particularly extensive occurrence of seagrass beds and substantial areas of intertidal mud/sandflats and mangrove swamp. The site supports what is probably the world's largest discrete population of dugong; it is also a major nursery and/or feeding area for turtles, rays, sharks, other fishes, prawns and other marine fauna; and is a major migration stop-over area for shorebirds. The area meets criteria 1, 2, 3, 4, 5 and 6 for inclusion on the Directory of Important Wetlands in Australia.
Australian Marine Parks (DNP, 2018a)						
Abrolhos Marine Park	-	-	✓	II, IV, VI	Abrolhos Marine Park is located adjacent to the WA Houtman Abrolhos Islands, covering a large offshore	Abrolhos Marine Park is significant because it contains habitats, species and ecological communities associated with four bioregions:

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					area of 88,060 km^2 extending from the WA State waters boundary to the edge of Australia's EEZ. The Abrolhos Marine Park is located within both the NWMR and SWMR.	• Central Western Province • Central Western Shelf Province • Central Western Transition • South-west Shelf Transition It includes seven KEFs: Commonwealth marine environment surrounding the Houtman Abrolhos Islands; Demersal slope and associated fish communities of the Central Western Province; Mesoscale eddies; Perth Canyon and adjacent shelf break, and other west-coast canyons; Western rock lobster; Ancient coastline at 90-120 m depth; and Wallaby Saddle. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging and breeding habitat for seabirds, foraging habitat for Australian sea lions and white sharks, and a migratory pathway for humpback and pygmy blue whales. The AMP is adjacent to the northernmost Australian sea lion breeding colony in Australia on the Houtman Abrolhos Islands.
Carnarvon Canyon Marine Park	-	-	✓	IV	Carnarvon Canyon Marine Park covers an area of 6177 km^2, located ~300 km north-west of Carnarvon.	Carnarvon Canyon Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Transition bioregion. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. There is limited information about species' use of this AMP.
Shark Bay Marine Park	-	-	✓	VI	Shark Bay Marine Park covers an area of 7443 km^2 located ~60 km offshore of Carnarvon, adjacent to the Shark Bay World Heritage Property and National Heritage Place.	Shark Bay Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: • Central Western Shelf Province • Central Western Transition. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
						the EPBC Act. BIAs within the AMP include breeding habitat for seabirds, internesting habitat for marine turtles, and a migratory pathway for humpback whales.
Gascoyne Marine Park	-	-	✓	II, IV, VI	Gascoyne Marine Park covers an area of 81,766 km^2, located ~20 km off the west coast of the Cape Range Peninsula, adjacent to the Ningaloo Marine Park.	Gascoyne Marine Park is significant because it contains habitats, species and ecological communities associated with three bioregions: • Central Western Shelf Transition • Central Western Transition • Northwest Province. It includes four KEFs: Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula; Commonwealth waters adjacent to Ningaloo Reef; Continental slope demersal fish communities; and Exmouth Plateau. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, and foraging habitat and migratory pathway for pygmy blue whales.
Ningaloo Marine Park	-	-	✓	II, IV	Ningaloo Marine Park covers an area of 2435 km^2, stretching ~300 km along the west coast of the Cape Range Peninsula, and is adjacent to the WA Ningaloo Marine Park and Gascoyne Marine Park.	Ningaloo Marine Park is significant because it contains habitats, species and ecological communities associated with four bioregions: • Central Western Shelf Transition • Central Western Transition • Northwest Province • Northwest Shelf Province. It includes three KEFs: Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula; Commonwealth waters adjacent to Ningaloo Reef; and Continental slope demersal fish communities. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
						or foraging habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, foraging habitat and migratory pathway for pygmy blue whales, breeding, calving, foraging and nursing habitat for dugong and foraging habitat for whale sharks.
Montebello Marine Park	-	✓	-	VI	Montebello Marine Park covers an area of 3413 km^2, located offshore of Barrow Island and 80 km west of Dampier extending from the WA State waters boundary, and is adjacent to the WA Barrow Island and Montebello Islands Marine Parks.	Montebello Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province bioregion. It includes one KEF: Ancient coastline at 125 m depth contour. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding habitat for seabirds, internesting, foraging, mating, and nesting habitat for marine turtles, a migratory pathway for humpback whales and foraging habitat for whale sharks.
Dampier Marine Park	-	✓	-	II, IV, VI	Dampier Marine Park covers an area of 1252 km^2, located ~10 km north-east of Cape Lambert and 40 km from Dampier extending from the WA State waters boundary.	Dampier Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province bioregion. The AMP provides protection for offshore shelf habitats adjacent to the Dampier Archipelago, and the area between Dampier and Port Hedland, and is a hotspot for sponge biodiversity. The AMP supports a range of species including those listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging habitat for seabirds, internesting habitat for marine turtles and a migratory pathway for humpback whales.
Eighty Mile Beach Marine Park	-	✓	-	VI	Eighty Mile Beach Marine Park covers an area of 10,785 km^2, located ~74 km north-east of Port Hedland, adjacent to the	Eighty Mile Beach Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province and consists of shallow shelf habitats, including terrace, banks and shoals.

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					WA Eighty Mile Beach Marine Park.	The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding, foraging and resting habitat for seabirds, internesting and nesting habitat for marine turtles, foraging, nursing and pupping habitat for sawfishes and a migratory pathway for humpback whales.
Argo – Rowley Terrace Marine Park	✓	✓	-	II, VI, VI (Trawl)	Argo-Rowley Terrace Marine Park covers an area of 146,003 km^2, located ~270 km north-west of Broome, and extends to the limit of Australia's EEZ. The AMP is adjacent to the Mermaid Reef Marine Park and the WA Rowley Shoals Marine Park.	Argo–Rowley Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: • Northwest Transition • Timor Province. It includes two KEFs: Canyons linking the Argo Abyssal Plain with the Scott Plateau; and Mermaid Reef and Commonwealth waters surrounding Rowley Shoals. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include resting and breeding habitat for seabirds and a migratory pathway for the pygmy blue whale.
Mermaid Reef Marine Park	-	✓	-	II	Mermaid Reef Marine Park covers an area of 540 km^2, located ~280 km north-west of Broome, adjacent to the Argo–Rowley Terrace Marine Park and ~13 km from the WA Rowley Shoals Marine Park. Mermaid Reef is one of three reefs forming the Rowley Shoals. The other two are Clerke Reef and Imperieuse Reef, to the	Mermaid Reef Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Transition. It includes one KEF: Mermaid Reef and Commonwealth waters surrounding Rowley Shoals. The Rowley Shoals have been described as the best geological examples of shelf atolls in Australian waters. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding habitat for seabirds and a migratory pathway for the pygmy blue whale.

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					south-west of the AMP, which are included in the WA Rowley Shoals Marine Park.	
Roebuck Marine Park	-	✓	-	VI	Roebuck Marine Park covers an area of 304 km^2, located ~12 km offshore of Broome, and is adjacent to the WA Yawuru Nagulagun/Roebuck Bay Marine Park.	Roebuck Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Province and consists entirely of shallow continental shelf habitat. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and resting habitat for seabirds, foraging and internesting habitat for marine turtles, a migratory pathway for humpback whales and foraging habitat for dugong.
Kimberley Marine Park	✓	✓	-	II, IV, VI	Kimberley Marine Park covers an area of 74,469 km^2, located ~100 km north of Broome, extending from the WA State waters boundary north from the Lacepede Islands to the Holothuria Banks offshore from Cape Bougainville.	Kimberley Marine Park is significant because it includes habitats, species and ecological communities associated with three bioregions: • Northwest Shelf Province • Northwest Shelf Transition • Timor Province. It includes two KEFs: Ancient coastline at 125 m depth contour; and Continental slope demersal fish communities. The AMP supports a range of species, including protected species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging habitat for seabirds, internesting and nesting habitat for marine turtles, breeding, calving and foraging habitat for inshore dolphins, calving, migratory pathway and nursing habitat for humpback whales, migratory pathway for pygmy blue whales, foraging habitat for dugong and foraging habitat for whale sharks.
Ashmore Reef Marine Park	✓	-	-	Ia, IV	Ashmore Reef Marine Park covers an area of 583 km^2, located ~630 km north of	Ashmore Reef Marine Park is significant because it includes habitats, species and ecological communities associated with the Timor Province. It includes two KEFs:

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					Broome and 110 km south of the Indonesian island of Roti. The AMP is located in Australia's External Territory of Ashmore and Cartier Islands and is within an area subject to a Memorandum of Understanding (MoU) between Indonesia and Australia, known as the MoU Box.	Ashmore Reef and Cartier Island and surrounding Commonwealth waters; and Continental slope demersal fish communities. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding, foraging and resting habitat for seabirds, resting and foraging habitat for migratory shorebirds, foraging, mating, nesting and internesting habitat for marine turtles, foraging habitat for dugong, and a migratory pathway for pygmy blue whales.
Cartier Island Marine Park	✓	-	-	Ia	Cartier Island Marine Park covers an area of 172 km^2, located ~45 km south-east of Ashmore Reef Marine Park and 610 km north of Broome. It is also located in Australia's External Territory of Ashmore and Cartier Islands and within an area subject to an MoU between Indonesia and Australia, known as the MoU Box.	Cartier Island Marine Park is significant because it includes habitats, species and ecological communities associated with the Timor Province. It includes two key ecological features: Ashmore Reef and Cartier Island and surrounding Commonwealth waters and continental slope demersal fish communities. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging habitat for seabirds, internesting, nesting and foraging habitat for marine turtles and foraging habitat for whale sharks. The AMP is also internationally significant for its abundance and diversity of sea snakes, some of which are listed species under the EPBC Act.
Joseph Bonaparte Gulf Marine Park	✓	-	-	VI	Joseph Bonaparte Gulf Marine Park covers an area of 8597 km^2 and is located ~15 km west of Wadeye, NT, and ~90 km north of Wyndham, WA, in the Joseph Bonaparte Gulf.	Joseph Bonaparte Gulf Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Transition bioregion. It includes one KEF: Carbonate bank and terrace system of the Sahul Shelf. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					It is adjacent to the WA North Kimberley Marine Park. The Joseph Bonaparte Gulf Marine Park is located within both the NWMR and NMR.	the EPBC Act. BIAs within the AMP include foraging habitat for marine turtles and the Australian snubfin dolphin.
Oceanic Shoals Marine Park	✓	-	-	II, IV, VI	Oceanic Shoals Marine Park covers an area of 71,743 km^2 and is located west of the Tiwi Islands, ~155 km north-west of Darwin, NT and 305 km north of Wyndham, WA. The Oceanic Shoals Marine Park is located within both the NWMR and NMR.	Oceanic Shoals Marine Park is significant because it contains habitats, species and ecological communities associated with the Northwest Shelf Transition bioregion. It contains four KEFs: Carbonate bank and terrace systems of the Van Diemen Rise; Carbonate bank and terrace systems of the Sahul Shelf; Pinnacles of the Bonaparte Basin; and Shelf break and slope of the Arafura Shelf. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging and internesting habitat for marine turtles.
State Marine Parks and Reserves						
North Kimberley Marine Park	✓	-	-	Sanctuary, Special Purpose and General Use Zones	The North Kimberley Marine Park covers approx. 18,450 km^2 with its south-western boundary located ~270 km north-east of Derby.	The coral reefs of the north Kimberley have the greatest diversity in Western Australia and are some of the most pristine and remarkable reefs in the world. The park surrounds more than 1000 islands and is home to listed species such as dugongs, marine turtles, and sawfishes (DPAW, 2016a).
Lalang-garram / Horizontal Falls Marine Park and North Lalang-garram Marine Park (jointly managed)	✓	-	-	Sanctuary, Special Purpose and General Use Zones	The Lalang-garram / Horizontal Falls Marine Park covers ~3530 km^2 from Talbot Bay in the west and Glenelg River in the east. The North Lalang-garram Marine Park covers ~1100	The Lalang-garram / Horizontal Falls Marine Park's most celebrated attraction is created by massive tides of up to 10 m and narrow gaps in two parallel tongues of land meaning the tide falls faster than the water can escape, producing 'horizontal falls'. There are also islands with fringing coral reefs and mangrove-lined creeks and bays. The North Lalang-garram Marine Park has a number of islands fringed with coral reef and has been identified as an

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
					km^2 between Camden Sound and North Kimberley Marine Parks.	ecological hotspot and supports more than 1% of the world's population of brown boobies, with up to 2000 breeding pairs. About 500 pairs of crested terns also nest on the island (DPAW, 2016b).
Lalang-garram / Camden Sound Marine Park	✓	-	-	Sanctuary, Special Purpose and General Use Zones	Lalang-garram / Camden Sound Marine Park covers 7050 km^2 located about 150 km north of Derby.	The Lalang-garram / Camden Sound Marine Park is the most important humpback whale nursery in the Southern Hemisphere. It also features the spectacular coastal Montgomery Reef. The marine park is home to six species of threatened marine turtle. Australian snubfin and Indo-Pacific humpback dolphins, dugongs, saltwater crocodiles, and several species of sawfish (DPAW, 2013).
Rowley Shoals Marine Park	-	✓	-	Sanctuary, Recreation and General Use Zones	The Rowley Shoals comprise of three reef systems, Mermaid Reef, Clerke Reef and Imperieuse Reef, all 30-40 km apart. These reef systems are located ~300 km west north-west of Broome.	The three coral atolls of the Rowley Shoals Marine Park comprise of shallow lagoons inhabited by diverse corals and abundant marine life, each covering around 80 km^2 at the edge of Australia's continental shelf. Further offshore, the seafloor slopes away to the abyssal plain, some 6000 m below. Undersea canyons slice the slope; these features are commonly associated with diverse communities of deep-water corals and sponges and create localised upwellings that aggregate pelagic species like tunas and billfish (DEC, 2007a).
Yawuru Nagulagun / Roebuck Bay Marine Park	-	✓	-	Special Purpose Zone	Yawuru Nagulagun / Roebuck Bay Marine Park is a series of intertidal flats lying on the coast to the south-east of Broome.	Roebuck Bay is an internationally significant wetland and one of the most important feeding grounds for migratory shorebirds in Australia. Australian snubfin and Australian humpback dolphins frequent the waters and humpback whales pass through on their annual migration. Flatback turtles nest on the shores and are found in the bay's waters with other sea turtle species. Seagrass and macroalgae communities provide food for protected species such as the dugong and flatback turtle (DPAW, 2016c).
Eighty Mile Beach Marine Park	-	✓	-	Sanctuary, Recreation, Special	Eighty Mile Beach Marine Park covers ~2000 km^2 stretching across 220km of	Eighty Mile Beach Marine Park is one of the world's most important feeding grounds for small wading birds that migrate to the area each summer, travelling from countries

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
				Purpose and General Use Zones	coastline between Port Hedland and Broome.	thousands of kilometres away. The marine park is a major nesting area for flatback turtles which are found only in northern Australia. Sawfishes, dugongs, dolphins and millions of invertebrates inhabit the sand and mud flats, seagrass meadows, coral reefs and mangroves (DPAW, 2014).
Montebello Islands Marine Park, Barrow Island Marine Park and Barrow Island Marine Management Area (jointly managed)	-	✓	-	Sanctuary, Recreation, General Use and Special Purpose Zones	The Montebello Islands Marine Park, Barrow Island Marine Park and Barrow Island Marine Management Area are located off the north-west coast of WA, ~1600 km north of Perth, and cover areas of ~583 km^2, 42 km^2 and 1,147 km^2, respectively.	The Montebello/Barrow islands marine conservation reserves have very complex seabed and island topography, resulting in a myriad of different habitats subtidal coral reefs, macroalgal and seagrass communities, subtidal soft-bottom communities, rocky shores and intertidal reef platforms, which support a rich diversity of invertebrates and finfish. The reserves are important breeding areas for several species of marine turtles and seabirds, which use the undisturbed sandy beaches for nesting. Humpback whales migrate through the reserves and dugongs occur in the shallow warm waters (DEC, 2007b).
Ningaloo Marine Park and Muiron Islands Marine Management Area (jointly managed)	-	-	✓	Sanctuary, Recreation, General Use and Special Purpose Zones	The Ningaloo Marine Park and Muiron Islands Marine Management Area are located off the North-west Cape of WA, ~1200 km north of Perth, and cover areas of ~2633 km^2 and 286 km^2, respectively.	Ningaloo Reef is the largest fringing coral reef in Australia. Temperate and tropical currents converge in the Ningaloo region resulting in highly diverse marine life including spectacular coral reefs, abundant fishes and species with special conservation significance such as turtles, whale sharks, dugongs, whales and dolphins. The region has diverse marine communities including mangroves, algae and filter-feeding communities and has high water quality. These values contribute to the Ningaloo Marine Park being regarded as the State's premier marine conservation icon. The Muiron Islands Marine Management Area is also important, containing a very diverse marine environment, with coral reefs, filter-feeding communities and macroalgal beds. In addition, the Islands are important seabird and green turtle nesting areas. (CALM, 2005a).

Protected Area	Woodside Activity Area			IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
	Browse	NWS/S	NW Cape			
Shark Bay Marine Park and Hamelin Pool Marine Nature Reserve (jointly managed)	-	-	✓	Sanctuary, Recreation, General Use and Special Purpose Zones	The Shark Bay Marine Park and Hamelin Pool Marine Nature Reserves are located 400 km north of Geraldton, covering areas of ~7487 km^2 and 1270 km^2, respectively.	Seagrass covers over 4000 km^2 of the Shark Bay Marine Park, with 12 different species making it one of the most diverse seagrass assemblages in the world. Dugongs regularly use this habitat, with the bay containing one of the largest dugong populations in the world. Humpback whales also use the bay as a staging post in their migration along the coast. Green and loggerhead turtles occur in the bay with Dirk Hartog Island providing the most important nesting site for loggerheads in Western Australia. Hamelin Pool contains the most diverse and abundant examples of stromatolites found in the world. These are living representatives of stromatolites that existed some 3500 million years ago (CALM, 1996).

**Conservation objectives for IUCN categories include:*

Ia: Strict Nature Reserve

Ib: Wilderness Area

II: national Park

III: Natural Monument or Feature

IV: Habitat/Species Management Area

V: Protected Landscape

VI: Protected area with sustainable use of natural resources – allow human use but prohibits large scale development.

IUCN categories for the marine park are provided and, in brackets, the IUCN categories for specific zones within each Marine Park as assigned under the North-west Marine Parks Network Management Plan 2018 (DNP, 2018a)

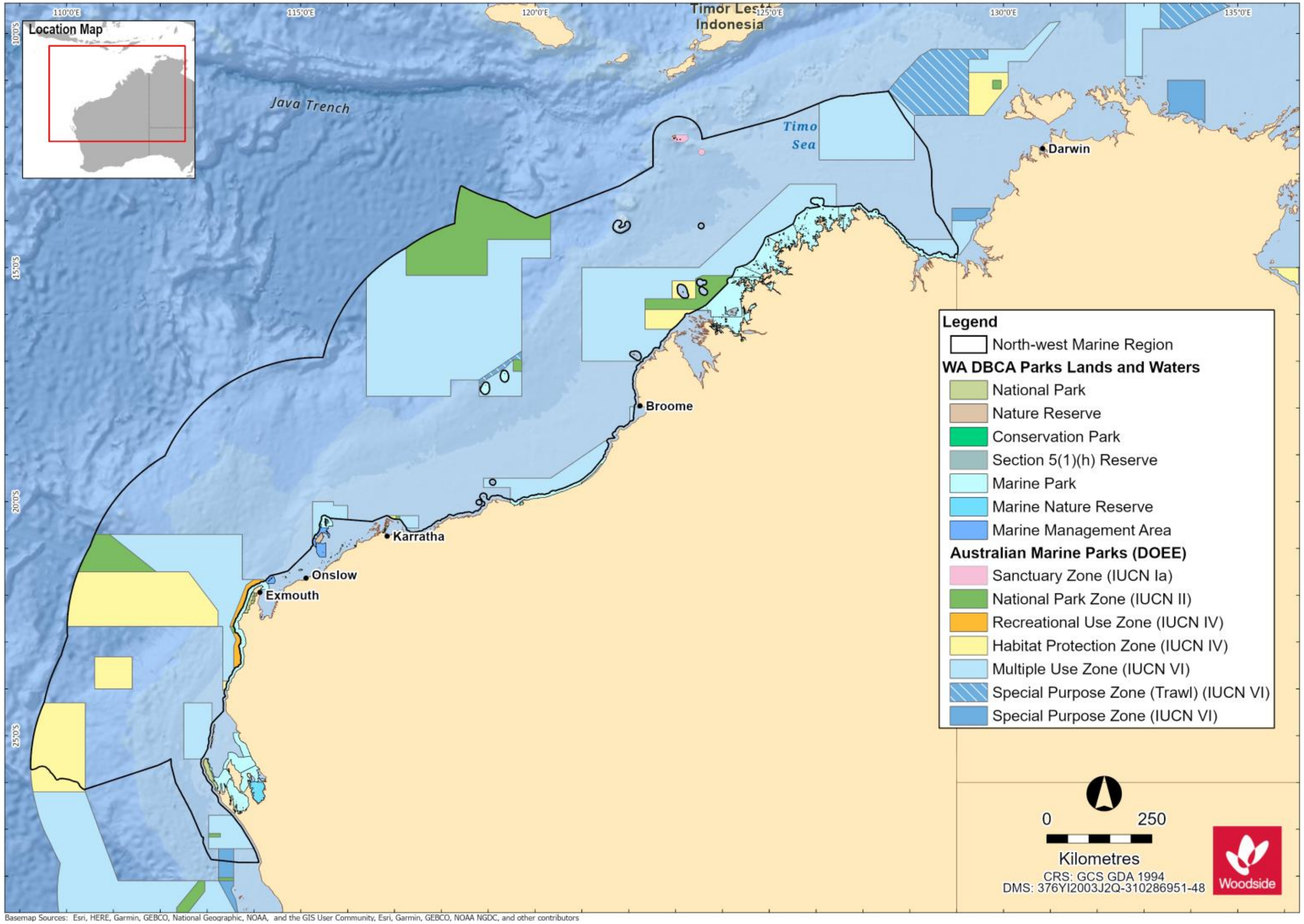


Figure 10-1 Commonwealth and State Marine Protected Areas for the NWMR

10.10 Summary of Protected Areas within the SWMR

Table 10-2 Protected Areas within the SWMR

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
World Heritage Properties			
N/A			
National Heritage Places - Natural			
N/A			
Commonwealth Heritage Places - Natural			
N/A			
Wetlands of International Importance (Ramsar)			
Beecher Point Wetlands	Ramsar	Beecher Point Wetlands is a system of about sixty small wetlands located near Rockingham in south-west WA, covering an area of around 7 km^2. The site was listed under the Ramsar Convention in 2001.	The wetlands support sedgelands, herblands, grasslands, open-shrublands and low open-forests. The sedgelands that occur within the linear wetland depressions of the Ramsar site are a nationally listed TEC. At least four species of amphibians and twenty-one (21) species of reptiles have been recorded on the site. The site also supports the southern brown bandicoot. The site meets criteria 1 and 2 of the Ramsar Convention.
Forrestdale and Thomsons Lakes	Ramsar	Forrestdale Lake is located in the City of Armadale and Thomsons Lake is located in the City of Cockburn both of which lie within the southern Perth metropolitan area, in Western Australia. The site was listed under the Ramsar Convention in 1990.	The lakes are surrounded by medium density urban development and some agricultural land. The sediments of Thomsons Lake are between 30,000 and 40,000 years old, which are the oldest lake sediments discovered in WA to date. These lakes are the best remaining examples of brackish, seasonal lakes with extensive fringing sedgeland, typical of the Swan Coastal Plain. The site meets criteria 1, 3, 5 and 6 of the Ramsar Convention.
Peel-Yalgorup System	Ramsar	Peel-Yalgorup System, located adjacent to the City of Mandurah in	Peel-Yalgorup System Ramsar site is the most important area for waterbirds in south-western Australia. It supports a large number of waterbirds, and a

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
		WA, is a large and diverse system of shallow estuaries, coastal saline lakes and freshwater marshes. The site was listed under the Ramsar Convention in 1990.	wide variety of waterbird species. It also supports a wide variety of invertebrates, and estuarine and marine fish. The site meets criteria 1, 3, 5 and 6 of the Ramsar Convention.
Vasse-wonnerup system	Ramsar	Vasse-Wonnerup System Ramsar wetland is situated in the Perth Basin, south-western WA. The site was listed under the Ramsar Convention in 1990.	Vasse-Wonnerup System is an extensive, shallow, nutrient-enriched wetland system of highly varied salinities. Large areas of the wetland dry out in late summer. Vasse-Wonnerup System supports tens of thousands of resident and migrant waterbirds of a wide variety of species. More than 80 species of waterbird have been recorded in the System such as red-necked avocets and black-winged stilts, wood sandpiper, sharp-tailed sandpiper, long-toed stint, curlew sandpiper and common greenshank. Thirteen waterbird species are also known to breed at the Ramsar site, including the largest regular breeding colony of black swans in south-western Australia. The site meets criteria 5 and 6 of the Ramsar Convention.
Wetlands of National Importance (DAWE, 2019)			
Rottnest Island Lakes		The Rottnest Island Lakes site is the cluster of 18 lakes and swamps on the north-east part of Rottnest Island.	An outstanding example of a series of lakes/swamps of varied depth and salinity located on an offshore island; the only island among 200 plus in WA exceeding 10 ha in area, that has a salt-lake complex; the only known example of seasonally meromictic lakes in Australia. The area meets criteria 1, 2, 3 and 6 for inclusion on the Directory of Important Wetlands in Australia.
Australian Marine Parks (DNP, 2018b)			
Abrolhos Marine Park	II, IV, VI	The Abrolhos Marine Park is located within both the NWMR and SWMR. Refer **Table 10-1** for description and conservation values.	
Bremer Marine Park	II, VI	Bremer Marine Park covers an area of 4472 km^2 and is located approximately half-way between Albany and Esperance, offshore from the Fitzgerald River National Park, extending from the WA State waters boundary.	Bremer Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: • Southern Province • South-west Shelf Province. It includes two KEFs: Albany Canyon group and adjacent shelf break; and Ancient coastline at 90-120 m depth.

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
			The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions, and white sharks, a migratory pathway for humpback whales, and a significant calving area for southern right whales. The AMP includes canyons—important aggregation areas for killer whales.
Eastern Recherche Marine Park	II, VI	Eastern Recherche Marine Park covers an area of 20,575 km^2 and is located ~135 km east of Esperance, adjacent to the Recherche Archipelago, close to the WA Cape Arid National Park.	Eastern Recherche Marine Park is significant because it contains habitats, species and ecological communities associated with three bioregions: • South-west Shelf Province • Southern Province • Great Australian Bight Shelf Transition. It includes three KEFs: Mesoscale eddies; Ancient coastline at 90-120 m depth; and Commonwealth marine environment surrounding the Recherche Archipelago. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions and white sharks, and a calving buffer area for southern right whales.
Geographe Marine Park	II, IV, VI	Geographe Marine Park covers an area of 977 km^2 and is located in Geographe Bay, ~8 km west of Bunbury and 8 km north of Busselton, adjacent to the WA Ngari Capes Marine Park.	Geographe Marine Park is significant because it contains habitats, species and ecological communities associated with the South-west Shelf Province bioregion. It includes two KEFs: Commonwealth marine environment within and adjacent to Geographe Bay; and Western rock lobster. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, a migratory pathway for humpback and pygmy blue whales, and a calving buffer area for southern right whales.
Great Australian Bight Marine Park	II, VI	Great Australian Bight Marine Park covers an area of 45,822 km^2 and is located ~12 km south-east of Eucla and 174 km west of Ceduna, adjacent to the SA Far West Coast and Nuyts Archipelago Marine Parks.	Great Australian Bight Marine Park is significant because it contains habitats, species and ecological communities associated with two bioregions: • Great Australian Bight Shelf Transition • Southern Province. It includes three KEFs: Ancient coastline at 90-120 m depth; Benthic invertebrate communities of the eastern Great Australian Bight; and Small pelagic fish of the South-west Marine Region. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions, white sharks and

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
			pygmy blue and sperm whales, and a calving area, migratory pathway and large aggregation area for southern right whales.
Jurien Marine Park	II, VI	Jurien Marine Park covers an area of 1851 km^2 and is located ~148 km north of Perth and 155 km south of Geraldton, adjacent to the WA Jurien Bay Marine Park.	Jurien Marine Park is significant because it includes habitats, species and ecological communities associated with two bioregions: • South-west Shelf Transition • Central Western Province. It includes three KEFs: Ancient coastline at 90-120 m depth; Demersal slope and associated fish communities of the Central Western Province; and Western rock lobster The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions and white sharks, and a migratory pathway for humpback and pygmy blue whales.
Perth Canyon Marine Park	II, IV, VI	Perth Canyon Marine Park covers an area of 7409 km^2 and is located ~52 km west of Perth and ~19 km west of Rottnest Island.	Perth Canyon Marine Park is significant because it includes habitats, species and ecological communities associated with four bioregions: • Central Western Province • South-west Shelf Province • Southwest Transition • South-west Shelf Transition. It includes four KEFs: Perth Canyon and adjacent shelf break, and other west-coast canyons; Demersal slope and associated fish communities of the Central Western Province; Western rock lobster; and Mesoscale eddies. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Antarctic blue, pygmy blue and sperm whales, a migratory pathway for humpback, Antarctic blue and pygmy blue whales, and a calving buffer area for southern right whales.
South-west Corner Marine Park	II, IV, VI	South-west Corner Marine Park covers an area of 271,833 km^2 and is located adjacent to the WA Ngari Capes Marine Park. It covers an extensive offshore area that is closest to WA State waters ~48 km west of Esperance, 73 km west of Albany and 68 km west of Bunbury.	South-west Corner Marine Park is significant because it contains habitats, species and ecological communities associated with three bioregions: • Southern Province • South-west Transition • South-west Shelf Province. It includes six KEFs: Albany Canyon group and adjacent shelf break; Cape Mentelle upwelling; Diamantina Fracture Zone; Naturaliste Plateau; Western rock lobster; and Ancient coastline at 90 m-120 m depth.

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
			The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions, white sharks and sperm whales, a migratory pathway for Antarctic blue, pygmy blue and humpback whales, and a calving buffer area for southern right whales.
Twilight Marine Park	II, VI	Twilight Marine Park covers an area of 4641 km^2 and is located ~245 km south-west of Eucla and 373 km north-east of Esperance, adjacent to the WA State waters boundary.	Twilight Marine Park is significant because it contains habitats, species and ecological communities associated with the Great Australian Bight Shelf Transition bioregion. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds, Australian sea lions and white sharks, and a calving buffer area for southern right whales.
Two Rocks Marine Park	II, VI	Two Rocks Marine Park covers an area of 882 km^2 and is located ~25 km north-west of Perth, to the north-west of the WA Marmion Marine Park.	Two Rocks Marine Park is significant because it includes habitats, species and ecological communities associated with the South-west Shelf Transition bioregion. It includes three KEFs: Commonwealth marine environment within and adjacent to the west-coast inshore lagoons; Western rock lobster; and Ancient coastline at 90-120 m depth. The AMP supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat for seabirds and Australian sea lions, a migratory pathway for humpback and pygmy blue whales, and a calving buffer area for southern right whales.
State Marine Parks and Reserves			
Jurien Bay Marine Park	Sanctuary, Special Purpose and General Use Zones.	The Jurien Bay Marine Park is located on the central west coast of WA ~200 km north of Perth and covers an area of 824 km^2.	An extensive limestone reef system parallel to the shore has created a huge shallow lagoon that provides perfect habitat for Australian sea lions, dolphins and a myriad of juvenile fish. Extensive seagrass meadows inside the reef shelter many marine animals such as western rock lobsters, octopus and cuttlefish that make up the diet of young sea lions. The marine park also surrounds dozens of ecologically important islands that contain rare and endangered animals found nowhere else in the world (CALM, 2005b).
Marmion Marine Park	Sanctuary, Recreation and Special Use Zones.	The Marmion Marine Park lies within State waters between Trigg Island and Burns Beach and encompasses a coastal area of ~95 km^2. Marmion	The marine park has a number of sanctuary zones including Little Island, The Lumps and the Boyinaboat Reef protecting a variety of habitats from limestone reefs, seagrass beds and clear shallow lagoons that support a diversity of marine life. In addition, to a general use zone and the Waterman Recreation Area. The marine park contains important habitat for the endemic Australian

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
		Marine Park was the State's first marine park, declared in 1987.	sea lion, an array of seabird species migratory whales are regular visitors (CALM, 1992; DPAW, 2016d).
Swan Estuary Marine Park	Special Purpose and Nature Reserve Zones.	Three biologically important areas of Perth's Swan River make up the Swan Estuary Marine Park, including Alfred Cove, Pelican Point and Crawley. These three sites cover a total area of 3.4 km^2.	The sand flats, mud flats and beaches at the three locations of the Swan Estuary Marine Park provide the only remaining significant feeding and resting areas in the Swan Estuary, for trans-equatorial migratory wading and waterbirds. The Park and adjacent reserves also provide habitat for a diverse assemblage of aquatic and terrestrial flora and fauna (CALM, 1999).
Shoalwater Islands Marine Park	Sanctuary, Special Purpose and General Use Zones.	The Shoalwater Islands Maine Park is located adjacent to Rockingham on the south-west coast of WA, ~50 km south of Perth and covers an area of ~66 km^2.	The Shoalwater Islands Marine Park consists of a complex seabed and coastal topography consisting of islands, limestone ridges and reef platforms, protected inshore areas and deeper basins, sandbars and beaches, and is home to five species of cetacean and 14 species of sea and shore bird. The waters of the marine park are also used to access feeding grounds for the little penguin (*Eudyptula minor*) colony on Penguin Island, which is close to the northernmost limit of the species' range and is the largest known breeding colony in Western Australia (DEC, 2007c).
Ngari Capes Marine Park	Sanctuary, Special Purpose and Recreation Zones.	The Ngari Capes Marine Park is located off the south-west coast of WA, ~250 km south of Perth, covering ~1238 km^2.	The Ngari Capes Marine Park consists of a complex arrangement of sandy bays, high energy limestone and granite reefs bordered by headlands and cliffs and two weathered capes. Coral communities consist of both tropical and temperate species. Cetaceans and pinnipeds are resident in and/or transient through the marine park as well as a diverse range of seabirds and shorebirds (DEC, 2013).
Walpole and Nornalup Inlets Marine Park	Recreation Zone.	The Walpole and Nornalup Inlets Marine Park is located adjacent to the towns of Walpole and Nornalup on the south coast of WA, ~120 km west of Albany, and covers ~14 km^2.	The Walpole and Nornalup Inlets Marine Park consists of a geologically complex lagoonal estuarine system comprising three significant rivers and two connected inlets that are permanently open to the ocean. Approximately 40 marine and estuarine finfish species commonly inhabit the inlet system, as well as a variety of shark and ray species and numerous seabirds and shorebirds. The sandy beaches and shoreline vegetation of the inlet system are of high ecological and social importance to the marine park (DEC, 2009).

**Conservation objectives for IUCN categories include:*

Ia: Strict Nature Reserve

Ib: Wilderness Area

II: national Park

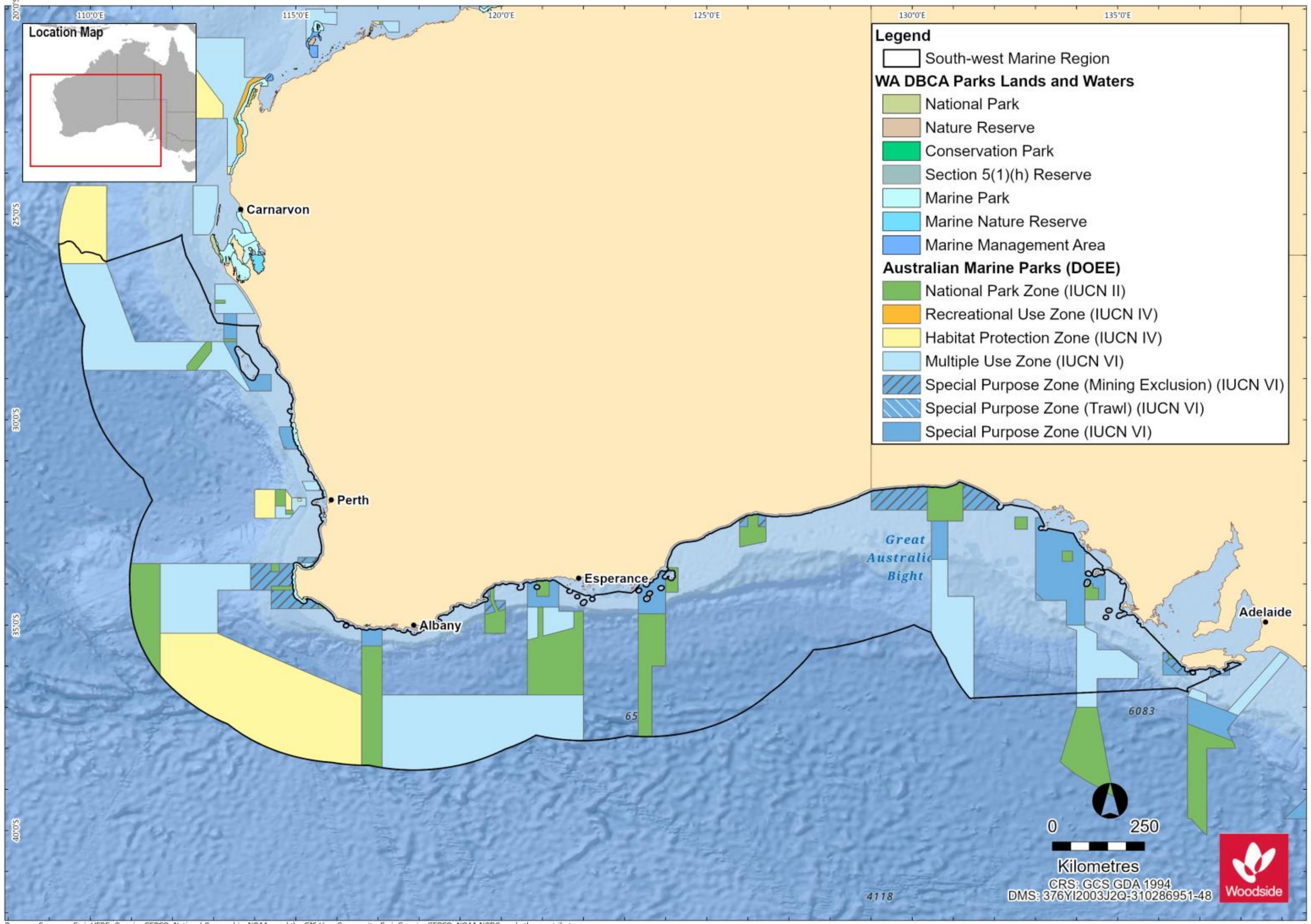
III: Natural Monument or Feature

IV: Habitat/Species Management Area

V: Protected Landscape

VI: Protected area with sustainable use of natural resources – allow human use but prohibits large scale development.

IUCN categories for the marine park are provided and, in brackets, the IUCN categories for specific zones within each Marine Park as assigned under the South-west Marine Parks Network Management Plan 2018 (DNP, 2018b)



Basemap Sources: Esri, HERE, Garmin, GEBCO, National Geographic, NOAA, and the GIS User Community, Esri, Garmin, GEBCO, NOAA NGDC, and other contributors

Figure 10-2. Commonwealth and State Marine Protected Areas for the SWMR

10.11 Summary of Protected Areas within the NMR

Table 10-3 Protected Areas within the NMR

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
World Heritage Properties			
Kakadu National Park		Kakadu National Park is a living landscape with exceptional natural and cultural values. It is the largest National Park in Australia and preserves the greatest variety of ecosystems on the Australian continent including extensive areas of floodplains, mangroves, tidal mudflats, coastal areas and monsoon forests. The park was inscribed the World Heritage list in three stages over 11 years. It is located in tropical north Australia covering a total area of 19,804 square kilometres.	The conservation values reflect the WHA Criterion: (i), (vi), (vii) and (ix): Natural features relate to Criterion (vii) – the remarkable contrast between the internationally recognised Ramsar-listed wetlands and the spectacular rocky escarpment and its outliers and Criterion (ix) – four major river systems of tropical Australia and floodplains that are dynamic environments, shaped by changing sea levels and big floods every wet season. These floodplains illustrate the ecological and geomorphological effects that have accompanied Holocene climate change and sea level rise. Kakadu National Park contains important and significant habitats supporting a diverse range of flora and fauna.
National Heritage Places - Natural			
Kakadu National Park		Refer to World Heritage property description above.	Refer to World Heritage property conservation values above
Commonwealth Heritage Places - Natural			
N/A			
Wetlands of International Importance (Ramsar)			
Kakadu National Park		Australian Ramsar site number 2. The stage 1 and 2 Ramsar sites, established in 1980, 1985 and 1989, respectfully were combined into a single Ramsar site in 2010.	The Kakadu National Park Ramsar site straddles the western edge of the Arnhem Land Plateau encompassing a range of landforms and extensive floodplains. It is a mosaic of contiguous wetlands comprising the catchments of two large river systems, the East and South Alligator rivers and encompasses extensive tidal mudflat areas. It is an internationally important site for migratory shorebirds as part of the EAAF.

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
Cobourg Peninsula		Australian Ramsar site number 1 established in 1974. This Ramsar site includes freshwater and extensive intertidal areas but excludes subtidal areas. It is in a remote location and there has been minimal human impact on the site.	The wetlands encompassed in the Ramsar site are some of the better protected and near-natural wetlands in the bioregion and there is a diverse array of wetland in a confined area. The site supports important turtle nesting habitat and habitat for coastal dolphin species and is an internationally significant migratory shorebird habitat as part of the EAAF and an important location for seabird breeding colonies.
Wetlands of National Importance (DAWE, 2019)			
Southern Gulf Aggregation		The site is a complex continuous wetland aggregation in the Gulf of Carpentaria, covering an area of ~5460 km^2 located 58 km east of Burketown, Queensland.	The Southern Gulf Aggregation is the largest continuous estuarine wetland aggregation of its type in northern Australia. It is one of the three most important areas for shorebirds in Australia. The area meets criteria 1, 2, 3, 4, 5 and 6 for inclusion on the Directory of Important Wetlands in Australia.
Australian Marine Parks (DNP, 2018c)			
Arafura Marine Park	VI	Arafura Marine Park covers an area of 22,924 km^2 is located ~256 km north-east of Darwin and 8 km offshore of Croker Island, NT. It extends from NT waters to the limit of Australia's EEZ.	The AMP is significant because it contains habitats, species and ecological communities associated with two bioregions: • Northern Shelf Province • Timor Transition. It includes one KEF: Tributary canyons of the Arafura Depression. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include internesting habitat for marine turtles and important foraging and breeding habitat for seabirds.
Arnhem Marine Park	VI	Arnhem Marine Park covers an area of 7125 km^2 and is located ~100 km south-east of Croker Island and 60 km south-east of the Arafura Marine Park. It extends from NT waters surrounding the Goulburn Islands, to the waters north of Maningrida.	Arnhem Marine Park is significant because it contains habitats, species and ecological communities associated with the Northern Shelf Province bioregion. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include foraging habitat and a migratory pathway for marine turtles and seabirds.
Gulf of Carpentaria Marine Park	II, VI	Gulf of Carpentaria Marine Park covers an area of 23,771 km^2 and is located ~90 km north-west of Karumba, Queensland and is adjacent to the Wellesley Islands in	Gulf of Carpentaria Marine Park is significant because it contains habitats, species and ecological communities associated with the Northern Shelf Province bioregion.

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
		the south of the Gulf of Carpentaria basin.	It includes four KEFs: Gulf of Carpentaria basin; Gulf of Carpentaria coastal zone; Plateaux and saddle north-west of the Wellesley Islands; and Submerged coral reefs of the Gulf of Carpentaria. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging areas for seabirds and internesting and foraging areas for turtles.
Joseph Bonaparte Gulf Marine Park	VI	The Joseph Bonaparte Gulf Marine Park is located within both the NWMR and NMR. Refer **Table 10-1** for description and conservation values.	
Limmen Marine Park	IV	Limmen Marine Park covers an area of 1399 km^2 and is located ~315 km south-west of Nhulunbuy, NT, in the south-west of the Gulf of Carpentaria. It extends from NT waters, between the Sir Edward Pellew Group of Islands and Maria Island in the Limmen Bight, adjacent to the NT Limmen Bight Marine Park.	Limmen Marine Park is significant because it contains habitats, species and ecological communities associated with the Northern Shelf bioregion. It includes one KEF: Gulf of Carpentaria coastal zone. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include internesting and foraging habitat for marine turtles.
Oceanic Shoals Marine Park	II, IV, VI	The Oceanic Shoals Marine Park is located within both the NWMR and NMR. Refer **Table 10-1** for description and conservation values.	
Wessel Marine Park	IV, VI	Wessel Marine Park covers an area of 5908 km^2 and is located ~22 km east of Nhulunbuy, NT. It extends from NT waters adjacent to the tip of the Wessel Islands to NT waters adjacent to Cape Arnhem.	Wessel Marine Park is significant because it contains habitats, species and ecological communities associated with the Northern Shelf bioregion. It includes one KEF: Gulf of Carpentaria basin. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding habitat for seabirds and internesting and foraging habitat for marine turtles.
West Cape York Marine Park	II, IV, VI	West Cape York Marine Park covers an area of 16,012 km^2 and is located adjacent to the northern end	West Cape York Marine Park is significant because it contains species and ecological communities associated with two bioregions: • Northeast Shelf Transition

Protected Area	IUCN Protected Area Category* or Relevant Park Zone	Description	Conservation Values
		of Cape York Peninsula ~25 km south-west of Thursday Island and 40 km north-west of Weipa, Queensland.	• Northern Shelf Province. It includes two KEFs: Gulf of Carpentaria basin; and Gulf of Carpentaria coastal zone. The AMP supports a range of species, including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the AMP include breeding and foraging habitat for seabirds, internesting and foraging habitat for marine turtles and dugong, and foraging, breeding and calving habitat for dolphins.
Territory Marine Parks and Reserves			
Cobourg Marine Park	II, IV, VI	Cobourg Marine Park covers an area of 2,290 km^2 and is located in the waters surrounding the Cobourg Peninsula ~220 km north-east of Darwin. The Marine Park is part of the larger Garig Gunak Barlu National Park. Garig Gunak Barlu National Park includes both the Marine Park and the Cobourg Sanctuary.	Cobourg Marine Park is located in the Cobourg and Van Diemen Gulf marine bioregions with the northern portion of the Park covered by the Cobourg marine bioregion and the southern portion covered by the Van Diemen Gulf marine bioregion. The Marine Park is characterised by a number of deeply incised bays and estuaries on its northern shores. These bays are ancient river valleys that were drowned during periods of sea level rise and provide a varied environment and habitat that is quite distinct from the open water areas of the Park. The areas of the Park that have been studied and where extensive collections have been made indicates that the Park supports rich and diverse marine life including live coral reefs, seagrass, diverse reef and pelagic fish populations, marine turtles and dugong.

**Conservation objectives for IUCN categories include:*

Ia: Strict Nature Reserve

Ib: Wilderness Area

II: National Park

III: Natural Monument or Feature

IV: Habitat/Species Management Area

V: Protected Landscape

VI: Protected area with sustainable use of natural resources – allow human use but prohibits large scale development.

IUCN categories for the marine park are provided and, in brackets, the IUCN categories for specific zones within each Marine Park as assigned under the North Marine Parks Network Management Plan 2018 (DNP, 2018c)

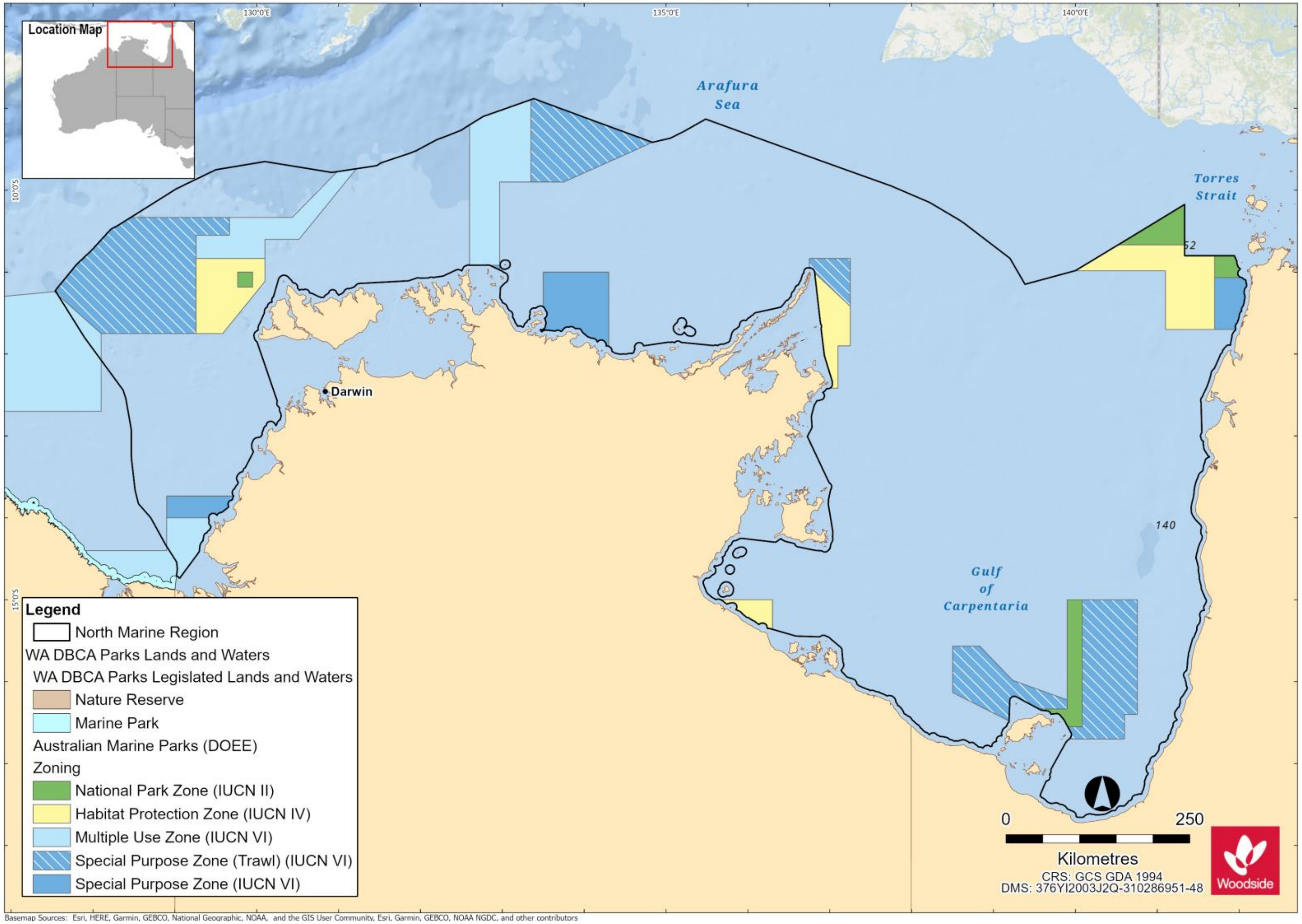


Figure 10-3. Commonwealth and State Marine Protected Areas within the NMR

11. SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

This section summarises the information relating to the socio-economic and cultural environment of the regions offshore Western Australia, with a focus on the NWMR and to a lesser extent the SWMR and NWR.

The cultural environment includes Indigenous and European heritage values, including underwater values such as historic shipwrecks. Socio-economic values include commercial and traditional fishing, tourism and recreation, shipping, oil and gas activities and defence activities.

11.1 Cultural Heritage

11.1.1 Indigenous Sites of Significance

Murujuga (the Burrup Peninsula) has a very high density of significant Indigenous heritage sites and places with tangible and intangible heritage values. The area has one of the largest, densest, and most diverse collections of rock art in the world. It is estimated that the peninsula and surrounding islands contain over a million petroglyphs (rock engravings) covering a broad range of styles and subjects. The landscape also contains quarries, middens, fish traps, rock shelters, ceremonial sites, artefact scatters, grinding patches and stone arrangements that evidence tens of thousands of years of human occupation. These places are linked to Aboriginal cosmology, Dreaming stories and songs through the stories, knowledge and customs that are still held by traditional custodians.

In 2007 the Dampier Archipelago (including the Burrup Peninsula) was included on the National Heritage List due to outstanding heritage values relating to Australia’s cultural history contained in the large number, density, diversity, distribution and fine execution of rock art. Within the National Heritage Place, the Murujuga National Park covers 4913 ha and is co-managed by the Murujuga Aboriginal Corporation and the Department of Biodiversity, Conservation and Attractions. The Murujuga Cultural Landscape was also added to Australia’s Tentative World Heritage List in 2020, with full World Heritage Listing anticipated in 2024.

Woodside also recognises the potential for heritage to survive in submerged landscapes. Sea-level rises since the last ice age mean that areas now under the sea were once exposed, that many of today’s islands would have been connected to the mainland, and that Aboriginal people are highly likely to have inhabited these places. Woodside works with traditional custodians, academics and heritage professionals to identify tangible and intangible heritage values in the submerged landscape to avoid disturbing heritage where possible and to minimise impacts where heritage cannot be avoided.

It is an offence to excavate, destroy, damage, conceal or alter Indigenous heritage onshore or in state waters under section 17 of the *Aboriginal Heritage Act 1972 (WA) (AHA)* without ministerial authorisation. Where there is a risk of injury or desecration to a significant Aboriginal area, even where permitted under the AHA, any Aboriginal person may apply to the federal Environment Minister for a declaration under sections 9 or 10 of the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (Cth)* for the protection and preservation of that area.

The Department of Planning, Lands and Heritage maintains a register of registered sites and heritage places including middens, burial, ceremonial [sites], artefacts, rock shelters, mythological [sites] and engraving sites. There are over 1600 registered sites on Murujuga and the Dampier Archipelago with around 1100 other heritage places. This register is not comprehensive and will be complemented by heritage surveys where necessary. Protection of National and World Heritage values is also legislated through various provisions of the *Environment Protection and Biodiversity Conservation Act 1999 (Cth)*. Murujuga National Park is managed under the *Conservation and Land Management Act 1984 (WA)*.

11.1.2 European Sites of Significance

European sites of significance and heritage value are found along adjacent foreshores of the SWMR, NWMR and NWR. Heritage values are protected in Western Australia under the *Heritage Act 2018*.

11.1.3 Underwater Cultural Heritage

Places of historic cultural significance are protected under Commonwealth, State and local regimes. Places inscribed on the National or World Heritage list are protected through various provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth). Historic places may also be protected under the *Heritage Act 2018* (WA); under section 129 the prohibited alteration, demolition, damage, despoilment or removal of objects from a registered place may result in a fine of A$1 million. Protection of heritage by local government typically emanates from local planning schemes produced under Part 5 of the *Planning and Development Act 2005* (WA).

The remains of vessels and aircraft in Commonwealth waters, along with any associated article, are automatically protected under the *Underwater Cultural Heritage Act 2018* (Cth) after 75 years. Remains and relics of any ship lost, wrecked or abandoned in Western Australian waters before 1900 are protected by the *Maritime Archaeology Act 1973* (WA).

The Australian National Shipwreck Database and the WA Maritime Museum Shipwreck Database list these protected wrecks.

11.1.4 National and Commonwealth Listed Heritage Places

Australia's National Heritage Sites are those of outstanding natural, historic and/or Indigenous significance to Australia. National Heritage places classed as natural are discussed in **Section 10.3**. Historic and/or Indigenous National Heritage Listed Places of the NWMR include:

- Dampier Archipelago (including Burrup Peninsula)
- Dirk Hartog Landing Site/Cape Inscription
- HMAS Sydney II and the HSK Kormoran Shipwreck Sites
- Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos

Commonwealth Heritage Places are a collection of sites recognised for their Indigenous, historical and/or natural values, which are owned or controlled by the Australian Government. A number of these sites are owned or controlled by the Department of Defence, as well as Government agencies relating to maritime safety, customs and communication. Commonwealth Heritage places classed as natural are discussed in **Section 10.3**. Listed Heritage Places in the NWMR include:

- Mermaid Reef – Rowley Shoals (refer **Section 10.3**)
- Ashmore Reef National Nature Reserve (refer **Section 10.3**)
- Scott Reef and Surrounds – Commonwealth Area (refer **Section 10.3**)
- Ningaloo Marine Area (refer **Section 10.3**)

World Heritage Properties are those sites that hold universal value which transcends any value they may be held by any one nation. These sites and their qualities are detailed in the Convention concerning the Protection of the World Cultural and Natural Heritage (the World Heritage Convention), to which Australia is a founding member. The Protected Matters Search Report (**Appendix A**) lists two natural World Heritage Properties in the NWMR (refer **Section 10.2**). There are no cultural heritage listings located within the NWMR.

Summary tables of heritage places for NWMR, SWMR and NMR are presented in **Table 11-1,Table 11-2** and **Table 11-3**.

11.2 Summary of Heritage Places within the NWMR

Table 11-1 Heritage Places (Indigenous and Historic) within the NWMR

Heritage Places	Woodside Activity Area			Class	Description	Conservation Values
	Browse	NWS/S	NW Cape			
National Heritage Properties						
Dampier Archipelago (including Burrup Peninsula)	-	✓	-	Indigenous	The Dampier Archipelago (including the Burrup Peninsula) contains one of the densest concentrations of rock engravings in Australia with some sites containing thousands or tens of thousands of images.	The rock engravings comprise images of avian, marine and terrestrial fauna, schematised human figures, figures with mixed human and animal characteristics and geometric designs. At a national level it has an exceptionally diverse and dynamic range of schematised human figures some of which are arranged in complex scenes. The fine execution and dynamic nature of the engravings, particularly some of the composite panels, exhibit a degree of creativity that is unusual in Australian rock engravings.
Dirk Hartog Landing Site 1616 – Cape Inscription Area	-	-	✓	Historic	Cape Inscription is the site of the oldest known landings of Europeans on the WA coastline.	The Cape Inscription area displays uncommon aspects of Australia's cultural history because of the cumulative effect its association with these explorers and surveyors had on growing knowledge of the great southern continent in Europe. The association of the site with these early navigators stimulated the development of the European view of the great southern continent at a time when they began to look at the world with a modern scientific outlook.
Commonwealth Heritage Properties						
N/A						

11.3 Summary of Heritage Places within the NMR

Table 11-2 Heritage Places (Indigenous and Historic) within the NMR

Heritage Places	Class	Description	Conservation Values
National Heritage Properties			
None			
Commonwealth Heritage Properties			
None			

11.4 Summary of Heritage Places within the SWMR

Table 11-3 Heritage Places (Indigenous and Historic) within the SWMR

Heritage Places	Class	Description	Conservation Values
National Heritage Properties			
Cheetup Rock Shelter	Indigenous	Cheetup meaning “place of the birds” is the name of a spacious rock shelter located in Cape Le Grand National Park, about 55 km east of Esperance in WA. Aboriginal people associated with the place identify themselves as Nyungar/Noongar, Ngadju (shortened from Ngadjunmaia) or Mirning.	Cheetup rock shelter provides outstanding evidence for the antiquity of processing and use of cycad seeds by Aboriginal people. The seeds of the cycad are extremely toxic and can cause speedy death if eaten fresh without proper preparation to remove the toxins. The presence of *Macrozamia riedlei* seeds in a pit lined with Xanthorrhoea (grass tree) leaf bases indicates that the Aboriginal people in the Esperance region had the knowledge to remove the toxins of this important source of carbohydrate and protein at least 13,200 years ago.

Heritage Places	Class	Description	Conservation Values
Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos	Historic	The Batavia and its associated sites hold an important place in the discovery and delineation of the WA coastline. The wreck of the Batavia, and other Dutch ships like her, convinced the VOC (Dutch East India Company) of the necessity of more accurate charts of the coastline and resulted in the commissioning of Vlamingh's 1696 voyage.	Because of its relatively undisturbed nature the archaeological investigation of the wreck itself has revealed a range of objects of considerable value as well as to artefact specialists and historians.
HMAS Sydney II and HSK Kormoran Shipwreck Sites	Historic	The naval battle fought between the Australian warship HMAS Sydney II and the German commerce raider HSK Kormoran off the WA coast during World War II was a defining event in Australia's cultural history. HMAS Sydney II was Australia's most famous warship of the time and this battle has forever linked the stories of these warships to each other. The loss of HMAS Sydney II along with its entire crew of 645 following the battle with HSK Kormoran, remains as Australia's worst naval disaster.	The shipwreck sites of HMAS Sydney II and HSK Kormoran have outstanding heritage value to the nation because of their importance in a defining event in Australia's cultural history and for their part in development of the process of the defence of Australia.
Commonwealth Heritage Properties			
Cliff Point Historic Sites	Historic	Cliff Head is a limestone bluff on the east coast of Garden Island. Evidence of occupation has been reported from the beach just north of the head, the immediate hinterland, the ridge above and on the south face of the ridge.	The Cliff Point Historic Site, individually significant within the area of Garden Island is important as the first site inhabited by Governor Stirling's party in 1829 when founding the colony of WA, and as WA's first official non-convict settlement. The site was occupied in the first instance by Captain Charles Fremantle before the arrival of Captain Stirling. The party occupied the site for two months before a move was made to the Swan River settlement on the mainland.
HMAS Sydney II and HSK Kormoran Shipwreck Sites	Historic	As above	As above
J Gun Battery	Historic	J Battery comprised two 155 mm long range guns, the other similar battery being at Cape Peron on the mainland at the entrance to Cockburn Sound. Located in the dune systems at the north western	J Gun Battery (1942) is individually significant within the area of Garden Island (Register No. 019544) and is historically important as the first gun battery constructed on Garden Island and as one of two long range gun batteries which played a

Heritage Places	Class	Description	Conservation Values
		corner of Garden Island elements of the J Battery complex are now covered in part by sand.	strategic role in the coastal defences of Cockburn Sound and Fremantle following the entry of Japan into the Second World War (1939-45).

11.5 Fisheries - Commercial

11.5.1 Commonwealth and State Fisheries

The diverse range of habitats and species offshore WA has allowed for various fisheries to develop and operate throughout the region.

The Australian Fisheries Management Authority (AFMA) manages fisheries on behalf of the Commonwealth Government and is bound by objectives under the Commonwealth *Fisheries Management Act 1991*.

WA State commercial fisheries are managed by the WA Department of Primary Industries and Regional Development (WA DPIRD) under the WA *Fish Resources Management Act 1994* (FRMA), Fisheries Resources Management Regulations 1995, relevant gazetted notices and licence conditions, and applicable Fishery Management Plans.

Commonwealth and State managed fisheries that operate within the NWMR and in areas beyond this region are summarised in the **Table 11-4**.

Table 11-4 Commonwealth and State managed fisheries

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th rowspan="2" colspan="4">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td colspan="8">Commonwealth Managed Fisheries</td></tr>
<tr><td rowspan="5">Southern Bluefin Tuna Fishery</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td>Management area</td><td colspan="3">The Southern Bluefin Tuna Fishery (SBTF) covers the entire EEZ around Australia, out to 200 nm from the coast. They do not fish in the Woodside activity area.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Southern bluefin tuna (Thunnus maccoyii)</td><td>Longline and purse seine fishing.</td><td>Southern bluefin tuna is a pelagic species which can be found to depths of 500 m (AFMA, 2021a)</td></tr>
<tr><td>Fishing effort</td><td colspan="3">Most of the Australian fishing effort is by purse-seine vessels in the Great Australian Bight and waters off South Australia during summer months, and by longline off the New South Wales coastline during winter months (Patterson et al., 2020).
SBTF is a fishery that is shared amongst many countries. Australia currently has a 35% share of the total global allowable catch, and while wild capture fishing in Australia to sell directly to market can occur anywhere throughout the SBTF’s range, currently the vast majority of that quota is value-added through ranching (on-growing the wild captured fish for extra 5-6 months). Ranching requires significant infrastructure, a resident labour force, plus proximity to a fishery able to supply a large quantity of natural feed/sardines (40,000+ tonnes) (for example as available in Port Lincoln). North-west WA is critically important regardless of how the quota is fished because of the proximity to the single spawning ground of this global roaming species.
The stock remains classified as overfished.</td></tr>
<tr><td>Active licences/vessels</td><td colspan="3">Seven purse seine vessels, 20 longline vessels (Patterson et al., 2020).</td></tr>
<tr><td>Western Skipjack Tuna Fishery</td><td>✓</td><td>✓</td><td>✓</td><td>Management area</td><td colspan="3">The combined western and eastern skipjack tuna (Katsuwonus pelamis) fisheries (STF) encompass the entire Australian EEZ. The Western Skipjack Tuna Fishery (WSTF) extends westward from the SA/Victorian border across the Great Australian Bight and around the west coast of WA to the Cape York Peninsula.</td></tr>
</table>

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Western skipjack tuna (Katsuwonus pelamis)</td><td>Fishers use purse seine gear (about 98% of catch) and sometimes pole and line when fishing for skipjack tuna.</td><td>Western skipjack tuna is a pelagic species that can be found to depths of 260 m (AFMA, 2021b).</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">The Skipjack Tuna Fishery (STF) has not been actively fished since the 2008-2009 fishing season (Patterson et al., 2020). The management arrangements for this fishery will be reviewed if active boats re-enter the fishery.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">No active vessels operating since 2009.</td></tr>
<tr><td rowspan="5">Western Tuna and Billfish Fishery</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td rowspan="5">✓</td><td>Management area</td><td colspan="3">The Western Tuna and Billfish Fishery (WTBF) extends to the Australian EEZ boundary in the Indian Ocean.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Bigeye tuna (Thunnus obesus)
Yellowfin tuna (Thunnus albacares)
Swordfish (Xiphias gladius)
Albacore (Thunnus alalonga)
Striped marlin (Kajikia audax)</td><td>Fishers mainly use pelagic longline fishing gear to catch the targeted species. Minor line (including handline, troll, rod and reel) can also be used.</td><td>Species have a broad depth distribution, with tuna occurring at 150 – 300 m, striped marlin at 150 m and swordfish at up to 600 m (BRS, 2007).</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">The WTBF operates in Australia’s EEZ and high seas of the Indian Ocean. Fishing effort in recent years has been concentrated off south-west WA, with occasional activity off SA.</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Two pelagic longline vessels and two minor longline vessels (Patterson et al., 2020).</td></tr>
<tr><td>Western Deepwater Trawl Fishery</td><td></td><td></td><td>✓</td><td>Management area</td><td colspan="3">The Western Deepwater Trawl Fishery (WDTF) is located in deep water off WA, from the line approximating the 200 m isobath to the edge of the Australian Fishing Zone (AFZ).</td></tr>
</table>

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
				Species targeted	**Fishing methods**	**Fishing depth**
				More than 50 species, historically dominated by six commercial finfish species or species groups: Orange roughy (*Hoplostethus atlanticus*) Oreos (Oreosomatidae) Boarfish (Pentacerotidae) Eteline snapper (Lutjanidae: Etelinae) Apsiline snapper (Lutjanidae: Apsilinae) Sea bream (Lethrinidae)	Demersal trawl.	Water deeper than 200 m, stakeholder consultation has indicated that this may be to depths of 800 m.
				Fishing effort:	The number of vessels active in the fishery and total hours trawled have fluctuated from year to year. Notably, total hours trawled were relatively high for a brief period during the early 2000s when fishers targeted ruby snapper and deepwater bugs (Patterson *et al*., 2020). Total fishing effort has been variable but relatively low since then. Effort in 2018-2019 (492 trawl hours) was less than half that of 2017-2018 (1108 trawl hours) (Patterson *et al*., 2020).	
				Active licences/vessels:	One active vessel in 2018-2019 (Patterson *et al.*, 2020).	
North-west Slope Trawl Fishery	✓	✓		**Management area**	The North-west Slope Trawl Fishery (NWSTF) extends, from 114 °E to 125 °E, from the 200 m isobath to the outer limit of the AFZ (200 nm from the coastline, which is the boundary of the Australian EEZ).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Australian scampi (*Metanephrops australiensis*) and smaller quantities of velvet and Boschma's scampi (*M. velutinus* and *M. boschmai*) Mixed snappers have historically been an important component of the catch.	Demersal trawl.	Typically at depths of 350 to 600 m (Patterson *et al*., 2017), however stakeholder consultation has indicated that this may be to depths of 800 m.

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th rowspan="2" colspan="3">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2"></td><td>Fishing effort:</td><td colspan="2">The NWSTF commenced in 1985 and the number of active vessels peaked at 21 in the 1986-1987 season and declined through the 1990s before increasing to 10 vessels in 2000-2001 and 2002-2002 seasons. Four vessels operated in the 2017-2018 and 2018-2019 seasons (Patterson et. al. 2020).
Fishing for scampi occurs over soft, muddy sediments or sandy habitats, using demersal trawl gear on the continental slope (Patterson et al., 2017).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">Four vessels (Patterson et. al., 2020).</td></tr>
<tr><td colspan="7">State Managed Fisheries</td></tr>
<tr><td rowspan="4">Pilbara Fish Trawl (Interim) Managed Fishery</td><td rowspan="4"></td><td rowspan="4">✓</td><td rowspan="4"></td><td>Management area</td><td colspan="2">The Pilbara Trawl (Interim) Managed Fishery is of high intensity and is divided into two zones and an area governed by Schedule 5 (prohibited to trawling). In addition to the Prohibited Trawl Fishing area, no fish trawl units are allocated for use in Zone 1 or Areas 3 and 6 of Zone 2 (which comprises six management areas) (Newman et al., 2020a). No fish trawl units have been allocated for use in Area 6 of Zone 2 since the management plan commenced operation in 1998.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>The Pilbara Fish Trawl (Interim) Managed Fishery (PFTIMF) targets more than 50 scalefish species.
The five main demersal scalefish species landed by the fisheries in the Pilbara region are blue-spotted emperor, crimson snapper, rosy threadfin bream, red emperor and goldband snapper in 2018 (Newman et al., 2020a).</td><td>Demersal trawl.</td><td>The Pilbara Fish Trawl Fishery lands the largest component of the catch and operates in waters between 50 and 200 m water depth (Allen et al., 2014, Newman et al. 2015). Stakeholders have advised that trawling can occur in depths of up to approximately 800 m.</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">Based on State of the Fisheries annual reports provided by DPIRD, catch trends are seen to be increasing over the past reporting years:</td></tr>
</table>

Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
					Pilbara Trawl (Interim) Managed Fishery caught 1996 t in 2018-19, 1780 t in 2017-18, 1529 t in 2016-17, 1172 t in 2015-16, 1105 t in 2014-15.	
				Active licences/vessels:	Two Pilbara Trawl (Interim) Managed Fishery vessels in 2017 (Newman *et al*., 2020a). Active vessels data are confidential as there were fewer than three vessels in the Pilbara Fish Trawl Interim Managed Fishery (Newman *et al*., 2020a).	
Pilbara Trap Managed Fishery		✓	✓	**Management area**	The Pilbara Trap Fishery covers the area from Exmouth northwards and eastwards to the 120° line of longitude, and offshore as far as the 200 m isobath. Like the trawl fishery, the trap fishery is also managed using input controls in the form of individual transferable effort allocations monitored with a satellite-based vessel management system. The fishery includes six licences allocated to three vessels, operating principally from Onslow.	
				Species targeted	**Fishing methods**	**Fishing depths**
				Pilbara Trap Managed Fishery catch is made up of around 45-50 different fish species. The four main species landed by the fisheries in the Pilbara region are blue-spotted emperor, red emperor, goldband snapper and Rankin cod.	Demersal fish traps.	Greatest effort in waters less than 50 m depth targeting high value species such as red emperor and goldband snapper.
				Fishing effort	Based on State of the Fisheries annual reports provided by DPIRD, catch trends are seen to be increasing over the past reporting years: Pilbara Trap Managed Fishery caught 563 t in 2018-19, 573 t in 2017-18, 495 t in 2016-17, 510 t in 2015-16, 268 t in 2014-15. In 2018, the total catch for the Pilbara Trap Managed Fishery was 563 t, making up 21% of the total catch by the Pilbara Demersal Scale Fishery (Newman *et al*., 2019).	

Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Active licences/vessels	In the 2019 season, there were six licences in the Pilbara Trap Managed Fishery, (Newman *et al*., 2020a). Active vessels data are confidential as there were fewer than three vessels in the Pilbara Trap Managed Fishery (Newman *et al*., 2019).	
Pilbara Line Managed Fishery		✓	✓	**Management area**	The Pilbara Line Managed Fishery boat licences are permitted to operate anywhere within "Pilbara waters", bounded by a line commencing at the intersection of 21°56'S latitude and the high water mark on the western side of the North-west Cape on the mainland of WA; west along the parallel to the intersection of 21°56'S latitude and the boundary of the AFZ and north to longitude 120°E.	
				Species targeted	**Fishing method**	**Fishing depths**
				The Pilbara Line Managed Fishery catch is made up around 45-50 different fish species. The Pilbara Line Managed Fishery targets similar demersal species to the Pilbara Trap and Trawl fisheries, as well as some deeper offshore species such as ruby snapper and eightbar grouper The Pilbara Line Managed Fishery operates on an exemption basis that enables licence holders to fish for any nominated five-month block during the year.	Demersal long line.	Pilbara Line Fishing Depth: Operates up to a depth of 600 m.
				Fishing effort	Based on State of the Fisheries annual reports provided by DPIRD, catch trends are seen to be increasing over the past reporting years: Pilbara Line Managed Fishery caught 93 t in 2018-19, 143 t in 2017-18, 126 t in 2016-17, 97 t in 2015-16, 40 t in 2014-15. The total catch in 2018 for the Pilbara Line Managed Fishery was 93 t, making up 3% of the total catch by the Pilbara Demersal Scalefish Fishery (Newman *et al*., 2019).	

Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Active licences/vessels	In the 2018 season there are nine individual licences in the Pilbara Line Fishery, held by seven operators. Active vessels data is confidential as there were fewer than three vessels in the Pilbara Line Fishery (Newman *et al*., 2018).	
Mackerel Managed Fishery	✓	✓	✓	**Management area**	The commercial fishery extends from Geraldton to the Northern Territory border. There are three managed fishing areas: Kimberley (Area 1), Pilbara (Area 2), and Gascoyne and West Coast (Area 3).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Spanish mackerel (*Scomberomorus commerson*) Grey mackerel (*S. semifasciatus*) Other species from the genus *Scomberomorus*	Near-surface trawling gear. Jig fishing.	Previous engagement with WAFIC suggests that the depth of fisheries may extend to 70 m.
				Fishing effort:	Most of the catch is taken from waters off the Kimberley coasts (Lewis and Brand-Gardner, 2018), reflecting the tropical distribution of mackerel species (Molony *et al.*, 2015). Most fishing activity occurs around the coastal reefs of the Dampier Archipelago and Port Hedland area, with the seasonal appearance of mackerel in shallower coastal waters most likely associated with feeding and gonad development before spawning (Mackie *et al.*, 2003). Based on State of the Fisheries annual reports provided by DPIRD, catch trends are as follows: 213 t in 2018-19 (the lowest on record (Lewis *et al*., 2020), 283 t in 2017-18, 276 t in 2016-17, 302 t in 2015-16, 322 t in 2014-15.	
				Active licences/vessels:	Fifteen boats fished in 2018, with approximately 35-40 people directly employed in the Mackerel Managed Fishery, primarily from May-November (Lewis *et al*., 2020).	
Marine Aquarium Managed Fishery	✓	✓	✓	**Management area**	The Marine Aquarium Managed Fishery is able to operate in all State waters. The fishery is typically more active in waters south of Broome and higher levels of effort around the Capes region, Perth, Geraldton, Exmouth, Dampier and Broome (Newman *et al.*, 2020b).	
				Species targeted	**Fishing methods**	**Fishing depth**

Fishery	Woodside Activity Area			Description			
	Browse	NWS/S	NW Cape				
				Finfish, hard coral, soft coral, tridacnid clams, syngnathids (seahorses and pipefish), other invertebrates (including molluscs, crustaceans, echinoderms etc.), algae, seagrasses and 'live rock'.		The fishery is diver-based, which typically restricts effort to safe diving depths (less than 30 m).	Less than 30 m, as advised by WAFIC.
				Fishing effort:	Total catch for the Marine Aquarium Managed Fishery in 2018 was 156,188 fishes, 32.025 t of coral, live rock and living sand and 176.02 L of marine plants and live feed.		
				Active licences/vessels:	Eleven licences were active in 2019 (Newman *et al.*, 2020b).		
Beche-de-mer Fishery	✓	✓	✓	**Management area**	Fishing occurs in the northern half of WA from Exmouth Gulf to the NT border and is managed under Ministerial Exemptions.		
				Species targeted		**Fishing methods**	**Fishing depth**
				The sea cucumber fishery targets two main species: sandfish (*Holothuria scabra*) and redfish (*Actinopyga echinites*).		Diving	The targeted species typically inhabit nearshore in shallow depths.
				Fishing effort	Based on State of the Fisheries annual reports provided by DPRID, catch trends are as follows: 62t in 2018 (Gaughan and Santoro, 2020), 135t in 2017, 93t in 2016, 38t in 2015		
				Active licences/vessels	Six active licences in 2019 (Hart *et al*., 2019). Active vessels data is confidential as there were fewer than three vessels.		
Onslow Prawn Managed Fishery		✓		**Management area**	The Onslow Prawn Managed Fishery encompasses a portion of the continental shelf off the Pilbara.		
				Species targeted		**Fishing methods**	**Fishing depth**

Fishery	Woodside Activity Area			Description			
	Browse	NWS/S	NW Cape				
				The fishery targets: Western king prawns (*Penaeus esculentus*) Brown tiger prawns (*Penaeus esculentus*) Blue endeavour prawns (*Metapenaeus endeavouri*		Low opening, otter prawn trawl systems.	Prawn trawling takes place in water depths of approximately 30 metres and less (licence holder feedback). Fishery and or fishing activity overlaps the Beadon Creek dredging scope (Sporer *et al*., 2015).
				Fishing effort:	The total landings for the Onslow Prawn Managed Fishery in 2018 were less than 60 t below the target catch range (Kangas *et al*., 2020a).		
				Active licences/vessels:	One vessel (Kangas *et al*., 2020a).		
Pearl Oyster Managed Fishery	✓	✓	✓	**Management area**	Located in shallow coastal waters with the pearl oyster managed fishery designated by four zones extending from Exmouth to Kununurra and the seaward boundary demarcated by the 200 nm EEZ.		
				Species targeted		**Fishing methods**	**Fishing depth**
				Pearl oysters (*Pinctada maxima*).		Drift diving.	Fishing effort is mostly focussed in shallow coastal waters (10-15 m depth), with a maximum depth of 35 m (Lulofs *et al.* 2002).
				Fishing effort:	In 2018, catch was taken from Zones 2 and 3 with no fishing in Zone 1. The number of pearl oysters caught for 2018-19 was 614,002. Total effort was 15,637 dive hours, this was an increase from 2017 effort of 12,845 hours. No fishing occurred in Zone 1 in 2017 and 2018 (Gaughan and Santoro, 2020).		
				Active licences/vessels:	15,637 diver hours (Hart *et al.*, 2020a).		
		✓	✓	**Management area**	The Pilbara Crab Managed Fishery comprises WA waters off the north-western coast of WA north of 23° 34′ south latitude and west of 120° 00′ east longitude. Areas of the fishery north and east of Exmouth and		

Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
Pilbara Crab Managed Fishery					nearshore are currently closed as per Schedule 2 of the Draft Management Plan for the Pilbara Crab Managed Fishery.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Crabs of the Family Portunidae, excluding crabs of the genus *Scylla*.	Traps.	Up to 50 m deep.
				Fishing effort:	The capacity of the fishery is 600 traps.	
				Active licences/vessels:	No information available at this time.	
South-west Coast Salmon Managed Fishery	✓	✓	✓	**Management area**	The South-west Coast Salmon Managed Fishery operates on various beaches south of the metropolitan area and includes all WA waters north of Cape Beaufort except Geographe Bay.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Western Australian salmon (*Arripis truttaceus*)	Beach seine nets.	Information not available however, species generally found in shallow waters (up to 30 m).
				Fishing effort:	No fishing occurs north of the Perth metropolitan area, despite the managed fishery boundary extending to Cape Beaufort (WA/Northern Territory border), as advised by WAFIC. The 2018 commercial catch was 191 t, with 72% taken by the South West Coast Salmon Managed Fishery, 25% by the South Coast Salmon Managed Fishery and 3% by other fisheries (Duffy and Blay, 2020a).	
				Active licences/vessels:	Six licences.	
	✓	✓	✓	**Management area**	The Specimen Shell Managed Fishery (SSMF) encompasses the entire WA coastline, but effort is concentrated in areas adjacent to the population centres such as Broome, Exmouth, Shark Bay,	

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
Specimen Shell Managed Fishery					Geraldton, Perth, Mandurah, the Capes area and Albany (Hart *et al.*, 2020b). There are a number of closed areas where the SSMF is not permitted to operate. These include various marine parks and aquatic reserves, such as Ningaloo Marine Park.	
				Species targeted	**Fishing methods**	**Fishing depth**
				The Specimen Shell Managed Fishery targets the collection of specimen shells for display, collection, cataloguing and sale.	Collection is predominantly by hand when diving to wading in shallow, coastal waters, though in deeper water collection may be conducted by remotely operated vehicles (limited to one per licence).	For collection by hand, (diver-based) this typically restricts effort to safe diving depths (less than 30 m). ROV collection could enable depths up to 300 m (Hart *et al.*, 2017). In the past there has been one licence holder in the Specimen Shell Managed Fishery who has trialled ROV means of shell collection, WAFIC have provided advice that this fishery is no longer active.
				Fishing effort:	Information not available.	
				Active licences/vessels:	In 2018 there were 31 licences with only two divers allowed in the water per licences at one time (Hart *et al.*, 2018). The number of people employed regularly in the fishery is likely to be about 21 (Hart *et al.*, 2018).	
West Australian Abalone Fishery	✓	✓	✓	**Management area**	The Western Australian Abalone Fishery includes all coastal waters from the WA and SA border to the WA and NT border. The fishery is concentrated on the south coast and the west coast.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Greenlip abalone (*Haliotis laevigata*) Brownlip abalone (*Haliotis conicopora*) Roe's abalone (*Haliotis roei*)	Divers.	Distribution to 5 m depth for Roe's abalone and 40 m depth for greenlip / brownlip abalone (DOF, 2011).

Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Fishing effort:	In 2018, the total commercial catch was 48 t, 1 t less than the catch in each of the last two seasons. No commercial fishing for abalone north of Moore River (Zone 8 of the managed fishery) has occurred since 2011–2012 (Strain *et al.*, 2018).	
				Active licences/vessels:	26 vessels active in Roe's abalone fishery (WAFIC[5]).	
West Coast Deep Sea Crustacean Managed Fishery	✓	✓	✓	**Management area**	The West Coast Deep Sea Crustacean Managed Fishery extends north from Cape Leeuwin to the WA/NT border in water depths greater than 150 m within the AFZ.	
				Species targeted	**Fishing methods**	**Fishing depth**
				The fishery targets deepwater crustaceans. Catches were dominated by crystal crabs of which 99% of their Total Allowable Catch (TAC) was landed (How and Orme, 2020a). Crystal (snow) crab (*Chaceon albus*) Giant (king) crab (*Pseudocarcinus gigas*) Champagne (spiny) crabs (*Hypothalassia acerba*)	Baited pots, or traps, are operated in long-lines which have between 80 and 180 pots attached to a main line marked by a float at each end.	Deeper than 150 m (and mostly at depths of between 500 m – 800 m). Most of the commercial Crystal crab catch is taken in depths of 500 m – 800 m (WAFIC[6]).
				Fishing effort:	The total landings in 2018 was 168. t. Two vessels operated in the fishery in 2017, using baited pots operated in a longline formation in the shelf edge waters, mostly in depths between 500 and 800 m (How and Orme, 2020a). Fishing effort was concentrated between Fremantle and Carnarvon.	
				Active licences/vessels:	There were four active vessels in 2018 (How and Orme, 2020a).	

[5] https://www.wafic.org.au/fishery/roes-abalone-fishery/
[6] https://www.wafic.org.au/fishery/west-coast-deep-sea-crustacean-fishery/

Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
Abrolhos Islands and Mid-West Trawl Fishery			✓	**Management area**	The Abrolhos Islands and Mid-West Trawl Fishery (AIMWTMF) operates around the Abrolhos Islands within the SWMR.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Saucer scallops (*Ylistrum balloti,* formerly *Amusium balloti*)	Trawl.	Information not available, however, the species occurs at depth of around 30-60 m and therefore fishing effort would likely be at these depths (Himmelman *et al*., 2009).
				Fishing effort:	The scallop landings in the AIMWTMF were 31.0 t meat weight (154.8 t whole weight). Between 2011 and 2015, the annual pre-season surveys showed very low recruitment (1-year old), as a result of the 2011 extreme marine heatwave and subsequent poor pawning stock (Kangas *et al.*, 2020b). The fishery was closed between 2011 and 2016.	
				Active licences/vessels:	Information about licences or vessels is not available but the Department of Primary Industry and Regional Development reported 774 t of catch from this fishery in the 2019 annual report (DPIRD, 2019).	
Broome Prawn Managed Fishery	✓			**Management area**	The Broome Prawn Managed Fishery (BPMF) operates off Broome and forms part of the North Coast Prawn Fishery.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Western king prawn (*Penaeus latisulcatus*) Coral prawn	Trawl.	Trawling is generally in waters between 30 and 60 m deep, however can occur down to 100 m (DOEH, 2004).
				Fishing effort:	BPMF recorded extremely low fishing effort in 2018. Only two vessels undertook trial fishing to investigate whether the catch rates were sufficient for commercial fishing. This resulted in negligible landings of Western king prawn (Kangas *et al*., 2020a).	

Fishery	Woodside Activity Area			Description			
	Browse	NWS/S	NW Cape				
				Active licences/vessels:	Two vessels conducting fishing trial operated in 2018 (Kangas *et al*., 2020a).		
Exmouth Gulf Prawn Managed Fishery			✓	**Management area**	The estimated employment in the fishery in 2017 was 18 people including skippers and other crew (Kangas *et al*., 2018). The fishery occupies a total area of 4000 km², with only half of this area being trawled (Fletcher and Santoro, 2015).		
				Species targeted		**Fishing methods**	**Fishing depth**
				Western king prawn (*Penaeus latisulcatus*) Brown tiger prawn (*Penaeus esculentus*) Blue endeavour prawn (*Metapenaeus endeavouri*) Banana prawn (*Penaeus merguinensis*)		Trawl.	Information not available.
				Fishing effort:	The total landings of prawns in 2018 were 880 t (Kangas *et al*., 2020a). In the 2016 season, a fishing effort of about 23,000 hours resulted in a catch of 822 t.		
				Active licences/vessels:	The precise number of vessels is unreported. Eighteen people were said to be employed in this fishery in 2018 (Kangas *et al.*, 2019); however, in 2013 it was reported that 18 skippers as well as other crew and support staff were employed (WAFIC[7]).		
Gascoyne Demersal Scalefish Managed Fishery			✓	**Management area**	The Gascoyne Demersal Scalefish Fishery (GDSF) is located between the southern Ningaloo Coast to south of Shark Bay (23°07.30'S to 26°.30'S) with a closure area at Point Maud to Tantabiddi (21°56.30'S) (WAFIC[8]).		
				Species targeted		**Fishing methods**	**Fishing depth**

[7] https://www.wafic.org.au/fishery/exmouth-gulf-prawn-fishery/
[8] https://www.wafic.org.au/fishery/gascoyne-demersal-scalefish-fishery/

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
				Pink snapper (*Chrysophrys auratus*) Goldband snapper (*Pristipomoides multidens*) Red emperor (*Lutjanus sebae*) Cods (*Gadus morhua*) Emperors (*Lethrinus miniatus)*	Mechanised handlines.	Information not available.
				Fishing effort:	The GDSF reported a total commercial catch of 210 t in 2017-18.	
				Active licences/vessels:	In 2018, 13 vessels fished during the season, in the 2017 season there were 16 vessels (Gaughan and Santoro, 2018).	
Kimberley Developing Mud Crab Fishery	✓			**Management area**	The Kimberley Developing Mud Crab Fishery is one of two small trap-based crab fisheries that exist in the North Coast Bioregion between Cambridge Gulf and Broome (Gaughan and Santoro, 2018).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Brown mud crab (*Scylla olivacea*) Green mud crab (*Scylla serrata*)	Trap.	Information not available.
				Fishing effort:	The catch landed represents all commercially caught mud crabs landed in WA for 2018. A nominal catch rate of 0.66 kg/traplift was recorded for 2018, which is a 28% decrease from 2017 but remains above the harvest strategy threshold (Johnston *et al*., 2020).	
				Active licences/vessels:	There are currently three licences issued to commercial operators (600 trap limit), and three exemptions issued to Indigenous groups (total of 210 traps currently allocated of a maximum 600 traps) (Johnston *et al*., 2020).	
Nickol Bay Prawn Managed Fishery		✓		**Management area**	The Nickol Bay Prawn Managed Fishery operates in nearshore and offshore waters of the Pilbara region along the NWS.	
				Species targeted	**Fishing methods**	**Fishing depth**

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
				Banana prawn (*Penaeus merguiensis*) Western king prawn (*Penaeus latisulcatus*) Brown tiger prawn (*Penaeus esculentus*) Blue endeavour prawn (*Metapenaeus endeavouri*)	Trawl.	Information not available.
				Fishing effort:	Trawling has been reported to occur at several locations along the Pilbara coast to the east of the Burrup Peninsula, including within the waters of Nickol Bay (Fletcher and Santoro, 2015). The total landings for the 2018 season were 81 t. Fishing effort was less than half at 138 days, compared to 281 boat days in 2017 (Kangas *et al*., 2020a).	
				Active licences/vessels:	The precise number of vessels is unreported, though low effort produced a catch of 17 t in 2016 (Kangas *et al.*, 2018).	
Northern Demersal Scalefish Managed Fishery	✓			**Management area**	The fishery is divided into two fishing areas: an inshore sector (Area 1) and an offshore sector (Area 2) (Newman *et al.*, 2018). Area 1 permits line fishing only, between the high water mark and the 30 m isobath. Area 2 permits handline, dropline and fish trap fishing methods and is further divided into zones. Zone A is an inshore area, Zone B comprises the area with most historical fishing activity, and Zone C is an offshore deep slope area representing waters deeper than 200 m (Fletcher *et al.*, 2017).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Goldband snapper (*Pristipomoides multidens*) Blue-spotted emperor (*Lethrinus punctulantus*) Red emperor (*Lutjanus sebae*) Rankin cod (*Epinephelus multinotatus*)	Line fishing, handline, dropline and fish trap fishing.	Information not available.

Fishery	Woodside Activity Area			Description		
	Browse	NWS/S	NW Cape			
				Fishing effort:	In 2018, the fishery reported a total catch of 1297 t. Most of the catch is landed from Zone B, with a catch of 1106 t in 2018. The level of catch in Zone B is the highest reported since zoning was implemented in 2006 (Newman *et al.*, 2019).	
				Active licences/vessels:	Six vessels fished in the 2018 season and at least 20 people were directly employed (Gaughan and Santoro, 2018).	
Octopus Interim Management Fishery				**Management area**	The developing Octopus Fishery operates from Kalbarri Cliffs in the north to Esperance in the south.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Octopus sp. cf. tetricus	Passive shelter pots and active traps.	In inshore waters to a depth of 70 m (DPIRD, 2018).
				Fishing effort:	In 2019, the total commercial octopus catch was 314 t, which was 22% higher than the 2017 catch of 257 t. In 2016, about 200 vessels reported a total catch of 252 t (Hart *et al.*, 2020c).	
				Active licences/vessels:	About 21 vessels fish within the octopus specific fisheries, and about 200 vessels from the West Coast Rock Lobster Fishery catch octopus as bycatch (Gaughan and Santoro, 2018).	
Shark Bay Beach Seine and Mesh Net Managed Fishery				**Management area**	The Shark Bay Beach Seine and Mesh Net Managed Fishery operates from Denham.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Whiting (yellowfin *Sillago schomburgkii* and goldenline *S. analis*) Sea mullet (*Mugil cephalus*) Tailor (*Pomatomus saltatrix*) Western yellowfin bream (*Acanthopagrus australis*)	Beach seine and mesh net.	Information not available.

Fishery	Woodside Activity Area			Description			
	Browse	NWS/S	NW Cape				
				Fishing effort:	In 2018, the total catch was 176 t (Gaughan and Santoro, 2020). The fishery currently employs about 14 fishers based on the seven fishery licences in operation (WAFIC[9]).		
				Active licences/vessels:	Six vessels operated employing around 12 fishers (Gaughan and Santoro, 2018).		
Shark Bay Crab Managed Fishery				**Management area**	The Shark Bay Crab Managed Fishery operates within the NWMR.		
				Species targeted		**Fishing methods**	**Fishing depth**
				Blue swimmer crab (*Portunus armatus*)		Trap and trawl.	Information not available.
				Fishing effort:	Commercial fishing for blue swimmer crabs in Shark Bay was voluntarily halted by industry in 2012 to facilitate stock rebuilding. The stock is still in a recovery phase; however, the fishery has resumed and reported a total commercial catch of 518 t in the 2017/18 season. The average commercial trap catch rate was 1.5 kg/traplift during 2017/18 (Chandrapavan *et al.*, 2017).		
				Active licences/vessels:	The precise number of vessels in the Shark Bay Blue Swimmer Crab Fishery is unreported. There are five crab trap permits. These permits are consolidated onto three active vessels (WAFIC[10]).		
Shark Bay Prawn and Scallop Managed Fishery				**Management area**	The Shark Bay Prawn Managed Fishery is the highest producing WA fishery for prawns.		
				Species targeted		**Fishing methods**	**Fishing depth**
				Western king prawn (*Penaeus latisulcatus*) Brown tiger prawn (*Penaeus esculentus*)		Low-opening otter trawls.	Information not available.

[9] https://www.wafic.org.au/fishery/inner-shark-bay-scalefish-fishery/
[10] https://www.wafic.org.au/fishery/shark-bay-prawn-and-scallop-managed-fisheries/

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
				Endeavour prawns (*Metapenaeus endeavouri*) Coral prawns (*Metapenaeopsis sp.*) Saucer scallop (*Amusium balloti*)		
				Fishing effort:	The Shark Bay Scallop Managed Fishery is currently in a recovery phase due to the results from the pre-season survey of stock abundance (Fletcher and Santoro, 2015; Kangas *et al.*, 2018).	
				Active licences/vessels:	The precise number of vessels in the Shark Bay Prawn Managed Fishery is unreported; however, about 100 people are employed in this fishery (Gaughan and Santoro, 2018). About 20 skippers and crew are employed in scallop fishing in the Shark Bay and South Coast fisheries across 18 vessels in 2015 (Sporer *et al.*, 2015).	
South Coast Crustacean Managed Fishery	-	-	-	**Management area**	The South Coast Crustacean Managed Fishery comprises four fisheries: the Windy Harbour/Augusta Rock Lobster Managed Fishery, the Esperance Rock Lobster Managed Fishery, the Southern Rock Lobster Pot Regulation Fishery and the South Coast Deep-Sea Crab Fishery.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Southern rock lobster (*Jasus edwardsii*) Western rock lobster (*Panulirus cygnus*) Giant crab (*Pseudocarcinus gigas*) Crystal crab (*Chaceon albus*) Champagne crab (*Hypothalassia acerba*)	Pots.	Information not available.
				Fishing effort:	The South Coast Crustacean Managed Fishery reported a total catch of 101.2 t in 2018 season and the value of the fishery for 2017/2018 was about $5.9 million (Howe and Orme, 2020b).	
				Active licences/vessels:	The number of vessels is unknown; however, a total of 1977 pots are licensed to be used.	
	-	-	-	**Management area**	The fishery is active in coastal waters between Cape Leeuwin and the South Australia border. Landings are primarily at Albany, Bremer Bay and Esperance (Norriss and Blazeski, 2020).	

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
South Coast Purse Seine Managed Fishery				**Species targeted**	**Fishing methods**	**Fishing depth**
				Small pelagic finfish such as pilchards and yellowtail scad using purse seine nets from vessels. Sandy sprat (*Hyperlophus vittatus*) Blue sprat (*Spratelloides robustus*)	Purse seine.	Information not available.
				Fishing effort:	In the 2017/18 season the total catch effort was 2,168 t (Norriss and Blazeski, 2020).	
				Active licences/vessels:	Nine active vessels in 2017/18 (Norriss and Blazeski, 2020).	
South-west Trawl Managed Fishery	-	-	-	**Management area**	The South-west Trawl Managed Fishery is a multi-species fishery and includes two of WA's smaller scallop fishing grounds at Fremantle and north of Geographe Bay (Fairclough and Walters, 2018).	
				Species targeted	**Fishing methods**	**Fishing depth**
				Scallops (*Ylistrum balloti,* formerly *Amusium balloti*) and associated by-products Western king prawn (*Penaeus latisulcatus*) In years of low scallop catches licencees may use other trawl gear to target fin-fish species.	Trawl.	Information not available.
				Fishing effort:	Effort in the fishery is highly variable and typically fluctuates in response to recruitment variability in saucer scallops and prawns. The fishery was not active in 2015 or 2016 (Fairclough and Walters, 2018).	
				Active licences/vessels:	Only one boat fished in 2018 for a total of 5 boat days for minimal catch (Fairclough and Walters, 2018).	

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th colspan="4" rowspan="2">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="5">The South Coast Salmon Managed Fishery</td><td rowspan="5">-</td><td rowspan="5">-</td><td rowspan="5">-</td><td>Management area</td><td colspan="3">The South Coast Salmon Managed Fishery is one of two fisheries operating in the South Coast Bioregion that target nearshore and estuarine finfish.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Western Australian salmon (Arripis truttaceus)
Southern school whiting (Sillago bassensis)
Australian herring (Arripis georgianus)
King George whiting (Sillaginodes punctatus)
Sea mullet (Mugil cephalus)
Estuary cobbler (Cnidoglanis macrocephalus)
Black bream (Acanthopagrus butcheri)</td><td>Beach seines, haul nets and gill nets.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">The total catch for 2018 was 243 t (Duffy and Blay, 2020b).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="3">Number of vessels is unknown; however, 12 commercial fishers were employed in 2018 (Duffy and Blay, 2020b).</td></tr>
<tr><td rowspan="4">West Coast Beach Bait Managed Fishery</td><td rowspan="4">-</td><td rowspan="4">-</td><td rowspan="4">-</td><td>Management area</td><td colspan="3">Primarily active in the Bunbury areas in the SWMR.</td></tr>
<tr><td colspan="2">Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td colspan="2">Whitebait</td><td>Beach-based haul nets.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="3">In recent years the fishery is primarily active in the Bunbury area. Total catch of whitebait in 2015 was 40.2 t (Duffy and Blay, 2020c).</td></tr>
</table>

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th colspan="3" rowspan="2">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Active licences/vessels:</td><td colspan="2">Number of vessels is unknown; however, only one license was issued (DPIRD, 2019).</td></tr>
<tr><td rowspan="5">West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery</td><td rowspan="5">-</td><td rowspan="5">-</td><td rowspan="5">-</td><td>Management area</td><td colspan="2">The West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WCDGDLF) is part of the Temperate Demersal Gillnet and Demersal Longline Fishery (TDGDLF), which operates between 26° and 33° S, and the Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (JASDGDLF), which operates from 33° S to the WA/SA border (Braccini and Blay, 2020).</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Gummy shark (Mustelus antarcticus)
Dusky shark (Carcharhinus obscurus)
Whiskery shark (Furgaleus macki)
Sandbar shark (C. plumbeus)</td><td>Gillnet and longline.</td><td>Information not available.</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">Catch estimated annual value of the fishery was $0.2 million for 2017 to 2018 (Braccini and Blay, 2020).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">Vessel numbers are unknown; however, 17 interim managed fishery permits were held in 2019 (DPIRD, 2019) and between 18 and 21 skippers and crew were employed between 2016 and 2017.</td></tr>
<tr><td rowspan="3">West Coast Demersal Scalefish Fishery</td><td rowspan="3">-</td><td rowspan="3">-</td><td rowspan="3">-</td><td>Management area</td><td colspan="2">These fisheries include the West Coast Demersal Scalefish (Interim) Managed Fishery (51 boats), the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery and the temperate Demersal Gillnet and Demersal Longline Fisheries. The West Coast Demersal Scalefish Managed Fishery is the main commercial fishery that targets demersal species in the West Coast Bioregion. It encompasses the waters from just south of Shark Bay down to just east of Augusta and extends seaward to the 200 nm boundary. The fishery is divided into four inshore management areas and one offshore management area.</td></tr>
<tr><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Baldchin groper (Choerodon rubescens)
Dhufish (Glaucosoma hebraicum)
Pink snapper (Pagrus auratus)</td><td>Lines.</td><td>Inshore species – 20 to 250 m water depth.</td></tr>
</table>

Fishery	Woodside Activity Area: Browse	Woodside Activity Area: NWS/S	Woodside Activity Area: NW Cape	Description		
						Offshore species – more than 250 m water depth.
				Fishing effort:	In 2016, the West Coast Demersal Scalefish (interim) Managed Fishery reported a total catch of 256 t.	
				Active licences/vessels:	The precise number of vessels in the West Coast Demersal Scalefish Fisheries is unreported; however, it is restricted to 60 interim managed fishery permit holders.	
West Coast Purse Seine Managed Fishery	-	-	-	**Management area**	Located in waters from Cape Bouvard extending to Lancelin.	
				Species targeted	**Fishing methods**	**Fishing depth**
				Small pelagic finfish such as: Scaly mackerel (*Sardinella lemuru*) Pilchards (*Sardinops sagax*) Australian anchovy (*Engraulis australis*) Yellowtail scad (*Trachurus novaezelandiae*) Maray (*Etrumeus teres*)	Purse seine.	Information not available.
				Fishing effort:	Information not available	
				Active licences/vessels:	Seven vessels in 2017 (Gaughan and Santoro, 2018).	
West Coast Rock Lobster Managed Fishery			✓	**Management area**	The West Coast Rock Lobster Fishery operates from Shark Bay south to Cape Leeuwin. The fishery is managed using zones, seasons and total allowable catch. The recreational fishery targets the western rock lobsters using baited pots and by diving between North-west Cape and Augusta.	

<table>
<tr><th rowspan="2">Fishery</th><th colspan="3">Woodside Activity Area</th><th colspan="3" rowspan="2">Description</th></tr>
<tr><th>Browse</th><th>NWS/S</th><th>NW Cape</th></tr>
<tr><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td rowspan="4"></td><td>Species targeted</td><td>Fishing methods</td><td>Fishing depth</td></tr>
<tr><td>Western rock lobster (Panulirus cygnus)</td><td>Baited pots.</td><td>Less than 20 m.</td></tr>
<tr><td>Fishing effort:</td><td colspan="2">In 2018, 234 vessels reported a total catch of 6400 t in 2017 (de Lestang et al., 2018). In 2016, 226 vessels reported a total catch of 6,086 t (Gaughan and Santoro, 2018).</td></tr>
<tr><td>Active licences/vessels:</td><td colspan="2">234 vessels operated in 2017 and 233 vessels operated in 2018 (Gaughan and Santoro, 2018).</td></tr>
</table>

11.5.2 Aquaculture

Aquaculture operations in the northwest are typically restricted to inland and shallow coastal waters.

West Coast Bioregion

Aquaculture activities in the West Coast bioregion, defined by the Department of Primary Industries and Regional Development (DPIRD) (as the government body responsible management of primary industries in WA) are focused on blue mussels and edible oysters (mainly in Cockburn Sound) and marine algae for production of beta-carotene, used as a food additive and as a nutritional supplement. Offshore marine finfish production is also being developed, initially focusing on yellowtail kingfish.

There is also an emerging black pearl industry (from the *Pinctada margaritifera* oyster) in the Abrolhos Islands. As well as expansion in the production of Akoya pearls (small white pearls from *Pinctada fucata martensi*), *Pinctada albina* (small, yellow pearls) and *Pteria penguin*, which are often used to produce half (mabe) pearls in pink and bluish shades.

Aquaculture licences for producing coral and live rock (pieces of old coral reefs colonised by marine life, such as beneficial bacteria, for aquariums) at the Abrolhos Islands have also been issued and other applications are being assessed.

Gascoyne Coast Bioregion

In the Gascoyne Coast bioregion, aquaculture activities are focused on the blacklip oyster (*Pinctada margaritifera*) and Akoya pearl oyster (*Pinctada imbricata*) (Gaughan and Santoro, 2020). Several hatcheries supply *P. margaritifera* juveniles to the region's developing black pearl farms.

Other aquaculture developments in the Gascoyne Coast bioregion include emerging producers of coral and live rock species for aquariums.

North Coast Bioregion

Aquaculture activities in the North Coast bioregion is dominated by the production of pearls. A large number of pearl oysters for seeding are obtained from wild stocks and supplemented by hatchery produced oysters, with major hatcheries operating at Broome and around the Dampier Peninsula (Gaughan and Santoro, 2018). Primary spawning of the pearl oyster occurs from mid-October to December. A smaller secondary spawning occurs in February and March (Gaughan and Santoro, 2020).

Other aquaculture developments in the North Coast include emerging producers of coral and live rock species for aquariums as well as barramundi (*Lates calcarifer)* farms and microalgae culturing for Omega-3, biofuels and protein biomass (Gaughan and Santoro, 2020).

11.6 Fisheries – Traditional

Traditional or customary fisheries are typically restricted to shallow coastal waters and/or areas with structures such as reef.

Dugong, fish and marine turtles that move between coastal and Commonwealth waters are important components of the Aboriginal people's culture and diet. Aboriginal people continue to actively manage their sea country in coastal waters of WA in order to protect and manage the marine environment, its resources and cultural values.

Indonesian fishers can fish within designated areas under the Australia-Indonesia Memorandum of Understanding regarding the Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974 (MoU 74). Traditional fishing is allowed within the MoU Box (**Figure 11-1)**, which encompasses: Ashmore Reef (Pulau Pasir), Cartier Island (Pulau Baru), Seringapatam Reef (Afringan), Scott Reef (Pulau Dato) and Browse Island (Berselan). Restrictions have since been introduced around Ashmore Reef and Cartier Island following their designation as Nature Reserves under the Commonwealth's *National Parks and Wildlife Conservation Act 1975* in 1983 and 2000, respectively.

The MoU allows Indonesian fishers to fish in designated areas using traditional methods only. These methods include reef gleaning, free-diving, hand lining and other non-mechanised methods. Scott Reef is currently the principal reef in the MoU 74 Box and is utilised seasonally by Indonesian fishers to harvest trepang, trochus shells and other reef species. The peak season is July to October due to more favourable wind conditions, and to allow fishers to sun dry their catch on their boat decks (ERM, 2009). Browse Island is also frequently visited by shark fishers who mostly fish along the eastern margin of the MoU 74 Box.

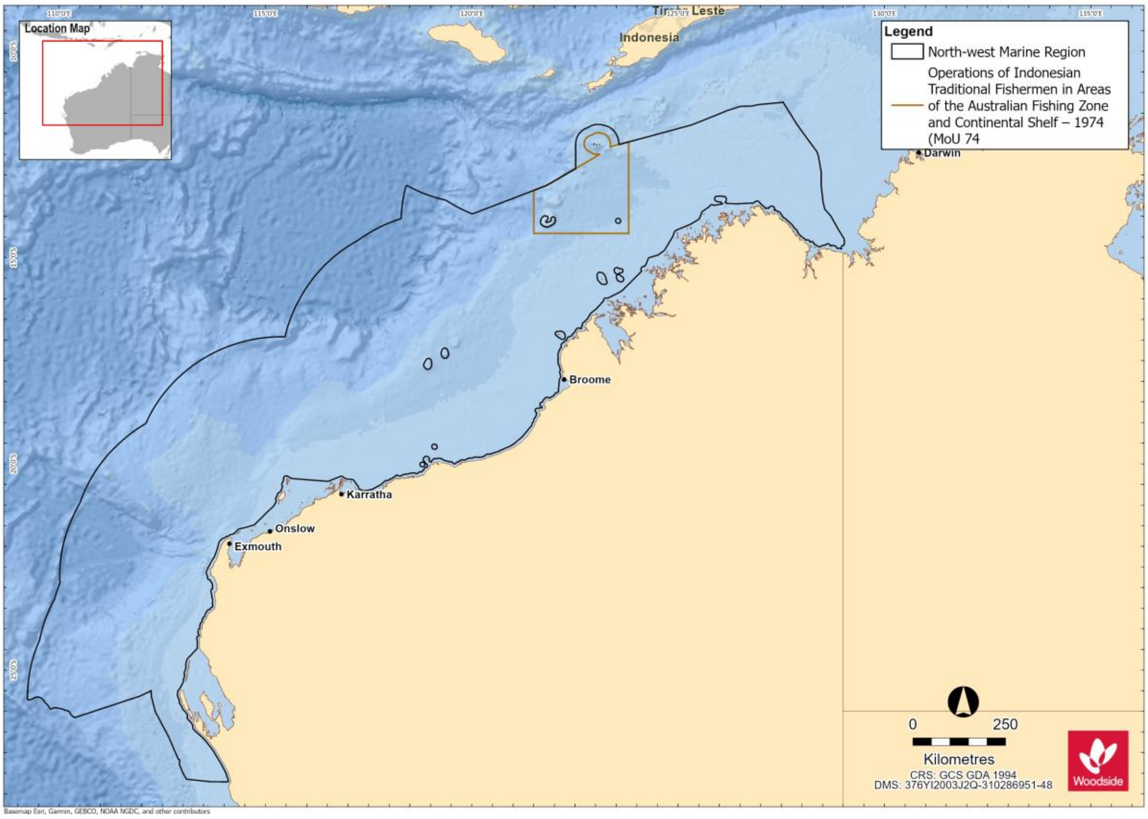


Figure 11-1 MOU 74 Box. Operations of Indonesian Traditional Fishermen in Areas of the Australian Fishing Zone and Continental Shelf – 1974

11.7 Tourism and Recreation

There are growing tourism and recreational sectors in WA. The Kimberley, Pilbara and Gascoyne regions are popular visitor destinations for Australian and international tourists. Tourism is concentrated in the vicinity of population centres including Broome, Dampier, Exmouth, Coral Bay and Shark Bay.

Recreational and tourism activities include: charter fishing, other recreational fishing, diving, snorkelling, marine fauna watching, and yachting.

11.7.1 Gascoyne Region

Outside the petroleum industry, tourism is the largest revenue earner of all the major industries of the Gascoyne region. It contributes significantly to the local economy in terms of both income and employment. In 2018 there was an average of 337,400 visitors with a visitor spend of $359 million (Gascoyne Development Commission[11]).

In 2018-19, the Ningaloo region (Ningaloo Reef and the surrounding coastal region Exmouth Gulf, communities of Exmouth and Coral Bay, and adjacent proposed southern coastal reserves and pastoral leases) contributed an estimated $110 million in value added to the WA economy (DCBA, 2020). Ningaloo's economic contribution to WA is attributed to four key types of economic activity, tourism expenditure by international, interstate and WA visitors to the Ningaloo region, commercial fishing in the Exmouth Gulf, recreation activity involving the Reef by residents of the Ningaloo region and management and research relating to the Reef (DCBA, 2020). More than 90% of this value added is attributed to the domestic and international tourists who visit Ningaloo each year (DCBA, 2020). The main marine nature-based tourist activities are concentrated around and within the Ningaloo WHA.

11.7.2 Pilbara region

Recreation and tourism activities within the Pilbara are of high social value. Tourism is a key economic driver for the Pilbara with more than 1 million visitors to the region every year, generating $413 million in gross revenue annually (Pilbara Development Commission[12]).

Recreational fishing within the Pilbara region tends to be concentrated in State waters adjacent to population centres. Recreational fishing is known to occur around the Dampier Archipelago with boats launched from boat ramps around Dampier and Karratha (Williamson *et al.*, 2006). Once at sea, charter vessels may also frequent the waters surrounding the Montebello Islands.

11.7.3 Kimberley Region

Recreation and tourism activities in the Kimberley region occur predominantly in WA State waters (extending offshore 3 nm from the mainland), adjacent to coastal population centres (e.g. Broome), with a peak in activity during the winter months (dry season). These activities include recreational fishing, diving, snorkelling, wildlife watching and boating.

Primary dive locations in the Kimberley region include the Rowley Shoals, including Mermaid Reef AMP, Scott Reef, Seringapatam Reef, Ashmore Reef AMP and Cartier Island.

11.8 Shipping

Commercial shipping traffic is high within the NWMR with vessel activities including commercial fisheries, tourism such as cruises, international shipping and oil and gas operations. There are 12 ports adjacent to the NWMR, including the major ports of Dampier, Port Hedland and Broome, which are operated by their respective port authorities. These ports handle large tonnages of iron ore and petroleum exports in addition to salt, manganese, feldspar chromite and copper (DEWHA, 2008).

Heavy vessel traffic exists within the Pilbara Port Authority management area which recorded 10,064 vessel movements in Port of Dampier 2019/20 annual reporting period (PPA, 2020). Twenty-six designated anchorages for bulk carriers, petroleum and gas tankers, drilling rigs, offshore platforms, and pipelay vessels are located offshore of Rosemary Island.

In 2012, AMSA established a network of shipping fairways off the northwest coast of Australia. The shipping fairways, while not mandatory, aim to reduce the risk of collision between transiting vessels and offshore infrastructure. The fairways are intended to direct large vessels such as bulk carriers and LNG ships trading to the major ports into pre-defined routes to keep them clear of existing and planned offshore infrastructure (AMSA, 2013).

[11] https://www.gdc.wa.gov.au/industry-profiles/tourism/
[12] https://www.pdc.wa.gov.au/our-focus/strategicinitiatives/tourism

11.9 Oil and Gas Infrastructure

The NWMR supports a number of industries including petroleum exploration and production.

Within the NWMR there are seven sedimentary petroleum basins: Northern and Southern Carnarvon basins, Perth, Browse, Roebuck, Offshore Canning and Bonaparte basins. Of these, the Northern Carnarvon, Browse and Bonaparte basins hold large quantities of gas and comprise most of Australia's reserves of natural gas (DEWHA, 2008), which is reflected by the level of development in the area. In addition to existing facilities, there are proposed developments in the region. This includes proposals to develop gas and condensate from a number of fields within the NWMR.

In addition to the oil and gas industry, other land-based industries depend upon the marine environment in the nearshore area. These include ports, salt mines such as Karratha and Onslow, LNG onshore processing facilities such as Burrup Hub, Thevenard Island, Barrow Island, Varanus Island, and small-scale desalination plants at Barrow Island, Burrup, Cape Preston, and Onslow.

11.10 Defence

Key Australian Department of Defence (DoD) operational areas and facilities areas of the NWMR for training and operational activities, include:

- An operating logistics base has been established in Dampier to support vessels patrolling the waters around offshore oil and gas facilities. A dedicated navy administrative support facility is also being constructed at the nearby township of Karratha.
- The Royal Australian Air Force currently maintains two 'bare bases' in remote areas of WA that are used for military exercises. One of these is the Royal Australian Air Force Base in Learmonth. The Royal Australian Air Force maintains the Commonwealth Heritage listed Learmonth Air Weapons Range Facility, which is located between Ningaloo Station and the Cape Range National Park. The air training area associated with the Learmonth base extends over the offshore region.
- The Royal Australian Air Force Base Curtin is located on the north coast of WA, south-east of Derby and 170 km east of Broome. It provides support for land, air and sea operations aimed to support Australia's northern approaches.
- The Naval Communications Station Harold E. Holt is located ~6 km north of Exmouth. The main role of the station is to communicate at very low frequencies (19.8 kHz) with Australian and United States submarines and ships in the eastern Indian Ocean and the western Pacific Ocean.

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APPENDIX A. PROTECTED MATTER SEARCH REPORTS FOR NWMR, SWMR AND NMR

Australian Government

Department of Agriculture, Water and the Environment

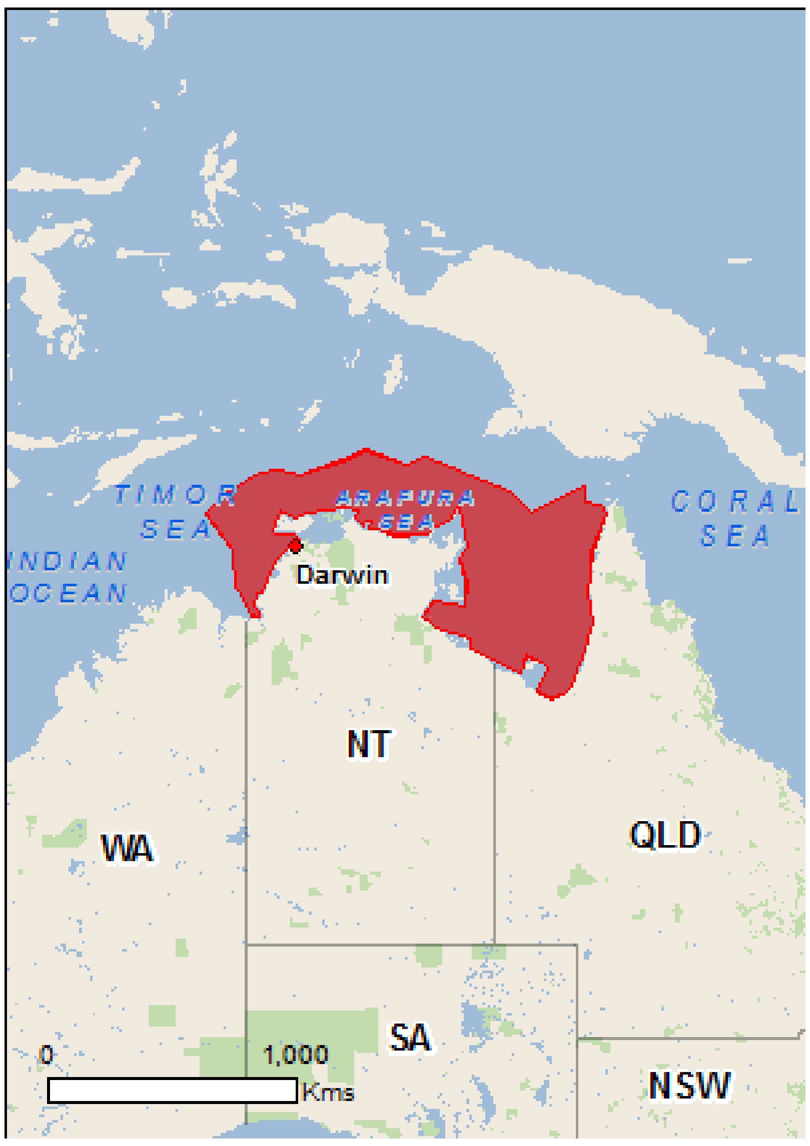
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

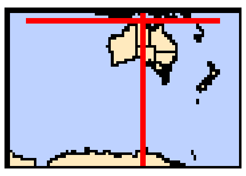
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/05/21 12:59:15



Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	33
Listed Migratory Species:	70

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	127
Whales and Other Cetaceans:	25
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	15

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Regional Forest Agreements:	None
Invasive Species:	1
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	8

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris		
Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus		
Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae		
Gouldian Finch [413]	Endangered	Species or species habitat may occur within area
Falcunculus frontatus whitei		
Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri		
Nunivak Bar-tailed Godwit, Western Alaskan Bar-	Vulnerable	Species or species

Name	Status	Type of Presence
tailed Godwit [86380]		habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Notomys aquilo Northern Hopping-mouse, Woorrentinta [123]	Endangered	Species or species habitat may occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Cryptoblepharus gurrmul Arafura Snake-eyed Skink [83106]	Endangered	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Congregation or aggregation known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat known to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species

[Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Congregation or aggregation known to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding likely to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
[Tringa nebularia](#) Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
[Tringa stagnatilis](#) Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
[Xenus cinereus](#) Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Foraging, feeding or related behaviour known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Stiltia isabella Australian Pratincole [818]		Species or species habitat known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area
Fish		

Name	Threatened	Type of Presence
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys ocellatus Orange-spotted Pipefish, Ocellated Pipefish [66203]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Cosmocampus maxweberi Maxweber's Pipefish [66209]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus macrorhynchus Whiskered Pipefish, Ornate Pipefish [66222]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys heptagonus Madura Pipefish, Reticulated Freshwater Pipefish [66229]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippichthys spicifer Belly-barred Pipefish, Banded Freshwater Pipefish [66232]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Hippocampus zebra Zebra Seahorse [66241]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Micrognathus brevirostris thorntail Pipefish, Thorn-tailed Pipefish [66254]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Microphis brachyurus Short-tail Pipefish, Short-tailed River Pipefish [66257]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Congregation or aggregation known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis caerulescens Dwarf Seasnake [1103]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis gracilis Slender Seasnake [1106]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis melanosoma Black-banded Robust Seasnake [1109]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Hydrophis vorisi a seasnake [25927]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Laticauda colubrina a sea krait [1092]		Species or species habitat may occur within area
Laticauda laticaudata a sea krait [1093]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area

Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Arafura	Multiple Use Zone (IUCN VI)
Arafura	Special Purpose Zone (Trawl) (IUCN VI)
Arnhem	Special Purpose Zone (IUCN VI)
Gulf of Carpentaria	National Park Zone (IUCN II)
Gulf of Carpentaria	Special Purpose Zone (Trawl) (IUCN VI)
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)

Name	Label
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Limmen	Habitat Protection Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)
Wessel	Habitat Protection Zone (IUCN IV)
Wessel	Special Purpose Zone (Trawl) (IUCN VI)
West Cape York	Habitat Protection Zone (IUCN IV)
West Cape York	National Park Zone (IUCN II)
West Cape York	Special Purpose Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Anindilyakwa	NT
Marthakal	NT

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Plants		
Andropogon gayanus		
Gamba Grass [66895]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Southern Gulf Aggregation	QLD

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Van	North
Gulf of Carpentaria basin	North
Gulf of Carpentaria coastal zone	North
Pinnacles of the Bonaparte Basin	North
Plateaux and saddle north-west of the Wellesley	North
Shelf break and slope of the Arafura Shelf	North
Submerged coral reefs of the Gulf of Carpentaria	North
Tributary Canyons of the Arafura Depression	North

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-14.758882 129.178077,-13.960657 128.826514,-13.768665 128.606788,-12.484784 128.496924,-11.183724 127.563087,-10.460737 128.233253,-9.746889 129.518653,-9.660256 130.254737,-9.779371 130.935889,-9.280976 132.528907,-8.901286 133.385841,-9.411062 134.858008,-9.129149 135.473243,-10.363488 138.582374,-11.129831 139.395362,-10.190527 141.339942,-10.806262 141.317969,-10.817053 141.922217,-11.10827 142.087012,-12.527687 141.559669,-13.330764 141.515723,-13.960657 141.40586,-15.045535 141.570655,-15.945419 141.317969,-17.22994 140.823585,-17.513041 140.53794,-17.659661 140.032569,-17.429205 139.593116,-16.630864 139.966651,-16.409675 139.812842,-16.177683 139.208594,-16.820251 138.966895,-15.924291 137.165137,-15.575354 137.132178,-15.458909 136.934424,-15.289418 136.11045,-14.822615 135.45127,-14.269641 135.846778,-14.418655 136.97837,-13.608551 137.011329,-12.784952 136.780616,-12.388227 137.055274,-10.957305 136.76963,-10.957305 136.703712,-11.399198 136.407081,-11.679068 135.824805,-11.904912 135.616065,-11.947909 134.473487,-11.679068 133.869239,-11.700585 133.50669,-11.431505 133.528663,-11.442273 133.363868,-11.64679 133.254005,-11.313028 132.979346,-11.04358 133.067237,-10.90337 132.583839,-11.151389 131.221534,-11.3238 130.782081,-11.054363 130.287696,-11.474575 130.111915,-11.765126 129.958106,-11.947909 130.067969,-11.894162 130.760108,-12.119827 130.913917,-12.441874 130.474464,-12.870649 130.100928,-13.939333 129.584571,-13.971319 129.419776,-14.47185 129.28794,-14.631358 129.507667,-14.843856 129.452735,-14.769505 129.178077,-14.758882 129.178077

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Australian Government

Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

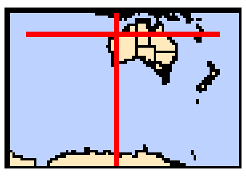
This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/05/21 13:07:00

Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	2
National Heritage Places:	5
Wetlands of International Importance:	2
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	1
Listed Threatened Species:	70
Listed Migratory Species:	84

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	1
Listed Marine Species:	149
Whales and Other Cetaceans:	34
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	17

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	23
Nationally Important Wetlands:	3
Key Ecological Features (Marine)	5

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Shark Bay, Western Australia	WA	Declared property
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place
The West Kimberley	WA	Listed place
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place
Historic		
Dirk Hartog Landing Site 1616 - Cape Inscription Area	WA	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Eighty-mile beach	Within Ramsar site
Ord river floodplain	Within 10km of Ramsar

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species

Name	Status	Type of Presence
		habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Falcunculus frontatus whitei Crested Shrike-tit (northern), Northern Shrike-tit [26013]	Vulnerable	Species or species habitat likely to occur within area
Geophaps smithii blaauwi Partridge Pigeon (western) [66501]	Vulnerable	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Malurus leucopterus leucopterus White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren [26004]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat likely to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat likely to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat may occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Isoodon auratus auratus Golden Bandicoot (mainland) [66665]	Vulnerable	Species or species habitat likely to occur within area
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Translocated population known to occur within area
Leporillus conditor Wopilkara, Greater Stick-nest Rat [137]	Vulnerable	Translocated population known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area
Perameles bougainville bougainville Western Barred Bandicoot (Shark Bay) [66631]	Endangered	Translocated population known to occur within area
Petrogale concinna monastria Nabarlek (Kimberley) [87607]	Endangered	Species or species habitat known to occur within area
Phascogale tapoatafa kimberleyensis Kimberley brush-tailed phascogale, Brush-tailed Phascogale (Kimberley) [88453]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Lerista nevinae Nevin's Slider [85296]	Endangered	Species or species habitat known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Foraging, feeding or related behaviour likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur

Name	Threatened	Type of Presence
		within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Foraging, feeding or related behaviour known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Foraging, feeding or related behaviour likely to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding likely to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Species or species habitat known to occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Species or species habitat may occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species

Name	Status	Type of Presence
		habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Abrolhos	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	Special Purpose Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Kimberley	Multiple Use Zone (IUCN VI)
Ningaloo	Recreational Use Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Roebuck	Multiple Use Zone (IUCN VI)
Shark Bay	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bardi Jawi	WA
Dambimangari	WA
Dambimangari	WA
Dirk Hartog Island	WA
Faure Island	WA
Little Rocky Island	WA
Tent Island	WA
Unnamed WA36913	WA
Unnamed WA36915	WA
Uunguu	WA

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat may occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Jatropha gossypifolia		
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat may occur within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Tamarix aphylla		
Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Exmouth Gulf East	WA
Hamelin Pool	WA
Shark Bay East	WA

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Sahul	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Pinnacles of the Bonaparte Basin	North-west
Wallaby Saddle	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-11.269933 127.440005,-12.516962 128.274966,-13.416271 128.362857,-13.854015 128.406802,-14.652617 128.879214,-14.833236 128.956119,-14.737633 128.439761,-14.280288 127.769595,-13.864681 127.385074,-13.864681 127.143375,-13.67261 126.934634,-13.875347 126.418277,-13.843348 126.242496,-13.896678 125.967837,-14.077907 125.934878,-14.34416 125.836001,-14.216398 125.649234,-14.461212 125.099918,-14.641988 125.044986,-14.88633 125.143863,-14.971254 124.990054,-15.257624 124.649478,-15.268222 124.231998,-15.416549 124.16608,-15.490673 124.407779,-16.293713 124.286929,-16.072142 123.616763,-16.219884 123.429996,-16.567693 123.408023,-16.778181 123.561832,-16.914874 123.704654,-17.114478 123.397037,-16.546631 123.034488,-16.251529 123.078433,-16.704537 122.540103,-17.135476 122.144595,-17.502564 122.056705,-18.244939 122.078677,-18.432649 121.738101,-18.76585 121.551334,-19.45099 121.100894,-19.999097 119.584781,-19.906155 119.101382,-20.236365 118.727847,-20.308506 118.112613,-20.648142 117.321597,-20.555589 116.948062,-20.360014 117.01398,-20.318809 116.816226,-20.802273 116.26691,-20.822812 116.113101,-21.468342 115.377017,-21.754335 114.629947,-22.344932 114.355289,-22.202601 114.146548,-21.67268 114.245425,-21.886924 113.849918,-22.669716 113.586246,-23.003846 113.751041,-23.458145 113.696109,-24.031352 113.300601,-24.51208 113.311587,-25.893759 114.135562,-26.258875 114.003726,-25.953045 113.926822,-25.398562 113.45441,-25.686027 113.366519,-26.249022 113.641177,-26.229314 113.509341,-25.378711 112.949039,-25.557248 112.839175,-26.485263 113.256656,-27.161748 113.816959,-27.571531 114.036685,-27.552052 113.113834,-27.151972 112.981998,-25.368784 112.278873,-26.022173 110.389224,-25.893759 110.323306,-25.804776 109.872867,-25.537424 109.587222,-25.626608 109.23566,-24.582033 109.389468,-23.306884 109.872867,-22.882439 110.026675,-21.621623 110.169498,-20.945986 110.510074,-20.030065 110.949527,-19.025706 112.092105,-17.816621 112.981998,-17.271909 113.773013,-16.935895 115.442935,-15.681156 116.014224,-14.790751 116.89313,-14.056594 118.266421,-13.266614 118.42023,-13.949995 120.046207,-13.234532 121.825992,-12.838516 122.529117,-12.15205 122.51813,-11.883411 122.726871,-11.786636 123.067447,-11.926411 123.440982,-12.248693 123.583804,-11.63603 125.737125,-11.334573 126.539126,-11.280707 127.440005,-11.269933 127.440005

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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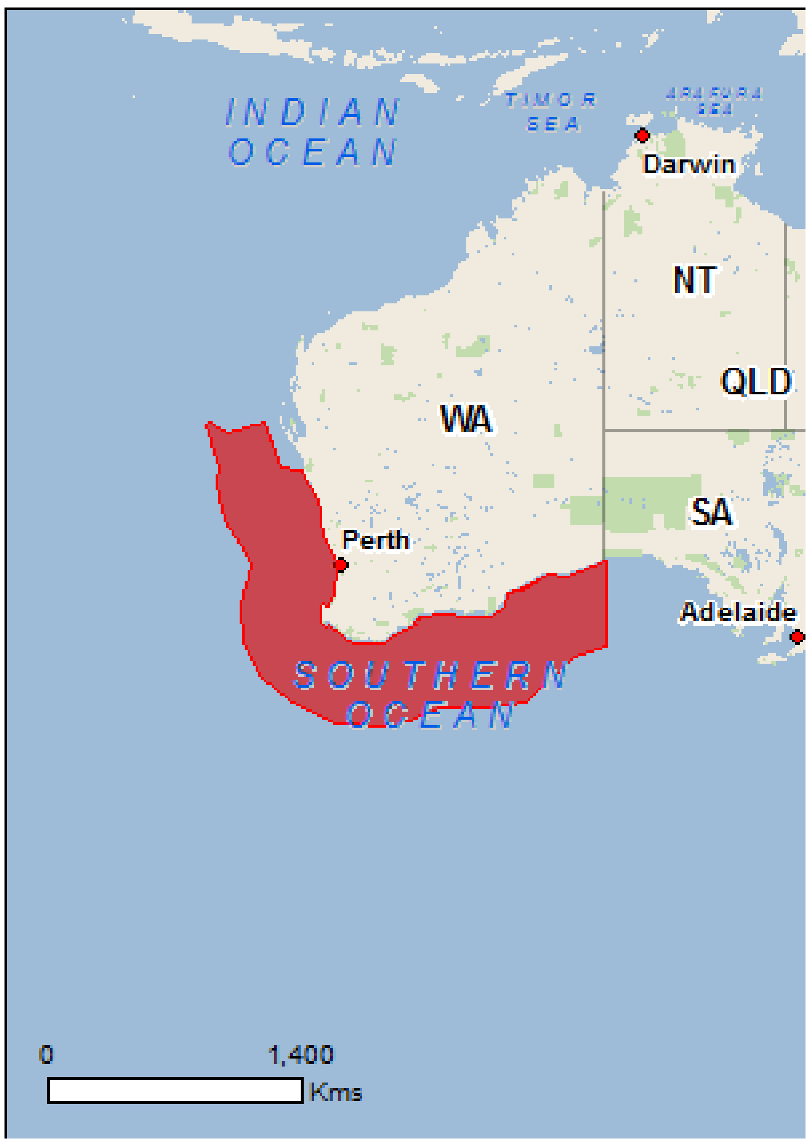
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

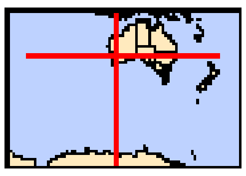
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/05/21 12:51:00



Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Importance:	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	65
Listed Migratory Species:	67

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	2
Commonwealth Heritage Places:	1
Listed Marine Species:	106
Whales and Other Cetaceans:	40
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	21

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	10
Regional Forest Agreements:	None
Invasive Species:	42
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	8

Details

Matters of National Environmental Significance

National Heritage Properties [Resource Information]

Name	State	Status
Indigenous		
Cheetup Rock Shelter	WA	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Becher point wetlands	Within 10km of Ramsar
Forrestdale and thomsons lakes	Within 10km of Ramsar
Peel-yalgorup system	Within 10km of Ramsar
Vasse-wonnerup system	Within 10km of Ramsar

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
South-west

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community may occur within area
Proteaceae Dominated Kwongkan Shrublands of the Southeast Coastal Floristic Province of Western Australia	Endangered	Community may occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops		
Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Atrichornis clamosus		
Noisy Scrub-bird, Tjimiluk [654]	Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus		
Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat likely to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Breeding known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel	Endangered	Species or species

Name	Status	Type of Presence
[1060]		habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pezoporus flaviventris Western Ground Parrot, Kyloring [84650]	Critically Endangered	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
[Dasyurus geoffroii](#) Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat may occur within area
[Eubalaena australis](#) Southern Right Whale [40]	Endangered	Breeding known to occur within area
[Megaptera novaeangliae](#) Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Neophoca cinerea](#) Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
[Parantechinus apicalis](#) Dibbler [313]	Endangered	Species or species habitat known to occur within area
[Petrogale lateralis hacketti](#) Recherche Rock-wallaby [66849]	Vulnerable	Species or species habitat known to occur within area
[Potorous gilbertii](#) Gilbert's Potoroo, Ngilkat [66642]	Critically Endangered	Translocated population known to occur within area
[Pseudocheirus occidentalis](#) Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat may occur within area
[Setonix brachyurus](#) Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Plants		
[Caladenia elegans](#) Elegant Spider-orchid [56775]	Endangered	Species or species habitat may occur within area
[Caladenia granitora](#) [65292]	Endangered	Species or species habitat may occur within area
[Caladenia hoffmanii](#) Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
[Diuris micrantha](#) Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
[Drummondita ericoides](#) Morseby Range Drummondita [9193]	Endangered	Species or species habitat likely to occur within area
[Eucalyptus insularis](#) Twin Peak Island Mallee [3057]	Endangered	Species or species habitat likely to occur within area
[Isopogon uncinatus](#) Albany Cone Bush, Hook-leaf Isopogon [20871]	Endangered	Species or species habitat likely to occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia		
Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat may occur within area
Liopholis pulchra longicauda		
Jurien Bay Skink, Jurien Bay Rock-skink [83162]	Vulnerable	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Breeding known to occur within area
Ardenna grisea		
Sooty Shearwater [82651]		Species or species habitat may occur within area
Ardenna pacifica		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris		
Short-tailed Shearwater [82652]		Breeding known to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena		
Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur

Name	Threatened	Type of Presence
		within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Garden Island	WA	Listed place

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat likely to occur within area
Calidris alba Sanderling [875]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat known to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Cereopsis novaehollandiae grisea Cape Barren Goose (south-western), Recherche Cape Barren Goose [25978]	Vulnerable	Breeding known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area

Name	Threatened	Type of Presence
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat likely to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Breeding known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Puffinus assimilis Little Shearwater [59363]		Breeding known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Breeding known to occur within area
Puffinus griseus Sooty Shearwater [1024]		Species or species habitat may occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Puffinus tenuirostris Short-tailed Shearwater [1029]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		

Name	Threatened	Type of Presence
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Reptiles		
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tasmacetus shepherdi Shepherd's Beaked Whale, Tasman Beaked Whale [55]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Abrolhos	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	Special Purpose Zone (IUCN VI)
Bremer	National Park Zone (IUCN II)
Bremer	Special Purpose Zone (Mining
Eastern Recherche	National Park Zone (IUCN II)
Eastern Recherche	Special Purpose Zone (IUCN VI)
Geographe	Habitat Protection Zone (IUCN IV)
Geographe	Multiple Use Zone (IUCN VI)
Geographe	National Park Zone (IUCN II)
Geographe	Special Purpose Zone (Mining
Great Australian Bight	Special Purpose Zone (Mining
Jurien	Special Purpose Zone (IUCN VI)
South-west Corner	Habitat Protection Zone (IUCN IV)
South-west Corner	Multiple Use Zone (IUCN VI)
South-west Corner	National Park Zone (IUCN II)
South-west Corner	Special Purpose Zone (IUCN VI)
South-west Corner	Special Purpose Zone (Mining
Twilight	National Park Zone (IUCN II)
Twilight	Special Purpose Zone (Mining
Two Rocks	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Bald Island	WA
Boullanger, Whitlock, Favourite, Tern And Osprey Islands	WA
Eclipse Island	WA
Escape Island	WA
Flinders Bay	WA
Penguin Island	WA
Recherche Archipelago	WA
St Alouarn Island	WA
Unnamed WA44682	WA
Unnamed WA48968	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 90-120m depth	South-west
Commonwealth marine environment surrounding	South-west
Commonwealth marine environment within and	South-west
Commonwealth marine environment within and	South-west
Diamantina Fracture Zone	South-west
Naturaliste Plateau	South-west
Western demersal slope and associated fish	South-west
Western rock lobster	South-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-25.765206 109.237891,-25.725623 109.501563,-25.992551 109.732276,-25.992551 109.875098,-26.071525 110.182716,-26.229314 110.325538,-25.656321 112.127296,-27.717513 112.984229,-27.814726 114.02793,-28.202708 114.159766,-28.483117 114.445411,-28.695347 114.577247,-28.974447 114.599219,-29.147305 114.818946,-29.530391 114.950782,-29.921554 114.89585,-30.746498 115.082618,-31.517621 115.533057,-31.863505 115.730811,-32.523601 115.67588,-32.634692 115.544044,-33.16049 115.620948,-33.619137 115.302344,-33.49096 114.994727,-33.737988 114.928809,-34.275319 114.972755,-34.46575 115.126563,-34.366055 115.269385,-34.818257 115.917579,-34.908402 116.060401,-35.106373 116.598731,-35.11536 117.389747,-35.169263 117.774268,-35.169263 118.081885,-34.980447 118.312598,-34.402321 119.663917,-34.30255 119.56504,-34.029844 119.883643,-33.938746 120.960303,-33.911398 121.399757,-34.011632 121.949073,-34.102652 122.476417,-34.038948 123.432227,-33.591687 124.091407,-33.10529 124.212257,-32.902593 125.014258,-32.319576 126.134864,-32.375265 127.123633,-31.760809 129.035255,-35.294897 129.068214,-35.634921 127.541114,-37.453004 125.157081,-37.696807 123.058692,-37.688114 120.817481,-38.46644 118.664161,-38.337294 115.697852,-37.418109 113.368751,-36.584603 112.028419,-34.998448 111.061622,-33.545916 110.973731,-31.984725 111.512061,-31.414542 111.270362,-30.026241 110.182716,-28.396173 109.798194,-27.756409 109.875098,-25.765206 109.237891,-25.765206 109.237891

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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APPENDIX B. SUPPORTING FIGURES FOR SECTION 2.3 METEOROLOGY AND OCEANOGRAPHY

Browse

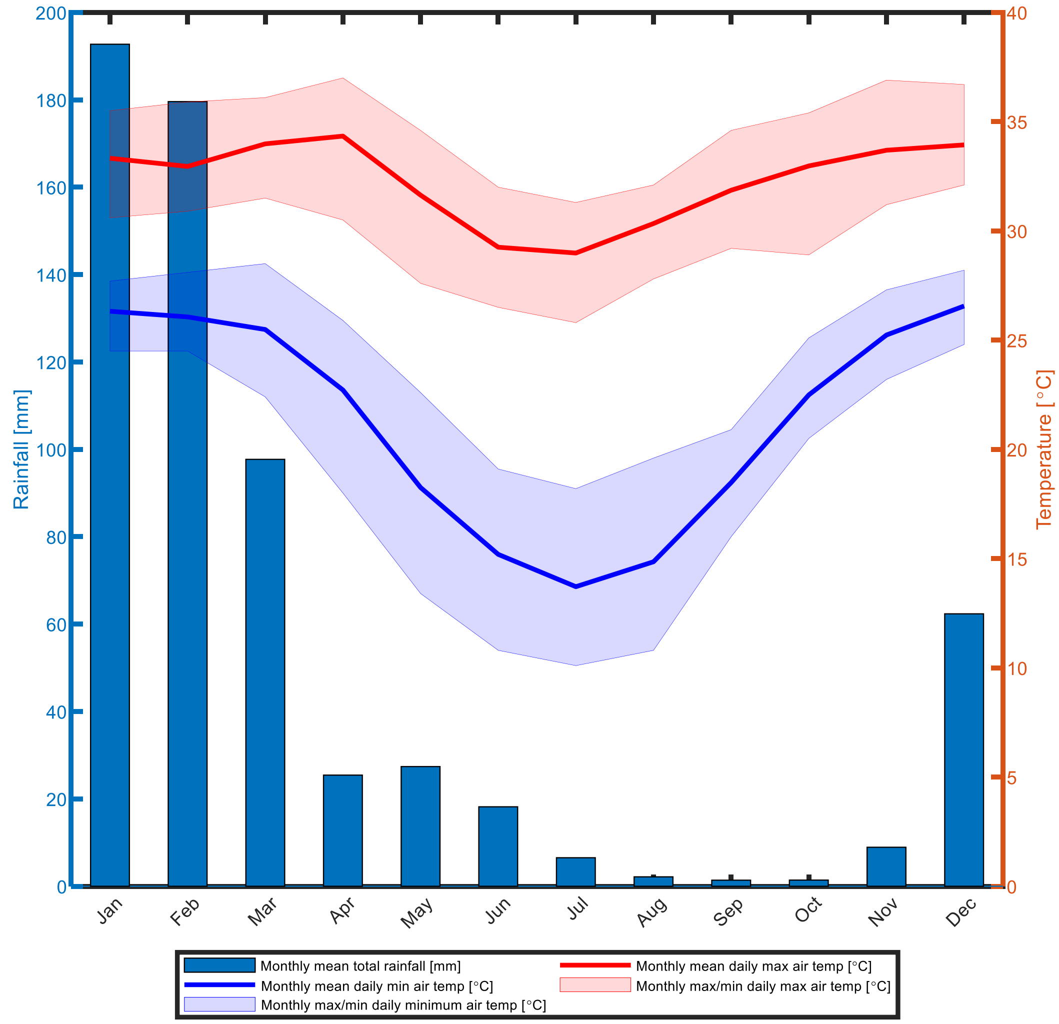
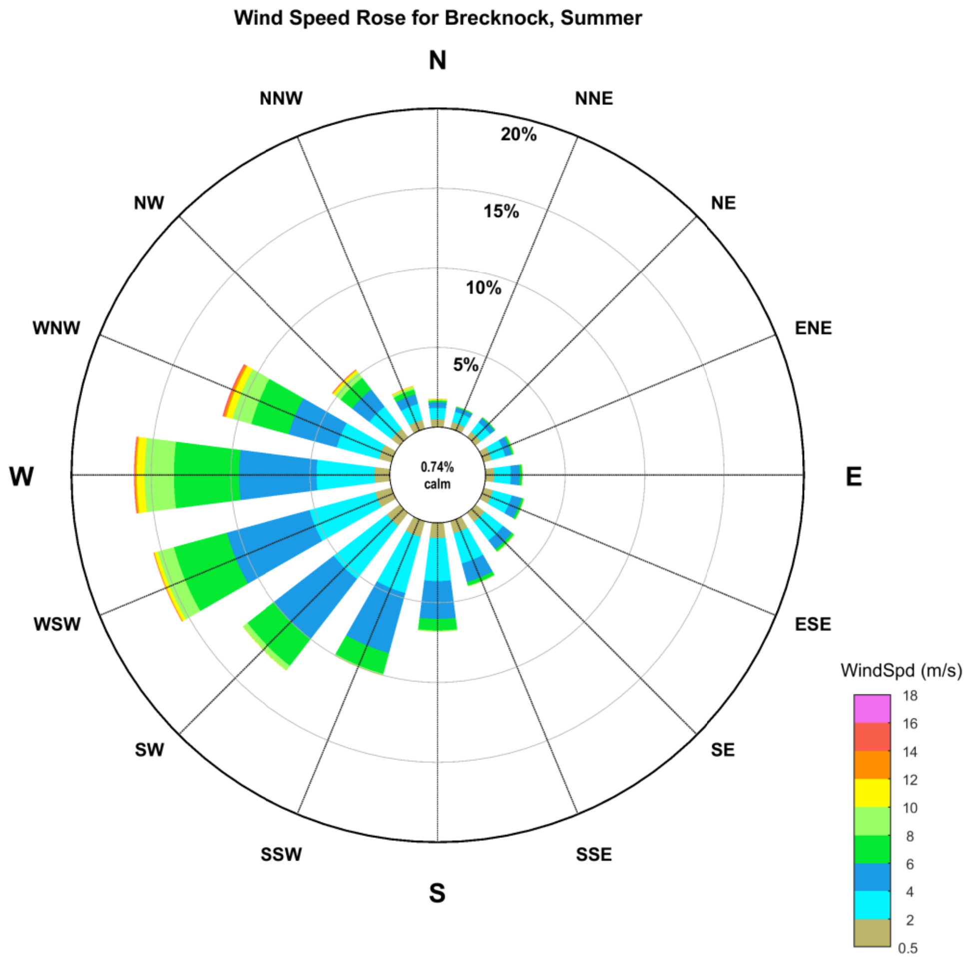


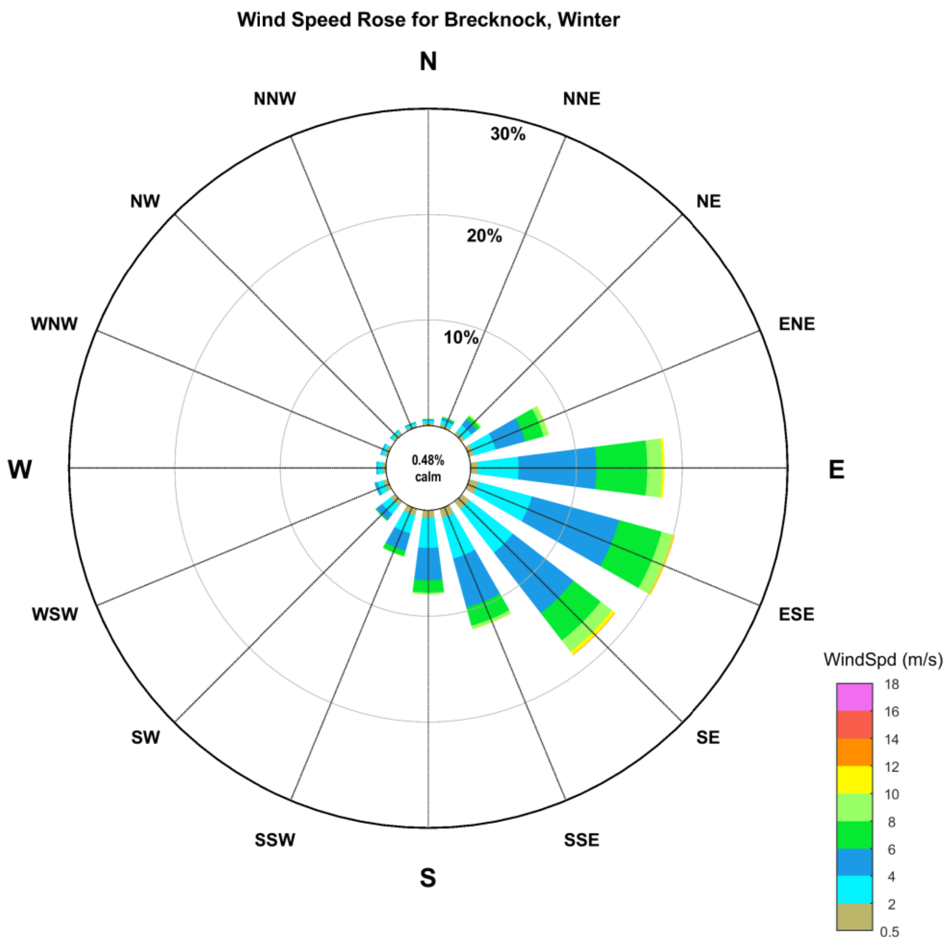
Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Broome Airport weather station from 1939-2020 (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote monthly average daily minimum and maximum air temperatures, respectively. Shaded blue and red areas denote monthly recorded extremes of daily minimum and maximum air temperature, respectively.



Data Information:
Project: Browse
Location: Brecknock [121.6500°E, 14.5300°S]
Data Period: Summer (01-Jan-1979 to 01-Jan-2019)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 560
Data Summary: Summer
Number of Records: 164812
Missing Data (%): 5.80
Calm (% < 0.50m/s): 0.74
Measurement Format: 10-minute avg.

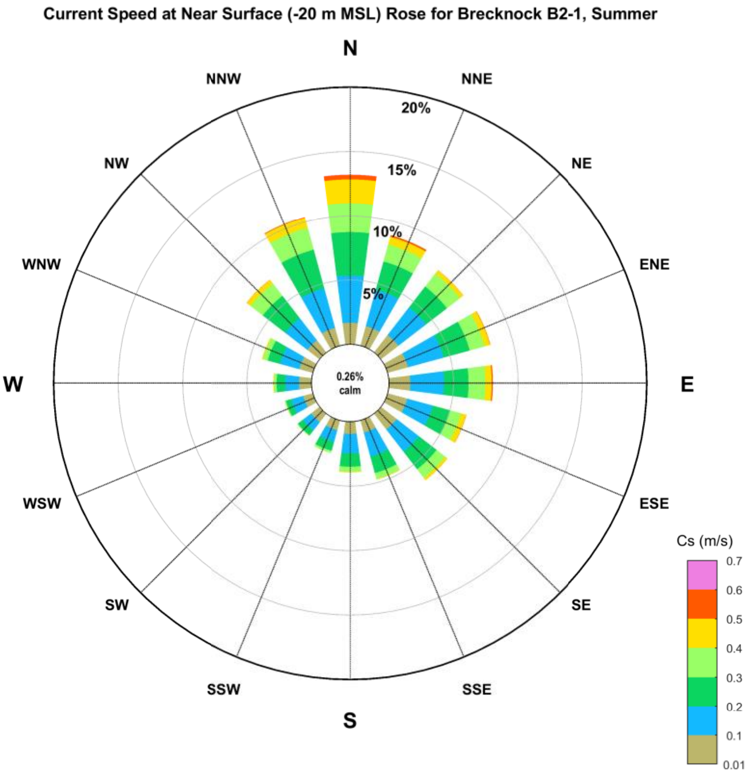
Key Statistics for Data Shown:
Max Wind Speed: 20.60 m/s
Mean Wind Speed: 4.55 m/s
StdDev. Wind Speed: 2.31 m/s

Figure 2. Summer distributions of 10-minute average wind speeds by 22.5° directional sectors at the Brecknock site (Metocean Solutions Ltd, 2019). Note tropical cyclone events were not included in this distribution. Winds at Brecknock in summer are predominantly from the WNW to SW due to the North West Monsoon (WEL, 2019).



Data Information:	**Key Statistics for Data Shown:**
Project: Browse	Max Wind Speed: 14.34 m/s
Location: Brecknock [121.6500°E, 14.5300°S]	Mean Wind Speed: 4.71 m/s
Data Period: Winter (01-Apr-1979 to 30-Sep-2018)	StdDev. Wind Speed: 2.01 m/s
Data Source: Modelled Hindcast	
Record Elevation: 10 m AMSL	
Local Water Depth (m): 560	
Data Summary: Winter	
Number of Records: 173751	
Missing Data (%): 1.10	
Calm (% < 0.50m/s): 0.48	
Measurement Format: 10-minute avg.	

Figure 3. Winter distributions of 10-minute average wind speeds by 22.5° directional sectors at the Brecknock site (Metocean Solutions Ltd, 2019). Note tropical cyclone events were not included in this distribution. Winds at Brecknock in winter are predominantly from the E to SE due to the South East Trade Winds coming from the Australian mainland (WEL, 2019).

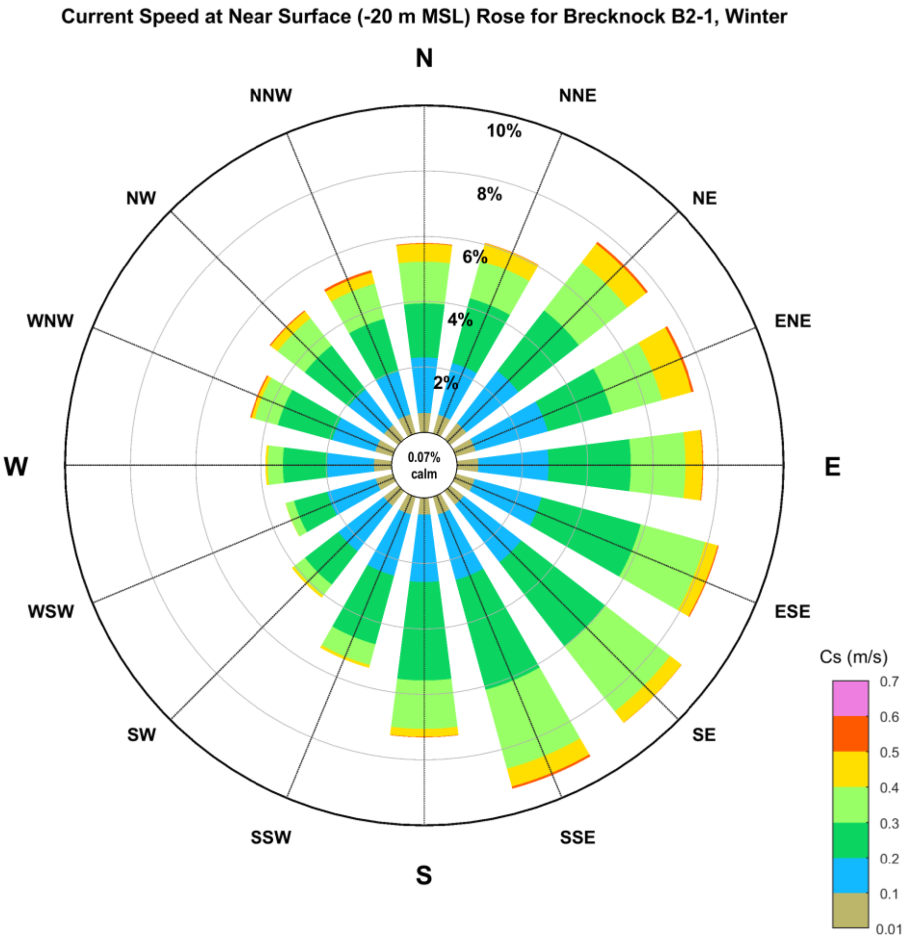


Data Information:
Project: Browse
Location: Brecknock B2-1 [121.5700°E, 14.5100°S]
Data Period: Summer (01-Oct-2006 to 31-Mar-2007)
Data Source: CM04 Measured
Record Elevation: Near Surface (-20 m MSL)
Local Water Depth (m): 560
Data Summary: Summer
Number of Records: 243472
Missing Data (%): 7.10
Calm (% < 0.01m/s): 0.26

Key Statistics for Data Shown:
Max Curr Spd: 0.63 m/s
Mean Curr Spd: 0.20 m/s
StdDev. Curr Spd: 0.11 m/s

Woodside

Figure 4. Summer (Nov-Apr) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at Brecknock B2-1 location (cyclones removed) (RPS Metocean Ltd. 2008).



Data Information:
Project: Browse
Location: Brecknock B2-1 [121.5700°E, 14.5100°S]
Data Period: Winter (17-Sep-2006 to 08-Sep-2007)
Data Source: CM04 Measured
Record Elevation: Near Surface (-20 m MSL)
Local Water Depth (m): 560
Data Summary: Winter
Number of Records: 246184
Missing Data (%): 1.46
Calm (% < 0.01m/s): 0.07

Key Statistics for Data Shown:
Max Curr Spd: 0.62 m/s
Mean Curr Spd: 0.24 m/s
StdDev. Curr Spd: 0.10 m/s

Figure 5. Winter (May-Sep) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at Brecknock B2-1 location (cyclones removed) (RPS Metocean Ltd. 2008).

North-west Shelf/Scarborough

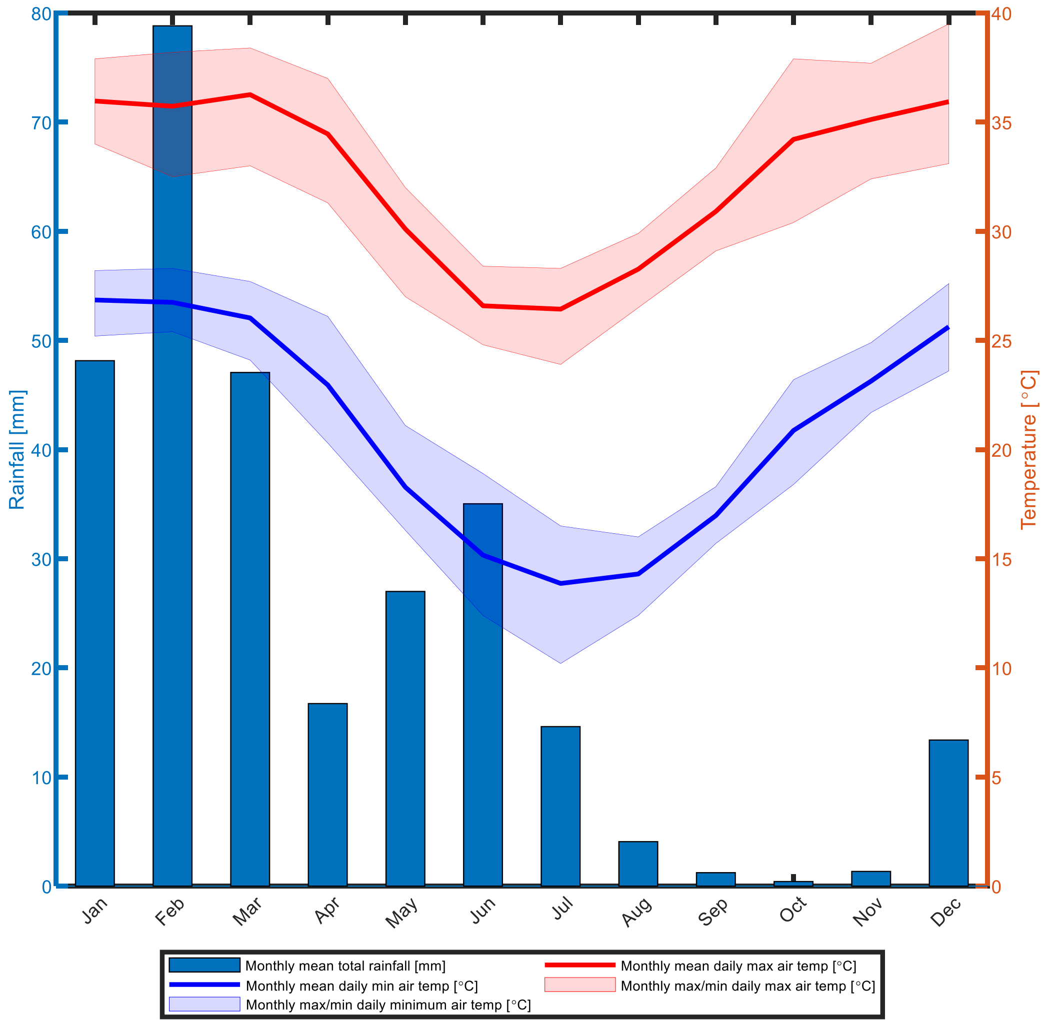
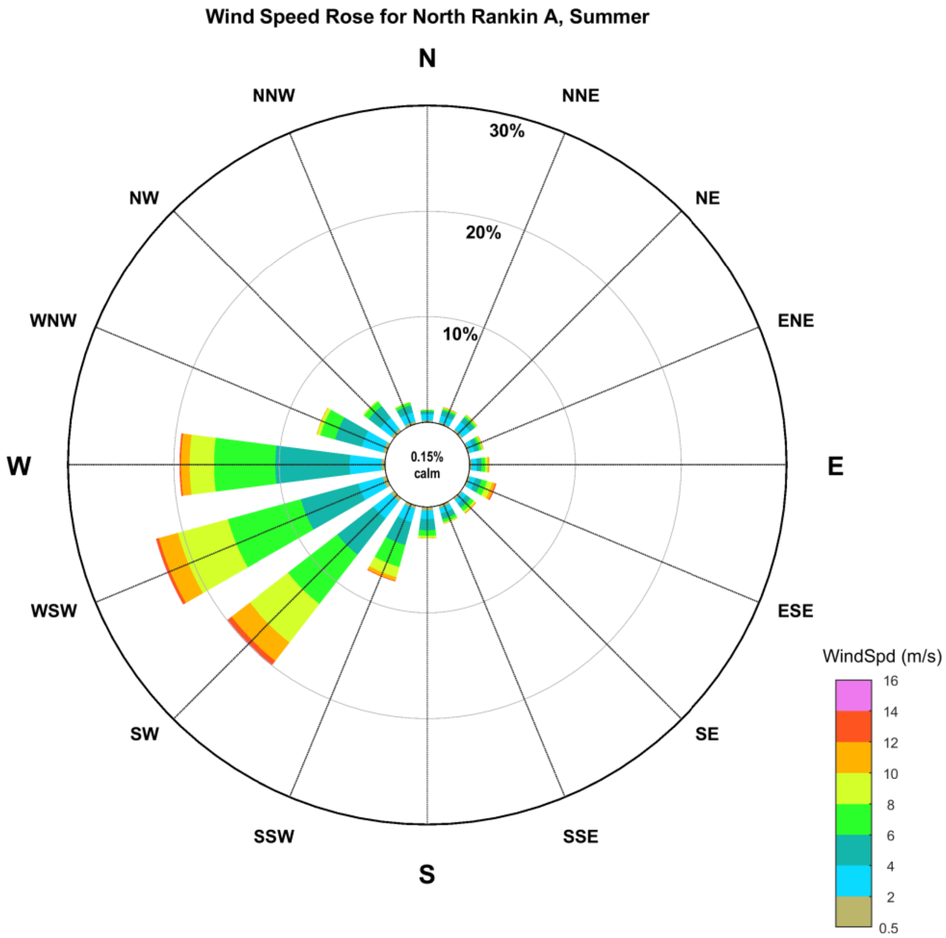


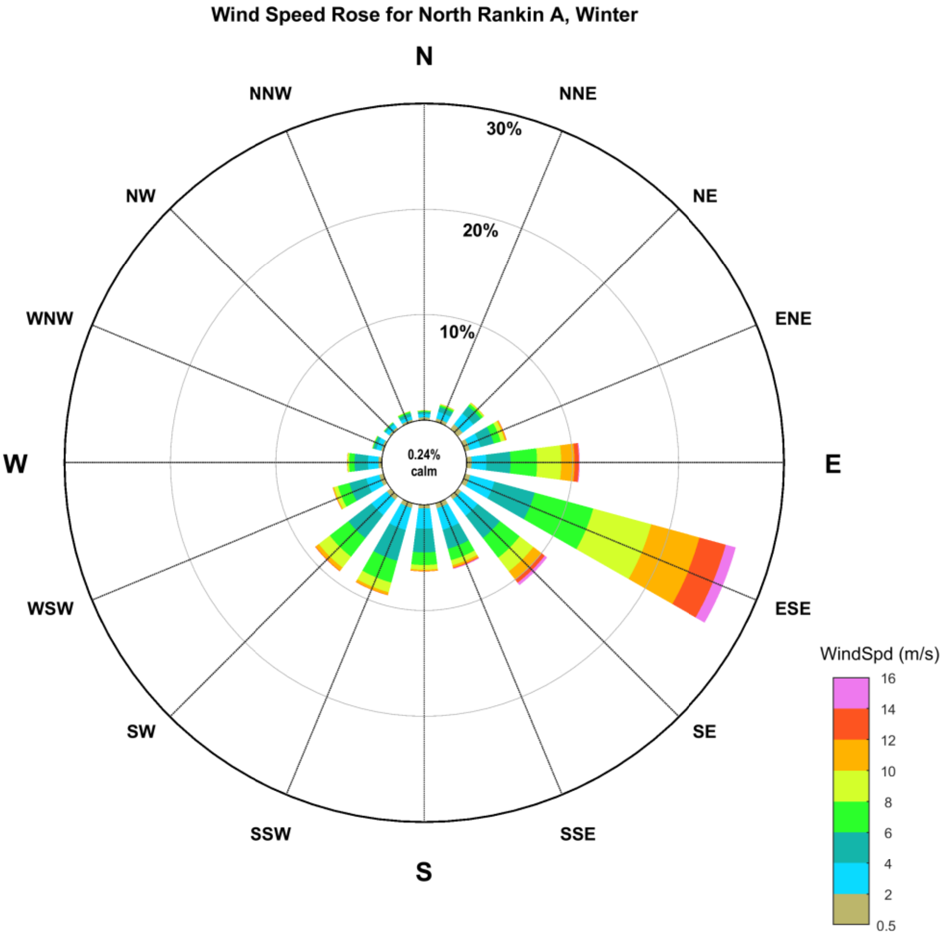
Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Karratha Aero weather station from 1972-2020 and 1993-2020 respectively (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote monthly average daily minimum and maximum air temperatures, respectively. Shaded blue and red areas denote monthly recorded extremes of daily minimum and maximum air temperature, respectively.



Data Information:	Key Statistics for Data Shown:
Project: North West Shelf	Max Wind Speed: 18.50 m/s
Location: North Rankin A [116.1200°E, 19.6100°S]	Mean Wind Speed: 6.04 m/s
Data Period: Summer (01-Oct-1995 to 30-Nov-2015)	StdDev. Wind Speed: 2.55 m/s
Data Source: Measured Winds	
Record Elevation: 10 m AMSL	
Local Water Depth (m): 125	
Data Summary: Summer	
Number of Records: 674659	
Missing Data (%): 7.24	
Calm (% < 0.50m/s): 0.15	
Measurement Format: 10-minute avg.	

Woodside

Figure 2. Summer distributions of 10-minute average wind speeds by 22.5° directional sectors at the North Rankin A site (WEL, 2015). Note tropical cyclone events were not included in this distribution. Winds at North Rankin A in summer are characterised by W to SW driven by the North West Monsoon (RPS, 2016).



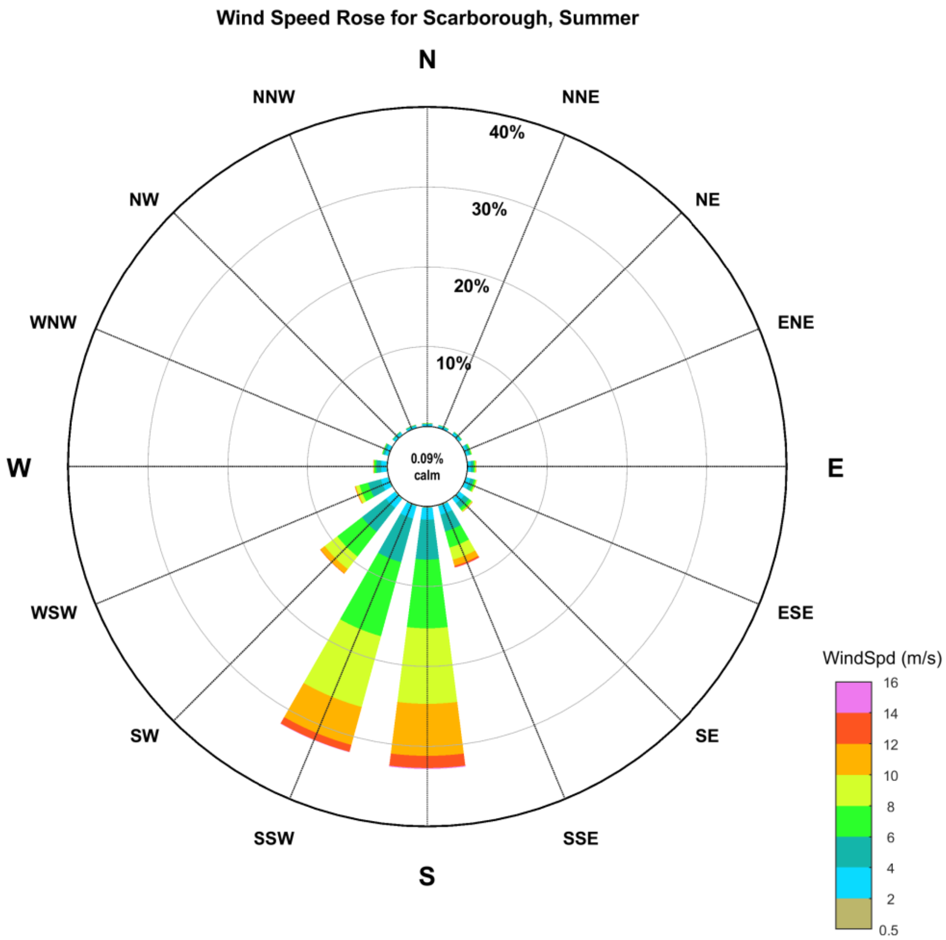
Data Information:
Project: North West Shelf
Location: North Rankin A [116.1200°E, 19.6100°S]
Data Period: Winter (22-Jun-1995 to 30-Sep-2015)
Data Source: Measured Winds
Record Elevation: 10 m AMSL
Local Water Depth (m): 125
Data Summary: Winter
Number of Records: 673213
Missing Data (%): 4.43
Calm (% < 0.50m/s): 0.24
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 24.23 m/s
Mean Wind Speed: 6.25 m/s
StdDev. Wind Speed: 3.16 m/s

Woodside

Figure 3. Winter distributions of 10-minute average wind speeds by 22.5° directional sectors at the North Rankin A site (WEL, 2015). Note tropical cyclone events were not included in this distribution. Winds at North Rankin in winter are predominantly influenced by the South East Trade Winds over Australia (RPS, 2016).

Scarborough

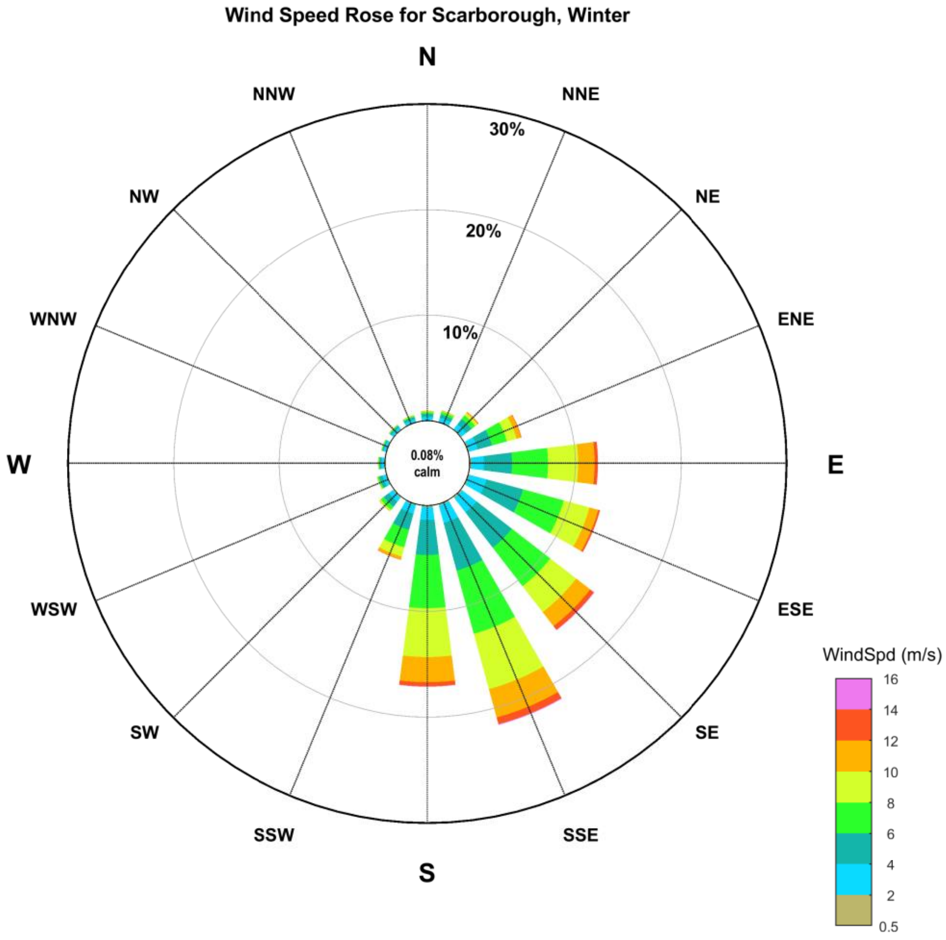


Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Summer (01-Jan-1979 to 01-Jan-2011)
Data Source: CSFR
Record Elevation: 10 m AMSL
Local Water Depth (m): 950
Data Summary: Summer
Number of Records: 129521
Missing Data (%): 7.46
Calm (% < 0.50m/s): 0.09
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 16.75 m/s
Mean Wind Speed: 7.23 m/s
StdDev. Wind Speed: 2.64 m/s

Woodside

Figure 4. Summer distributions of wind speeds (10-minute at 10m ASL) by 22.5° directional sectors at the Scarborough site (WEL, 2018). Note tropical cyclone events were not included in this distribution. Winds at Scarborough in summer are predominantly from the S to SSW due to a Pilbara Heat Low forming over the northwest coast of Western Australia [R8] SW winds are also experienced at this site due to the monsoon trough.



Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Winter (01-Apr-1979 to 30-Sep-2010)
Data Source: CSFR
Record Elevation: 10 m AMSL
Local Water Depth (m): 950
Data Summary: Winter
Number of Records: 138863
Missing Data (%): 1.20
Calm (% < 0.50m/s): 0.08
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 19.15 m/s
Mean Wind Speed: 6.90 m/s
StdDev. Wind Speed: 2.57 m/s

Woodside

Figure 5. Winter distributions of wind speeds (10-minute at 10 m ASL) by 22.5° directional sectors at the Scarborough site (WEL, 2018). Note tropical cyclone events were not included in this distribution. Winds at Scarborough in winter are predominantly from the S to E driven by the South East Trade Winds over Australia (RPS, 2016).

North-west Shelf

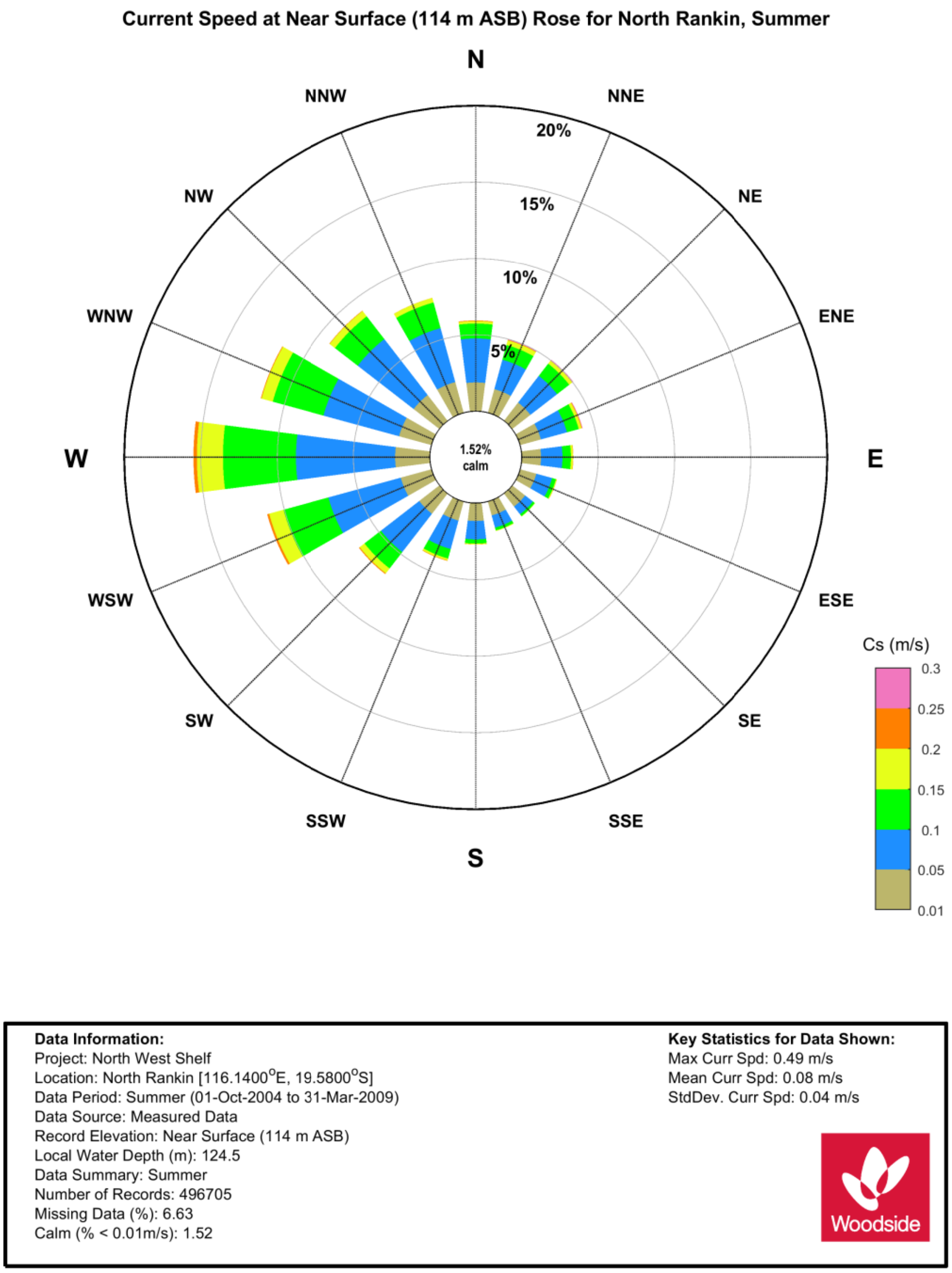
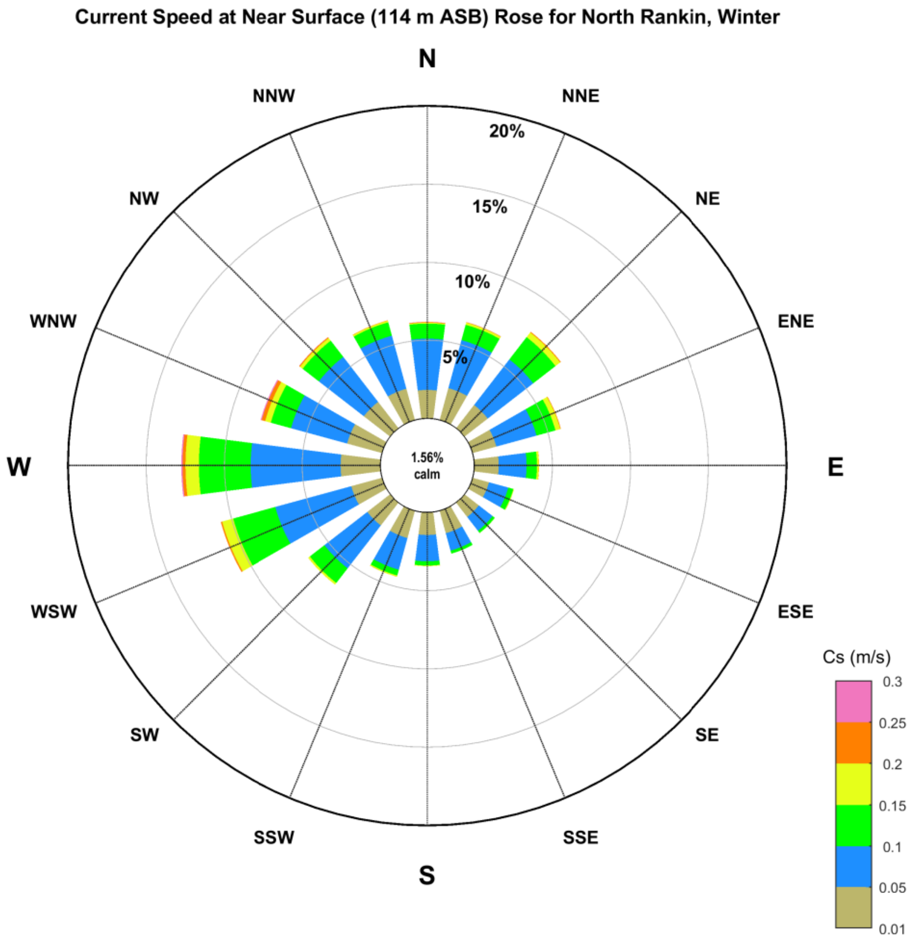


Figure 6. Summer (Nov-Apr) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the North Rankin location (cyclones removed) (WEL, 2011).



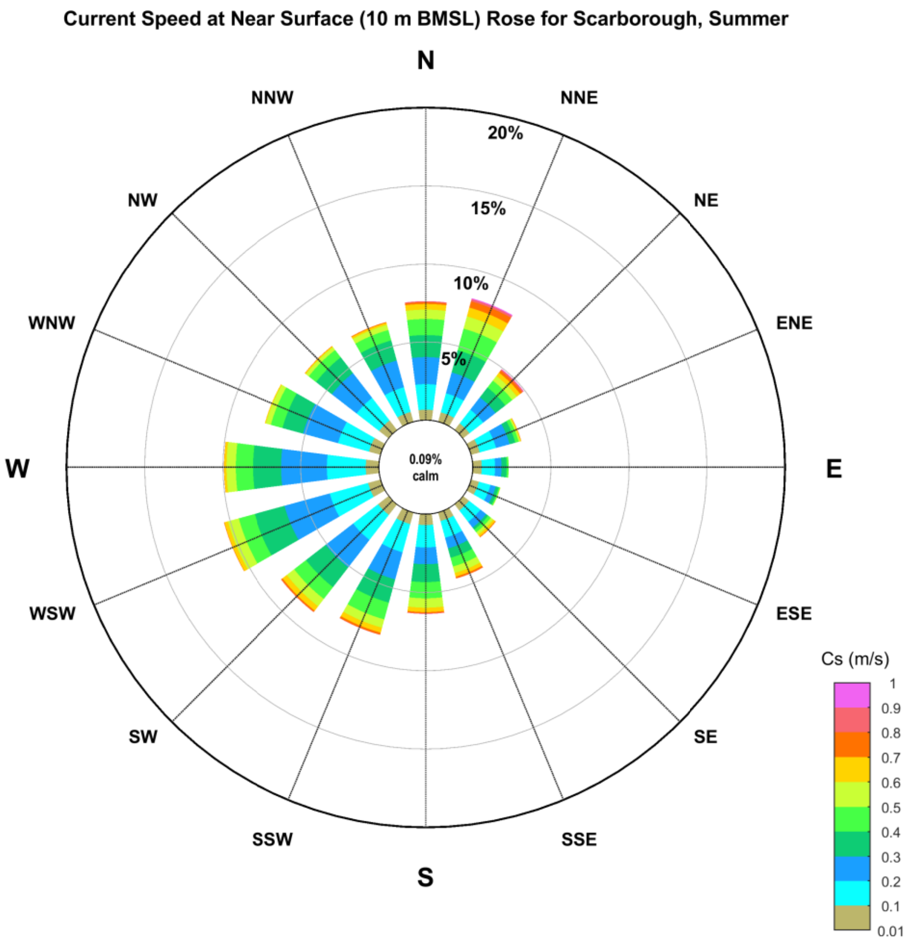
Data Information:
Project: North West Shelf
Location: North Rankin [116.1400°E, 19.5800°S]
Data Period: Winter (21-Sep-2004 to 08-May-2009)
Data Source: Measured Data
Record Elevation: Near Surface (114 m ASB)
Local Water Depth (m): 124.5
Data Summary: Winter
Number of Records: 337723
Missing Data (%): 0.88
Calm (% < 0.01m/s): 1.56

Key Statistics for Data Shown:
Max Curr Spd: 0.32 m/s
Mean Curr Spd: 0.07 m/s
StdDev. Curr Spd: 0.04 m/s

Woodside

Figure 7. Winter (May-Sep) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the North Rankin location (cyclones removed) (WEL, 2011).

Scarborough

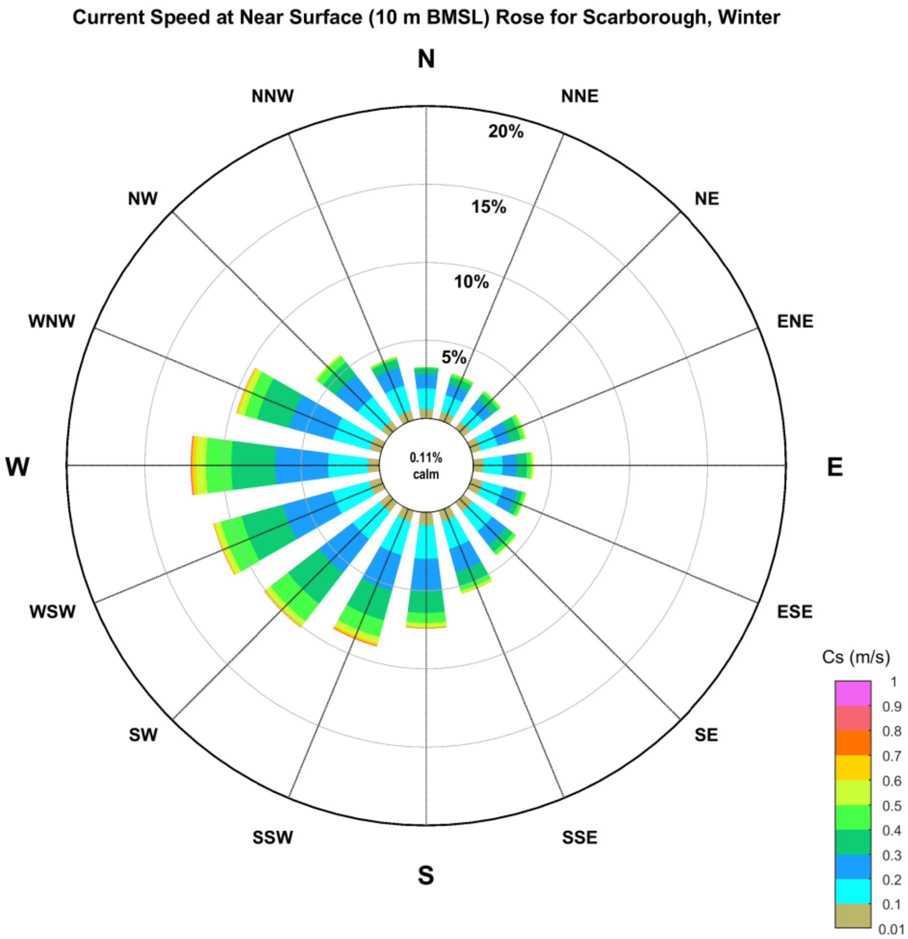


Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Summer (15-Jan-2010 to 29-Feb-2012)
Data Source: Measured Data
Record Elevation: Near Surface (10 m BMSL)
Local Water Depth (m): 950
Data Summary: Summer
Number of Records: 43600
Missing Data (%): 7.11
Calm (% < 0.01m/s): 0.09

Key Statistics for Data Shown:
Max Curr Spd: 1.03 m/s
Mean Curr Spd: 0.29 m/s
StdDev. Curr Spd: 0.17 m/s

Woodside

Figure 8. Summer (Nov - April) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the Scarborough location (cyclones removed) (WEL, 2018).



Data Information:
Project: North West Shelf
Location: Scarborough [113.2000°E, 19.8800°S]
Data Period: Winter (01-Apr-2010 to 30-Sep-2011)
Data Source: Measured Data
Record Elevation: Near Surface (10 m BMSL)
Local Water Depth (m): 950
Data Summary: Winter
Number of Records: 49345
Missing Data (%): 3.01
Calm (% < 0.01m/s): 0.11

Key Statistics for Data Shown:
Max Curr Spd: 1.03 m/s
Mean Curr Spd: 0.25 m/s
StdDev. Curr Spd: 0.13 m/s

Woodside

Figure 9. Winter (May-Sep) near surface combined frequency of 1-min mean current speed and direction (towards) measured at the Scarborough location (cyclones removed) (WEL, 2018).

North-west Cape

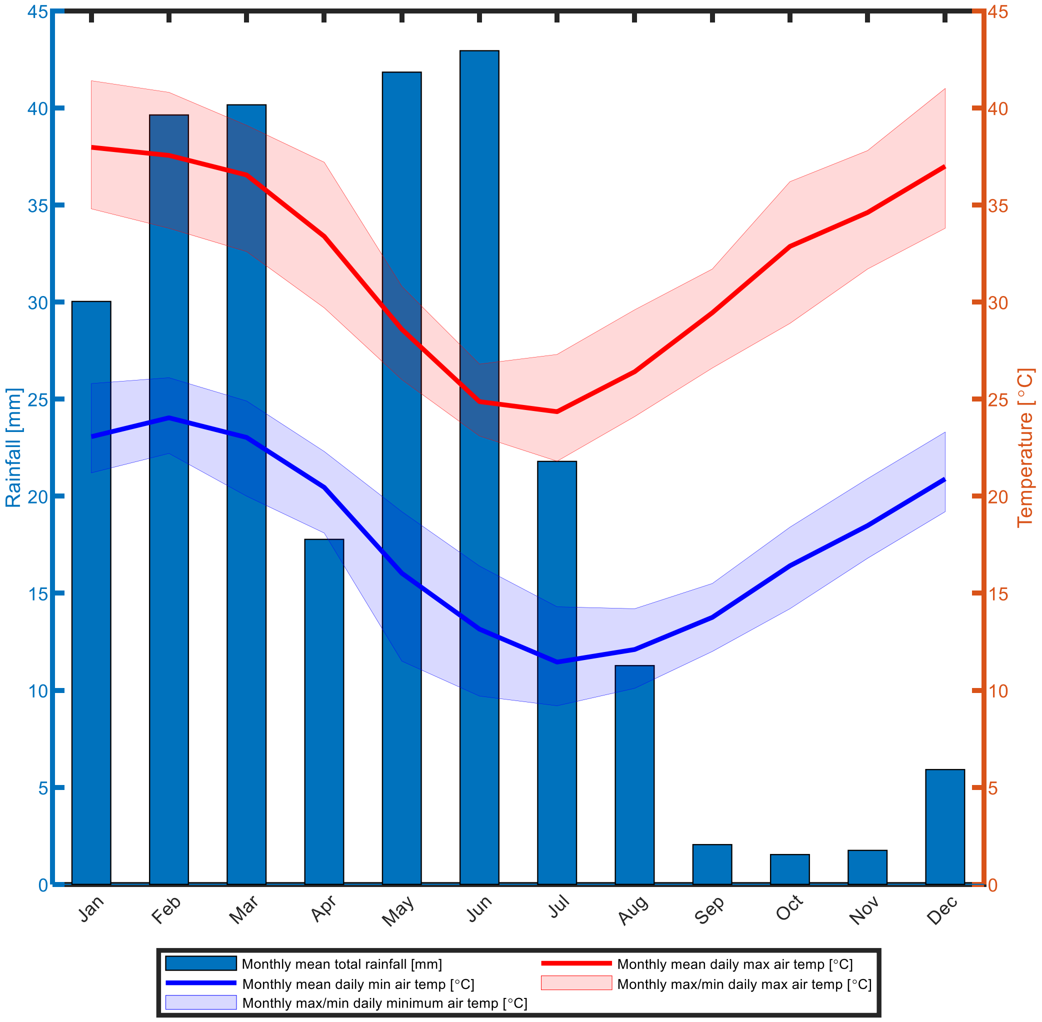
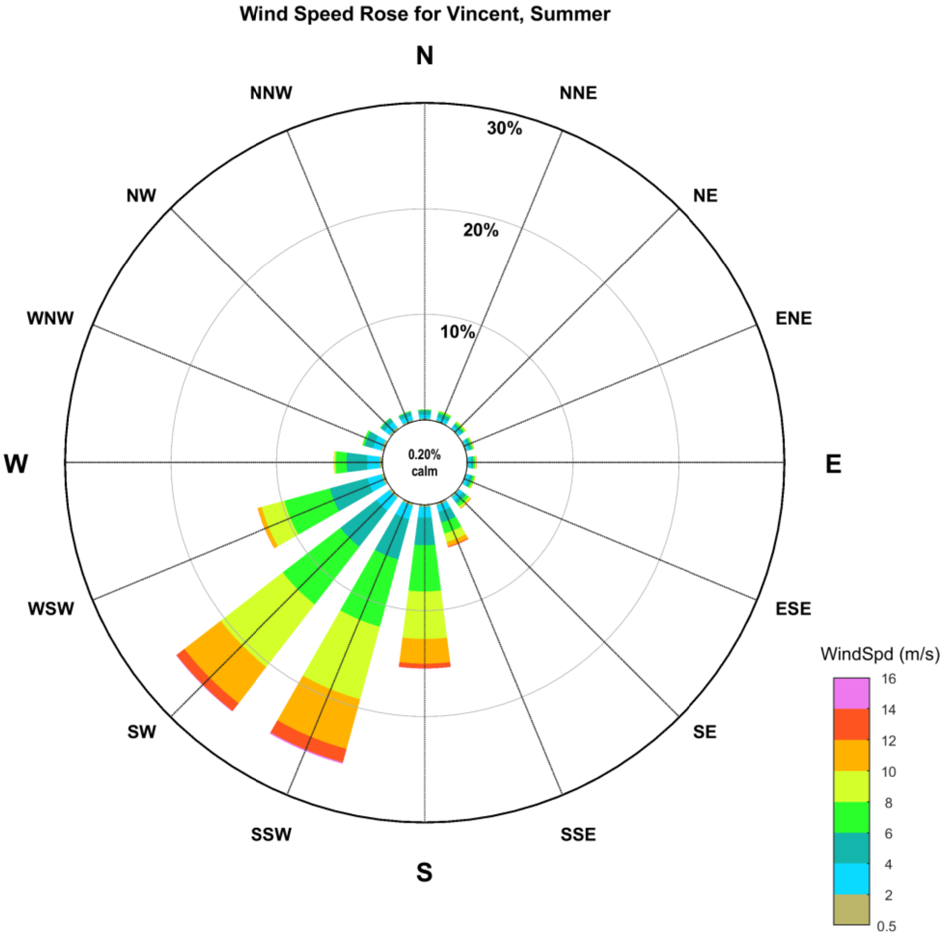


Figure 1. Monthly average total rainfall [mm] and air temperature [°C], calculated based on observations at the Learmonth Airport weather station from 1945-2020 and 1975-2020 respectively (Bureau of Meteorology 2020). Bars show the monthly average total rainfall values, and thick blue and red lines denote monthly average daily minimum and maximum air temperatures, respectively. Shaded blue and red areas denote monthly recorded extremes of daily minimum and maximum air temperature, respectively.

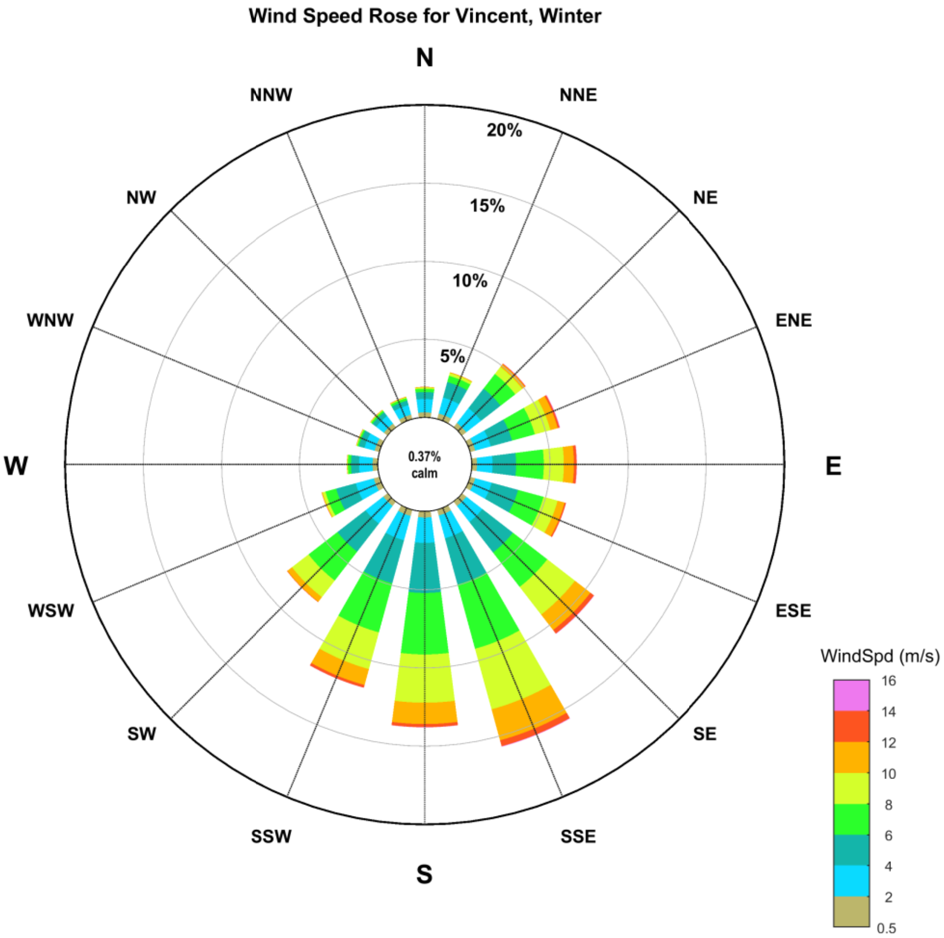


Data Information:
Project: North West Cape
Location: Vincent [114.0600°E, 21.4400°S]
Data Period: Summer (01-Jan-1979 to 01-Jan-2019)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 350
Data Summary: Summer
Number of Records: 159379
Missing Data (%): 8.91
Calm (% < 0.50m/s): 0.20
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 18.86 m/s
Mean Wind Speed: 7.10 m/s
StdDev. Wind Speed: 2.75 m/s

Woodside

Figure 2. Summer distributions of wind speeds (10-minute at 10 m ASL) by 22.5° directional sectors at the Vincent site (Vincent Metocean). Note tropical cyclone events were not included in this distribution. Winds at Vincent in summer are predominantly from the SW to SSW in summer due to the presence of the Pilbara Heat Low (MetOcean Engineers, 2005).



Data Information:
Project: North West Cape
Location: Vincent [114.0600°E, 21.4400°S]
Data Period: Winter (01-Apr-1979 to 30-Sep-2018)
Data Source: Modelled Hindcast
Record Elevation: 10 m AMSL
Local Water Depth (m): 350
Data Summary: Winter
Number of Records: 173626
Missing Data (%): 1.17
Calm (% < 0.50m/s): 0.37
Measurement Format: 10-minute avg.

Key Statistics for Data Shown:
Max Wind Speed: 19.39 m/s
Mean Wind Speed: 6.23 m/s
StdDev. Wind Speed: 2.78 m/s

Woodside

Figure 3. Winter distributions of wind speeds (10-minute at 10 m ASL) 22.5° directional sectors at the Vincent site (Vincent Metocean). Note tropical cyclone events were not included in this distribution. In winter, winds at are predominantly from the S to SE, associated with the South East Trades. Easterly gales are experienced at the Vincent location due to high pressure systems generating from the Great Australian Bight area to the site (MetOcean Engineers, 2005).

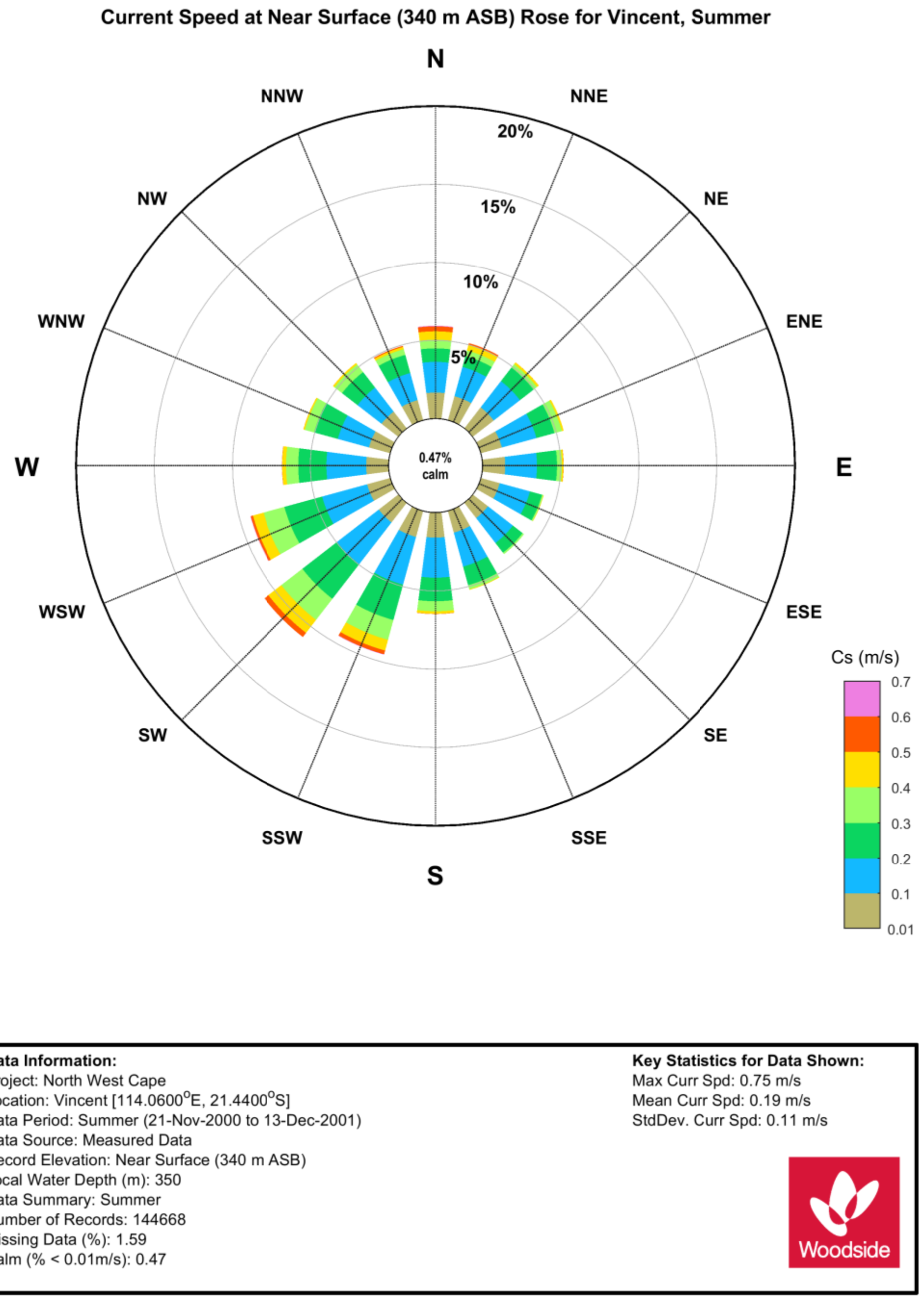
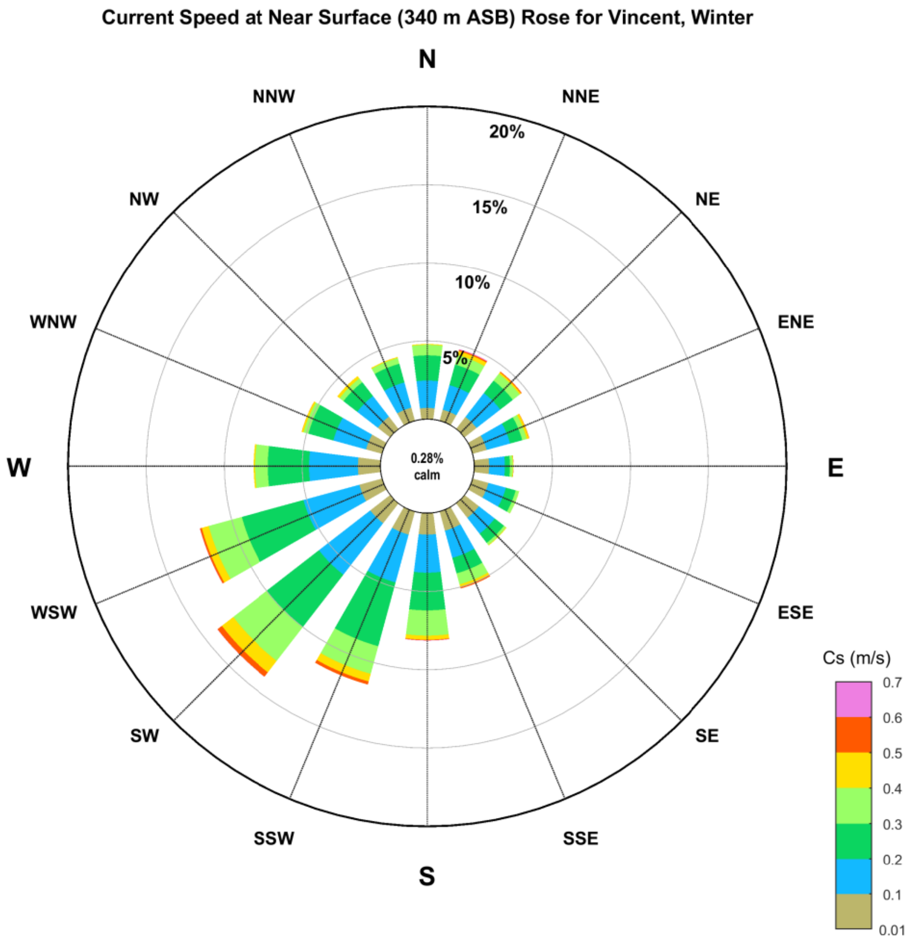


Figure 4. Summer (May – Sep) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the Vincent location (cyclones removed) (WEL, 2016).



Data Information:
Project: North West Cape
Location: Vincent [114.0600°E, 21.4400°S]
Data Period: Winter (01-Apr-2001 to 30-Sep-2001)
Data Source: Measured Data
Record Elevation: Near Surface (340 m ASB)
Local Water Depth (m): 350
Data Summary: Winter
Number of Records: 126313
Missing Data (%): 4.13
Calm (% < 0.01m/s): 0.28

Key Statistics for Data Shown:
Max Curr Spd: 0.64 m/s
Mean Curr Spd: 0.20 m/s
StdDev. Curr Spd: 0.11 m/s

Woodside

Figure 5. Winter (Nov – Apr) near surface combined frequency of 1-minute mean current speed and direction (towards) measured at the Vincent location (cyclones removed) (WEL, 2016).

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