BAA-100 0329

Santos

# Barossa Gas Export Pipeline Installation Environment Plan

| | |
|---|---|
| PROJECT / FACILITY | Barossa Gas Export Pipeline |
| REVIEW INTERVAL (MONTHS) | No Review Required |
| SAFETY CRITICAL DOCUMENT | NO |

| Rev | Owner | Reviewer/s *Managerial/Technical/Site* | Approver |
|---|---|---|---|
| 3.4 | Pipeline Delivery Manager | Team Leader – Barossa HSE | Subsea Project Manager |
| Signed | | | |

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| Rev | Rev Date | Author / Editor | Amendment |
|---|---|---|---|
| 3.4 | 27/10/2023 | Santos | Internal Revision to further incorporate MoC 268 to address opportunities for improvement from NOPSEMA inspection. |
| 3.3 | 17/10/2023 | Santos | Internal Revision – Update to incorporate MoC 270 (Doc ID BAS-210 0079), MoC 276 and MoC 268. Issued for Use. |
| 3.2 | 10/02/2023 | Santos | Internal Revision – Update following 2022 annual review of EP, as per MoC 271 (Doc ID BAS-210 0068). Issued for Use. |
| 3.1 | 21/09/2021 | Santos | Internal Revision – Updated EP to cover the transition from ConocoPhillips to Santos. Covered by MoC 245 (Doc ID BAA-100 0400): This internal revision was labelled revision 4. As per Santos MoC procedure (EA-91-IQ-10001.7.IFA), the EP has been revised to Revision 3.1. Issued for Use. |
| 3 | 06/02/2020 | ConocoPhillips | NOPSEMA accepted March 2020: Issued for Use |
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# ACRONYMS

| Abbreviation | Description |
|---|---|
| µg/L | micrograms per litre |
| °C | degrees Celsius |
| ACN | Australian Company Number |
| ADBAC | alkyl dimethyl benzyl ammonium chloride |
| AHS | Australian Hydrographic Service |
| AIIMS | Australasian Inter-service Incident Management System |
| AIMS | Australian Institute of Marine Science |
| AIS | automatic identification system |
| AFMA | Australian Fisheries Management Authority |
| AFZ | Australian Fishing Zone |
| ALAN | artificial light at night |
| ALARP | as low as reasonably practicable |
| ANZECC | Australian and New Zealand Environment and Conservation Council |
| AMOSC | Australian Marine Oil Spill Centre |
| AMSA | Australian Maritime Safety Authority |
| APLNG | Australia Pacific liquified natural gas |
| ARC | AMSA Response Centre |
| ARMCANZ | Agricultural and Resource Management Council of Australia and New Zealand |
| ATSB | Australian Transport Safety Bureau |
| BIA | biologically important area |
| BOM | Bureau of Meteorology |
| BTEX | benzene, ethylbenzene, toluene and xylenes |
| BRUVS | baited remove underwater video systems |
| BU | Business Unit |
| CDU | Charles Darwin University |
| CEFAS | Centre for Environment, Fisheries and Aquaculture Science |
| CHARM | Chemical Hazard and Risk Management |
| CHIRP | compressed high intensity radar pulse |
| CIMP | Crisis and Incident Management Plan |
| CM&ER | Crisis Management and Emergency Response |
| CMID | Common Marine Inspection Document |
| CMT | Crisis Management Team |
| COLREGS | Convention on the International Regulations for Preventing Collisions at Sea 1972 |
| CO | carbon monoxide |

| Abbreviation | Description |
|---|---|
| CO2 | carbon dioxide |
| dB | decibels |
| dB re 1µPa | decibel re 1 micro Pascal |
| DCCEEW | Department of Climate Change, Energy, the Environment and Water |
| DEH | Department of Environment and Heritage |
| DEWHA | Department of the Environment, Water, Heritage and the Arts |
| DLNG | Darwin liquified natural gas |
| DoE | Department of Environment |
| DoEE | Department of the Environment and Energy |
| DoAWR | Department of Agriculture and Water Resources |
| DP | dynamic positioning |
| DPGS | differential global positioning system |
| DPIF | Department of Primary Industry and Fisheries |
| DPIR | Department of Primary Industry and Resources |
| DSEWPaC | Department of Sustainability, Environment, Water, Population and Communities |
| EC50 | median effective concentration, concentration at which 50% of the test organisms are immobilised |
| EEZ | Exclusive Economic Zone |
| EIA | Environmental Impact Assessment |
| EIAPP | Engine International Air Pollution Prevention |
| EMBA | environment that may be affected |
| EOC | Emergency Operations Centre |
| EP | Environment Plan |
| EPBC Act | *Environment Protection and Biodiversity Act 1999* (Cth) |
| EPBC Regulations | Environment Protection and Biodiversity Regulations 2000 |
| EPO | environmental performance outcome |
| EPS | environmental performance standard |
| ERT | Emergency Response Team |
| ESD | ecologically sustainable development |
| FCGT | flooding, cleaning, gauging and testing |
| FPSO | floating production, storage and offloading facility |
| GHG | greenhouse gas |
| GIMAT | Global Incident Management Assist Team |
| GOMO | Guidelines for Offshore Marine Operations |
| GPS | global positioning system |
| $g/m^2$ | grams per square metre |
| ha | hectares |

| Abbreviation | Description |
|---|---|
| HAZID | hazard identification |
| HAZOP | hazard and operability |
| HF | high frequency |
| HFO | heavy fuel oil |
| HSE | health, safety and environment |
| HSEMS | health, safety and environment management system |
| HPZ | Habitat Protection Zone |
| HQ | hazard quotient |
| IAP | Incident Action Plan |
| IAPP | International Air Pollution Prevention |
| ICS | Incident Command System |
| IEE | International Energy Efficiency |
| IFO | intermediate fuel oil |
| IMDG Code | International Maritime Dangerous Goods code |
| IMCA | International Maritime Contractors Association |
| IMO | International Maritime Organisation |
| IMS | invasive marine species |
| IMT | Incident Management Team |
| IOPP | International Oil Pollution Prevention |
| IPP | International Pollution Prevention |
| ISO | International Organization for Standardization |
| ISPP | International Sewage Pollution Prevention |
| ITF | Indonesian Throughflow |
| IUCN | International Union for Conservation of Nature |
| JSA | job safety analysis |
| KEF | key ecological feature |
| kHz | kilohertz |
| km | kilometres |
| $km^2$ | square kilometres |
| km/day | kilometres per day |
| km/h | kilometres per hour |
| KP | kilometre point |
| LBL | long baseline |
| LC50 | concentration at which there is mortality of 50% of a group of specific test species |
| LF | low frequency |
| LNG | liquid natural gas |

| Abbreviation | Description |
|---|---|
| MSI | Maritime Safety Information |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MBES | multi-beam echo sounder |
| MEG | monoethylene glycol |
| MC | measurement criteria |
| MDO | marine diesel oil |
| MGO | marine gas oil |
| mg/L | milligrams per litre |
| MNES | Matters of National Environmental Significance |
| MOC | management of change |
| MODU | Mobile Offshore Drilling Unit |
| MoU | Memorandum of Understanding |
| MSDS | Material Safety Data Sheet |
| MSL | mean sea level |
| n/a | not applicable |
| National Plan | National Plan for Maritime Environmental Emergencies |
| NAXA | North Australian exercise area |
| NEBA | net environmental benefit analysis |
| NESP | Australian National Environmental Science Programme |
| NLC | Northern Land Council |
| nm | nautical miles |
| NMR | North Marine Region |
| NOPSEMA | National Offshore Petroleum Safety and Environmental Management Authority |
| NOx | oxides of nitrogen |
| NT | Northern Territory |
| NTEPA | Northern Territory Environment Protection Authority |
| NTU | nephelometric turbidity units |
| NWSTF | North West Slope Trawl Fishery |
| OCIMF | Oil Companies International Marine Forum |
| ODS | ozone-depleting substance |
| OECD | Organisation for Economic Cooperation and Development |
| OHS | occupational health and safety |
| OIW | oil in water |
| OMP | operational monitoring plan |
| OPEP | Oil Pollution Emergency Plan |
| OPGGS Act | Offshore Petroleum and Greenhouse Gas Storage |

| Abbreviation | Description |
|---|---|
| OPGGS (E) Regulations | Offshore Petroleum and Greenhouse Gas Storage Environment Regulations |
| OPP | Offshore Project Proposal |
| OSPAR | OSPAR Commission – based on the Oslo and Paris Conventions to protect the North-East Atlantic |
| OSMP | Operational and Scientific Monitoring Program |
| OVID | Offshore Vessel Inspection Database |
| PAR | photosynthetically active radiation |
| PEC:NEC | predicted effect concentration: no effect concentration |
| PLET | pipeline end termination |
| PMST | EPBC Protected Matters Search tool |
| POLREP | Marine Pollution Report |
| ppb | parts per billion |
| PPE | personal protective equipment |
| ppm | parts per million |
| ppt | parts per thousand |
| PSSR | Pre-start Safety Review |
| PSV | pipe supply vessels |
| PTS | permanent threshold shift |
| PTW | permit to work |
| QLD | Queensland |
| rms | root mean square |
| RCC | rescue coordination centre |
| ROV | remotely operated vehicle |
| RPS APASA | RPS Asia-Pacific Applied Science Associates |
| SBP | sub-bottom profiler |
| SD | sustainable development |
| SEEMP | Ship Energy Efficiency Management Plan |
| SEL | sound exposure level |
| SMP | scientific monitoring plan |
| SMPEP | Shipboard Marine Pollution Emergency Plan |
| SOLAS | Safety of Life at Sea |
| SOPEP | Shipboard Oil Pollution Emergency Plan |
| SO2 | sulphur dioxide |
| SPL | sound pressure level |
| sr | steradian |
| SSS | side scan sonar |
| STCW Convention | International Convention on Standards of Training, Certification and Watchkeeping |

| Abbreviation | Description |
|---|---|
| TEG | triethylene glycol |
| THPS | tetrakis (hydroxymethyl) phosphonium sulfate |
| TLC | Tiwi Land Council |
| TTS | temporary threshold shift |
| UK OCNS | United Kingdom Offshore Chemical Notification Scheme |
| USBL | ultra-short baseline |
| VHF | very high frequency |
| VOCs | volatile organic compounds |
| WA | Western Australia |

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# 1. Introduction

## 1.1 Overview

Santos proposes to install the Barossa Gas Export Pipeline. The pipeline is located in Commonwealth waters and extends from the Barossa Gas Field, approximately 227 km north of the Northern Territory (NT) mainland, to a location adjacent to the existing Bayu-Undan to Darwin pipeline, approximately 100 km north of the NT mainland. Santos and its Joint Venture Partners have applied to National Offshore Petroleum Titles Administrator (NOPTA) for a pipeline licence and the pipeline will be installed within the licence area.

The activity covered in this Barossa Gas Export Pipeline (GEP) Installation Environment Plan (EP) is part of the Barossa Development, a project to develop a gas and light condensate field using a Floating Production Storage and Offloading (FPSO) facility, subsea production system, supporting subsea infrastructure and the pipeline. The Barossa Development (including the pipeline) is described in the Barossa Area Development Offshore Project Proposal (OPP) which was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in March 2018.

This EP specifically addresses installation of the gas export pipeline. Other activities related to the Barossa Development are subject to separate EPs, where relevant.

## 1.2 Scope

The activity will consist of the installation of a 262 km long, 26-inch outer diameter carbon steel, concrete coated rigid pipeline. The pipeline installation activity includes pre-lay survey, installation of pre and post lay span rectification; installation of pipeline end terminations (PLETs) including foundations; flooding, cleaning, gauging and testing; dewatering and pre-conditioning activities. Operation of the gas export pipeline (once installed) is outside the scope of this EP.

This EP identifies and evaluates the potential environmental impacts and risks from routine/planned activities associated with the gas export pipeline installation within the operational area. The operational area comprises a 3000 m radius around the PLET locations and a 2000 m buffer along the gas export pipeline route; the buffer along the proposed pipeline route is reduced in some sections to the east and west of the pipeline centreline to remain within the pipeline installation corridor presented in the accepted OPP. The operational area is further defined in **Section 3.3.1**. The EP also includes assessment of any potential impacts and risks from non-routine/unplanned activities that originate from the gas export pipeline installation activities within the operational area.

Activities outside of the defined operational area, are outside the scope of this EP. These activities will be undertaken in accordance with relevant legislation – most notably, the Navigation Act 2012 (Cth) – and therefore fall within the jurisdiction of the Australian Maritime Safety Authority (AMSA).

## 1.3 Purpose and objective

This EP has been prepared as part of the requirements under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth) (OPGGS (E) Regulations), as administered by NOPSEMA. The purpose and objectives are to:

1. Meet the requirements of the OPGGS (E) Regulations.
2. Provide a document for the workforce detailing how the activities are to be undertaken in an environmentally responsible manner.
3. Structure of the Environment Plan.

The EP structure and the relevant sections of the OPGGS (E) Regulations are outlined in **Table 1-1**.

*Table 1-1: EP structure, content and relevant sections of the OPGGS (E) Regulations*

| OPGGS (E) Regulation | Summary of Requirements | EP Section |
|---|---|---|
| Regulation 13. Environmental assessment | | |
| Description of the activity | | |
| 13(1) (a, b, c, d) | Comprehensive description of the activity | Section 3 |
| Description of the environment | | |
| 13(2) (a, b) | Description of the existing environment that may be affected by the activity and details of the particular relevant values and sensitivities (if any) of that environment | Section 4 |
| 13(3) (a, b, c, d, e, f) | Description of the particular relevant values and sensitivities, including Matters of National Environmental Significance (MNES) as listed under Part 3 of the EPBC Act, e.g. National Heritage places, presence of listed threatened species and Commonwealth Marine Reserves | Section 4.5.1 |
| Requirements | | |
| 13(4) (a, b) | Description of the requirements, including legislative requirements, which apply to the activity and are relevant to the environmental management of the activity and demonstration of how these requirements will be met | Section 2<br>Appendix A |
| Evaluation of environmental impacts and risks | | |
| 13(5) (a, b, c)<br>13(6) (a, b) | Details of the environmental impacts and risks for the activity, and an evaluation of all the impacts and risks appropriate to the nature and scale of each impact and risk, including all the environmental impacts and risks arising directly or indirectly from all operations of the activity and potential emergency conditions<br>Details of the control measures that will be used to reduce the impacts and risks of the activity to ALARP and an acceptable level | Section 5 |
| 13(7) (a, b, c) | Definition of EPSs for the control measures, EPOs against which performance in protecting the environment is to be measured, and MC which will be used to determine whether the EPOs and EPSs are being met | Section 6 |
| Regulation 14. Implementation strategy for the environment plan | | |
| 14(1) | Description of implementation strategy for the activity | Section 7 |
| 14(2) | Details of when the titleholder will report to the Regulator in relation to the titleholder's environmental performance for the activity, including that the interval between reports will not be more than one year | Section 7.8 |
| 14(3) (a, b, c) | Description of the environmental management system, including specific measures that will be used to ensure that, for the duration of the activity, environmental impacts and risks of the activity continue to be identified and managed to ALARP and acceptable level through the control measures, and environmental outcomes and standards are being met. | Section 5.3.10 and 7.6 |
| 14(4) | Definition of a clear chain of command, setting out of the roles and responsibilities of personnel in relation to the implementation, management and review of the EP, including during emergencies or potential emergencies | Section 7.5 |
| 14(5) | Details of measures to ensure that each employee or contractor working on, or in connection with, the activity is aware of their responsibilities in relation to the EP, including during emergencies or potential emergencies, and have the appropriate competencies and training | Section 7.5 and 7.6 |

| OPGGS (E) Regulation | Summary of Requirements | EP Section |
|---|---|---|
| 14(6) | Provision of sufficient monitoring, recording, audit, management of nonconformance and review of environmental performance to ensure the environmental performance outcomes and standards in the EP are being met | Section 7.7 |
| 14(7) | Provision of sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges (whether occurring during normal operations or otherwise), such that the record can be used to assess whether the environmental performance outcomes and standards in the EP are being met | Section 7.7 |
| 14(8) | Oil Pollution Emergency Plan (OPEP) and provision for the maintenance of the plan | Section 7.11 and Barossa Gas Export Pipeline Installation OPEP (BAA-100 0330); Appendix H |
| 14(8AA) (a, b, c, d), 14(8ª), 14(8B), 14(8C) (a, b, c, d, e), 14(8D), 14(8E) | Details of arrangements for responding to and monitoring oil pollution and testing these response arrangements, including demonstrating that the response arrangements are consistent with the national system for oil pollution preparedness and response | Barossa Gas Export Pipeline Installation OPEP (BAA-100 0330); Appendix H |
| 14(9) (a, b) | Demonstration of consultation with relevant authorities of the Commonwealth, states, territories and other relevant interested persons or organisations | Section 8 and Appendix E |
| 14(10) | Description of the OPGGS Act, its associated regulations and any other environmental legislation applying to the activity | Section 2 |
| Regulation 15. Details of titleholder and liaison person | | |
| 15(1) | Details for the titleholder, including name, business address and telephone number | Section 1.5.1 |
| 15(2) | Details for the titleholder's nominated liaison person, including name, business address and telephone number | Section 1.5.2 |
| 15(3) | Details of arrangements for notifying NOPSEMA of a change in the titleholder, a change in the titleholder's nominated liaison person or a change in the contact details for either the titleholder or the liaison person | Section 1.5.3 |
| Regulation 16. Other information in the environment plan | | |
| 16(a) | Statement of the titleholder's corporate environmental policy | Section 7.2 |
| 16(b) | A report on all consultations between the titleholder and any relevant person | Section 8 and Appendix E |
| 16(c) | Details of all reportable incidents in relation to the proposed activity | Section 7.9 |

## 1.4 Description of the Titleholder

Santos NA Barossa Pty Ltd (ACN: 109 974 932) is the nominated titleholder for the petroleum activity covered under this EP. The contact details for all titleholders are:

| | |
|---|---|
| Business Address: | Level 7, 100 St Georges Terrace, Perth WA 6000 |
| Telephone number: | (08) 6218 7100 |
| Fax number: | (08) 6218 7200 |
| Email address: | barossa.regulatory@santos.com |

### 1.4.1 Liaison person

Details for Santos's nominated liaison person for the activity are as follows:

| | |
|---|---|
| Name: | Nick Phillips (HSE Manager) |
| Business address: | Level 7, 100 St Georges Terrace, Perth, WA 6000 |
| Telephone number: | (08) 6218 7100 |
| Email address: | barossa.regulatory@santos.com |

### 1.4.2 Relevant parties and interfaces

Santos NA Barossa Pty Ltd (37.5%) with its co-venturers SK E&S Australia Pty Ltd (37.5%), an affiliate of South Korean conglomerate SK Group, and Santos Offshore Pty Ltd (25%) have been granted a pipeline license (March 2020).

While each co-venturer participant of this activity is the petroleum titleholder (i.e. registered holder of the petroleum retention lease area), Santos NA Barossa Pty Ltd (as Operator) is now the nominated as titleholder for taking eligible voluntary actions for the activity, such as making submissions, under Subsection 775B of the OPGGS Act.

### 1.4.3 Notification procedure in the event of changed details

In the event there is a change in the nominated operator, the operator's nominated liaison person, or a change in the contact details for the operator or liaison person, Santos will notify NOPSEMA and provide the updated details.

# 2. Environmental legislation and other requirements

## 2.1 Commonwealth legislation

### 2.1.1 Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)

The OPGGS Act provides protection of the environment in Commonwealth Waters (as well as designated State and NT waters where functions have been conferred), by ensuring that all offshore petroleum and greenhouse gas storage activities are undertaken in a manner where impacts and risks to the environment including those matters of national environmental significance (MNES) protected under Part 3 of the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), are of an acceptable level and reduced to as low as reasonably practicable (ALARP). The OPGGS Act requires all activities to be consistent with the principles of ecologically sustainable development (ESD), as defined in the EPBC Act (Section 3A) and outlined in **Section 2.1.4** below.

Section 572(3) of the Act requires a titleholder to remove all structures from the title area. To this end the pipeline and associated structures shall be designed to meet the base case for removal.

The OPGGS Act is supported by a range of subordinate legislation. Of primary relevance to this EP are the OPGGS (E) Regulations, which provide further definition and guidance on the environment management of offshore petroleum and greenhouse storage activities. The OPGGS Act and supporting regulations are administered by NOPSEMA.

### 2.1.2 OPGGS (Environment) Regulations

The OPGGS (E) Regulations provide protection of the environment in Commonwealth waters, as well as designated State and Territory waters where functions have been conferred. The objectives of the OPGGS (E) Regulations are to ensure that petroleum and greenhouse gas activities undertaken in an offshore area are carried out in a manner:

+ consistent with the principles of ESD, as defined in section 3A of 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.

The criteria for determining an acceptable EP, as per Regulation 10A of the OPGGS (E) Regulations, are that the EP:

+ is appropriate for the nature and scale of the activity
+ demonstrates that the environmental impacts and risks of the activity will be reduced to ALARP
+ demonstrates that the environmental impacts and risks of the activity will be of an acceptable level
+ provides for appropriate environmental performance outcomes (EPOs), environmental performance standards (EPSs) and measurement criteria (MCs)
+ includes an appropriate implementation strategy and monitoring, recording and reporting arrangements
+ 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 EPBC Act
+ demonstrates that the titleholder has carried out the consultations required by Division 2.2A, and the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate
+ complies with the OPGGS Act and the regulations.

### 2.1.3 Barossa Offshore Project Proposal

Environmental management of petroleum activities in Commonwealth waters is governed under the OPGGS Act and OPGGS (E) Regulations. As an offshore project, the OPGGS (E) Regulations required an OPP for the Barossa Development, which was accepted by NOPSEMA in March 2018.

The OPP was developed in the early stages of the project before front end engineering design was complete. This EP has been developed based on more detailed engineering work and therefore includes more specifics than included in the OPP. In addition, some of the project characteristics and methodology have been refined based on the additional knowledge gained through further studies and surveys. These changes and any implications on the consequence of impacts have been reviewed and are summarised in **Appendix F**. No significant changes to environmental impacts or risks have been identified as a result of front-end engineering design.

The Barossa OPP presented a pipeline corridor within which the gas export pipeline would be installed. The Barossa OPP identified the activities associated with the installation, operation and decommissioning of the pipeline and assessed potential impacts. Subsequent field investigations and engineering studies have been completed and provided further information on potential pipeline routes within the proposed pipeline corridor both inside and outside of the Oceanic Shoals Marine Park Habitat Protection Zone. A comparative assessment of these candidate pipeline routes and determined a proposed pipeline route based on a number of considerations, including environmental, technical, financial and operational factors. The proposed pipeline route is the subject of this EP.

A more detailed description of the Barossa Development can be found in the Barossa OPP, which is available on the NOPSEMA website at:

+ https://www.nopsema.gov.au/environmental-management/assessment-process/offshore-project-proposals/offshore-project-proposals-public-comment/barossa-area-development-offshore-project-proposal/

### 2.1.4 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The EPBC Act and supporting regulations provide for the protection of the environment and conservation of biodiversity in Australia. Under Commonwealth government streamlining arrangements, NOPSEMA's assessment of this EP provides an appropriate level of consideration of the impacts to matters of national environmental significance (MNES) protected under Part 3 of the EPBC Act. This removes the requirement to refer the project to the Department of Climate Change, Energy, the Environment and Water (DCCEEW).

Regulation 3 of the OPGGS (E) Regulations requires that petroleum activities be carried out in a manner consistent with the principles of ESD set out in section 3A of the EPBC Act, which are:

+ decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations
+ if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation
+ the principle of inter-generational equity—that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
+ the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making
+ improved valuation, pricing and incentive mechanisms should be promoted.

The OPGGS (E) Regulations include requirements for the consideration of MNES, including the following (as per Regulation 13(3):

+ the world heritage values of a declared World Heritage property within the meaning of the EPBC Act

- the national heritage values of a National Heritage place within the meaning of that Act
- the ecological character of a declared Ramsar wetland within the meaning of that Act
- the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act
- the presence of a listed migratory species within the meaning of that Act
- any values and sensitivities that exist in, or in relation to, part or all of:
  - a Commonwealth marine area within the meaning of that Act or
  - Commonwealth land within the meaning of that Act.

### 2.1.5 Australian Marine Parks licence

The proposed Barossa gas export pipeline route traverses two zones of the Commonwealth Oceanic Shoals Marine Park: a 30 km section through the Multiple Use Zone; and 31.5 km through the Habitat Protection Zone.

#### 2.1.5.1 Multiple Use Zone

Mining operations, including oil and gas operations, may be conducted in a Multiple Use Zone (VI) subject to conditions of a class approval and prescriptions within the North Marine Parks Network Management Plan (Director of National Parks, 2018). The 'Class Approval – Mining Operations and Greenhouse Gas Activities' came into effect on 1 July 2018 at the same time as the management plan for Australian Marine Parks in the North Network. The conditions of the Class Approval for the North Marine Parks Network Management Plan that are considered relevant to the scope of this EP are provided in **Table 2-1**.

#### 2.1.5.2 Habitat Protection Zone

Construction and operation of a pipeline (and the carrying on of other activities for the purposes of those operations e.g. surveys) through a Habitat Protection Zone (IV) is authorised through the issue of a Commercial Activity Licence by the Director of National Parks. A licence from the Director of National Parks was applied for.

As part of the licence application process, the following in relation to the development of the gas export pipeline route is considered:

- the values of the Oceanic Shoals Marine Park (**Section 4.6.3**),
- the environmental impacts and risks from the installation, operation and decommissioning of the gas export pipeline within the Oceanic Shoals Marine Park
- consultation outcomes, including consultation in relation to the Barossa OPP, and
- the gas export pipeline route assessment, including potential alternative routes outside the Oceanic Shoals Marine Park.

As per the prescription (4.2.9.6) in the North Marine Parks Network Management Plan, the Director of National Parks will only authorise a pipeline through a Habitat Protection Zone if alternative routes are not feasible or practicable.

The licence application considered the alternative gas export pipeline routes that were identified both through and around the Oceanic Shoals Marine Park. Each of the alternative routes were subjected to an assessment process that considered the:

- footprint of the proposed activity
- feasibility – can the route feasibly be constructed using available technologies and within the constraints of the Barossa Development?

+ practicability – comparative assessment of environmental, societal, safety, technical and economic criteria.

As per the above criteria, routing the gas export pipeline through the Oceanic Shoals Marine Park Habitat Protection Zone (i.e. the route presented in this EP) was determined by this process to meet the decision-making criteria of the North Marine Parks Management Plan.

A Commercial Activity Licence from the Director of National Parks in April 2019 has been received for the activity. The 'Licensed Activities' include "the construction, installation, operation, inspection, maintenance, repair and decommissioning of the GEP and the related capture of images, video and sound within or of the Park". The 'Licence Area' is described in detail in the Licence and includes the pipeline installation corridor buffered by 2000 m on either side. The 'Licence Area' is consistent with the definition of 'operational area' in this EP (**Section 3.3.1**).

The licence is comprised of:

a. Part A – The brief Particulars of the Licence and execution page
b. Part B – Terms and conditions specific to the Licensed Activities and/or the Park, plus an Annexure specifying further details of the Particulars; and
c. Part C – The general terms and conditions that apply to the Licence.

Conditions considered relevant to the scope of this EP are provided in **Table 2-2**.

The commencement date of the licence is the date on which the Barossa Gas Export Pipeline Licence is granted under the OPGGS Act.

***Table 2-1: Conditions from the Class Approval – Mining Operations and Greenhouse Gas Activities for the North Marine Parks Network Management Plan 2018 relevant to the activities in this EP.***

| Condition Number | Condition | Relevant Section of EP |
|---|---|---|
| 1 | Approved action must be conducted in accordance with:<br>a. an environment plan accepted under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (2009) (Cth) | This EP |
| | b. the EPBC Act | Section 2.1.4 |
| | c. the Environment Protection Biodiversity Conservation Regulations 2000 (EPBC Regulations) | Section 2.1.4 |
| | d. the North Network Management Plan | Section 5.2<br>Section 5.3 |
| | e. any prohibitions, restrictions or determinations made under the EPBC Regulations by the Director of National Parks | Not applicable |
| | f. all other applicable Commonwealth and state and territory laws (to the extent those laws are capable of operating concurrently with the laws and instruments described in paragraphs a-e) | Section 2 |

| | | |
|---|---|---|
| 2 | If requested by the Director of National Parks, an Approved Person must notify the Director prior to conducting Approved Actions within Approved Zones.<br>Note: the timeframe for prior notice will be agreed to by the Director of National Parks and the Approved person. | Section 7.8.2 |
| 3 | If requested by the Director of National Parks, an Approved person must provide the Director with information relating to undertaking the Approved Actions or gathered while undertaking the Approved Actions) that is relevant to the Director's management of the Approved Zones.<br>Note: the information required and timeframe within which it is required will be agreed to by the Director of National Parks and the Approved Person. | Not applicable |

***Table 2-2: Conditions from the Commercial Activity Licence relevant to the environmental management of the activities in this EP.***

| Condition Number | Condition | Relevant Section of EP |
|---|---|---|
| **Part B** | **Park and Licensed Activities specific conditions** | |
| 4.1 | The Licensees must consult the Director as a Relevant Person during the development of all environment plans. | Section 7.11.8 |
| 4.4 | The Licensees must:<br>(a) notify the director of the grant of the GEP Licence (if granted) within 24 hours of its grant;<br>(b) notify the Director of the acceptance or refusal of an environment plan by NOPSEMA within 24 hours of its acceptance or refusal.<br>(c) following acceptance of an environment plan by NOPSEMA, provide the Director with a copy of that environment plan within 10 business days of acceptance.<br>(d) following the completion of construction of the GEP, promptly provide the Director with as built coordinates for the location of the GEP in degrees, minutes and seconds using geographic coordinate system GDA94. | Section 7.8.2 |
| 5.1 | The Licensed Activities conducted within the Licence Area must be conducted in accordance with an environment plan. | Section 7 |

| | | |
|---|---|---|
| 5.2 | In developing each environment plan, the Licensees must ensure they:<br>a) consult all relevant representative organisations for Aboriginal or Torres Strait Islander persons whose custodianship or traditional use of the Licence Area or the Park may be negatively impacted by the Licensed Activities<br>b) use reasonable endeavours to:<br>(i) address any feedback received in consultation undertaken for the purposes of clause 5.2(a)<br>(ii) mitigate or avoid negative impacts, by amending the proposed environment plan and manner in which the Licensees propose to undertake the Licensed Activities<br>c) at the same time that the Licensees provide the Director with a copy of the relevant Environment Plan in accordance with clause 4.4 (c), provide the Director with a report setting out:<br>(i) the scope of consultation undertaken in accordance with clause 5.2(a), including names of organisations from whom feedback was sought<br>(ii) a summary of the feedback received from organisations with whom consultation occurred<br>(iii) a summary of the amendments to the environment plan and manner in which the Licensed Activities are proposed to occur, made by the Licensees in order to address feedback and mitigate or avoid negative impacts on Aboriginal or Torres Strait Islander persons referred to in clause 5.2(a). | |
| **Part C** | **General Terms and Conditions** | |
| 9.2 | Compliance with Laws and Authorisations<br>a) in undertaking the Licensed Activities within the Licence Area and performing the Licensees' obligations under the Licence, the Licensees must comply with:<br>(i) all applicable laws, including the EPBC Act, EPBC Regulations and any Management Plan<br>(ii) all applicable Authorisations. | Section 2 |

### 2.1.6 Northern Territory legislation

The project is located entirely in Commonwealth waters; however, Northern Territory legislation relevant to emergency response and the environmental values of areas that may be affected by unplanned events is applicable.

### 2.1.7 International agreements

Australia is signatory to several international environmental protection agreements and conventions which are relevant to the region, these include conventions for protecting migratory birds and other marine fauna (Japan–Australia Migratory Birds Agreement/China–Australia Migratory Birds Agreement/Republic of Korea and Australia Migratory Birds Agreement/ACAP/Bonn), wetlands (Ramsar) and environmental values (International Convention for the Prevention of Pollution from Ships (MARPOL)).

# 3. Description of the activity

This section has been prepared in accordance with Regulation 13(1) of the OPGGS (E) Regulations and describes the activities that will be undertaken within the scope of this EP.

## 3.1 Pipeline route selection

The Barossa OPP (Section 2.1.3) presented a pipeline corridor within which the gas export pipeline would be installed and assessed the potential impacts and risks from undertaking pipeline installation and operational activities within that corridor. The evaluation of potential environmental impacts and risk conducted in the Barossa OPP was based on installation of the Barossa pipeline anywhere within that pipeline corridor. Since the OPP was developed, further field surveys and engineering studies have been conducted and a number of potential pipeline routes within the corridor assessed.

Following the assessment, the route presented in this EP was selected as it reduces potential environmental impacts and achieves the following benefits compared with alternative routes.

+ minimises the length of the pipeline that overlaps the Oceanic Shoals Marine Park Habitat Protection Zone
+ minimises the amount of span correction required and eliminates secondary stabilisation requirements for pipeline installation (which would be required if the pipeline was installed further east in shallower waters outside the Oceanic Shoals Marine Park Habitat Protection Zone)
+ minimises the installation of the pipeline over areas of seabed that are associated with the seafloor features/values of the shelf break and slope of the Arafura Shelf and carbonate bank and terrace system of the Van Diemen Rise key ecological features (KEFs)
+ reduces inspection, maintenance and repair requirements during operations due to the reduced route length and smoother seabed profile (fewer spans) as it represents the shortest length of pipeline required and minimises the amount of span supports and mitigation measures
+ minimises the time required for installation activities as the selected route is the shortest route.

## 3.2 Activity overview

An overview of the gas export pipeline installation campaign is detailed in **Table 3-1**.

*Table 3-1: Activity summary*

| | |
|---|---|
| **Permit areas** | NT/L1 (production license), NT/PL5 (pipeline license) |
| **Location** | Bonaparte Basin, Timor Sea |
| **Pipeline installation** | Approximately 262 km of 26-inch outer diameter carbon steel, concrete coated rigid pipeline. The pipeline runs from the PLET assembly in NT/L1 to the downstream PLET near the location of the existing Bayu-Undan pipeline. |
| **Subsea infrastructure/ hardware** | + two PLETs (including PLET foundations and a protection structure at downstream tie-in location)<br>+ subsea support structures (lateral buckling mattresses, fibre optic cable crossings, span rectification structures). |
| **Proposed schedule** | Installation of the pipeline is expected to be undertaken sometime between Q4 2021 and May 2024, and take nominally five months to complete. Pre-lay surveys would take additional time and be undertaken within this time window. |
| **Water depth** | Approximately 33 to 254 m |
| **Vessels** | Pipelay vessel and support vessels (including marine survey vessels, construction vessels, DP general cargo vessels, pipe supply vessels and supply vessels).<br>Nominally up to 15 vessels may be used throughout the installation activities.<br>These are collectively referred to as 'activity vessels' throughout this document. |
| **Key activities** | Vessel activities within the operational area, including:<br>+ pre-lay and post-lay surveys<br>+ delivering and transferring linepipe (sections of pipe) to the pipelay vessel<br>+ installation of supporting structures:<br>– pipeline crossing construction (fibre optic cable)<br>– lateral buckling initiation site(s) construction<br>– PLET foundations<br>– anti-snag frame over PLET located at downstream end of gas export pipeline<br>+ gas export pipeline installation, including PLETs<br>+ span rectification:<br>– pre-lay and post-lay span correction<br>– installation of scour mitigation at span shoulders and structures<br>– installation of local stabilisation at span shoulders and at the downstream tie-in location (if required).<br>+ pipeline pre-commissioning:<br>– flood, clean, gauge and pressure testing (FCGT)<br>– dewatering<br>– preconditioning.<br>+ nitrogen packing. |

## 3.3 Location and tenure

The gas export pipeline will be installed within the licence area, which extends from petroleum retention lease area NT/L1 to the proposed downstream tie-in location (**Figure 3-1**). The start and end locations of the pipeline are outlined in **Table 3-2**.

The proposed gas export pipeline route lies entirely within the Bonaparte Basin, in Commonwealth waters. Water depths along the gas export pipeline route vary from 254 m at the deepest point at the FPSO PLET location, to 33 m at the shallowest point approximately 47 km upstream from the downstream PLET location.

The water depth at the downstream PLET is approximately 55 m. Approximately 30 km of the pipeline route lies within the Oceanic Shoals Marine Park Multiple Use Zone, and approximately 31.5 km lies within the Habitat Protection Zone (**Table 3-3**).

***Table 3-2: Pipeline start and end locations***

| Location | Water Depth | Longitude | Latitude |
|---|---|---|---|
| PLET – Floating Production Storage and Offloading Facility (FPSO) | 254 m | 130° 15' 48” E | 9° 49' 15 “ S |
| PLET – Downstream Tie-In | 54 m | 129° 54’ 27” E | 12° 01' 22” S |

***Table 3-3: Pipeline route co-ordinates within the Multiple Use Zone and Habitat Protection Zone of the Oceanic Shoals Marine Park***

| Marine Park zone | Longitude | Latitude | Distance (km) |
|---|---|---|---|
| Enters Multiple Use Zone | 130° 17' 05” E | 10° 20' 00” S | Approx. 30 km |
| Exits Multiple Use Zone | 130° 16' 26” E | 10° 36' 00” S | |
| Enters Habitat Protection Zone | 130° 06' 00” E | 11° 00' 19” S | Approx. 31.5 km |
| Exits Habitat Protection Zone | 129° 58' 57” E | 11° 15' 31” S | |

### 3.3.1 Operational Area

The operational area for this EP (**Figure 3-1**) has been defined as 2,000 m either side of the gas export pipeline route, except:

+ where the width of the operational area has been reduced to the east and west of the pipeline centreline to remain within the pipeline installation corridor presented in the accepted OPP
+ at the Barossa FPSO PLET location where the operational area has been extended to a radius of 3,000 m for operational purposes (while remaining within the pipeline installation corridor in the accepted OPP
+ at the downstream proposed tie-in PLET where the operational area has been extended south by 3,000 m for operational purposes (while remaining within the pipeline installation corridor in the accepted OPP).

The operational area encompasses the installation of the gas export pipeline and support vessel movements in the immediate vicinity of the pipelay vessel.

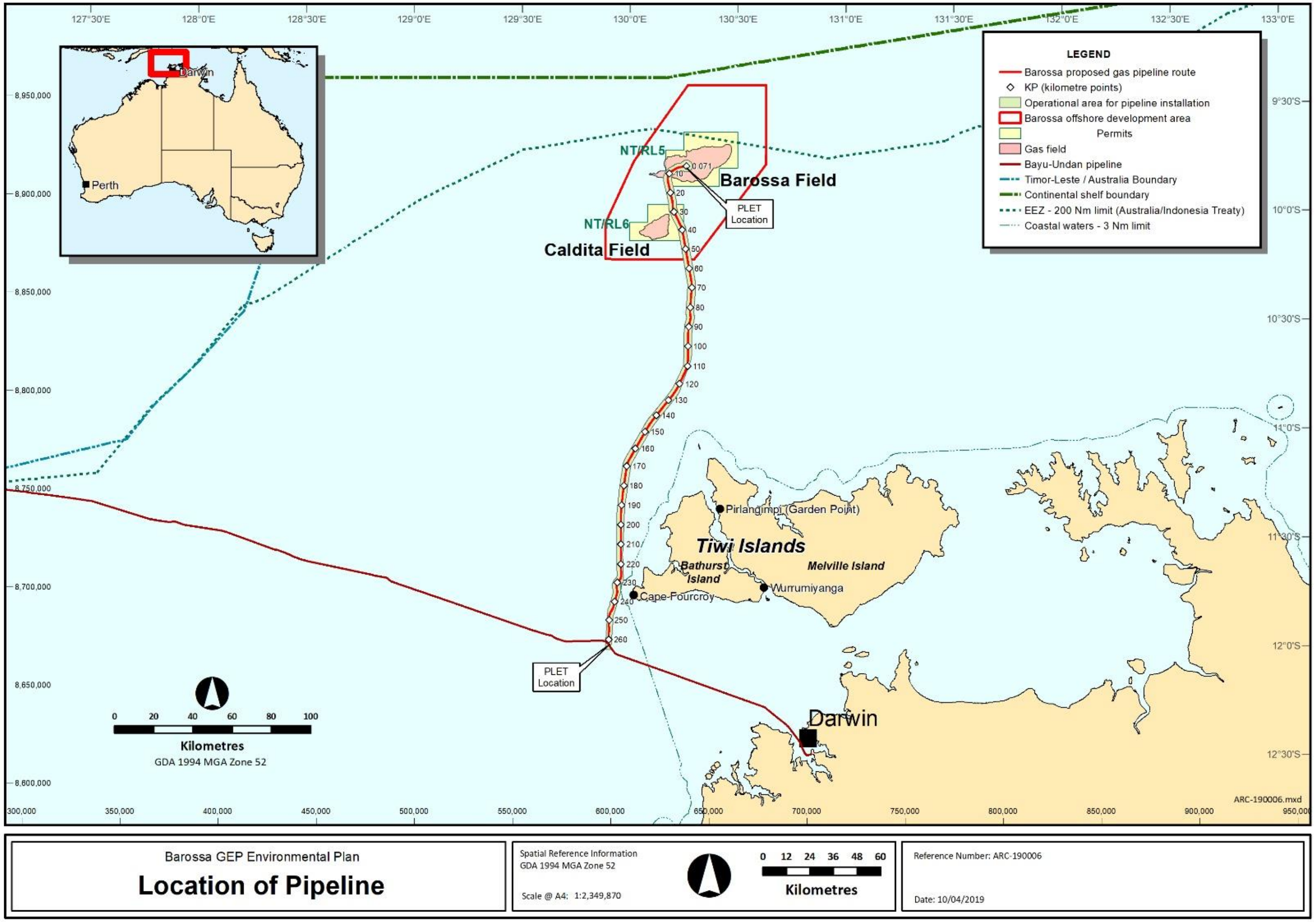



*Figure 3-1: Barossa field and gas export proposed pipeline route location*

## 3.4 Activity vessels

Multiple vessel types will be required to complete the activities within the operational area to support the gas export pipeline installation campaign. The vessels that may be required are summarised in **Table 3-4**.

***Table 3-4: Vessel types that may be used for the gas export pipeline installation activities***

| Vessel Type | Potential Activities |
|---|---|
| Marine survey vessel | + pre-lay survey of the pipeline route using multi-beam echo sounder (MBES) and sub-bottom profiler (SBP)<br>+ pipelay support activities<br>+ as-laid/post-laid survey |
| Pipelay vessel | Installation of the gas export pipeline and PLETs |
| Construction vessels | + pre-lay and post-lay surveys<br>+ pre-lay and post-lay span correction work<br>+ installation of supporting structures (PLET foundations, pre-lay pipeline crossing and buckle initiation site construction)<br>+ post-lay PLET protection structure installation (at the downstream tie-in location)<br>+ pipelay support activities (touch down monitoring, subsea positioning)<br>+ local stabilisation (could include mattresses)<br>+ installation of scour mitigation<br>+ FCGT activities<br>+ dewatering and pre-conditioning activities |
| Pipe supply vessels and DP general cargo vessels | Transport of linepipe and structures to pipelay vessel |
| Supply vessel | Support and supplies |

Activity vessels selected and on-boarded in accordance with the Offshore Marine Assurance Procedure (SO 91 ZH 10001) to ensure contracted vessels are operated, maintained and manned in accordance with industry standards (for example, Marine Orders) and regulatory requirements (this EP) and the relevant Santos procedures mentioned in this EP. The marine assurance process, includes close inspection of vessel suitability, equipment and design, and personnel training, including officer experience.

Vessels will generate and manage solid wastes. Vessels will also undertake routine discharges include the following: sewage, grey water, putrescible, brine (from desalination), ballast water and cooling water.

Atmospheric emissions will be emitted from power-generating equipment on board the vessels, including engines and generators.

Bunkering of the vessels may take place either at sea within the operational area (e.g. if required for the pipelay vessel), in sheltered or inshore waters, or in port (support and other vessels). When in the operational area, no bunkering will occur within 20 km of Tiwi Islands.

### 3.4.1 Pre-lay and post-lay survey vessels

#### 3.4.1.1 Marine survey vessel

A marine survey vessel may be used for pre-lay and post-lay surveys (**Section 3.4.1**). Marine survey vessels are generally 60 to 90 m long with a crew capacity of up to 50 persons. Marine survey vessels will be fuelled by marine diesel oil (MDO) or marine gas oil (MGO), which will be stored in multiple isolatable fuel tanks up to 250 $m^3$ capacity. Physical anchoring of the marine survey vessel to the seabed within the operational area shall not be performed unless in an emergency.

## 3.4.2 Pipeline installation vessels

### 3.4.2.1 Pipelay vessel

The gas export pipeline and PLETs will be installed using a specialised pipelay vessel with an enclosed firing line to shield the external environment from welding flashes and minimise light emissions.

The pipelay vessel will require sufficient capacity to hold the concrete coated linepipe as well as the PLETs. In addition, the pipelay vessel will need space for pre-fabrication areas and pipeline production areas. The pipelay vessel will be equipped with cranes to assist with construction work, pipe-loading, placement of equipment on the seafloor and the transfer of supplies. See **Table 3-5** for typical pipelay vessel specifications.

The pipelay vessel will use a dynamic positioning (DP) system, which allows it to maintain position while installing the pipeline (laying the pipe). The pipelay vessel will not anchor in the operational area unless in an emergency.

Throughout the installation of the gas export pipeline, the pipelay vessel will be supported by either a construction or survey vessel, fitted with a remotely operated vehicle (ROV), which will be used to inspect the installed equipment.

The pipelay vessel will require refuelling during the installation of the pipeline. The bunkering schedule will depend on the selected pipelay vessel and other operational criteria. The pipelay vessel may use MDO or MGO. Fuel tanks will be protected by water ballast compartments and no single tank will exceed 1400 $m^3$.

The pipelay vessel will have a helideck and receive helicopters for crew changes. A helicopter refuelling system will be in place on the helideck.

A 500 m exclusion zone will be in place around the pipelay vessel during the gas export pipeline installation campaign.

*Figure 3-2: Indicative pipeline installation vessel*

*Table 3-5: Typical specifications for a pipelay vessel*

| Vessel Systems | Typical Characteristics |
|---|---|
| Length | 180 to 350 m |
| Net Tonnage | 10,000 to 32,000 tonnes |
| Gross Tonnage | 33,000 to 105,000 tonnes |
| Total persons on board (POB) | 300 to 700 |
| Lighting | Navigational, deck, task-specific and emergency lighting |
| Ballast system | Ballast systems can vary in size with total volumes from 20,000 $m^3$ to 32,000 $m^3$ |
| Freshwater system | Evaporators/distillation units on board<br>Freshwater tanks vary in size from 1000 $m^3$ to 1500 $m^3$ |
| Cooling system | Seawater used to cool main engines, refrigerators and service cooling; seawater is circulated by pumps |
| Sewage system | International Maritime Organisation/International Convention for the Prevention of Pollution from Ships (IMO/MARPOL) compliant sewage treatment plants |
| Putrescible waste system | MARPOL-compliant comminuting (grinding) system |
| Incinerators | MARPOL-compliant incinerators |
| Fuel tanks | Multiple isolatable fuel tanks with total capacity 2000 $m^3$ to 8000 $m^3$ (no single tank will exceed 1400 $m^3$) |
| Power generation | Four to eight main diesel generators |

### 3.4.2.2 Construction vessels

Construction vessels vary in size and capability. The gas export pipeline installation campaign may use one or more construction vessels for:

- pre-lay surveys of the pipeline route and post-lay (as-laid, Out of Straightness and as-built) surveys of the installed gas export pipeline and PLETs
- pre-lay and post-lay span correction work
- installation of the PLET foundations (bases)
- pipeline crossing construction where the pipeline crosses existing fibre optic cables
- lateral buckle initiation site construction (installation of concrete mattresses) where required
- pipelay support activities such as touch down monitoring (monitoring installation of the pipeline along the seabed), ROV monitoring of installation of supporting structures and subsea positioning of the pipeline
- installation of the anti-snag frame over the PLET located at downstream end of the gas export pipeline
- local pipeline stabilisation at span shoulders and the downstream tie-in location (if required)
- installation of scour mitigation at span shoulders and supporting structures
- FCGT activities
- dewatering and pre-conditioning activities.

It is expected that the construction vessels will vary in size from approximately 90 to 150 m long with crew capacities between 60 and 100. Construction vessels will use either MDO or MGO. Fuel oil capacity and largest single tank volume are dependent on the type and size of construction vessel; however, the largest single tank capacity is expected to be less than 700 $m^3$. Construction vessels may be in the operational area for the duration of offshore operations. Seabed anchoring of the construction vessel within the operational area shall not be performed, unless in an emergency.

The construction vessel(s) are required to support activities that are performed prior to pipelay commencement (such as pre-lay span correction), after pipelay completion (such as FCGT, as-laid survey and post-lay span correction) as well as during pipelay (such as as-laid survey). The sequence of pre-lay activities, pipelay and post-lay activities shall be scheduled to occur in a single campaign in order to avoid the requirement to perform multiple mobilisations and demobilisations of the construction vessel(s). Performing the work in a single continuous campaign also enables pre-lay and post-lay activities to be performed in parallel with pipelay where practicable to further reduce the schedule and optimise the offshore campaign.

### 3.4.3 Pipe supply vessels

Pipe supply vessels (PSVs) or purpose-built general cargo vessels will be used to transport linepipe to the pipelay vessel daily. Typical PSVs are approximately 90 m long, with a crew capacity of approximately 30 personnel. PSVs will use either MDO or MGO and typically have a maximum single fuel tank volume of 250 m³. Purpose built general cargo vessels are typically up to 150 m in length with the maximum single fuel tank capacity of 295 m³ (either MDO or MGO). As only DP vessels will be used for transporting and transferring linepipe, no anchoring within the Operational Area shall be performed, unless in an emergency.

### 3.4.4 Supply vessels

Supply vessels will be required to undertake specific tasks and will travel to and from the operational area for the duration of the gas export pipeline installation campaign.

Supply vessels will transport food, fuel, supplies (e.g. consumables) and equipment between vessels in the Operational Area (pipelay vessel, construction vessel, survey vessel) and port (e.g. Darwin and international ports). Supply vessels will also be used to transfer solid waste from vessels back to the mainland for disposal. It is anticipated that up to two supply vessels will be used. Supply vessels may be up to 70 m in length with DP capability. Supply vessels will utilise MDO or MGO, with a largest single fuel tank volume of approximately 250 m³.

As supply vessels will be DP, no anchoring within the operational area shall be performed, unless in an emergency.

### 3.4.5 Other support

#### 3.4.5.1 Remotely operated vehicles

Remotely operated vehicles (ROVs) may be launched from the survey vessel, pipelay vessel and construction vessels to undertake:

+ pre- and post-lay surveys
+ monitor pipelay (touch down monitoring)
+ support PLET installation activities including the PLET foundation placement
+ support installation of scour mitigation measures
+ execution of pipeline crossing construction
+ span correction
+ localised stabilisation
+ pipeline pre-commissioning activities.

Typically, 150-200 horsepower (hp) Work Class ROVs will be used to support construction activities. These typically weigh between 2450 and 4400 kg and have a footprint of up to 1.8 m by 3.5 m. ROVs are operated using hydraulic control fluids.

#### 3.4.5.2 Helicopters

Helicopters will be used for crew transfers to the pipelay vessel and other helideck-equipped vessels such as the survey vessel and construction vessels. Helicopter operations may include offshore helicopter refuelling on the vessel helidecks, subject to flight distances and weight of the loads the helicopter will be carrying.

## 3.5 Pipeline installation activities

### 3.5.1 Site surveys

Site surveys will be undertaken at various stages throughout the gas export pipeline installation campaign. An initial pre-lay survey prior to commencement of pipeline installation will be undertaken up to 18 months before pipelay commences. The pre-lay survey identifies debris, seabed features or obstructions along the pipeline route. It is not a full geophysical survey. There is an allowance of 250 m either side of the pipeline route, allowing for localised re-routing if any significant obstructions and areas of spanning are identified during the pre-lay survey. Site surveys have already been undertaken for the pipeline route and no debris was identified that would require removal prior to installation, however if debris is identified during the pre-lay survey, debris removal could be undertaken by the pipelay vessel, survey vessel or construction vessels, in advance of pipelay where practicable.

The survey methods for identifying debris, seabed features, buried assets (e.g. fibre optic cable) and obstructions are non-intrusive, and the equipment does not disturb the seabed. Survey methods will primarily include multi-beam echo sounder (MBES), sub-bottom profiler (SBP) and side scan sonar (SSS). MBES uses sound pulses to establish the seabed profile. Most modern MBES systems work by transmitting a broad acoustic pulse from a hull or pole mounted transducer. SBP also uses acoustics, although the acoustic pulse is transmitted from a towed surface or deep-sea source and collected by a receival array that is towed below the water surface. ROV mounted equipment such as an altimeter and obstacle avoidance sonar may also be used.

As-laid, as-built and cathodic protection surveys will also be progressively undertaken throughout the gas export pipeline installation campaign. The data from these surveys will be used to determine the pipeline position once laid, inform free-span rectification, identify deviations from straightness etc. Surveys will use the same techniques as outlined above as well as visual inspection using remotely operated vehicles (ROVs) and cathodic protection equipment such as passive field gradient sensing equipment.

### 3.5.2 Underwater acoustic positioning

Installation of the pipeline requires accurate positioning on the seabed and therefore long base line (LBL) and/or Ultra Short Baseline (USBL) acoustic positioning may be required. These systems allow sub-metre accuracy.

USBL and LBL utilise transponders. Typically, for a USBL array, transponders are installed attached to subsea equipment and recovered once the equipment is correctly positioned on the seabed. For LBL, transponders are typically fixed to seabed frames which are deployed and then fully recovered once subsea equipment is correctly positioned.

Up to six LBL arrays, comprising six to eight LBL transporter frames, may be used within the operational area. LBL arrays will be required at both PLET locations. The footprint on the seabed of a typical LBL transponder frame is less than 5 $m^2$.

LBL and USBL systems work by emitting short pulses of medium to high frequency sound. Transmissions are not continuous but consist of short ‘chirps’ with a duration that ranges from 3 to 40 milliseconds.

### 3.5.3 Installation of supporting structures

Supporting structures include:

+ lateral buckling mattresses, each comprising three mattresses along the pipeline route within NT/RL5
+ concrete mattresses over the buried Northwest optic fibre cable

+ PLET foundations at both ends of the gas export pipeline (i.e. at the FPSO and at the tie-in location).

These will be installed before pipeline installation at the supporting structure location. The co-ordinates for the PLETs are provided in **Table 3-2** and shown in **Figure 3-1**. The estimated seabed footprint associated with supporting structures is provided in **Table 3-6**.

Lateral buckling mattresses, used to control the flex and movement of a pipeline on the seabed, will be installed in at least three locations along the pipeline route where the route is within NT/L1. Front end engineering design has defined the required mattress configurations, with an overall seabed footprint of approximately 42 $m^2$ (comprising two mattresses 4 m by 3 m and one mattress 6 m by 3 m) at each location. Certain mattresses require the installation of scour protection around their perimeter to ensure that the seabed material (e.g. sand) under the mattress is not undermined during operations (undermining results in the mattress sagging). The scour protection could result in nominally 2 m of additional material around a number of mattresses, increasing the nominal footprint by another 140 $m^2$ (comprising of two mattresses with scour protection of 8 m by 7 m and one mattress with scour protection of 10 m by 7 m) at each location where scour protection is used. The mattresses used to initiate lateral buckling will be installed by a construction vessel.

The gas export pipeline needs to cross over the existing northwest cable system (fibre optic cable), that is located nominally at KP257.3. The fibre optic cable is buried under the surface of the seabed. Concrete mattresses will be installed at the fibre optic cable crossing to ensure adequate separation is maintained between the pipeline and the buried fibre optic cable. Nominally three mattresses with a combined footprint of 66 $m^2$ shall be included at the crossing. Additional mattresses, nominally four with a combined footprint of 72$m^2$, shall be installed either side of the pipeline at each touchdown location for scour mitigation.

PLET foundations are steel structures that provide long-term support for the PLETs. Two PLET foundations will be installed (one foundation for each PLET). The PLET foundations will be designed to suit the local seabed geotechnical properties. Based on preliminary engineering, the PLET foundations are expected to have a footprint of approximately 25 m (long) by 15 m (wide), with scour protection that could extend out up to nominally 5 m all around the foundations. The expected total footprint at each PLET location for the foundation and scour protection is 875 $m^2$. The PLET foundations will be installed using the construction or pipelay vessel. The construction/pipelay vessel crane would be used to lift the structure from the deck of the vessel and lower onto the seabed. An ROV would be used during installation to position and orientate the structures.

### 3.5.4 Span rectification

Preliminary analysis of the pipeline route (SEA, 2019) has identified 61 span locations between KP107 to KP250 (Figure 3-3 to **Figure 3-5**). These will be fixed using one or more span supports, either mattresses, grout bags or mechanical support structures. Mass flow excavation may also be required in mobile sandwave region between KP237 and KP254.

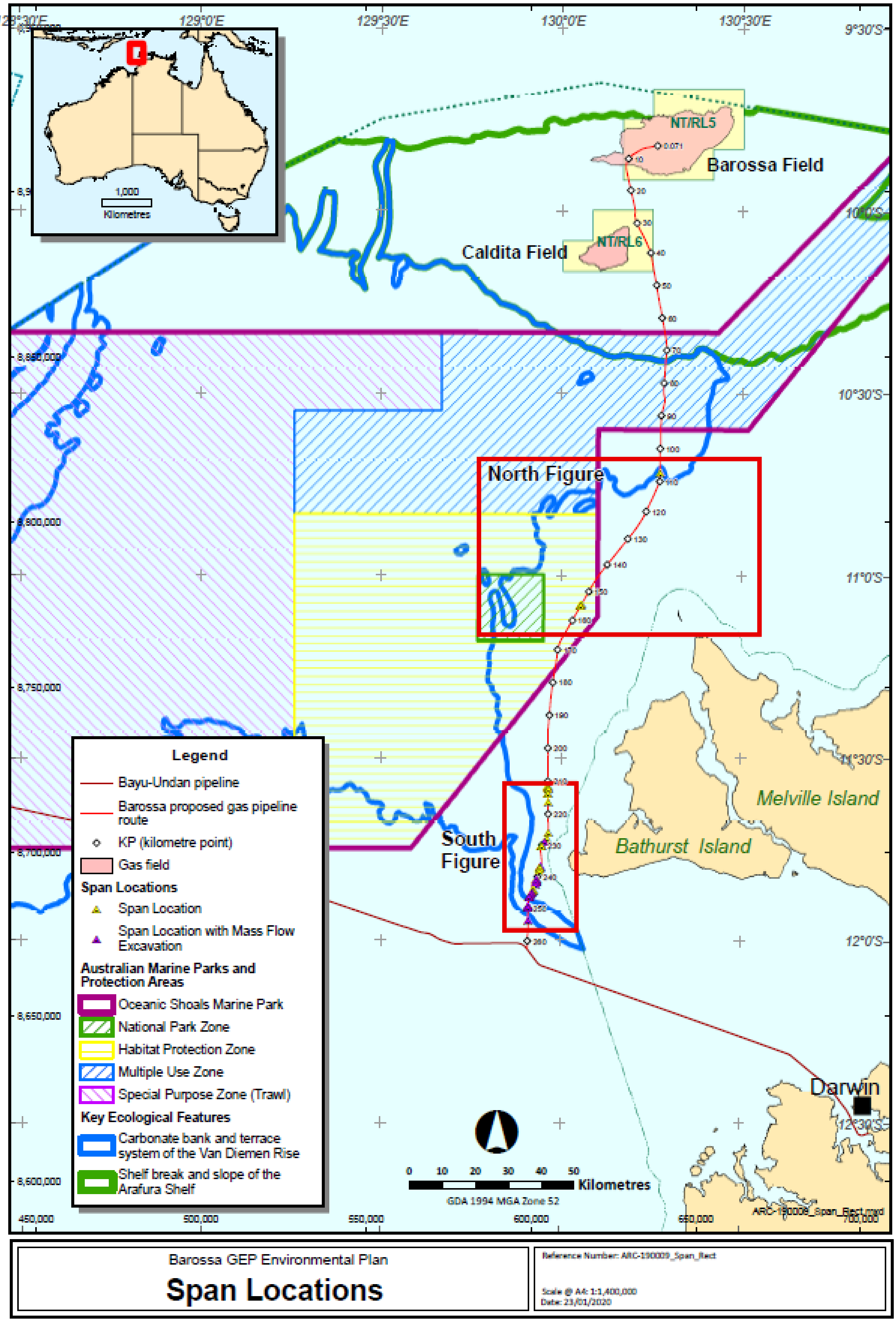



*Figure 3-3: Span locations – overall*

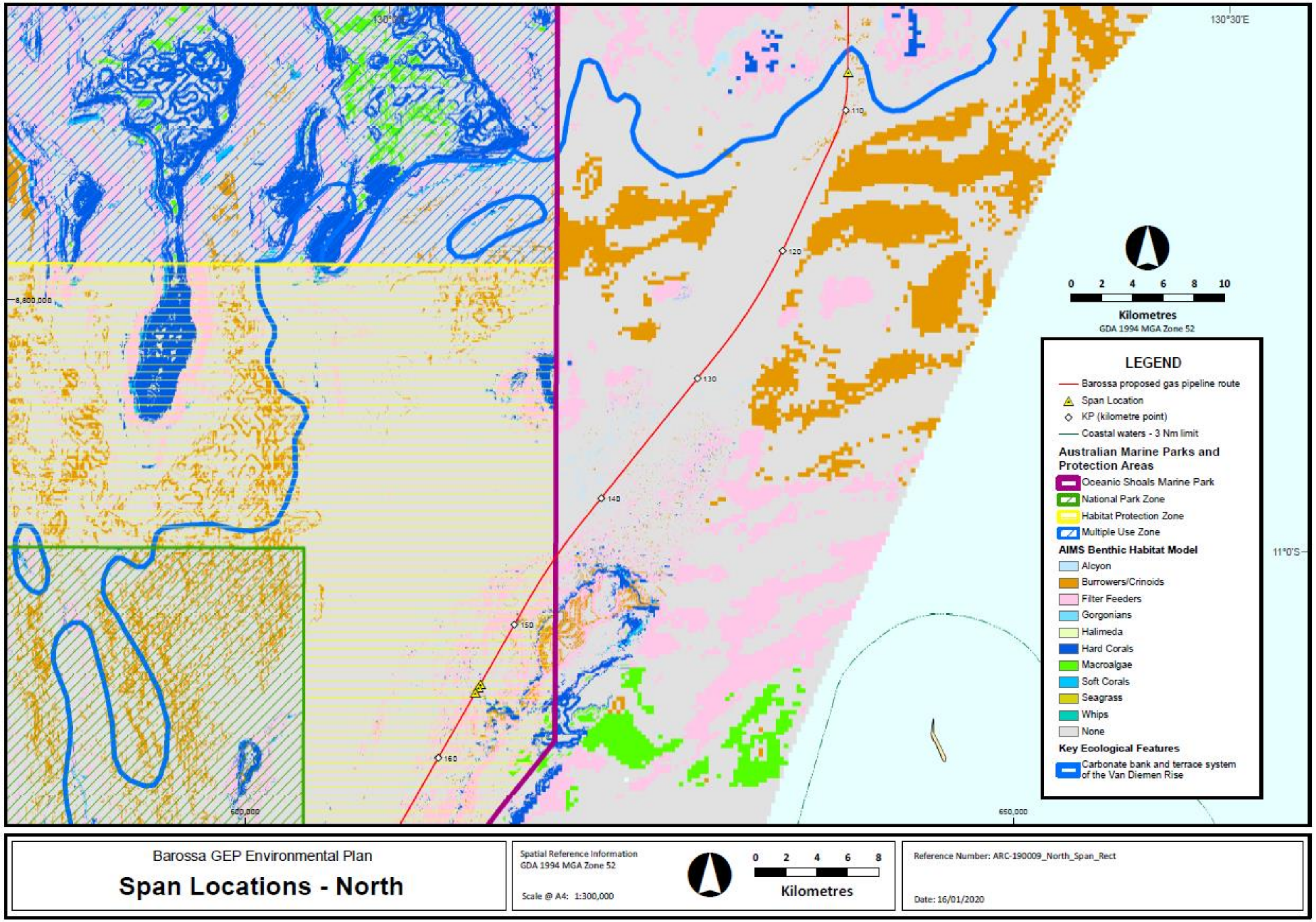



*Figure 3-4: Span locations – north*

Santos

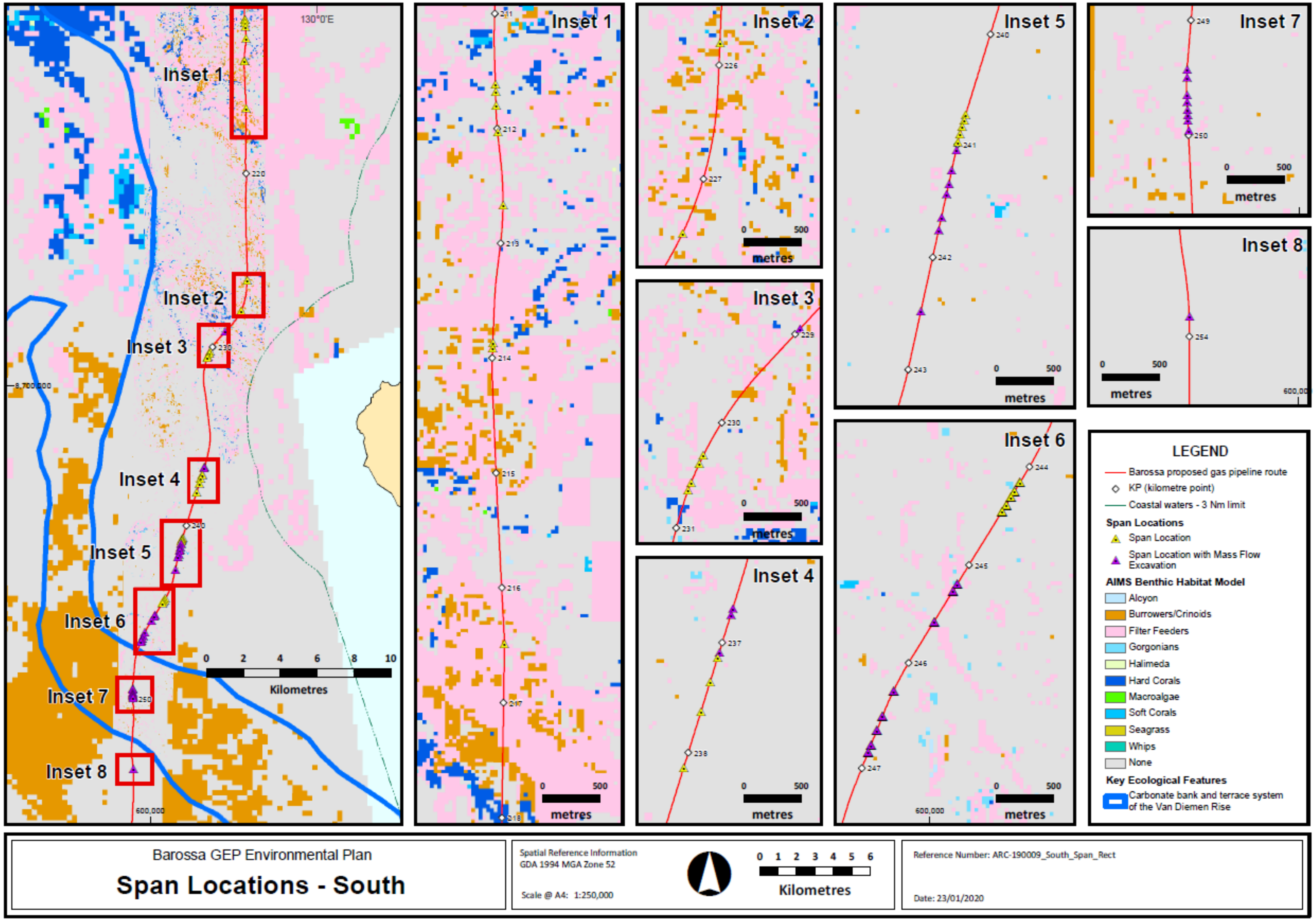



*Figure 3-5: Span locations – south*

Techniques for pre-lay and post-lay span correction are outlined below. The seabed footprint associated with span rectification is provided in **Table 3-6**.

#### 3.5.4.1 Concrete mattresses

Mattresses (**Figure 3-6**) are commonly used to correct pre-lay spans and provide scour control at span shoulders to mitigate against span growth during operations. Mattresses consist of blocks of dense material (typically concrete) bound together by flexible cables (usually artificial fibre ropes). The dimensions for each concrete mattress are typically 6 m by 3 m, but could be larger if required to suit installation tolerances and seabed topography. The mattresses will be lifted from the deck of the survey or construction vessel and lowered to the seabed by vessel crane. An ROV will be used during installation to position and orientate the mattresses prior to landing out on the seabed.

***Figure 3-6: Example of concrete mattresses***

Mattresses could also be used to locally supplement or replace concrete weight coating on the pipeline in critical regions, subject to vessel capability, such as at the PLET locations. Mattresses may be required at span shoulders and over mechanical support structures to ensure the pipeline remains on the span supports during storm conditions and span shoulders do not erode, increasing the length of the spans during operations.

#### 3.5.4.2 Grout bags

Grout bags (**Figure 3-7**), are commonly used to correct post-lay spans. Grout bags are made of flexible material (e.g. woven polypropylene) which is filled with granular material such as sand. A binder (typically cement) is included to stabilise the granular material within the bag. Grout bags can also come filled with rock without any binding material subject to size of rock particles. Small prefilled grout bags can be installed individually by ROV or can be lowered slowly to the seabed by crane in bulker bags for individual placement subject to the height of the span.

Higher spans are rectified using post filled grout bags. The empty grout bags are positioned under the pipe by ROV and are filled from the surface using a liquid slurry of grout via a downline. The grout lines are flushed to subsea after each operation to ensure the grout does not set in the downline between filling operations. Post filled grout bags are generally pyramidal in shape and the footprint of each grout bag can be up to 5 m by 5 m, subject to span height. Scour protection may also be required subject to the seabed conditions to ensure that the grout bags are not undermined; scour protection could extend nominally 3 m around the circumference of the grout bag.

*Figure 3-7: Example of grout bags*

#### 3.5.4.3 Mass flow excavation

Mass flow excavation (**Figure 3-8**) may be used for span rectification both pre-laying (i.e. by creating a trench for the pipeline) or post-laying (i.e. by facilitating burial) of a pipeline if a given span cannot be effectively rectified using mattresses or grout bags. Mass flow excavation reduces span heights at the span shoulders and assists pipeline stability by facilitating partial or complete burial of the pipeline in unconsolidated sediments. Mass flow excavation may be achieved by localised suction or jetting of water, with resuspended sediments being moved away from the pipeline. This process results in localised lowering of the pipeline into the sediment, with subsequent partial or complete burial of the pipeline providing stabilisation and therefore removal of a pipeline span. The direct disturbance footprint of mass flow excavation is dependent on the depth of excavation required. Use of mass flow excavation will be limited and any associated seabed disturbance has been included in the footprint estimations for span rectification in **Table 3-6**.


*Figure 3-8: Example of equipment used for mass flow excavation*

#### 3.5.4.4 Vortex-induced vibration strakes

The use of vortex induced vibration strakes can alleviate the need for span supports in certain areas as they limit fatigue damage by vortex induced vibration caused by high sea currents. Vortex induced vibration strakes (**Figure 3-9**) are installed on the pipeline onboard the pipelay vessel (in the firing line) prior to the pipe entering the water. Vortex induced vibration strakes work by changing the hydrodynamic profile of the pipeline thereby suppressing vortex induced vibration at critical span locations.

***Figure 3-9: Example of equipment used for suppressing vortex-induced vibration***

### 3.5.4.5 Mechanical support structures

Mechanical support structures (**Figure 3-10**) are made of steel and/or concrete and are typically used for spans having a clearance higher than 1.5 m. The structures are typically lifted from the deck of the survey or construction vessel and lowered to the seabed by vessel crane. An ROV is used during installation to position and orientate the structures prior to landing out on the seabed.

The design of mechanical support structures varies subject to the seabed properties, the installation contractor methodology and pipeline loading. Pre-lay span supports generally have a minimum length matching lateral pipeline installation tolerances. The typical seabed footprint of mechanical support structures is 6 m by 3 m. Scour protection may also be required subject to the seabed conditions; scour protection could extend nominally 3 m around the support structures.

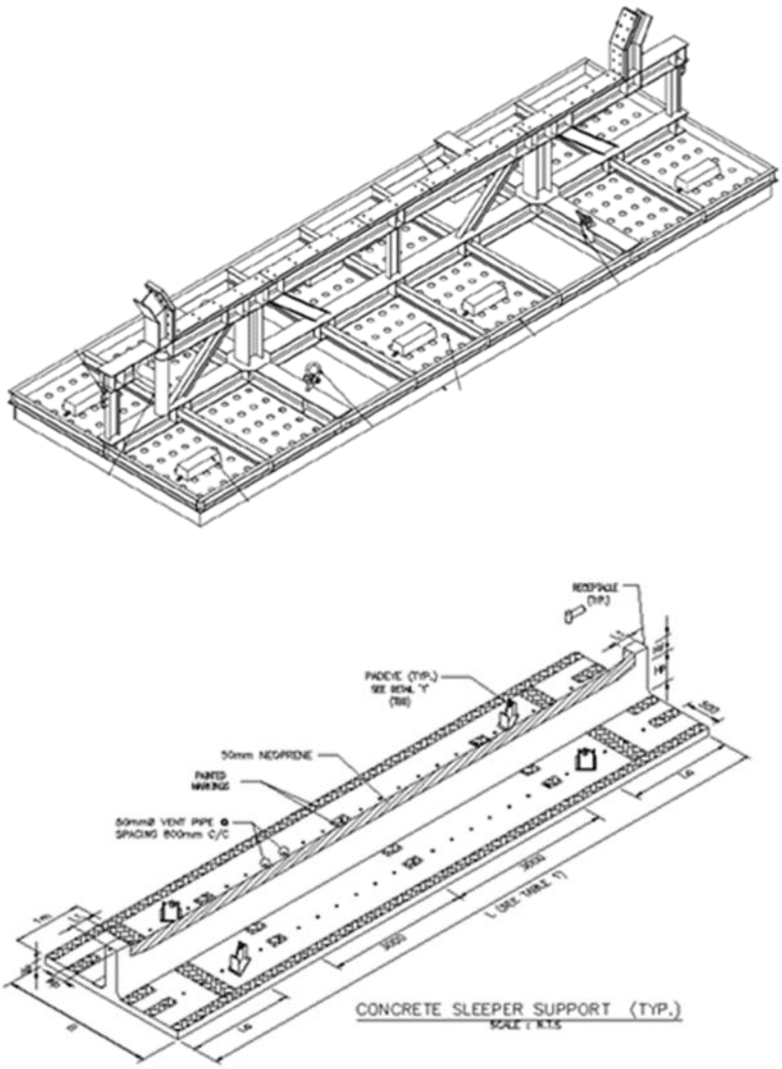



*Figure 3-10: Examples of mechanical pre-lay support structures*

Wedge-shaped mechanical support modules (**Figure 3-11**) can also be used as post-lay span supports. The module is a steel, wedge shaped frame that supports the pipeline. The module is pulled under the pipeline with the assistance of an ROV. When under the pipeline a support arm is installed by the ROV to capture the pipeline on the support's diagonal. The span support design will vary subject to the span height – typical designs that cover span heights between 500 mm and 1000 mm (left below) and the other for span heights greater than 1500 mm (right below) are provided. Wedge-shaped mechanical support modules have a typical seabed footprint of 4 m by 4 m (excluding scour mitigation). Scour protection may also be required and could extend nominally 3 m around the support structures.

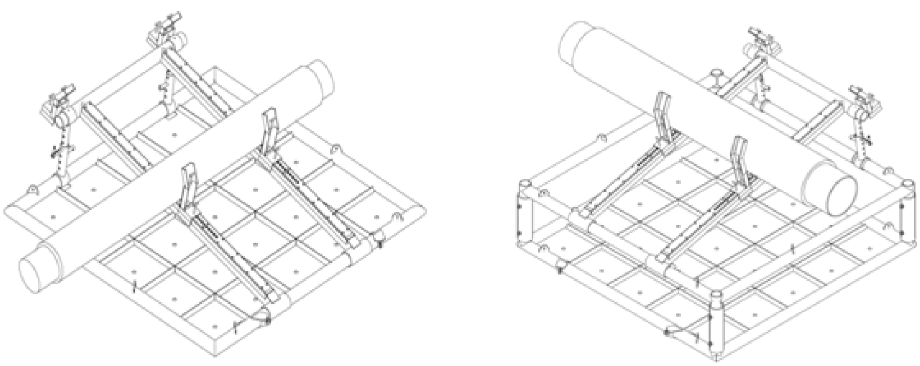


*Figure 3-11: Examples of wedge-shaped post-lay span correction mechanical support modules*

### 3.5.5 Pipeline initiation structure deployment

Initiation of the gas export pipeline will require an initiation structure to allow the pipeline to be tensioned. This may be installed at either the downstream tie-in PLET location, the FPSO PLET location, or at a point in between. The initiation structure will consist of either a suction pile, drag anchor or clump weight/dead-man anchor. The expected disturbance footprint on the seabed of the structure is up to 1,240 $m^2$ and is included in **Table 3-6**.Pre-lay and post-lay surveys will be undertaken at the pipeline initiation structure to ensure that the pipeline initiation structure is placed on a bare area of seabed.

### 3.5.6 Pipeline installation

Pipeline installation will commence either at the FPSO PLET location, the downstream tie-in PLET location or an intermediate location along the gas export pipeline to allow both PLETs to be installed as second end structures; in other words, they are laid down at the end of pipelay.

The pipelay vessel will install the pipeline using a traditional s-lay installation method. Once the linepipe is transferred onto the pipelay vessel, it is stored either on deck or in below deck holds subject to the pipelay vessel design.

Each piece of linepipe is inspected before use for damage that may have occurred during transportation and to confirm that the linepipe is clean and free of debris. Once inspected, the linepipe is prepared for welding by machine bevelling each end of the pipe.

The single linepipes are assembled in a horizontal working plane (the firing line) onboard the pipelay vessel. Joints are welded together, inspected using non-destructive testing methods (e.g. ultrasonic testing) and then coated.

As welding progresses the constructed pipeline is continuously lowered from the pipelay vessel to the seabed as the vessel slowly moves along the pre-determined pipeline route. The stinger (a steel structure with rollers extending from the end of firing line/vessel) supports the upper section of the pipeline catenary to control the curvature during installation.

Tension is applied to the pipeline by the vessel's tensioners and forward DP thrust to maintain the catenary and prevent the pipeline from buckling, as it is lowered to the seabed. The pipelay vessel will proceed forward at a speed of nominally 3 km per day.

The seabed footprint associated with installing the gas export pipeline is provided in **Table 3-6**.

### 3.5.7 Pipeline end termination structures

PLETs shall be installed utilising an in-line (s-lay) methodology where the PLET (excluding mudmat and protection structures) will be lowered from the pipelay vessel deck into the firing line where it is then welded into the pipe string. The PLET and pipeline are progressively lowered to the seabed, as the vessel moves forwards, until the PLET/pipeline assembly is landed onto the pre-installed foundation, during pipeline initiation or laydown operations.

A PLET Anti-Snag Frame will be installed at the downstream Pipeline tie-in location after completion of pipelay and will arch over the PLET. The PLET protection structure will not add to the seabed disturbance footprint generated by the PLET foundation.

The seabed footprint associated with installing the PLETs is provided in **Table 3-6**.

### 3.5.8 Seabed footprint

The overall nominal footprint from the gas export pipeline installation campaign has been estimated by calculating the footprint of the supporting structures (including PLETs) (**Sections 3.5.3** and **3.5.7**), span rectification works (**Section 3.5.4**) and gas export pipeline (including pipeline initiation structure) (**Sections 3.5.5** and **3.5.6**). The calculations are an estimation only, because not all supporting structures or span rectification methods will require scour protection (which increases the footprint of each structure) and further refinements in some areas (e.g. span rectification) will be made to reduce the footprint if practicable. The total estimated footprint is presented in **Table 3-6**.

***Table 3-6: Estimated seabed footprint from gas export subsea infrastructure***

| Subsea Infrastructure | Seabed footprint | Comment |
|---|---|---|
| Installation of supporting structures | 0.3 ha | Includes pipeline crossing, lateral buckling initiators, PLET foundations.<br>Fibre optic crossing – 0.0066 ha.<br>Lateral buckling initiators – assume five buckling initiation sites (5 by 42 $m^2$), each with an extra 140 $m^2$ footprint to allow for scour protection. |
| Gas export pipeline installation | 21.6 ha | Calculated based on the length of the pipeline multiplied by the diameter of the pipeline (with concrete weight coating included, average diameter is 875 mm). It also includes the footprint for the initiation structure. |
| Span rectification and stabilisation works | 2.0 ha | Calculated assuming 32 pre-lay spans and 34 post-lay spans to give a nominal disturbance area of 0.7 ha. This area is increased to 2.0 ha to allow for potential additional span corrections, changes in the footprint of individual spans and/or scour mitigation. |
| Contingency of 20% | 4.8 ha | To address potential increase in span rectification requirements, pipeline route optimisation and growth of supporting structure(s) footprint (subject to detailed design). |
| **Estimated total seabed footprint** | **28.7 ha** | |

### 3.5.9 Flood, clean, gauge and pressure testing (FCGT)

Once installed, the pipeline internal surfaces need to be cleaned and inspected to determine if any unacceptable restrictions and/or obstructions exist in the pipeline. This is conducted through pigging. A series of pigs will be pushed through the pipeline to clean the pipeline, gauge the pipeline and ensure all air is removed during the flooding process. The pigs are pushed using chemically treated seawater delivered via a downline from the vessel. The chemically treated seawater is typically a mixture of biocides (to prevent biofouling on the internal surfaces), an oxygen scavenger (to control corrosion of the pipeline) and a dye (allows for leaks to be detected through visual inspections).

The chemical concentration will be dependent on the preservation period, which is the period of time the pipeline will be left filled with chemically treated seawater before being dewatered for tie-in and commissioning (**Section 3.5.10**).

Treated seawater will separate each pig in the train and will be discharged to sea as each pig completes a run. A slug of filtered and chemically treated forewater will be injected ahead of the first pig to lubricate the rubber sealing discs on the pig and control pig speed. There is potential that some debris remaining from pipeline installation activities within the pipeline may be discharged with this water. It is estimated that up to approximately 15,000 $m^3$ of treated seawater may be discharged at the FPSO PLET location if the pipeline is flooded from the shallow end (downstream tie-in PLET location) to the deep end (FPSO PLET location). Up to approximately 12,000 $m^3$ of treated seawater may be discharged at the downstream PLET location if the pipeline is flooded from the deep end to the shallow end. Flooding water may be discharged at the seabed or the surface. Any discharges at the seabed will be through a vertical diffuser which assists in dilution and dispersion of the discharges. The treated seawater will be discharged over one to two days.

Once the pigging operations are completed and the condition of the gauge plates has been confirmed, the pipeline will be subjected to a hydrostatic pressure test (hydrotest). Water used for hydrotesting will be treated seawater, similar to the water used for flooding (as described above). The hydrotest pressure will be held for a period as per the relevant standard to test the pipeline integrity. There will be small localised discharges around each of the PLETs as that infrastructure is tested and the gas export pipeline is depressurised. Hydrotest water is expected to be discharged over half a day and up to approximately 2,000 m³ of treated seawater may be discharged, at either end of the pipeline and may be discharged at the seabed or the surface.

FCGT activities will be undertaken in accordance with Santos approved Contractor Pipelines Flooding, Cleaning, Gauging and Testing procedures. All chemicals used in FCGT activities will be subject to a chemical selection assessment process described in **Section 3.6**.

In the event of an issue that indicates remedial construction work is required, or in case of a pipeline wet buckle during pipelay, contingency plans will be implemented, and the affected lines may be dewatered to the environment to allow the repairs to be undertaken (refer **Section 3.7**).

### 3.5.10 Dewatering and pre-conditioning

On completion of FCGT, the flooded pipeline will be dewatered, conditioned with MEG and purged with nitrogen. The gas export pipeline will be dewatered using a train of dewatering pigs separated by MEG slugs. Discharge of most of the dewatering fluid will occur at the seabed through a vertically orientated diffuser at the FPSO PLET location, in the Barossa field. The MEG could be discharged at the seabed or the surface, subject to the methodology adopted to sample the MEG in order to confirm pipeline has been correctly preconditioned. This activity will require the discharge of chemically treated seawater and MEG. Approximately 85,000 m³ of treated seawater will be discharged over three to seven days, and up to approximately 1,000 m³ of MEG will be discharged over a period of less than one day.

On completion of dewatering, the gas export pipeline will be purged and packed with nitrogen and left as is, ready for installation of the remainder of the export system (subject to a future EP).

## 3.6 Chemical selection procedure

Before commencing the activity, all chemicals that may be discharged to the marine environment during the activity will be listed in the gas export pipeline installation campaign chemical register. This register will be checked during the activity and when new chemicals or substitutes are required.

All approved chemicals (hazardous and non-hazardous) are kept on the gas export pipeline installation campaign chemical register and have an environmental risk rating assigned to them. The environmental risk rating is allocated by the Santos Environmental Advisor and is based on the information supplied in the Chemical Approval Application Form and material safety data sheet (MSDS).

Subsea chemicals will be assessed in accordance with the UK OCNS Ranked List of Notified Chemicals. The CHARM model, under the OCNS, is the primary tool to rank offshore chemicals based on assessment of toxicity, biodegradation and bioaccumulation data provided by the chemical supplier. The CHARM model calculates the ratio of predicted effect concentration against no effect concentration (PEC: NEC) and expresses this as a Hazard Quotient (HQ), which is then used to rank the product **Table 3-7**). The HQ is converted to a colour banding.

Products not applicable to the CHARM model (i.e. inorganic substances, hydraulic fluids) are assigned an OCNS grouping (**Table 3-8**). The overall ranking is determined by that substance having the worst case OCNS ranking scheme assignment in terms of biodegradability and bioaccumulative criteria. Group A includes products considered to have the greatest potential environmental hazard and Group E the least. Chemical products within Group D or E are considered inherently biodegradable and non-bioaccumulative.

*Table 3-7: Offshore Chemical Notification Scheme chemical hazard and risk management hazard quotient and ranking*

| Minimum HQ value | Maximum HQ value | Colour banding | Hazard |
|---|---|---|---|
| >0 | <1 | Gold | Lowest |
| ≥1 | <30 | Silver | |
| ≥30 | <100 | White | |
| ≥100 | <300 | Blue | |
| ≥300 | <1000 | Orange | |
| ≥1000 | | Purple | Highest |

*Table 3-8: Offshore Chemical Notification Scheme groupings*

| OCNS grouping | Aquatic toxicity (LC50) (mg/L) | Sediment Toxicity (LC50) (mg/L) | Hazard |
|---|---|---|---|
| A | <1 | <10 | Highest |
| B | >1 to 10 | >10 to 100 | |
| C | >10 to 100 | >100 to 1000 | |
| D | >100 to 1000 | >1000 to 10,000 | |
| E | >1000 | >10,000 | Lowest |

Subsea chemicals for which the chemical products meet at least one of the following environmental criteria are considered suitable for use and can be discharged to the marine environment:

+ rated as Gold or Silver under OCNS CHARM model
+ if not rated under the CHARM model, has an OCNS group rating of D or E.

The use of non-rated subsea chemicals will only be considered following approval from the Lead Pipeline Engineer, in consultation with the Santos Environmental Specialist, after the completion of an environmental risk assessment. The environmental risk assessment includes the following:

+ technical justification for the usage
+ consideration of additional controls
+ how each chemical may be used
+ quantity to be used.

The environmental risk assessment will develop a residual risk rating based on:

+ evaluating the receiving marine environmental characteristics, values and sensitivities, with respect to the nature and scale of the proposed chemical product to be discharged
+ reviewing alternative chemical products that are equivalent in meeting the technical requirements of the scope of work and selection of the least hazardous chemical
+ evaluating ecotoxicity thresholds and application of OCNS ratings, which may include:
  - establishing an alternative 'pseudo' rating that can be applied to the chemical in accordance with international standard protocols or guidelines (e.g. International Organization for Standardization (ISO) test guidelines, Organisation for Economic Cooperation and Development (OECD) test guidelines, and OSPAR guidelines), or

- using alternative similar toxicity data if insufficient toxicity information is available on the non-rated chemicals.

Santos will use chemical products considered to be ALARP following the risk assessment.

The 'pseudo ranking' for individual substances will be defined based on the CHARM model or on the OCNS ranking system (**Figure 3-12** and **Figure 3-13**).

**– The OCNS grouping**

During the hazard assessment process, each individual substance is ranked by applying the OCNS ranking scheme. The overall ranking for a product is determined by the product substance which has the worst case OCNS ranking. The method of assignment of the OCNS letter grouping is described below.

**Initial grouping**

The initial group is determined using Table 2. All submitted toxicity data for each substance is compared against the table. The most toxic response is used as the initial Group for the substance.

Table 2: Initial OCNS grouping

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

- Aquatic toxicity refers to the Algae EC50, Crustacean LC50, and Fish LC50 toxicity tests (units = ppm or mg/kg)
- Sediment toxicity refers to the Sediment re-worker LC50 test (units = ppm or mg/kg)

**Adjustment of final OCNS group**

The final grouping is determined using Table 3 as a guide.

Select the column that applies to the candidate substance and adjust the initial Group accordingly. If the classification should theoretically move beyond Group A or E, the product will be assigned to that Group.

***Figure 3-12: Offshore Chemical Notification Scheme ranking system from CEFAS[1]***

[1] https://www.cefas.co.uk/cefas-data-hub/offshore-chemical-notification-scheme/hazard-assessment-process/

Table 3: Adjustment criteria for OCNS grouping

| Increase by 2 groups (e.g. from C to E) | Increase by 1 group (e.g. from C to D) | Do not adjust initial grouping | Decrease by 1 group (e.g. from C to B) | Decrease by 2 groups (e.g. from C to A) |
|---|---|---|---|---|
| Substance is readily biodegradable and is non-bioaccumulative | Substance is inherently biodegradable and is non-bioaccumulative | Substance is not biodegradable and is non-bioaccumulative or | Substance is inherently biodegradable and bioaccumulates | Substance does not biodegrade and bioaccumulates |
| | | Substance is readily biodegradable and bioaccumulates | | |

The Definitions of the terms are:

- **Readily biodegradable**: results of >60% biodegradation in 28 days (OECD 306,301B -F method), >70% in28 days (OECD 301A, 301E) to an OSPAR HOCNF accepted ready biodegradation protocols
- **Inherently biodegradable**: results of >20% and <60% (<70%) to an OSPAR HOCNF accepted ready biodegradation protocol.
- **Not biodegradable**: results from OSPAR HOCNF accepted ready biodegradation protocol or inherent biodegradation protocol are <20%, or half-life values derived from aquatic simulation tests indicate persistence
- **Non-bioaccumulative**: Log $P_{ow}$ <3, or BCF ≤100, the molecular weight is ≥700
- **Bioaccumulative**: Log $P_{ow}$ ≥3, or BCF >100, the molecular weight is <700, or if the conclusion of a weight-of-evidence expert judgement under OSPAR Agreement 2008-5 is negative

***Figure 3-13: Offshore Chemical Notification Scheme ranking system from CEFAS (continued)***

## 3.7 Pipeline installation contingencies

Unplanned situations may arise during pipeline installation. The pipelay contractor will develop contingency procedures for these unplanned but potential situations. Two contingent activities, wet buckle and a stuck pig contingency have potential environmental impacts.

### 3.7.1 Wet buckle

A wet buckle is when there is a failure in the pipeline during installation which results in the ingress of raw/untreated sea water into the pipeline. In the event of this occurring the untreated seawater will need to be removed from the pipeline and the pipeline may need to be flushed with treated seawater, subject to cause of the wet buckle and the activities required prior to pipelay operations being able to safely recommence.

A detailed incident investigation shall be performed in the instance of a wet buckle and any findings must be satisfactorily addressed before pipelay can recommence. If modifications are required to the pipelay vessel or procedures that will result in an extended period before pipelay can recommence then the pipeline will be flooded with inhibited seawater to safely preserve the pipeline in the intervening period before pipelay is recommenced. In this instance, the seawater will be treated with the same chemicals used for FCGT, as described in **Section 3.5.9** and will need to be dewatered immediately prior to pipelay recommencing in order to enable the pipeline to be recovered to the surface.

Should preservation, and subsequent dewatering be required, a detailed assessment shall be performed to confirm the direction the pipeline shall be dewatered from to minimise the environmental impact. Due to the uncertainty on the lay direction, the amount of pipe installed, the required preservation period (which will drive the required chemical concentration) and the location of buckle event it is not practicable to perform this assessment in advance.

The requirement to temporarily preserve the pipeline is not required if pipelay can safely be recommenced in a timely manner, typically less than 30 days from the introduction of raw seawater into the pipeline. In this instance the raw seawater shall be displaced using a series of bidirectional pigs and pipelay operations shall recommence. Once the pipelay is completed, the full pipeline shall be flooded, cleaned and gauged as detailed in **Section 3.5.9**.

### 3.7.2 Stuck pig

If a pig gets stuck in a pipeline, it would need to be forced out. This would require using additional treated seawater to push the pig out, resulting in a discharge to the environment (**Section 3.5.9**).

# 4. Existing environment

In accordance with Regulation 13(2) and 13(3) of the OPGGS (E) Regulations, this section provides a description of the existing environment, including details of any particular relevant values and sensitivities, that may be affected by both routine/planned and non-routine/unplanned activities. The spatial extent of the environment that may be affected (EMBA) has been defined using stochastic modelling for hydrocarbons, based on the thresholds defined in **Section 5.3.7**, from the credible hydrocarbon spill scenario of a vessel to vessel collision (**Section 5.3.7**), as this represents the largest geographic extent of the environment that may be affected by the activity (**Figure 5-10**).

The existing environment description (i.e. within the EMBA) is based on a comprehensive environmental baseline studies program (**Section 4.2**), literature reviews of scientific information, and material provided by DCCEEW (e.g. EPBC Protected Matters Search tool (PMST), species profile and threats database and the Conservation Values Atlas). Review of the available information identified a range of environmental receptors, such as Australian Marine Parks, Biologically Important Areas (BIAs), Key Ecological Features (KEFs) and shallow bathymetric features such as shoals, banks and reefs, occur within the EMBA. These receptors were subsequently researched and are reported in this section, along with other values and sensitivities within the operational area and EMBA. A summary of the key environmental characteristics is provided in **Table 4-1**. A description of the regional environment is also included to provide context for the characteristics of the existing environment values and sensitivities in and around the EMBA.

The description provided in this section has been used to inform the risk assessment for the activity (**Section 5**).

***Table 4-1: Key environmental characteristics of the operational area and environment that may be affected***

| Key Environmental Characteristics | Operational Area | EMBA |
|---|---|---|
| Bathymetry and seabed features | + Water depths range from 254 to 33 m.<br>+ Northern section of pipeline route has smooth to moderate slopes of fine to medium sands/silts and clay, with pockmarks and occasional outcrops.<br>+ Southern section of pipeline route has areas of highly irregular relief, smooth sandy/silty seabed (with megaripples and sand waves) and rock/reef outcrops with coarse sediments (sand, gravel and shells). | + Water depths generally from 10 to 200 m but exceed 1000 m in the northern region.<br>+ A number of shoals, banks and reef patches are present. |
| ***Habitats and Communities*** | | |
| Intertidal and benthic primary producers | + No coral or seagrass habitat was identified within the operational area<br>+ Based on habitat modelling there may be small areas of macroalgae | + Coral is generally confined to the shallower regions of banks, shoals and pinnacles, such as Tassie Shoal and Evans Shoal.<br>+ Seagrass may be present within shallow sheltered areas of the Tiwi Islands.<br>+ Mangroves occur along the Tiwi Islands tidal creeks. |

<table>
<tr><th>Key Environmental Characteristics</th><th>Operational Area</th><th>EMBA</th></tr>
<tr><td>Other benthic communities</td><td>The benthic habitats within the operational area predominantly support burrowers/crinoids (12%), filter feeders (7%) and abiotic areas that support little biota (81%).</td><td>Benthic habitat within the EMBA is dominated by bare sand and abiotic areas that support little biota.</td></tr>
<tr><td colspan="3">Marine Fauna of Conservation Significance</td></tr>
<tr><td>Biologically important areas</td><td>One BIA overlaps the operational area: flatback turtle internesting habitat.</td><td>Four BIAs overlap the EMBA:<br>1. flatback turtle internesting habitat<br>2. green turtle internesting habitat<br>3. Olive Ridley internesting habitat<br>4. crested turn breeding habitat.</td></tr>
<tr><td>Habitat critical to the survival of a species</td><td colspan="2">‘Habitat critical to the survival of a species’ for two marine turtle species (flatback turtles and Olive Ridley turtles) were identified as overlapping the operational area and EMBA.</td></tr>
<tr><td>Marine mammals</td><td colspan="2">The threatened and/or migratory marine mammals that potentially occur in the operational area and EMBA are sei whale, blue whale, fin whale, humpback whale, Bryde’s whale, dugong, Australian snubfin dolphin, Irrawaddy dolphin, killer whale (orca), sperm whale, Indo-Pacific humpback dolphin, Indo-Pacific bottlenose dolphin (Arafura/Timor Sea populations), spotted bottlenose dolphin and Omura’s whale*.</td></tr>
<tr><td>Marine reptiles</td><td colspan="2">The threatened and/or migratory marine reptiles that potentially occur in the operational area and EMBA are loggerhead turtle, green turtle, leatherback turtle, hawksbill turtle, Olive Ridley turtle, flatback turtle and salt-water crocodile.</td></tr>
<tr><td>Fish</td><td colspan="2">The threatened and/or migratory fish that potentially occur in the operational area and EMBA are grey nurse shark*, great white shark, northern river shark, speartooth shark, dwarf sawfish, freshwater, largetooth sawfish, green sawfish, whale shark, narrow sawfish, knifetooth sawfish, shortfin mako, longfin mako, giant manta ray and reef manta ray.</td></tr>
<tr><td rowspan="2">Seabirds and migratory shorebirds</td><td colspan="2">The threatened and/or migratory seabirds and shorebirds that potentially occur in the operational area and EMBA are red knot, knot, curlew sandpiper, eastern curlew, common sandpiper, common noddy, sharp-tailed sandpiper, pectoral sandpiper, streaked shearwater, lesser frigatebird, great frigatebird and osprey.</td></tr>
<tr><td>(Not applicable)</td><td>Six additional species were identified to only occur within the EMBA, being:<br>1. western Alaskan bar-tailed godwit<br>2. northern Siberian bar-tailed godwit<br>3. oriental reed-warbler<br>4. oriental plover<br>5. oriental pratincole<br>6. crested tern.</td></tr>
<tr><td colspan="3">Other Values and Sensitivities</td></tr>
<tr><td>Key ecological features</td><td colspan="2">Two KEFs overlap the operational area and the EMBA, being:<br>1. carbonate bank and terrace system of the Van Diemen Rise<br>2. shelf break and slope of the Arafura Shelf.</td></tr>
</table>

| Key Environmental Characteristics | Operational Area | EMBA |
|---|---|---|
| Shoals and banks | No shoals and banks occur within the operational area. | A number of shoals and banks were identified within the EMBA (distances in brackets below are distances from operational area), being:<br>+ Mesquite Shoal (2.1 km)<br>+ Marie Shoal (2.3 km)<br>+ Goodrich Bank (adjacent)<br>+ Moss Shoal (7.8 km)<br>+ Lynedoch Bank (58.2 km)<br>+ Parry Shoal (24.7 km)<br>+ Flat Top Shoal (40.5 km)<br>+ Mermaid Shoal (14.6 km)<br>+ Evans Shoal (61 km)<br>+ Afghan Shoal (10 km)<br>+ Shepparton Shoal (0.9 km) |
| *Socio-economic* | | |
| Australian marine parks | Sections of the operational area traverse through the following zones of Oceanic Shoals Marine Park:<br>+ Category VI (Multiple Use Zone – Managed resource protected area)<br>+ Category IV (Habitat Protection Zone – Habitat/species management area). | The EMBA overlaps all zones of the Oceanic Shoals Marine Park, including the:<br>+ Multiple Use Zone (VI)<br>+ Special Purpose Zone (Trawl) (VI)<br>+ National Park Zone (II)<br>+ Habitat Protection Zone (IV). |
| Reef protection areas | The operational area does not overlap any reef protection areas. | The EMBA overlaps the Bathurst Island and Lorna Shoal Reef Protection Areas. |
| European heritage | No known listed historic shipwrecks or plane wrecks occur within the operational area. | Three listed historic shipwrecks occur within the EMBA:<br>+ I-124 (submarine)<br>+ Florence D<br>+ Don Isidro USAT. |
| Aboriginal heritage | There are no recorded Indigenous heritage sites within the operational area. | The Tiwi Islands are a declared Aboriginal reserve and comprise protected sacred sites. |
| Commercial fisheries | The operational area and EMBA overlap one Commonwealth managed fishery (Northern Prawn Fishery) and five NT managed fisheries, being:<br>+ Demersal Fishery<br>+ Coastal Line Fishery<br>+ Offshore Net and Line Fishery<br>+ Spanish Mackerel Fishery<br>+ Timor Reef Fishery. | |
| Traditional fishing | No traditional fishing areas have been identified within the operational area. | Traditional fishing in the EMBA is mainly focused in the coastal areas of the Tiwi Islands and includes catching fish, hunting (turtles and dugongs) and gathering turtle eggs. |

| Key Environmental Characteristics | Operational Area | EMBA |
|---|---|---|
| Tourism and recreation | Offshore activities (such as deep-water fishing and diving) may occur within the operational area but are expected to be limited and infrequent. | Tourism and recreational activities in the EMBA are likely to be more concentrated within coastal waters (such as around the Tiwi Islands) but activities may potentially take place in offshore areas. |
| Defence activities | The operational area does not overlap any Defence areas. | The EMBA overlaps the North Australian Exercise Area (NAXA). |

## 4.1 Regional setting

The operational area is in Australian Commonwealth Waters of the North Marine Region (NMR), predominantly overlapping the Northwest Shelf Transition Provincial Bioregion, with approximately 40 km of the northern extent crossing into the Timor Transition Provincial Bioregion (**Figure 4-1**). Within the Northwest Shelf Transition Province, the operational area crosses two mesoscale bioregions; the Oceanic Shoals (also a Commonwealth managed marine park) and the Bonaparte Gulf. Where appropriate, these provincial and mesoscale bioregions have been used to describe the existing environment within the operational area.

The EMBA covers a wider area than the operational area. Within the Northwest Shelf Transition Province, the EMBA crosses four mesoscale bioregions; the Oceanic Shoals, Bonaparte Gulf, Tiwi and Anson Beagle. The EMBA also extends north towards waters of Indonesia and Timor-Leste, and south into NT coastal waters. Where appropriate, the NMR and Timor Sea have been used to describe the broad environmental characteristics of the EMBA.

The key physical characteristics of the NMR relevant to the EMBA include (DSEWPaC, 2012):

- a wide continental shelf, with water depths averaging less than 70 m
- the Van Diemen Rise, which provides an important link between the Joseph Bonaparte Gulf and the Timor Trough, and includes a range of geomorphological features such as shelves, shoals, banks, terraces and valleys
- a series of shallow calcium carbonate-based canyons (approximately 80 m to 100 m deep and 20 km wide) in the northern section of the region
- the Arafura Shelf, which is up to 350 km wide and has an average water depth of 50 m to 80 m, and is characterised by features such as canyons and terraces
- currents driven predominantly by strong winds and tides; in other words, the Indonesian throughflow current (ITF).

The Northwest Shelf Transition Provincial bioregion covers an area of 305,463 km$^2$ and includes NT and Commonwealth Waters. The bioregion extends from the Tiwi Islands to Cape Leveque with most of the area located over the continental shelf. The oceanographic environment in the Northwest Shelf Transition Province is mainly influenced by the Indonesian throughflow which varies in strength seasonally (Department of the Environment, Water, Heritage and the Arts (DEWHA), 2008a). Water depths average between 10 to 100 m, with a maximum depth of 330 m. Topography of the Northwest Shelf Transition Province is considered complex and comprises a diversity of features, including submerged terraces, carbonate banks, pinnacles, reefs and sand banks (DEWHA, 2008a).

KEFs within the bioregion, such as the Carbonate Banks and Terrace System of the Van Diemen Rise, are considered distinct features of the Northwest Shelf Transition Province and likely support higher diversity of marine species compared to the surrounding seabed. Sections of the KEF overlapping the EMBA are discussed in greater detail in **Section 4.5.6.1**. Species occurring within the Northwest Shelf Transition Province are typical of Indo-west Pacific tropical flora and fauna (DEWHA, 2008a), and the region includes BIAs for marine turtles and dolphins. BIAs overlapping the operational area and EMBA are outlined in **Section 4.5.5.3**.

The Timor Transition Provincial Bioregion covers an area of 24,040 km² and includes Commonwealth Waters. The bioregion extends offshore adjacent to Timor waters. The region is characterised by cooler pelagic waters (DEWHA, 2008a) influenced by the ITF. Water depths range between 15 and 357 m. Topography of the Northwest Shelf Transition Province is considered complex and comprises a diversity of features, including canyons, submerged terraces, ridges and deep escarpments (DEWHA, 2008a).

## 4.2 Baseline studies conducted for the Barossa development

An extensive and robust environmental baseline studies program has been completed to characterise the existing marine environment within and surrounding NT/L1, within which the Barossa field is located. The studies have involved the collection of detailed baseline data over 12 months (July 2014 to July 2015) to capture seasonal variability in the area. These studies also informed the Barossa Area Development OPP prepared in accordance with the requirements of the OPGGS (E) Regulations. In addition to providing specific data and information across the area, the studies collected data that have been used to validate the hydrodynamic model developed by RPS which underpins the credible hydrocarbon spill modelling and the dewatering modelling.

The baseline studies undertaken were preceded by early engagement with key agencies (e.g. the Australian Institute of Marine Science (AIMS)) and were informed by a comprehensive literature review and gap analysis. Subsequent environmental and geophysical and geotechnical studies have also been undertaken to enhance the understanding of the existing environment and inform the impact assessment presented within the EP. A summary of the studies relevant to this EP is provided in **Table 4-2** and **Figure 4-2** presents the extent of environmental sampling undertaken.

***Table 4-2: Summary of Barossa studies***

| Study type | Description of study | Reference |
|---|---|---|
| ***Field-based studies*** | | |
| Metocean data collection | Collection of metocean data on the surface and through the water column from July 2014 to March 2015, within and near the Barossa field; e.g. current, conductivity, wave and wind data. | Fugro, 2015 |
| Water quality survey | Collection of baseline data on physical and chemical components of water quality near the Barossa field. The surveys were completed in June 2014, January 2015 and April 2015. | Jacobs, 2015a, 2015b, 2014 |
| Sediment quality and infauna survey | Collection of baseline data on sediment quality and infauna communities in the vicinity of the Barossa field. | Jacobs, 2015c |
| Benthic habitat survey | Collection of baseline data to characterise topographic features, benthic habitats and macrofaunal communities near the Barossa field location and surrounding areas, including around Evans Shoal, Tassie Shoal and Lynedoch Bank, through the use of a specialised ROV. | Jacobs, 2016 |
| Underwater noise survey | Collection of baseline data on ambient underwater noise (physical, biological and anthropogenic sources) at three locations from July 2014 to July 2015 within the vicinity of the Barossa field and surrounding areas. One noise logger was deployed adjacent to the operational area (J2) and the other two were between approximately 12 and 38 km from the operational area. | JASCO Applied Sciences (JASCO), 2015 |

| Study type | Description of study | Reference |
|---|---|---|
| Shoals and shelf survey 2015:<br>+ benthic habitats<br>+ fish communities | A seabed biodiversity survey of three shoals to the west of the Barossa field (Evans Shoal, Tassie Shoal and Blackwood Shoal) and two mid-continental shelf regions relevant to the potential pipeline route. The survey was undertaken in September/October 2015 by AIMS and involved characterisation of the seabed habitats, associated biota and fish communities (shoals only). | Heyward et al., 2017 |
| Geophysical Survey | This survey undertook a preliminary geophysical survey of potential pipeline routes within the pipeline installation corridor presented in the accepted OPP. | Fugro, 2016 |
| Barossa Pipeline Environmental Survey | Collection of baseline data to characterise water quality, plankton, sediment quality and infauna communities. Sampling was undertaken in July to August 2017 along the southern end of the pipeline route in water depths from ~80 m to 25 m. | Jacobs, 2017 |
| Oceanic Shoals Marine Park Benthic Habitat and Fish Diversity Assessment | A seabed and fish biodiversity survey conducted between September and October 2017, by AIMS. The survey focused on six key sites inside and outside of the Oceanic Shoals Marine Park, including in the Habitat Protection Zone, and Shepparton Shoal. The objective was to incorporate this new data to update the predictive habitat model an undertake statistical comparison of the proportion and spatial diversity of habitats within and outside the Oceanic Shoals Marine Park. | Radford et al., 2019 |
| Geophysical Survey Report. Export Pipeline Route | This report presents the results from a geophysical survey carried out along the GEP route and provides a comprehensive assessment of the seafloor and shallow geological features along the GEP. | DOF Subsea (2018) |
| ***Desktop/modelling studies*** | | |
| Environmental literature review and gap analysis | Collection and collation of publicly available information pertaining to the marine environment within the vicinity of the Barossa field and gap analysis to determine whether there is sufficient information to inform an environmental impact assessment and any future regulatory approvals for a potential full field development. | JacobsSKM, 2014 |
| Hydrodynamic model validation study | Data from the metocean study and through the deployment of drifter buoys near the Barossa field and surrounding areas, were used to validate the underlying hydrodynamic model used to develop the spill and discharge models. | RPS APASA, 2015 |
| Tiwi Islands sensitivity mapping study | Collection of data on environmental, social, cultural and economic sensitivities for the Tiwi Islands. A desktop review of available data (spatial datasets) was followed by workshops with Traditional Owners to identify cultural and environmental sensitivities along the coast of the Tiwi Islands. | Jacobs, 2019 |

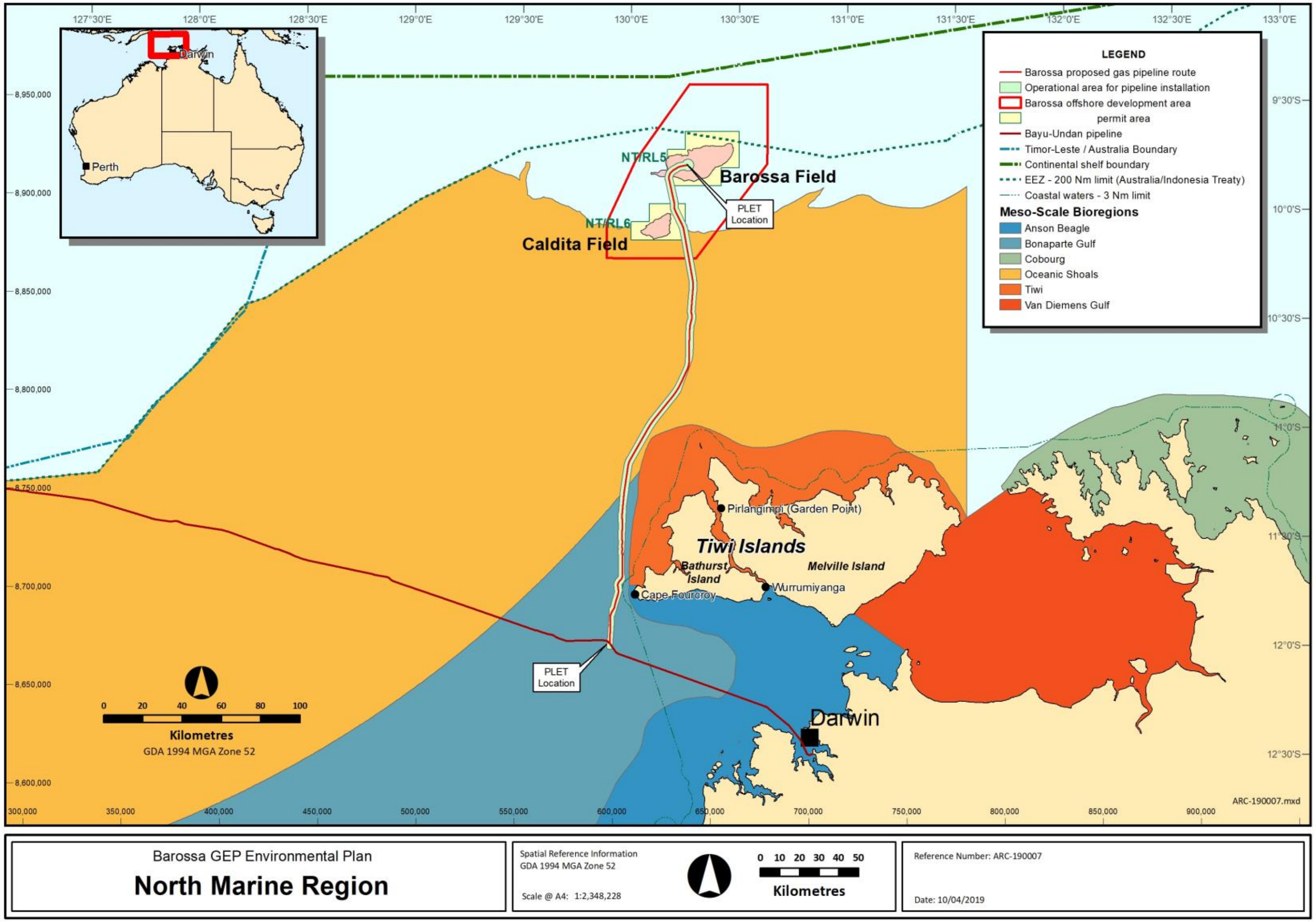



*Figure 4-1: Location of the North Marine Region and the operational area*

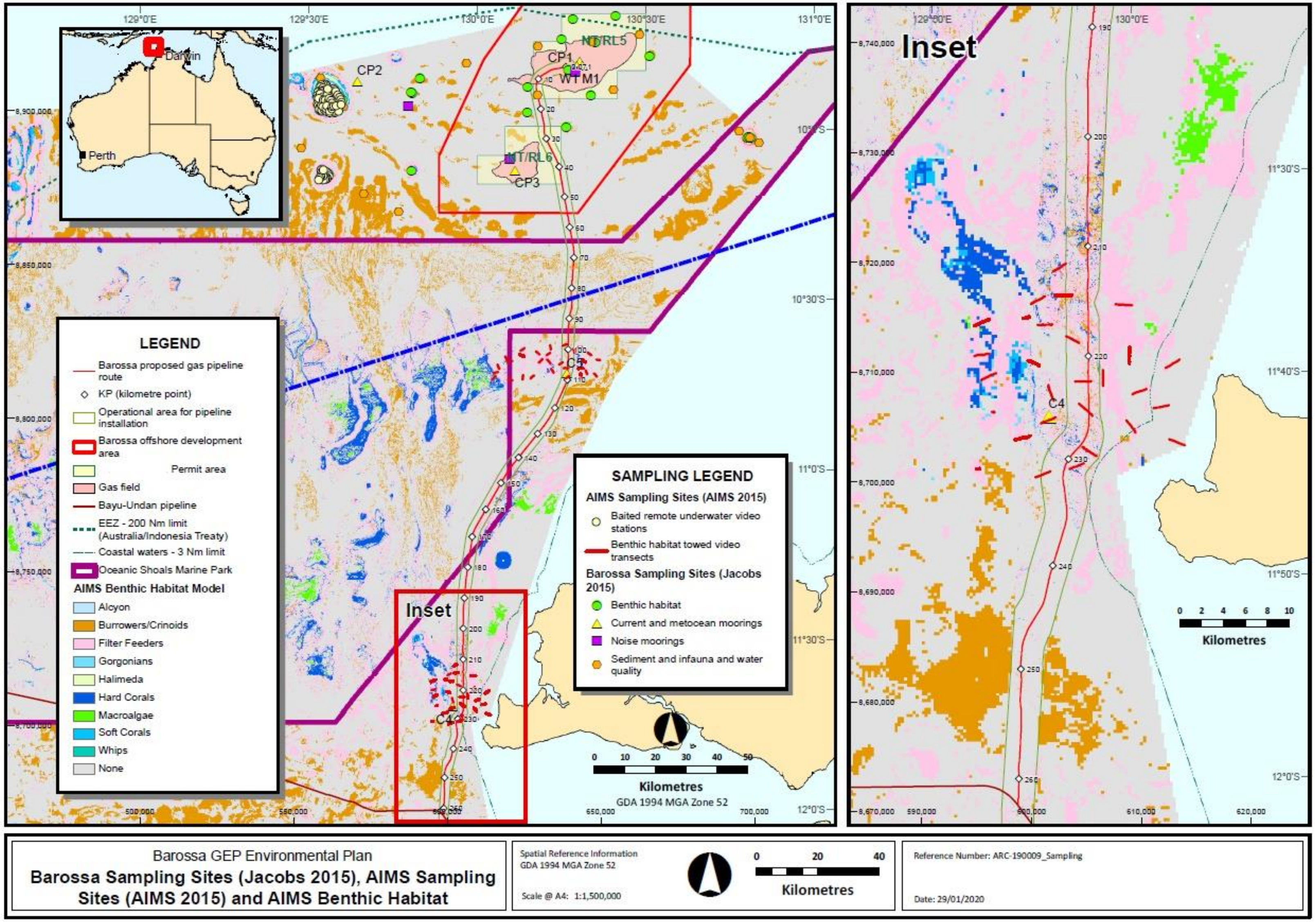



*Figure 4-2: Locations of sampling undertaken as part of the Barossa baseline studies program (refer Table 4-2 for a summary of each)*

## 4.3 Physical environment

### 4.3.1 Climate

The Bonaparte Basin and Timor Sea experiences a tropical climate and a distinct summer monsoonal wet season from December to March (north-west monsoon) followed by a typically cooler winter dry season from April to September (south-east monsoon). During the wet season the south-westerly winds can generate thunderstorm activity, high rainfall and cyclones, while in the dry season the easterly winds result in dry and warm conditions with very little rainfall. In addition, the region may also be subject to tropical squalls which are characterised by very high short period wind gusts.

Wind measurements in the Timor Sea indicate that large-scale ocean currents are typically not influenced by local scale wind conditions. The winter season is dominated by south east trade winds with wind speeds peaking in July with speeds up to 44 to 50 km per hour (km/h). The transitional period is characterised by generally light and variable winds while the summer season is characterised by cyclonic activity where wind speeds can exceed 120 km/h.

Within the NMR, the variation in seasonal air temperatures in the region is small. The mean maximum air temperatures recorded at Point Fawcett, Melville Island between 1961 and 2018 (the closest meteorological station to the operational area) range between 32.1 °C in July to 34.6 °C in November (Bureau of Meteorology (BOM), 2019). The annual mean maximum temperature is 32.9 °C and the mean minimum temperature 30.9 °C (BOM, 2019).

The operational area and EMBA are located within a cyclone-prone region. Tropical cyclones form in the area generally south of the equator in the Indian Ocean and the Timor and Arafura Seas. Most cyclones approach the area heading in a west or south-west direction. The average tropical cyclone frequency for the Timor Sea is one cyclone per year (BOM, 2017). Cyclones can bring vast amounts of rain to the area, with strong swell and rough seas common during these meteorological events. Most cyclones approach the region from the east-north-east, veering to a southerly track the further south they go.

### 4.3.2 Oceanography

#### 4.3.2.1 Regional current system

Regionally, circulation in the Timor Sea is dominated by the Indonesian throughflow system. This brings warm, low salinity, oligotrophic (low in nutrients) waters through a complex system of currents, linking the Pacific and Indian Ocean via the Indonesian Archipelago (DEWHA, 2008a). The strength of the Indonesian throughflow fluctuates seasonally, reaching maximum strength during the south-east monsoon, and weakening during the north-west monsoon. The Holloway Current, a relatively narrow boundary current that flows along the north-west shelf of Australia between 100 m to 200 m depth, also influences the seas in the area (DEWHA, 2008a). The direction of the current changes seasonally with the monsoon, flowing towards the north-east in summer and the south-west in winter (DEWHA, 2008a).

#### 4.3.2.2 Tides

Tides in the region are predominantly semi-diurnal (two highs and two lows per day) with a distinct inequality between successive tides during a single day. Ranges increase as the tide propagates over the Sahul shelf, increasing to 7 to 8 m in the Joseph Bonaparte Gulf. At the northern end of the pipeline, spring tidal ranges are 2.70 m, while at the southern end they are around 4.5 m.

#### 4.3.2.3 Currents

Currents were measured along the pipeline route at the four locations, CP1, CP3, C4 and C5, shown in **Figure 4-3**). Offshore surface currents are dominated by wind and oceanic drift (**Figure 4-4**) while further south, tidal forces dominate with strong rectilinear currents opposite Bathurst Island (**Figure 4-7**).

At the FPSO location (Station CP1; **Figure 4-4**), speeds reached a maximum of 0.88 m/s, with mean current speeds ranging from 0.14 m/s at depth to 0.22 m/s at the near surface. Current directions were predominantly south-westward to south-eastward during winter months, with dominant westward to north-westward flow in summer. The tidal component of flow became more prominent with greater depth, with flow along a south-eastward to north-westward axis. Near-bed the currents were predominantly tidal.

Just off the shelf, at Station CP3 (**Figure 4-5**), current speeds reached a maximum of 1.08 m/s with mean current speeds ranging from 0.19 m/s at depth to 0.27 m/s at the near surface. Current directions were dominated by south-eastward flow throughout depth during winter, reversing to a predominant north-westward flow during summer months. As at CP1, the tidal component of flow became more prominent with greater depth, with flow along a south-eastward to north-westward axis.

On the shelf at Station C5 tidal currents dominate. Current speeds were measured up to 0.71 m/s. The tide ebbs towards the north-north-east and floods towards the south-south-west. At Station C4 (**Figure 4-7**), adjacent to Bathurst Island currents were strongly rectilinear, flooding towards the south and ebbing towards the north. On the spring tide, maximum current speeds were around 1.1 m/s, reducing to around 0.3 m/s on the neaps.

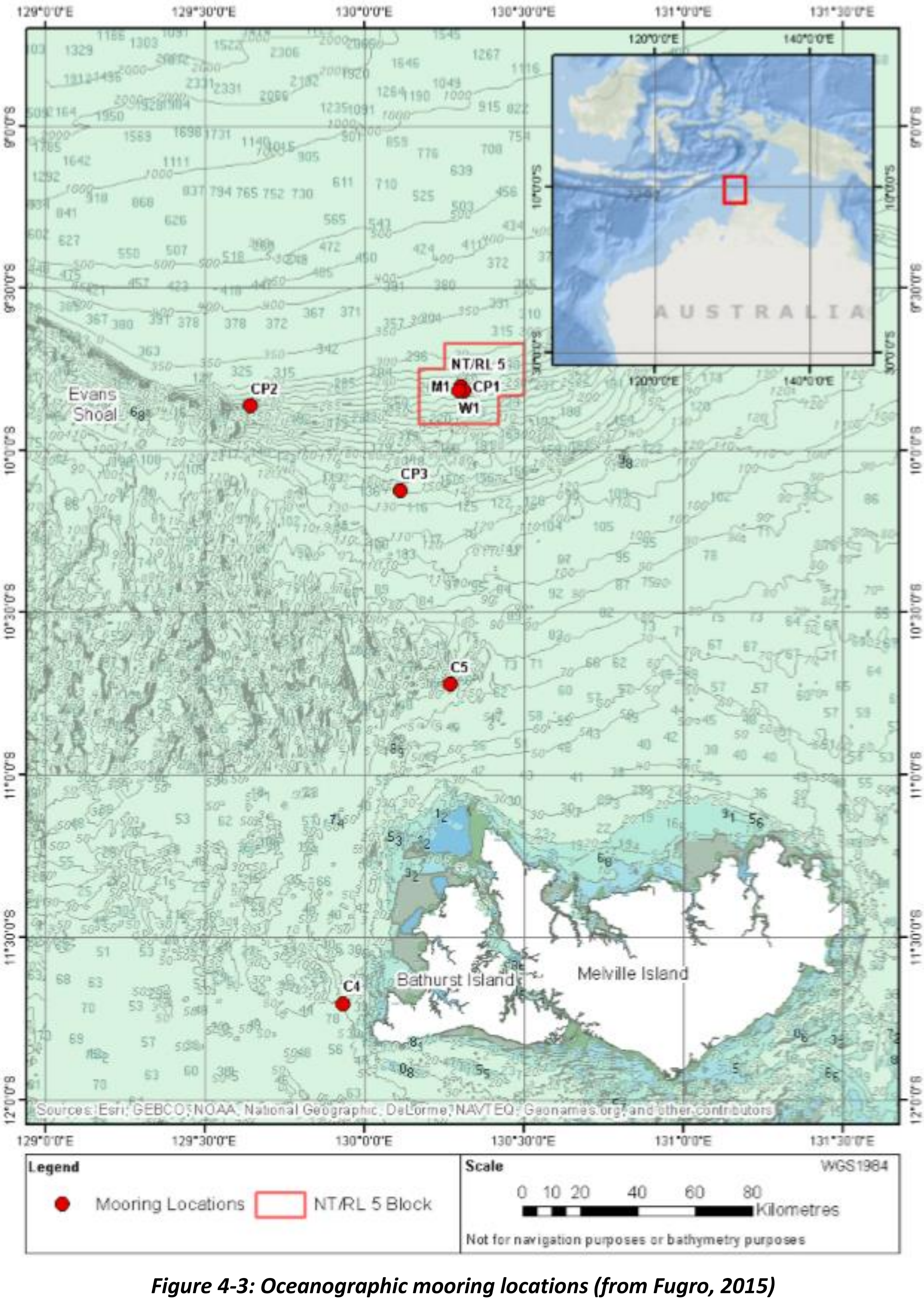
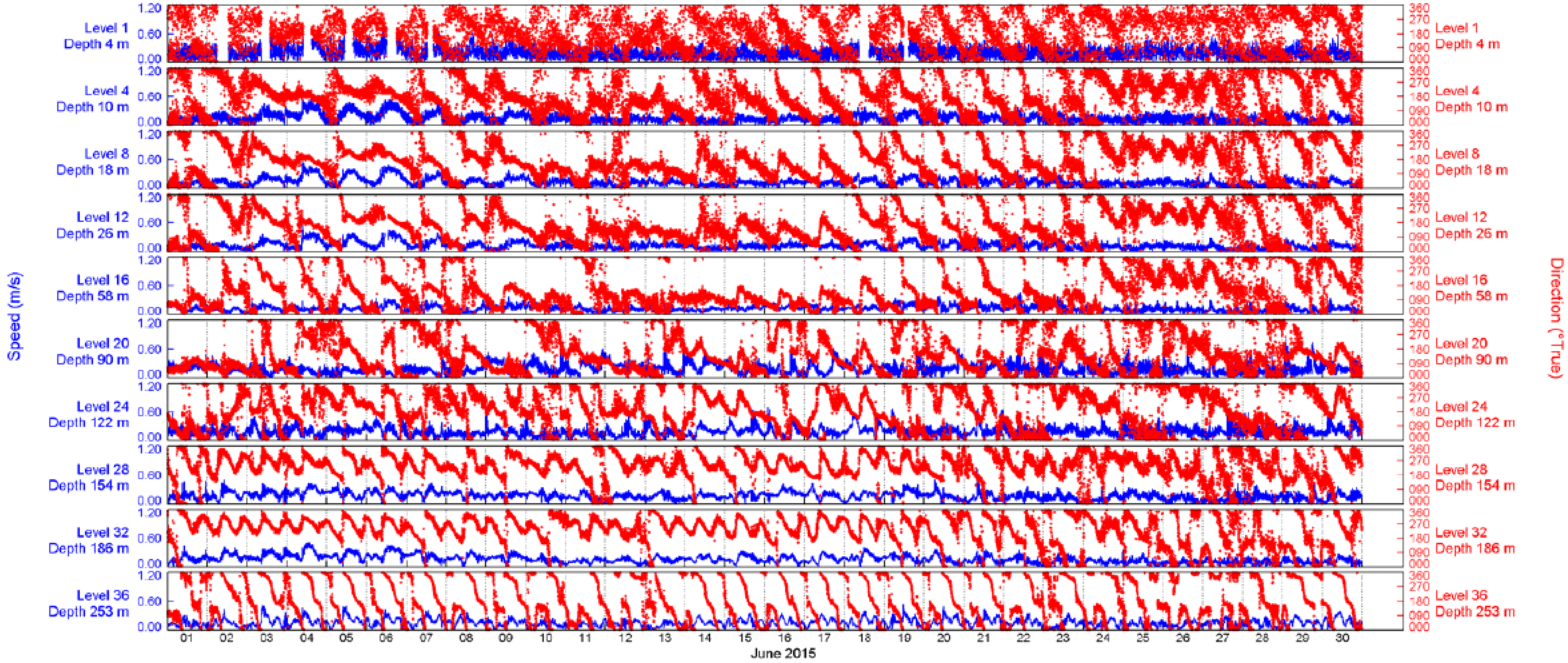
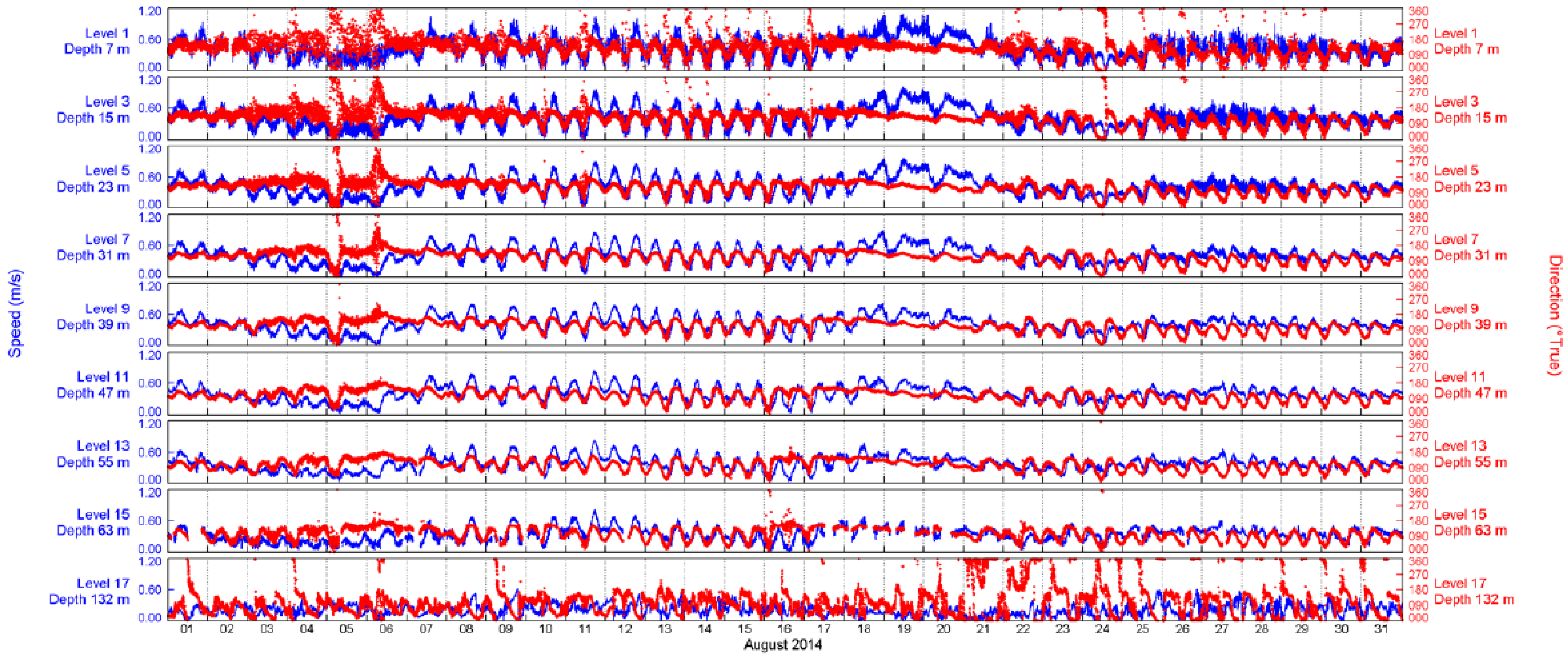



*Figure 4-3: Oceanographic mooring locations (from Fugro, 2015)*



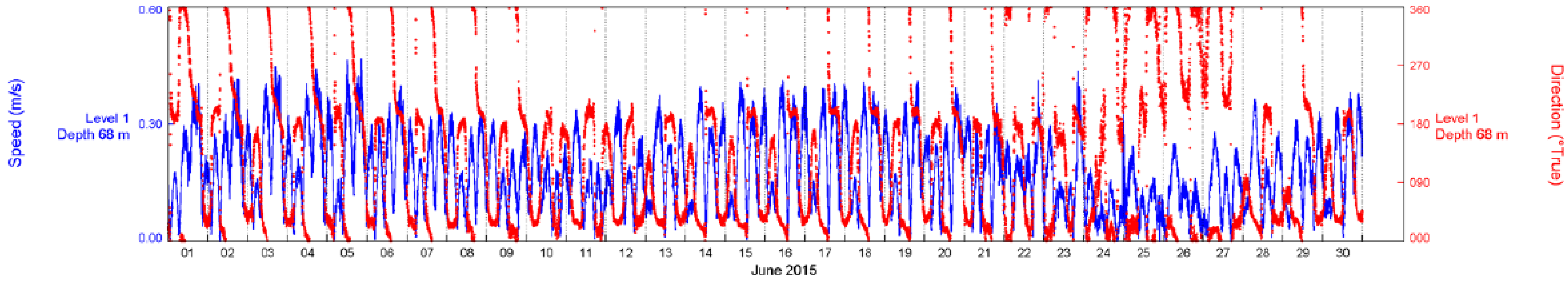

| | | |
|---|---|---|
| **Location:** CP1 | **Position:** 09° 48.315' S, 130° 18.228' E | **Datum:** MSL |
| **Water depth:** 260 m | **Instrument type:** WH ADCP, QM ADCP, SG | |
| **Notes:** Time Zone = UTC. | | |

*Figure 4-4: Time series of current speed and direction at the FPSO in-field location CP1 (from Fugro, 2015)*



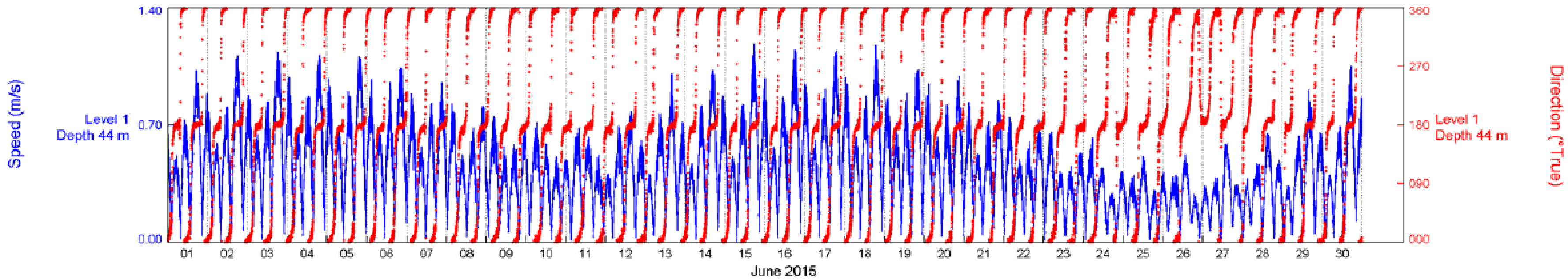

| | | |
|---|---|---|
| **Location:** CP3 | **Position:** 10° 07.560' S, 130° 06.796' E | **Datum:** MSL |
| **Water depth:** 139 m | **Instrument type:** WH ADCP, Lower SG | |
| **Notes:** Time Zone = UTC. | | |

*Figure 4-5: Time series of current speed and direction off the shelf at CP3 (from Fugro, 2015)*




| | | |
|---|---|---|
| **Location:** C5 | **Position:** 10° 43.447' S, 130° 16.170' E | **Datum:** MSL |
| **Water depth:** 75 m | **Instrument type:** SG | |
| **Notes:** Time Zone = UTC. | | |

***Figure 4-6: Time series of current speed and direction on the shelf at C5 (from Fugro, 2015)***




| | | |
|---|---|---|
| **Location:** C4 | **Position:** 11° 42.283' S, 129° 55.915' E | **Datum:** MSL |
| **Water depth:** 51 m | **Instrument type:** SG | |
| **Notes:** Time Zone = UTC. | | |

***Figure 4-7: Time series of current speed and direction adjacent to Bathurst Island at C4 (from Fugro, 2015)***

#### 4.3.2.4 Waves

In general, the wave climate and significant wave heights in the NMR are low. Approximately 67 % of the significant wave height records are less than 1 m, and less than 3% exceed 2 m. The calmest months are March, April, and September to November. Significant wave heights above 2 m are most common in December to February, particularly during monsoon conditions, and in May to July. Swells are generally low and from the west (originating in the Indian Ocean) but can enter the area from the east following cyclonic development in the Arafura Sea.

#### 4.3.2.5 Temperature

The sea surface temperature in the Timor Sea does not vary significantly during the year and typically ranges from approximately 26 °C to 27 °C. This temperature is characteristic for the top 50 m of the water column. Beneath that layer, there is typically a steady decrease in temperature with depth to about 23 °C at 110 m depth. The water temperatures of the Timor Sea are largely influenced by the Indonesian throughflow and a highly pronounced thermocline. Seawater temperature in the region ranges from 25ºC to 31ºC at the surface and 22ºC to 25ºC at the seafloor (Brewer et al., 2007).

### 4.3.3 Bathymetry and seabed features

Water depths throughout most of the Timor Sea range between 70 and 200 m, however, exceed 1,000 m in the northern region, towards Indonesia and Timor-Leste (Harris et al., 2003). Topography of the Northwest Shelf Transition Province is considered relatively complex and comprises a diversity of features, including coastal areas, shelf and basins within the Joseph Bonaparte Gulf and the banks/shoals, terraces and reefs within the Van Diemen Rise and Sahul Shelf (DEWHA, 2008b). Water depths along the gas export pipeline route vary from 254 m at the deepest point to 33 m at the shallowest point (**Figure 4-8**).

South of the operational area, towards coastal waters of the NT, the Bonaparte Gulf is relatively uniform with simple geomorphology and comprises mostly of shelf waters and a shallow depression (Joseph Bonaparte Gulf) (Rochester et al., 2007). NT coastal waters include numerous rocky reefs and shoals scattered throughout, as well as fringing coral reefs and patch reefs (Rochester et al., 2007). Shoals, banks and reef patches overlap the EMBA throughout the NMR and beyond Commonwealth Waters towards Indonesia and Timor-Leste; however, none of these overlap the operational area (**Figure 4-8**).

The operational area and EMBA overlap two KEFs (the 'Carbonate bank and terrace system of the Van Diemen Rise' and the 'Shelf break and slope of the Arafura Shelf'). The value of these KEFs are defined as "unique seafloor feature with ecological properties of regional significance" (DSEWPaC, 2012) (see **Section 4.6.1**).

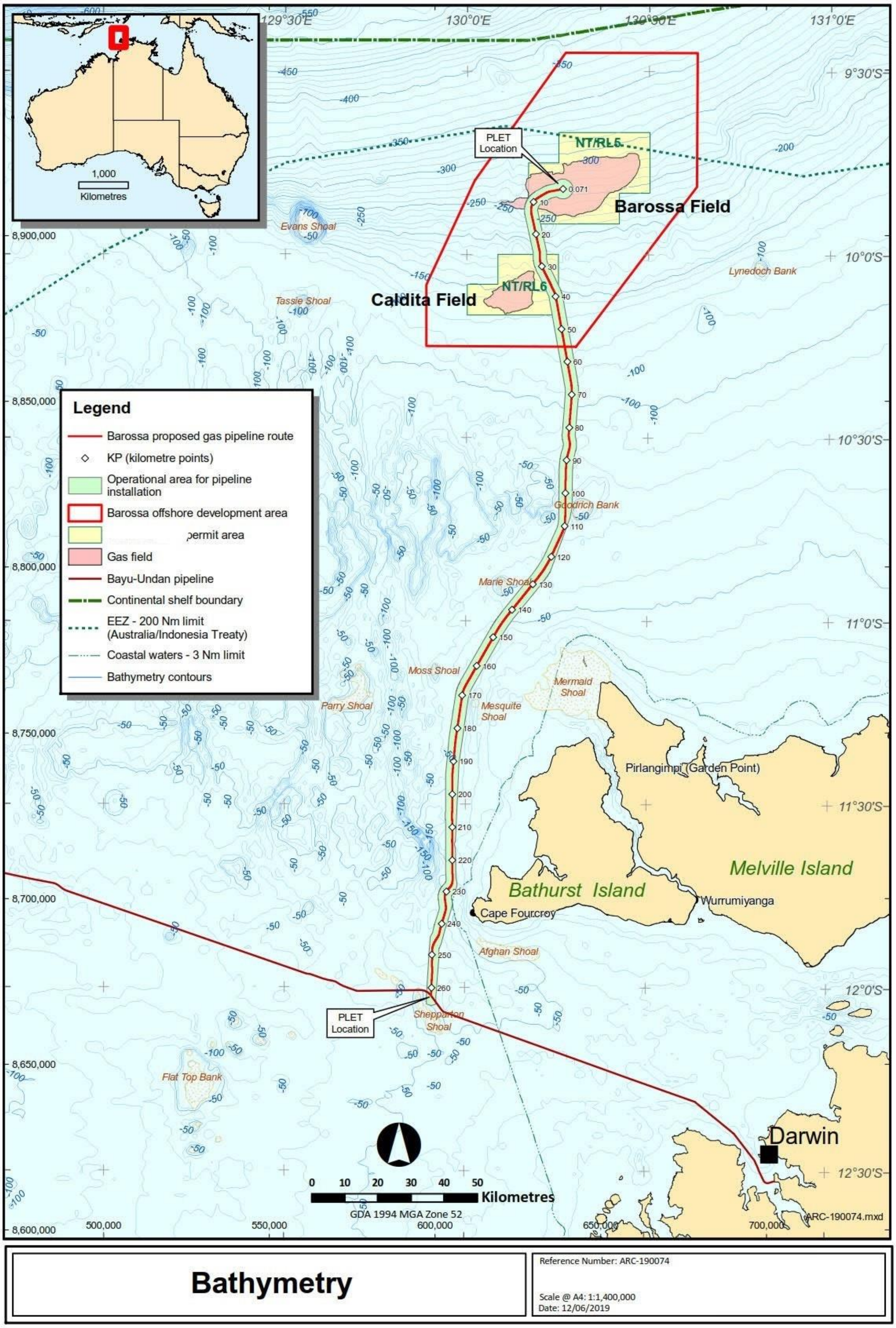



*Figure 4-8: Bathymetry of the operational area*

## 4.3.4 Water quality

Water quality in the Northwest Shelf Transition Province is influenced predominately by the Indonesian throughflow, which brings warm, low salinity, oligotrophic (low in nutrients) waters into the region from Indonesia (DEWHA, 2008b). Offshore waters are generally clear, with the euphotic zone extending down to 100 m across the shelf (DEWHA, 2008b). Localised upwellings of cooler and higher nutrient content waters occur throughout the Northwest Shelf Transition Province; however, the influence and extent of these upwellings are mostly unknown (DEWHA, 2008b).

Water quality was monitored as part of the Barossa marine studies program (**Table 4-2**) Temperature, pH, salinity and dissolved oxygen remained relatively consistent throughout the seasons. The pH in the surface waters ranged from 8.1 to 8.3 pH units, while the pH at the seabed ranged from 7.7 to 7.9 pH units (Jacobs, 2015a, 2015b, 2014). There was little difference in salinity between the surface water and the bottom water at all sites during all seasons. Salinity at the surface waters were approximately 34 parts per thousand (ppt), which was approximately 0.7 ppt lower than the bottom water of the deepest sites (Jacobs, 2015b). As the water quality sampling sites were remote from any large land masses, the only potential factors affecting surface water salinity are climatic ones (i.e. precipitation or evaporation).

Dissolved oxygen was high in the surface water (90%-100% saturation at all sites for each season) decreasing to approximately 35% saturation in the bottom water of the deepest sites (Jacobs, 2015b). Dissolved oxygen was highest near the ocean surface, where light for photosynthesis is strongest and oxygen exchange between the atmosphere and the ocean is at a (Jacobs, 2015b).

Within the northern extent of the operational area turbidity was very low throughout the water column and displayed minimal seasonal variability (less than 0.2 nephelometric turbidity units (NTU)) (Jacobs, 2015b). At 20 to 50 m above the seabed, the turbidity was slightly elevated and increased with depth, possibly caused by the action of currents passing over the seabed causing turbulence and resuspension of sediments (Jacobs, 2015b). Jacobs (2017) found that turbidity levels appeared to be dependent on the location of the site in relation to the Tiwi Islands, with sites just to the north and south of Bathurst Island characterised by relatively low turbidity (less than 0.8 NTU) and the sites closest to Bathurst having high turbidity (5.7 to 36.7 NTU) for bottom water samples.

Chlorophyll ‘a’ concentrations were low (more than 0.9 micrograms per litre (µg/L)) throughout the water column at all sites and during each season. Chlorophyll ‘a’ concentrations peaked at shallower depths during winter (30 to 50 m) and deeper depths during summer and autumn (50 m to 70 m) (Jacobs, 2015b). During summer the zone of maximum productivity lies some distance below the surface, most likely due to optimising the requirement for light and nutrients (Jacobs, 2015b).

Nutrient concentrations increase with depth and light penetration is greater in summer therefore the depth of maximum productivity would be greater in summer than winter.

While most metal concentrations were below the Australian and New Zealand Environment and Conservation Council and Agricultural and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ) (2000) guidelines, copper concentrations were occasionally slightly above the ANZECC & ARMCANZ guideline for 99% species protection of 0.3 µg/L. Further sampling along the pipeline route in 2017 did not identify any levels of aluminium, cadmium, chromium, cobalt, copper, nickel and lead above ANZECC & ARMCANZ (2000) dissolved metal trigger values (Jacobs, 2017).

Total recoverable hydrocarbons and benzene, toluene, xylenes and naphthalene were below the laboratory reporting limits at all sites and depths for each season (Jacobs, 2017, 2015b). There was little difference in the hydrocarbon profiles between sites, indicating a lack of hydrocarbons in the areas sampled (Jacobs, 2015b).

Overall, there was very little change in most water quality parameters recorded between the surveys, indicating minimal seasonal variation is experienced in the area. The water quality throughout the water column was consistent with expected trends given the location and natural processes like wind, waves and current movements that are found in deeper water offshore environments. However, nearshore waters may experience more variability due to seasonal change.

### 4.3.5 Sediment quality

The dominant sediments within the offshore NMR are very soft to soft silts, sandy silts and very loose to loose silty sands with variable shell content and sand fraction ranging from fine to coarse (Le Provost Dames and Moore, 1997). Between the described isolated features of the Northwest Shelf Transition Province, are large extents of soft substrate (Przeslawski et al., 2011a). Further inshore, sediment within the Bonaparte Gulf is relatively uniform, predominately comprising sand. Within NT coastal waters, sediments are a mixture of gravelly, sandy sediment (Rochester et al., 2007).

Sediment types observed during the Barossa marine studies program were comparable with those found in local and broader regional seabed habitat mapping studies undertaken in the Eastern Joseph Bonaparte Gulf and Timor Sea (Anderson et al., 2011; Fugro, 2006; Przeslawski et al., 2011b; URS Australia Pty Ltd (URS), 2008, 2005). As such, data are likely representative of the operational area and EMBA. Sediments sampled showed a gradual transition in composition over large spatial areas, particularly between the deep waters and shallow shoals (Jacobs, 2015c). In general, sediments transitioned from the finer sediments in deeper water to coarse sediments (i.e. gravelly sands) in shallow water around the shoals/banks (Jacobs, 2015c; Jacobs, 2017). In addition, sites to the north of Bathurst Island had finer sediments (higher percentage of clay and slit) compared to sites further south, likely due to the prevailing current direction which flows along a south-eastward to north-westward axis near the seabed (Jacobs, 2017).

Sediments along much of the pipeline route are characterised by sand- (0.063 mm to 2 mm) and gravel-sized (2 mm to 64 mm) particles, likely dominated by carbonates from weathering of hard substrate or biogenic production (DOF Subsea, 2018; Jacobs, 2017). The relatively low portion of fine sediments may be the result of tidal currents winnowing fine sediments, which may also account for the naturally high levels of turbidity observed near the seabed. Laboratory analysis of sediment samples collected by Jacobs (2017) indicated most resuspended sediments would be deposited within 12 hours or less, with sediments from half of all sites expected to have more than 90% deposition in less than an hour (Jacobs, 2017).

While most metal concentrations were below the ANZECC & ARMCANZ (2000) guidelines, cobalt and nickel were recorded above the trigger values (Jacobs, 2015c). Generally, sites to the north of Bathurst Island, had higher metal concentrations than those in the southern section of the pipeline and were likely to be associated with finer sediments (Jacobs, 2017). Nickel is commonly recorded at high levels in Australian sediments. Total recoverable hydrocarbons and BTEXN were below the laboratory reporting limits at all sites (Jacobs, 2015c).

Nitrogen, phosphorus and organic carbon are released when organic compounds decay. The highest concentrations of nitrogen and organic carbon were associated with deepest and the finest sediments (Jacobs, 2015c). Deep water sediment habitats are predominantly depositional, as indicated by their relatively high particle size distribution fines component and nutrient content. The benthic communities of these habitats are consumers rather than primary producers and therefore use the increased nutrient component of sediments (Jacobs, 2015c). The highest concentrations of nitrogen and organic carbon were associated with sediments with a higher percentage of fine particles (Jacobs, 2017).

### 4.3.6 Air quality

Within the offshore and remote areas of the operational area and EMBA, there are no permanent sources of air pollution. Therefore, the air quality of this region of the EMBA is expected to be pristine with only localised and temporary anthropogenic influences (e.g. from oil and gas and shipping activity).

## 4.4 Seabed characteristics along the pipeline route

Two geophysical surveys have been undertaken over the pipeline route (Fugro, 2016; DOF, 2018). Each consisted of MBES, SSS and sub bottom profiling (CHIRP – Compressed High Intensity Radar Pulse). Benthic habitat interpretations have been corroborated with sediment sampling undertaken in 2015 and in 2017

(Jacobs, 2015 and 2017; AIMS, 2015) (**Figure 4-28**). Results are reported in kilometres relative to the distance from the northern to the southern PLET (referred to as KPs, or Kilometre Points) as illustrated in **Figure 3-1**.

The Barossa GEP covers three main geomorphic regions:

4. Continental Outer Shelf/Slope (Infield area and GEP KP0 to ~KP73), comprising the shelf break and slopes of the Arafura Shelf characterised by gentle (up to 0.2°) slopes
5. Continental Middle Slope (GEP ~KP73 and ~ KP106), comprising a carbonate bank and terrace system of the Van Diemen Rise with intersecting valleys between banks
6. Continental Inner Shelf (GEP ~KP106 to KP262.39), comprising variable sediment types, including sub-aerially exposed cemented materials and significant terrestrial sediments especially in shallower water depths.

**Figure 4-9**, **Figure 4-11**, **Figure 4-15**, **Figure 4-17**, **Figure 4-19** and **Figure 4-23** show the bathymetric profile along the pipeline as well as soil units. Six primary geotechnical units are identified with general properties listed as follows:

+ Unit 1: soft silty siliceous-calcareous clay with a fines content greater than 50%.
+ Unit 1a: stiff carbonate clay with a fines content generally greater than 80%.
+ Unit 2: medium dense clayey and silty siliceous-calcareous sand, fines content of 20 to 40% with median diameter of approximately 0.2 mm.
+ Unit 3: dense clayey and silty siliceous-calcareous sand, with occasional gravel; fines content of 20 to 40% with median diameter of approximately 0.9 mm.
+ Unit 4: dense to very dense clayey siliceous-calcareous sand, with occasional gravel.; fines content of 10 to 35% with median diameter of 2.97 mm.
+ Unit 5: cemented sand/gravel/calcarentite.

### 4.4.1 KP0 to KP60

The pipeline route starts in 254 m of water and is essentially flat for the first 5 km. Thereafter, the seabed gradually shallows to 186 m at KP26.6. The seabed is generally smooth and featureless. Jacobs (2015) observed the seabed in the Permit Area as predominantly silty sand lacking in any hard substrate, with relic seabed features (namely sand waves less than 25 cm in height) widespread.

Bathymetry rises from 156 m depth at KP34.3 to 103 m at KP70.7. Between KP34.3 to KP41.8, the seabed is typically flat and featureless, the exception being a channel that crosses the route at KP39.8. A large sandwave field occurs between KP41.8 and KP50.75. The sandwaves are typically small with a wavelength in the order of 20 to 30 m and a height less than 1 m. Smaller megaripples are often superimposed on the larger sandwaves. Habitat is bare sand (**Figure 4-10**).

### 4.4.2 KP60 to KP110

The route shallows from 101 m depth at KP70.7 to 73.5 m at KP87.7 before rising again to 78.6 m at KP109 (**Figure 4-11**). Isolated and clustered pockmarks occur throughout the area (**Figure 4-13**). Pockmarks tend to be more prevalent in topographic lows. Thicker (more than 2 m) and softer sediments, interpreted as very soft to soft cohesive material, are associated with the topographic lows, while the topographic highs including the ridges and plateaus have typically less penetration indicating denser (and harder) conditions. Coarser material including sand and gravel, possibly of a calcareous nature, are associated with the ridges and plateaus. These positive relief features comprise hardgrounds and outcrop of a calcareous nature.

Habitat between KP70 and KP108, within the KEF and Marine Park, consists of burrowers and crinoids with a small outcrop of filter feeders at KP80 (**Figure 4-12**). Between KP100 and KP110, the pipeline passes adjacent to Goodrich Bank (**Figure 4-14**). Goodrich bank typically consists of coarse sandy substrate and sparse filter feeders. Hard coral habitat is rare and only encountered at the shallowest sites on the bank (**Figure 4-16**). Along the pipeline route, the seabed is sand (**Figure 4-15**).

### 4.4.3 KP110 to KP165

The route shallows from 79 m in the northeast to 56.5 m in the southwest (**Figure 4-17**). The seabed is typically smooth and featureless except for numerous pockmarks and a large area of small depressions (attributed to biological activity) which occurs between KP109 and KP122.5.

The shallow geology generally consists of 1 to 2 m of sediment, which is largely thought to comprise sand and gravel, especially where associated with hardgrounds and outcrop. Finer material, possibly softer, may be associated with the thicker sequences, especially in topographic lows.

Habitat between KP110 and KP140 is mainly bare sediment with outcrops of burrowers and crinoids and filter feeders either side (**Figure 4-18**). At KP135, the pipeline passes approximately 2.3 km to the east of Marie Shoal. Between KP145 and KP175 it passes through the Habitat Protection Zone (**Figure 4-22**). Hard corals are predicted to the east of the pipeline. Between KP135 and KP165, filter-feeding habitat becomes more prevalent.

### 4.4.4 KP165 to KP210

Between KP187 and KP188.5, DOF (2018) reports a large single sandwave bedform which has an asymmetrical shape, indicating a current direction from the north. The structure is approximately 3.5 km long and has a height of 9.5 m. Between KP191.5 and KP193.5, there is a distinctive sandwave field. Individual sandwaves are linear to cuspate in shape and have a wavelength typically 50 to 100 m and a height of 5 to 9 m. Secondary superimposed smaller sandwaves and megaripples area also common. Between KP206 and KP220, the route shoals across a wide area which is typically around 45 m depth, but shallows to around 33 m at KP216 (**Figure 4-19**).

Habitat between KP165 and KP210 is mainly bare sand with outcrops of filter feeders (**Figure 4-20**). The habitat model predicts hard corals between KP200 and KP210. Note that AIMS (2017) found phototropic species such as hard corals were rare along the shelf area due to high turbidity and lack of light (see **Figure 4-2** for AIMS sampling locations). The sparse nature of the seabed is confirmed by photograph in **Figure 4-21**. Moss shoal is approximately 7.8 km to the west of KP165 and Mesquite Shoal 2.1 km to the east of KP170 (**Figure 4-22**).

### 4.4.5 KP210 to KP262.5

This section of the pipeline route is located between 34 m and 75 m and comprises an undulating topography that is locally rugged (**Figure 4-23**). The seabed is dominated by a series of ridges and plateaus formed from harder material. Hardgrounds occur as low to high relief topography which includes specific areas of outcrop. Outcrop areas may exhibit a karst weathering which may include potholes.

The AIMS habitat model (**Section 4.5.2**) predicts outcrops of hard corals and filter feeders (**Figure 4-24**) adjacent to the pipeline route between KP210 and KP235. AIMS (2107) reports macroscopic biota was generally sparse but low to medium density filter feeder habitats were encountered. Sponges tended to dominate the filter feeder habitats with various small to medium sized soft corals contributing less biomass. In all cases these communities were associated with small scale patches and consolidated substrate, either sandy pavement or minor rocky outcrops.

The inner shelf sediments (KP235 to KP262.5) typically comprise loose sand and cohesive deposits which form a flat and featureless seabed. The exception being where coarser material, possibly biogenic in origin from nearby reefs, forms discreet ripple and megaripple ‘trains’ which cut across the seabed (**Figure 4-27**). Sediment ribbons are also a feature on the seabed and are attributed to strong currents. The subsurface comprises a 1 to 5 m thick surficial horizon (**Figure 4-27**). Between KP247 and KP252, the pipeline re-enters the Van Diemen Rise KEF.

Near the existing Bayu-Undan pipeline, the seabed comprises a generally flat topography with discreet 'trains' of mega ripples crossing across the otherwise featureless seabed which typically comprises more than 1 m of sand and gravel.

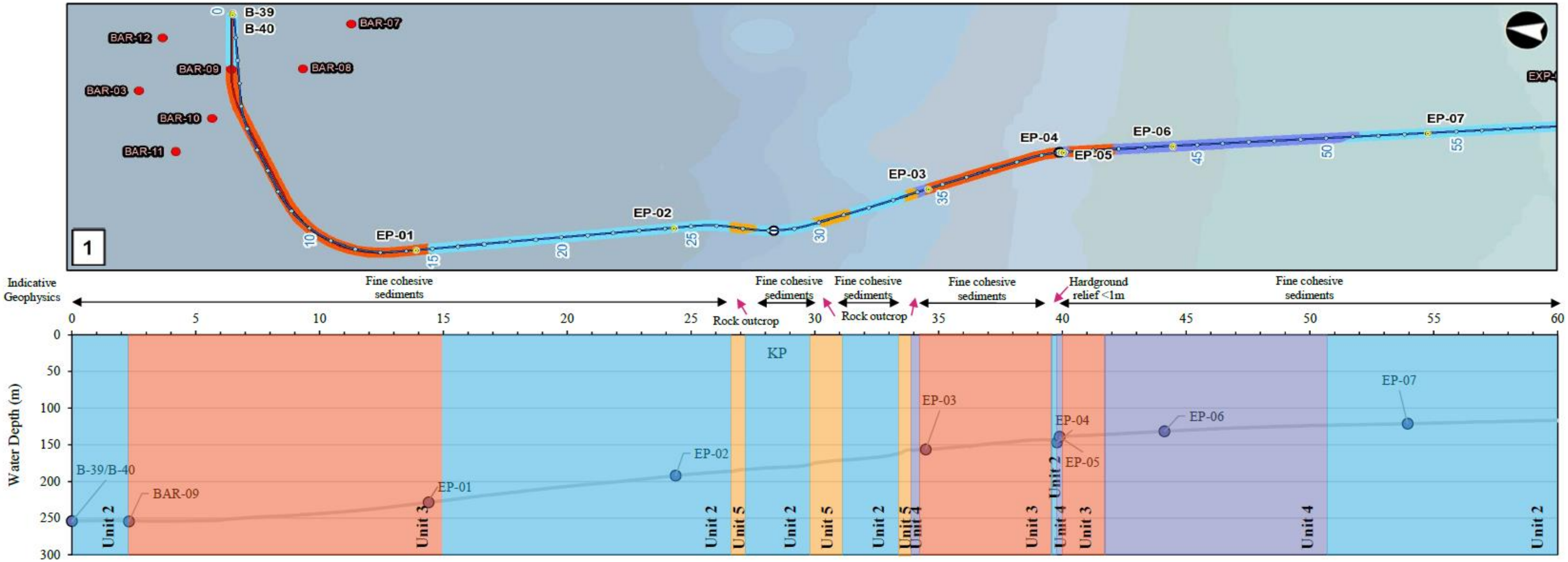



*Figure 4-9: Bathymetric profile along the gas export pipeline route KP0 to KP60*

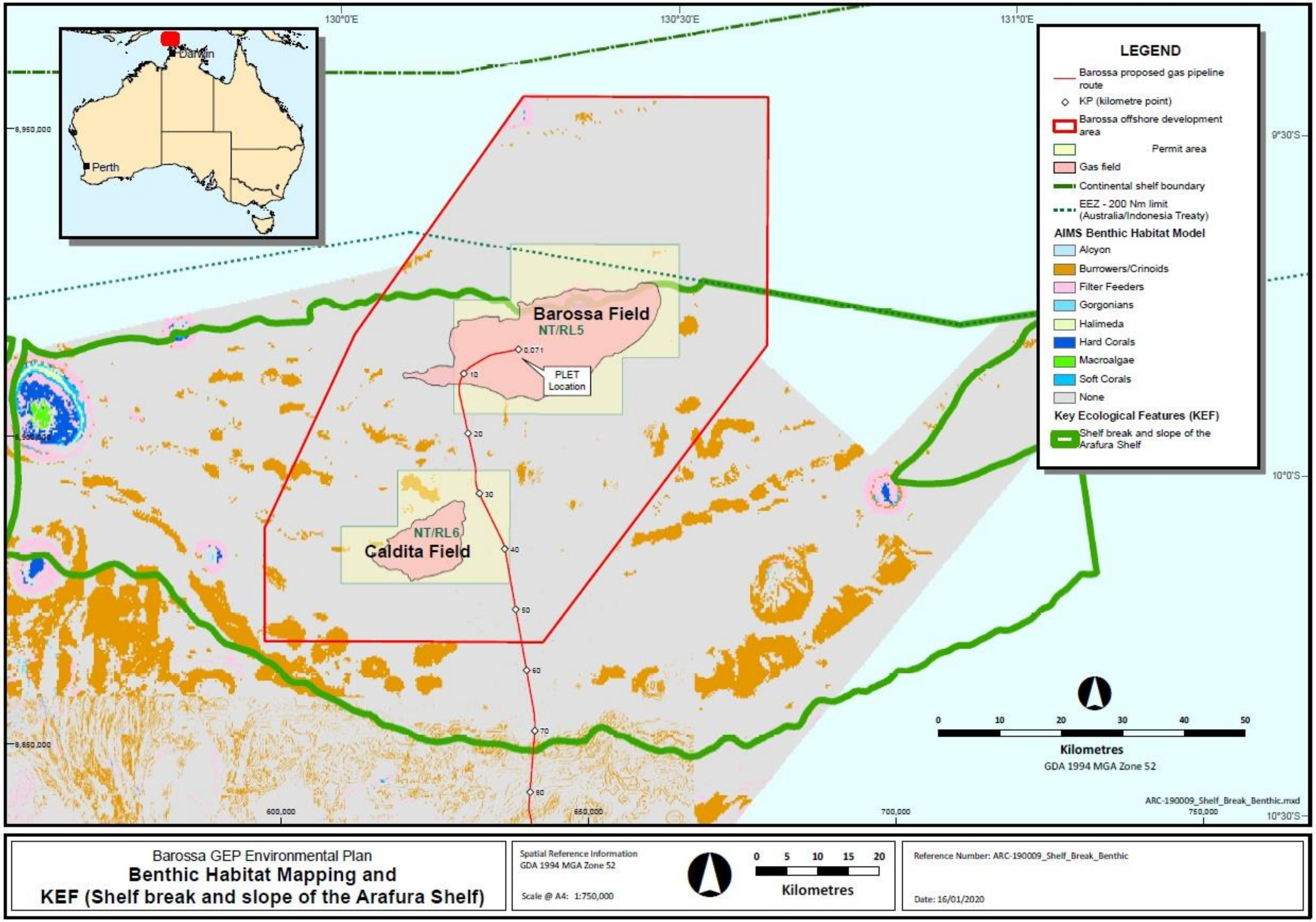



*Figure 4-10: Benthic habitat mapping along the gas export pipeline route KP0 to KP60*

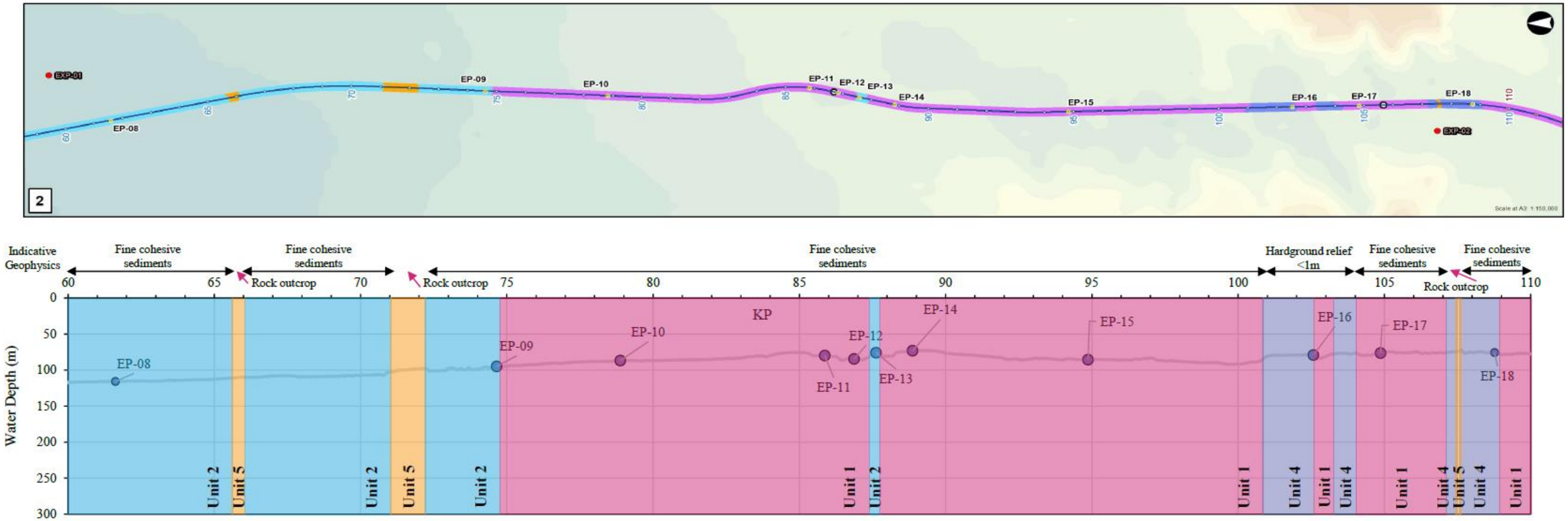



*Figure 4-11: Bathymetric profile along the gas export pipeline route KP60 to KP110*

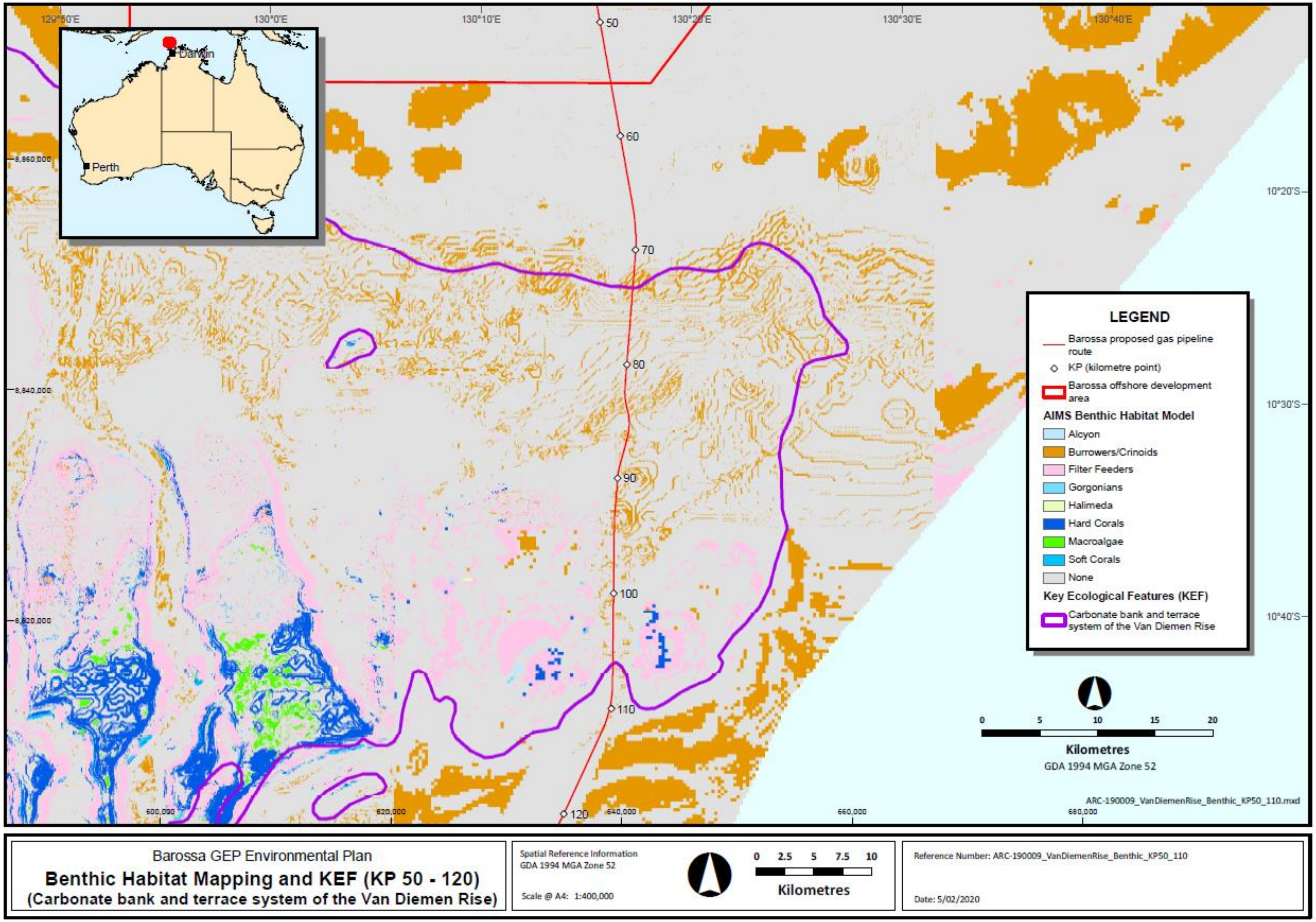



*Figure 4-12: Benthic habitat mapping along the gas export pipeline route KP50 to KP120*

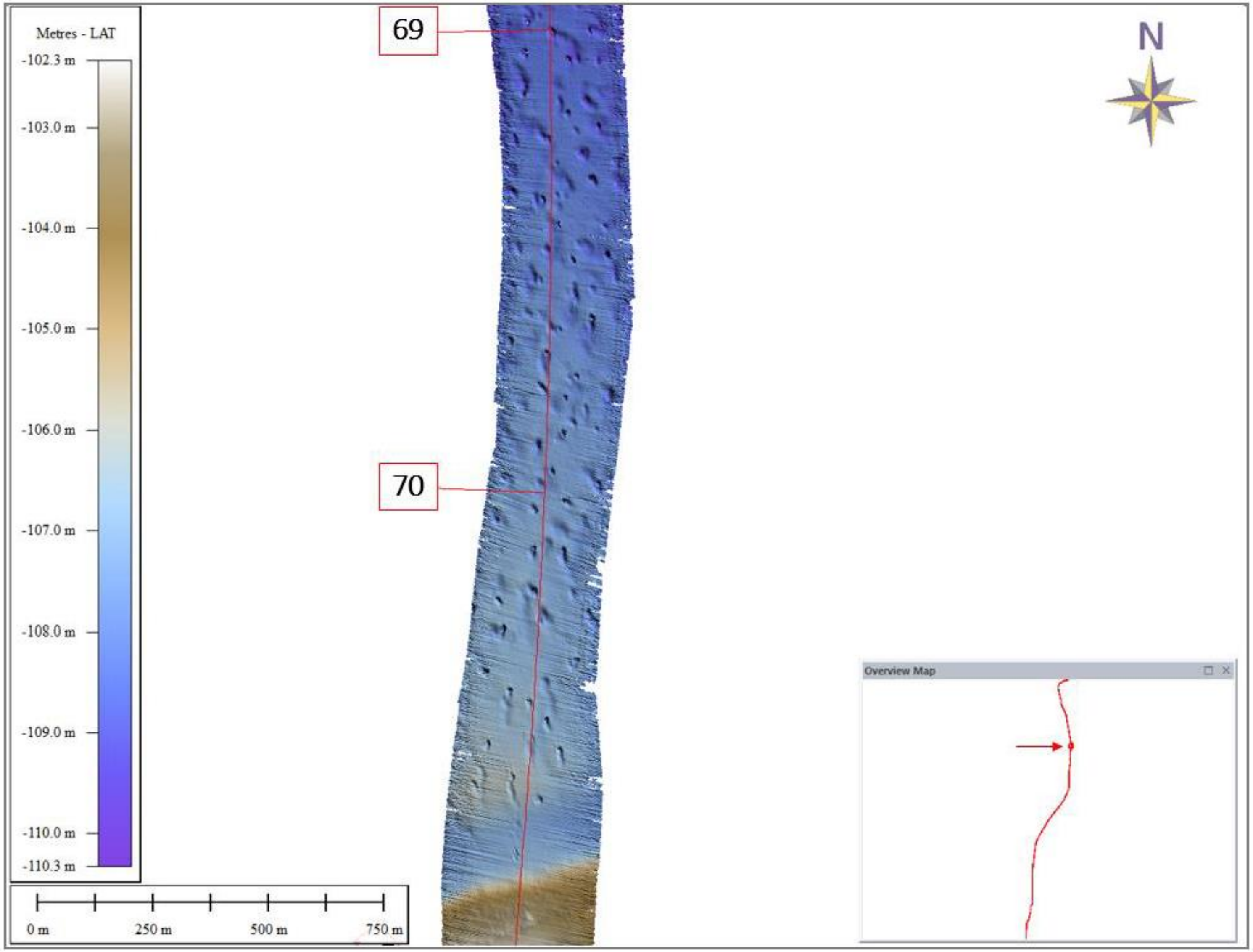



*Figure 4-13: Multibeam image showing numerous isolated pockmarks in the vicinity of KP69 and KP70*

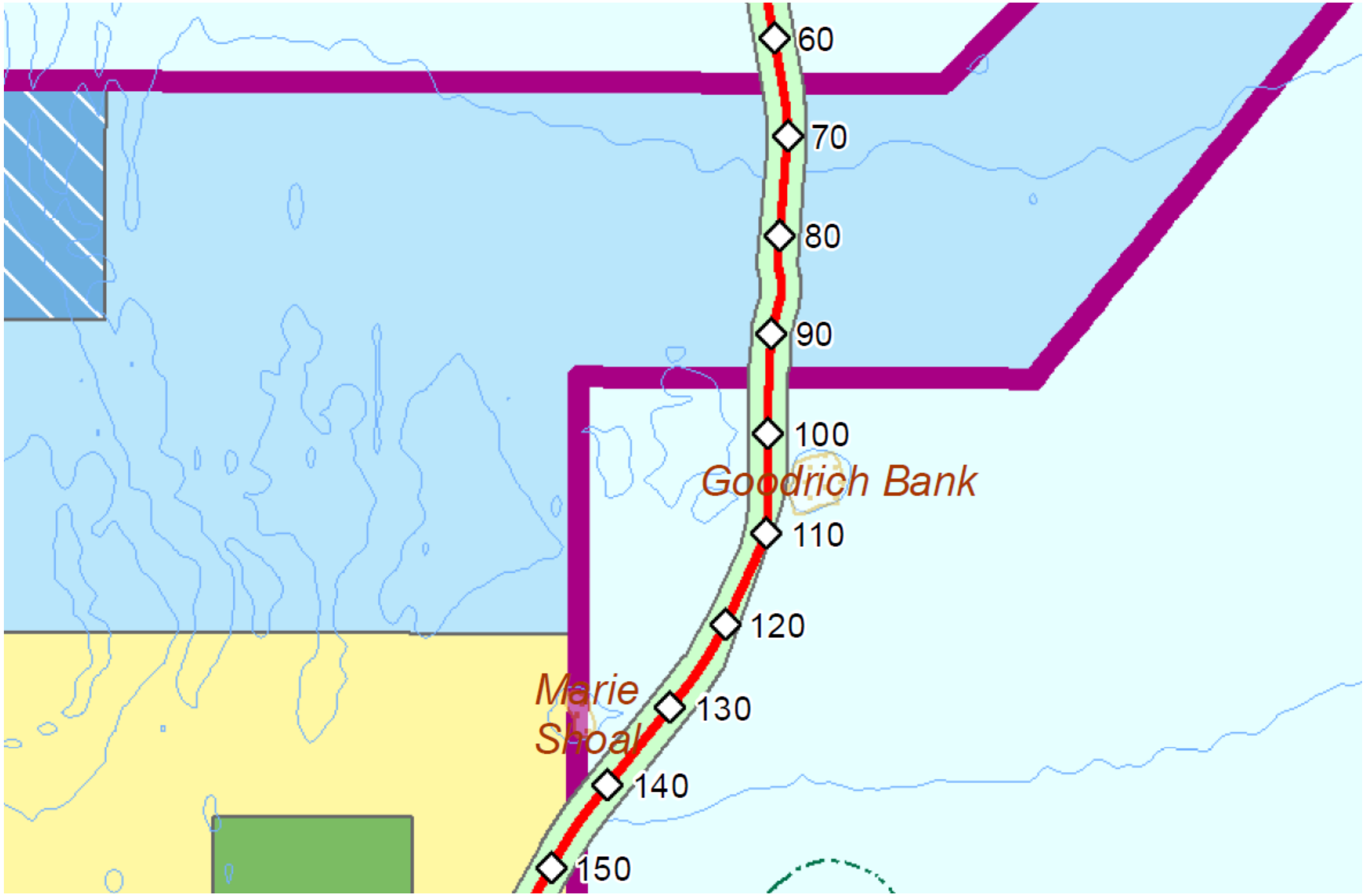



*Figure 4-14: Location of the pipeline in relation to Goodrich Bank*

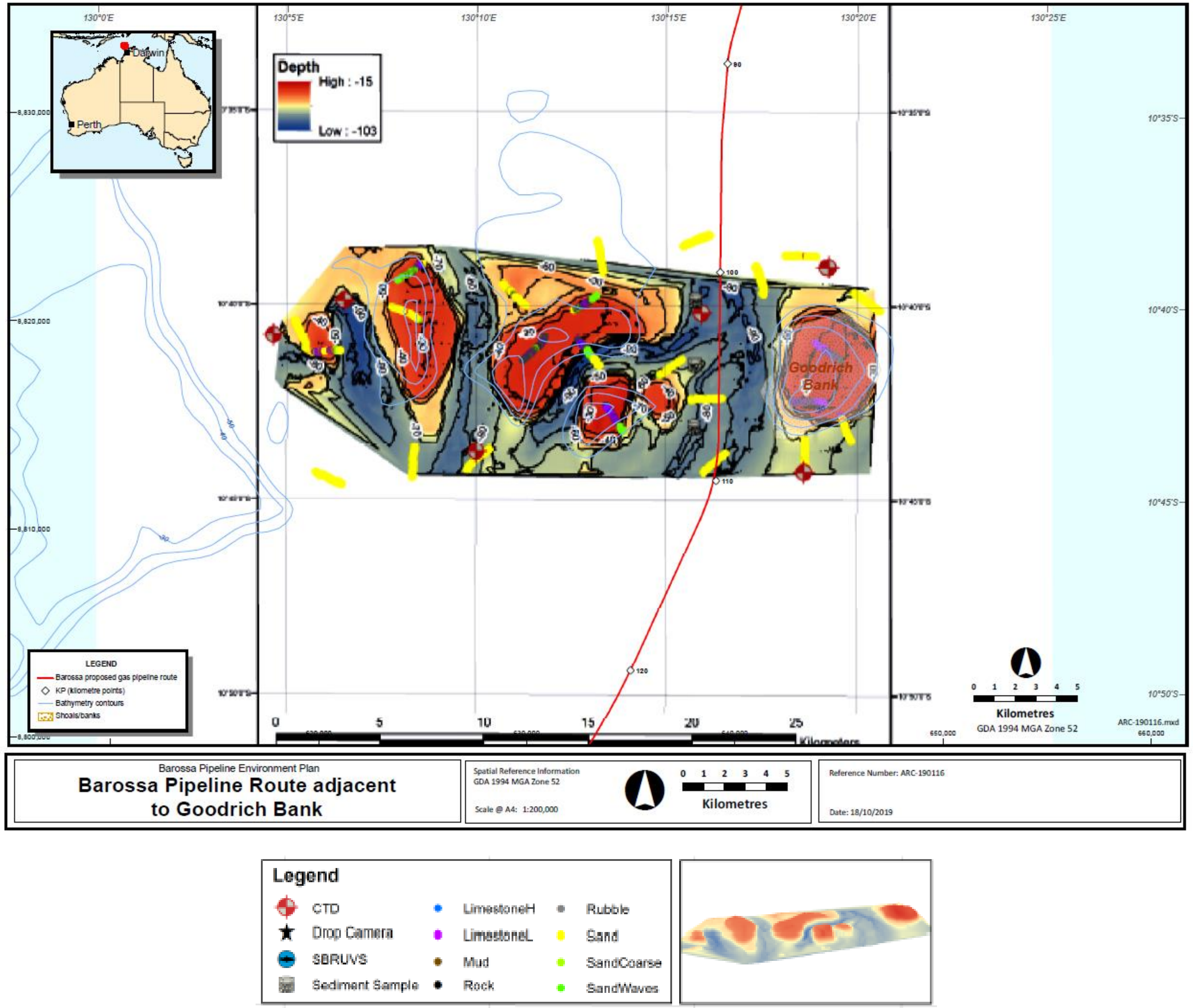
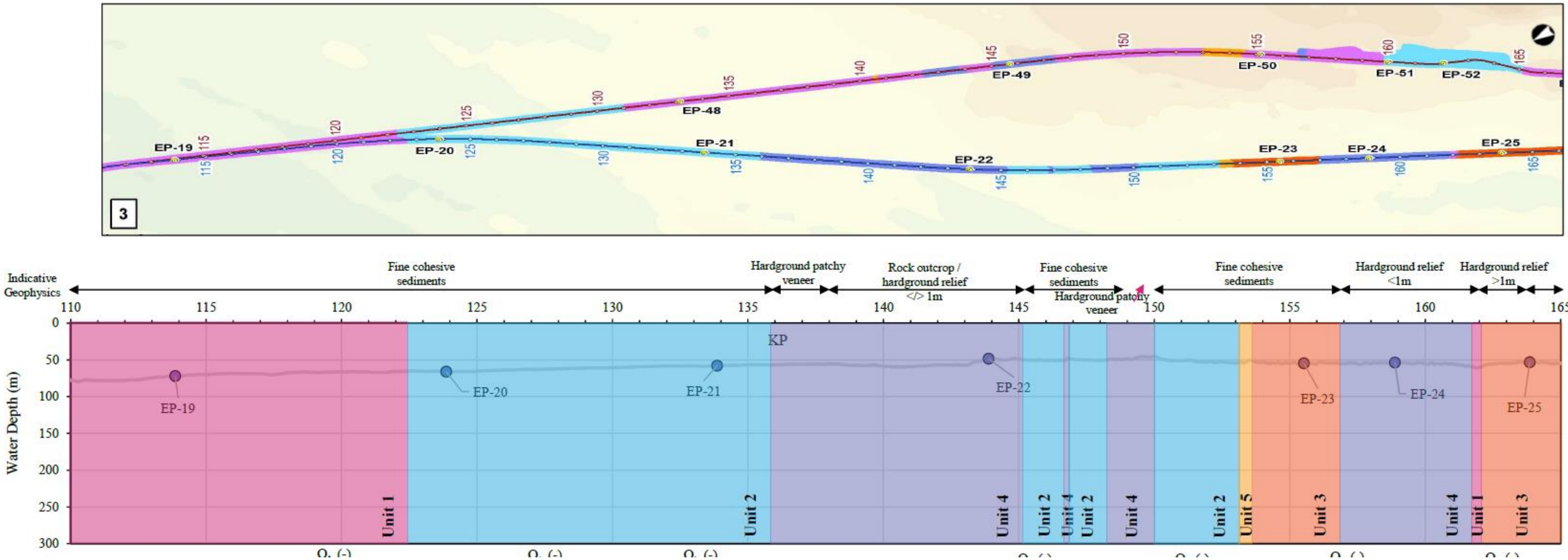



*Figure 4-15: Bathymetry of Goodrich Bank (from AIMS, 2015)*

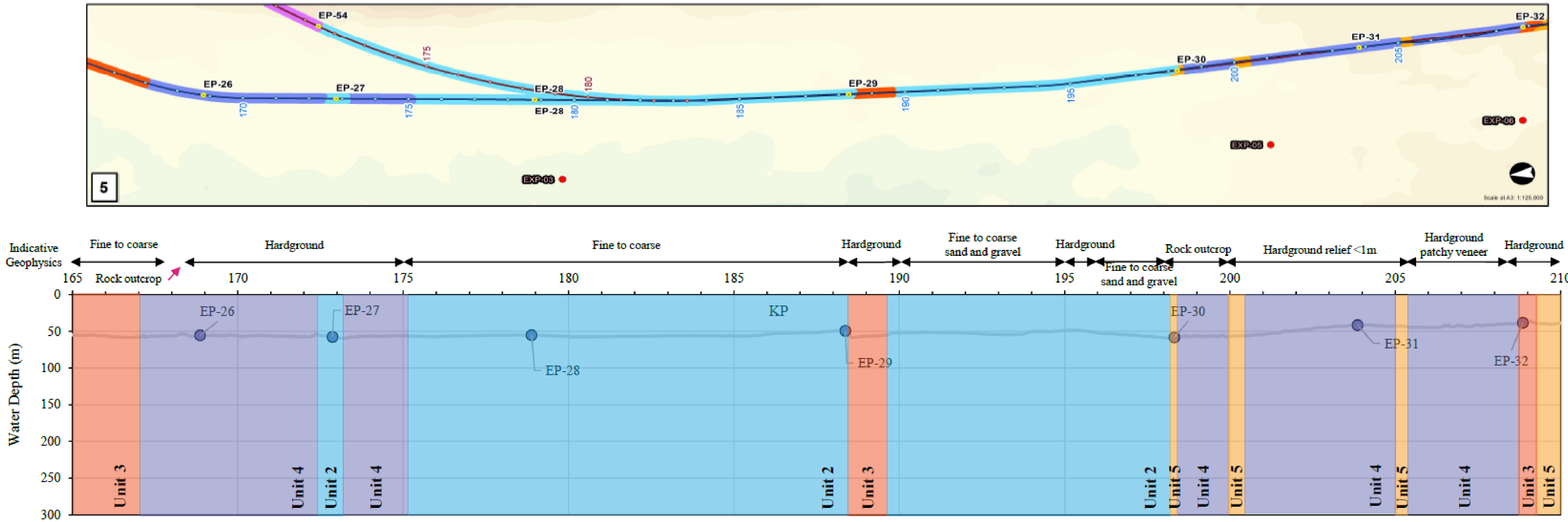
*Figure 4-16: Images of Goodrich Bank (from AIMS, 2015)*




*Note: the lower route (EP-20 to EP-25) is the proposed pipeline route.*

***Figure 4-17: Bathymetric profile along the gas export pipeline route KP110 to KP165***

***Figure 4-18: Benthic habitat mapping along the gas export pipeline route KP110 to KP165***




*Note: the lower route (EP-26 to EP-27) is the proposed pipeline route.*

***Figure 4-19: Bathymetric profile along the gas export pipeline route KP165 to KP210***

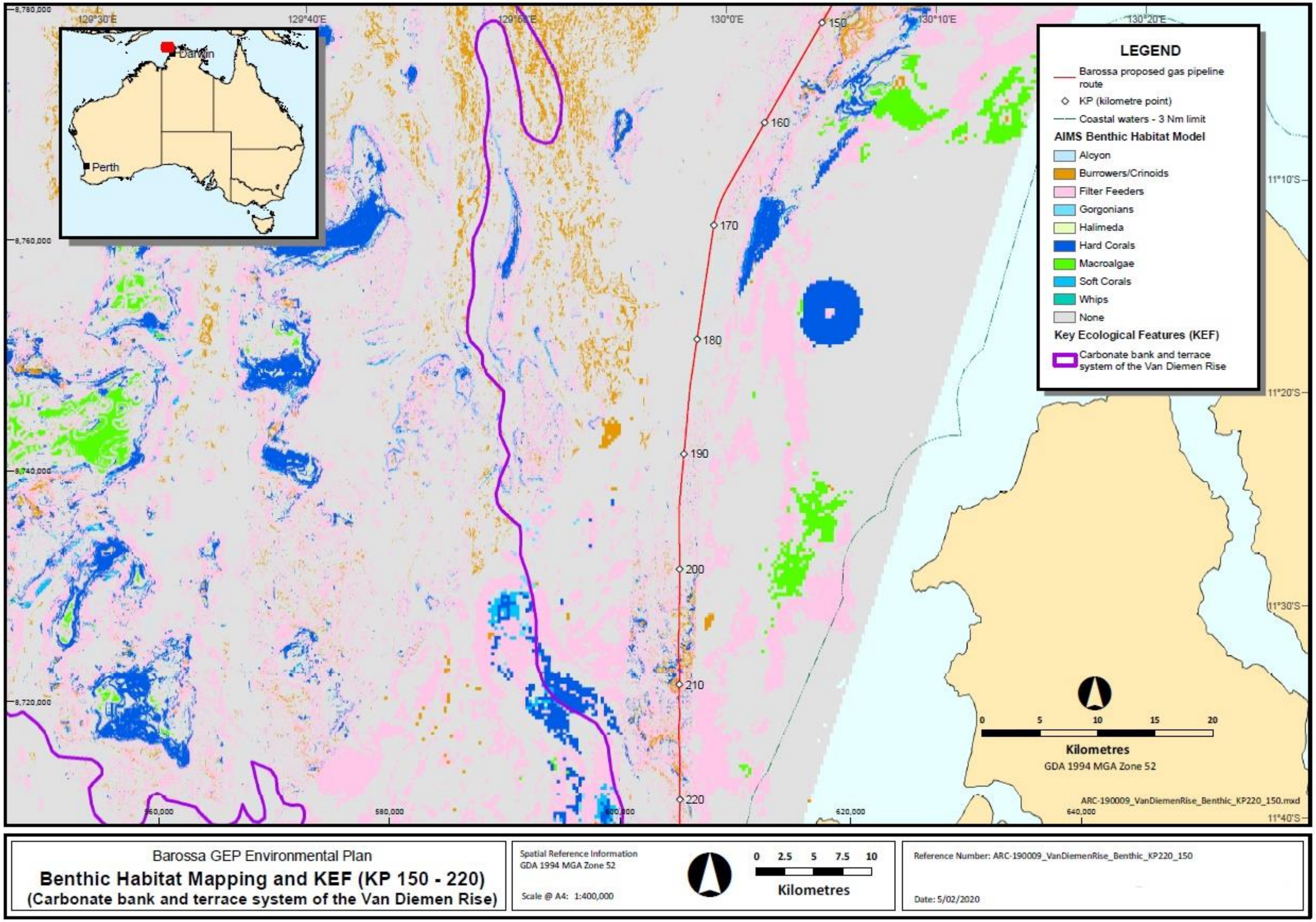



*Figure 4-20: Benthic habitat mapping along the gas export pipeline route KP165 to KP210*

Santos

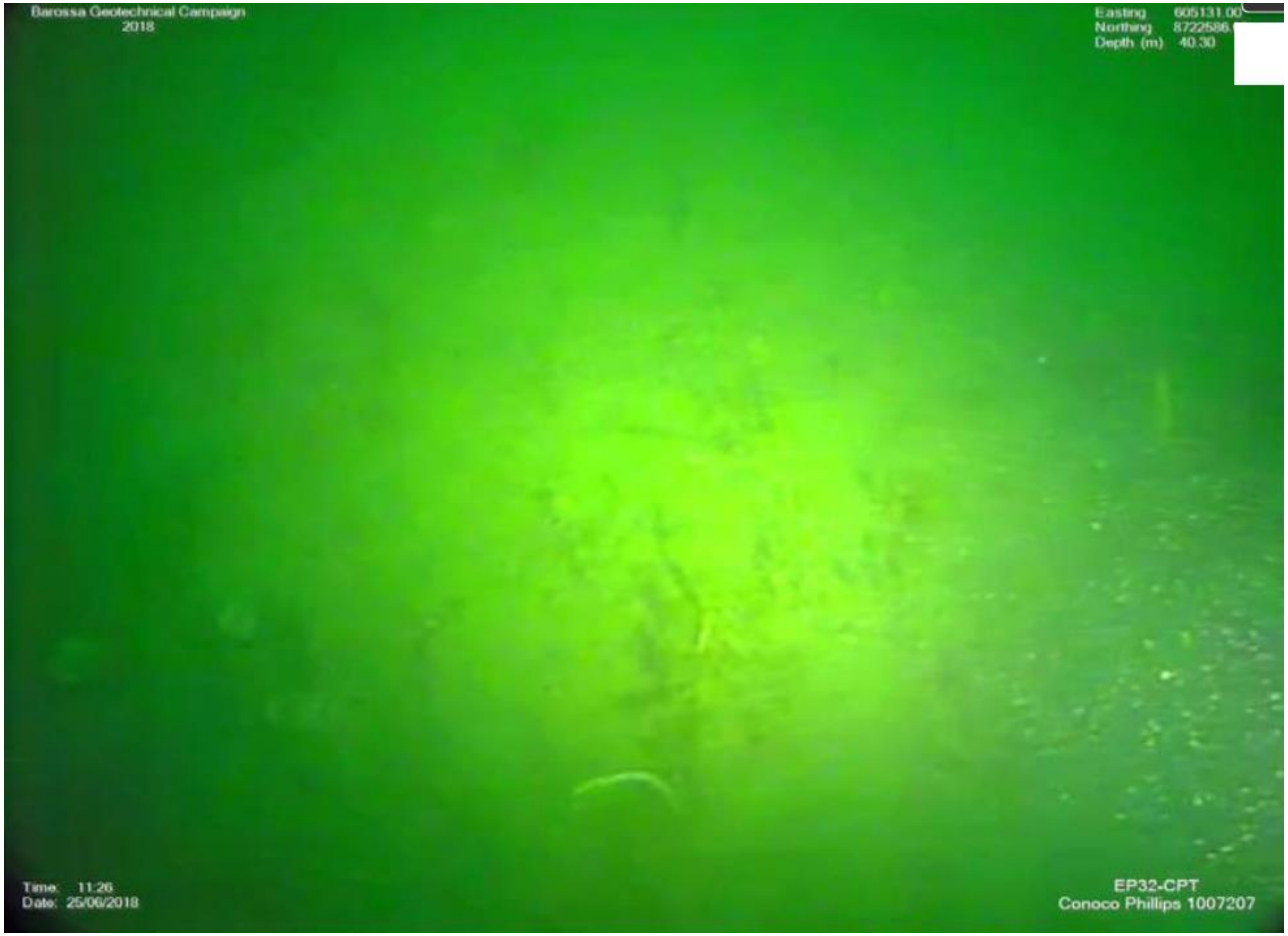



*Figure 4-21: Photographic image of seabed at KP208.7 (from DOF, 2018) showing sparse habitat*

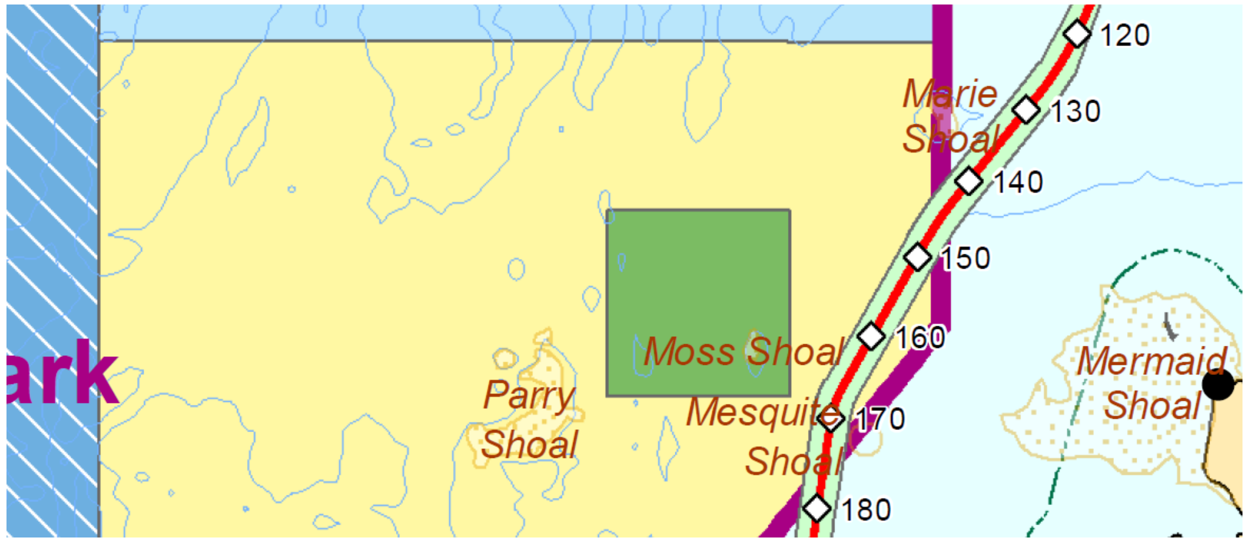



*Figure 4-22: Location of the pipeline in relation to the Marine Park Habitat Protection Zone, Moss Shoal and Mesquite Shoal*

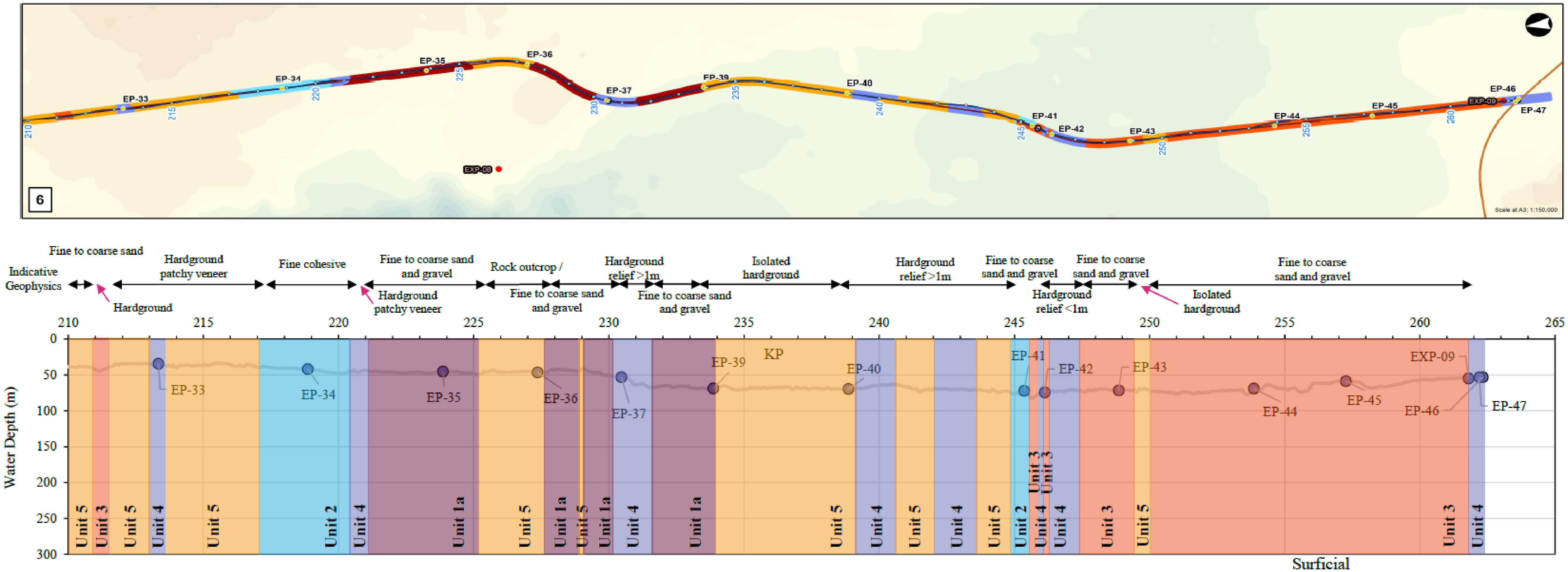



*Figure 4-23: Bathymetric profile along the gas export pipeline route KP210 to KP265.5*

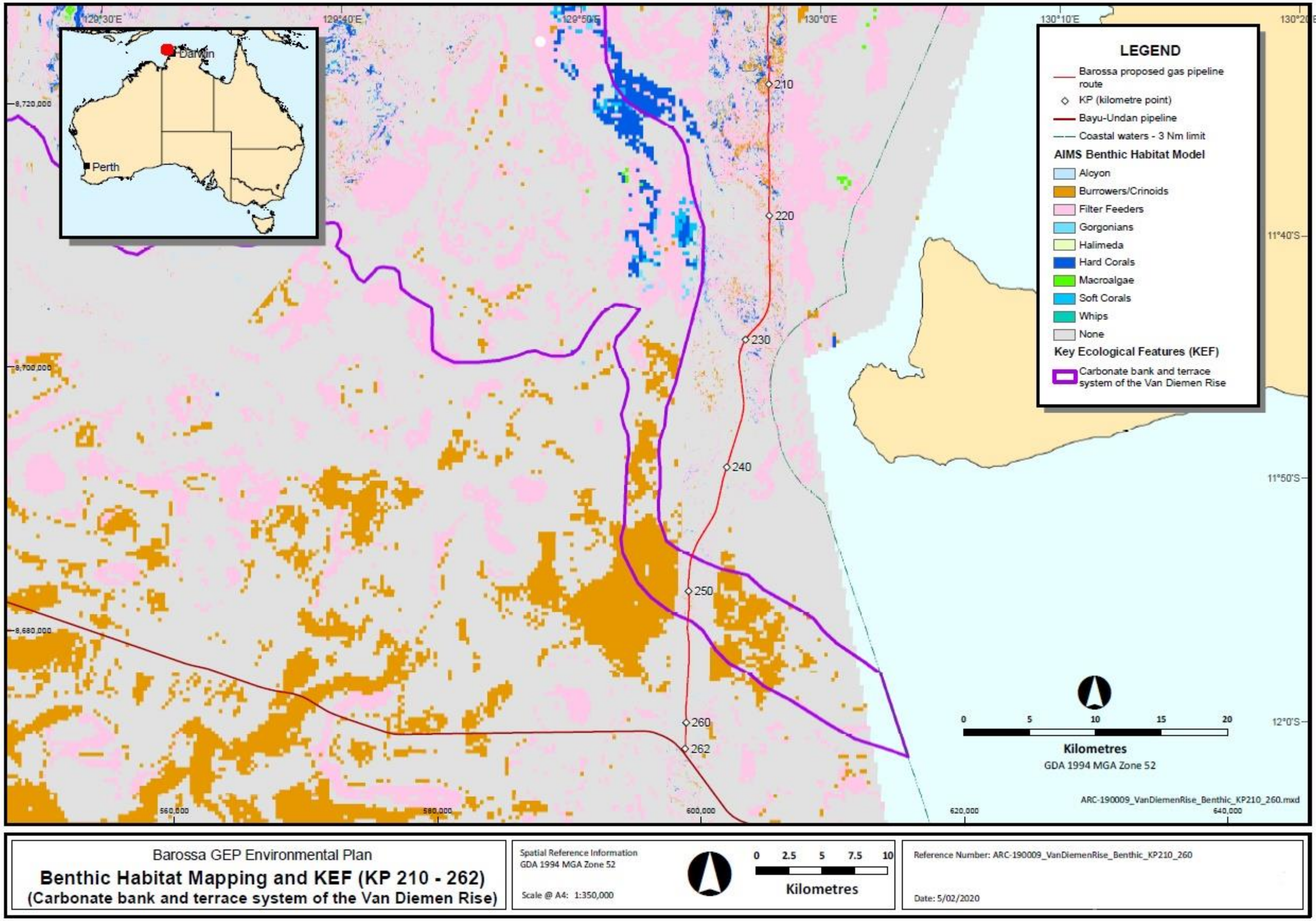



*Figure 4-24: Benthic habitat along the gas export pipeline route KP210 to KP265.5*

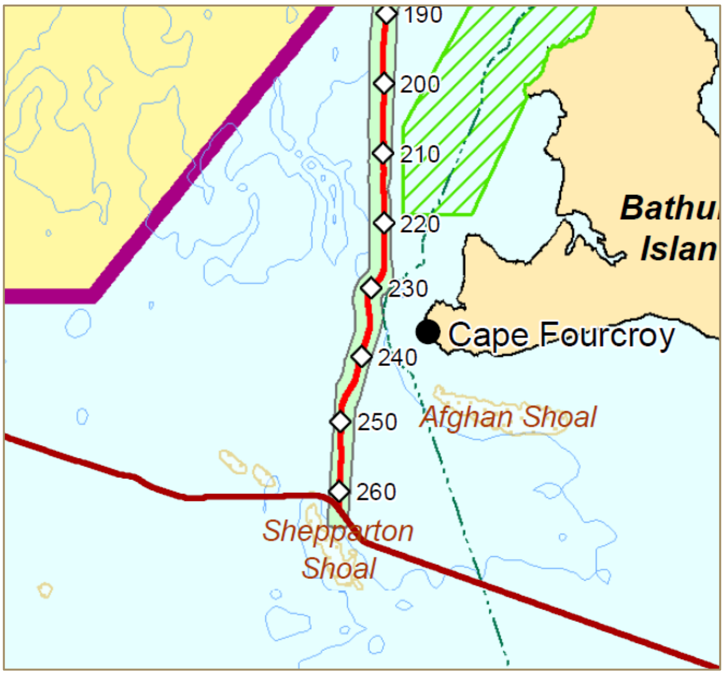



*Figure 4-25: Location of pipeline from KP250.1 to KP262.5*

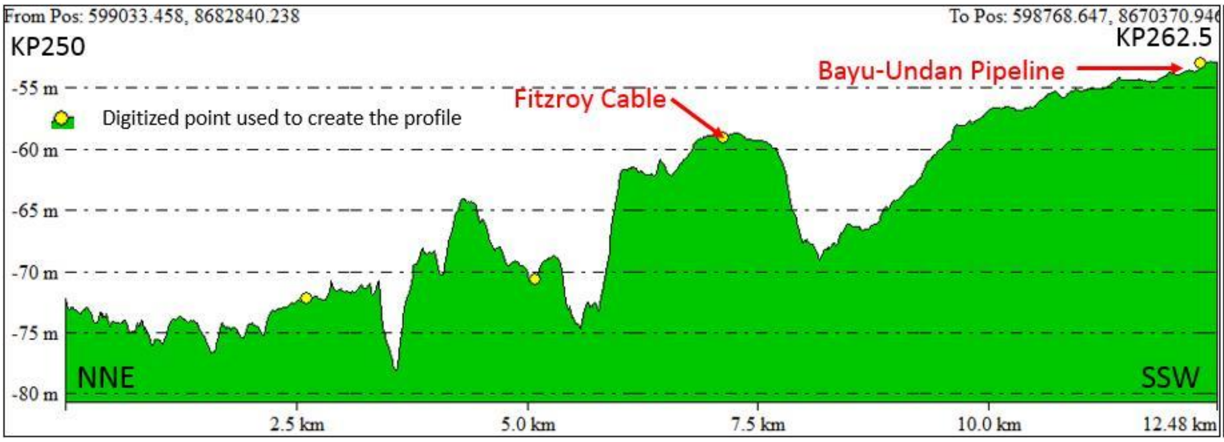



*Figure 4-26: Seabed profile from KP250 to KP262.5*

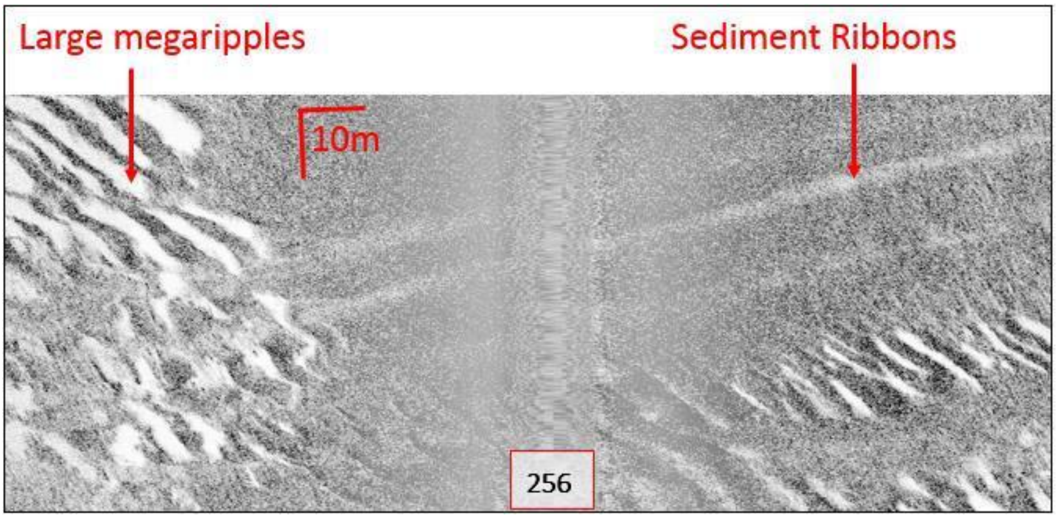



*Figure 4-27: Side scan sonar image from KP256 showing large megaripples and sand ribbon lineations indicating significant currents*

## 4.5 Biological environment

### 4.5.1 Environment protection and biodiversity conservation matters of national environmental significance

Two EPBC Act PMST database searches were conducted to identify threatened species and communities occurring within the operational area and EMBA. The search areas are considered adequate to represent those listed marine species that may occur, or have habitat, in the marine environment which is encompassed by the operational area and EMBA. The EPBC PMST reports are included in **Appendix B**.

The full results of the PMST reports, including species excluded and justification for their exclusion, are included in **Appendix B**. **Table 4-3** summarises the relevant results from the reports, relevant species are considered further in **Section 4.5.5** (i.e. those identified as potentially occurring within the operational area and EMBA).

***Table 4-3: Summary of matters of national environmental significance identified as potentially occurring within the operational area and environment that may be affected***

| MNES | Number |
|---|---|
| World Heritage properties | None |
| National Heritage places | None |
| Wetlands of International Importance | None |
| Listed Threatened Ecological Communities | None |
| Listed threatened species (**Section 4.5.5.1**) | 20 (operational area)<br>42 (EMBA) |
| Listed Migratory species (**Section 4.5.5.1**) | 41 (operational area)<br>50 (EMBA) |
| Commonwealth marine areas (**Section 4.5.2**) | 2 – Exclusive Economic Zone (EEZ), Territorial Sea and Extended Continental Shelf |
| Great Barrier Reef Marine Park | None |

### 4.5.2 Intertidal and benthic primary producers

The understanding of intertidal and benthic habitats, both primary producers and other benthic communities has been developed based on the extensive field sampling undertaken (refer **Section 4.2**, including **Table 4-2** and **Figure 4-2**) and through the interpretation of habitat modelling and mapping undertaken by AIMS (Heyward et al., 2017; Radford et al., 2019).

A spatial predictive benthic habitat model of the Oceanic Shoals Marine Park had previously been developed by AIMS as part of the Australian National Environmental Science Programme (NESP) to determine the spatial heterogeneity of the benthic environment and key classes of organisms within the reserve (Radford and Puotinen, 2016 and refer https://northwestatlas.org/node/1710 for an interactive version of the map). To ensure the model was robust, ecologically meaningful and accurate, it was verified through the use of field data and statistical relationships (between the predictors and field data presence/absence of benthic classes) using a non-parametric statistical method of classification trees (Radford and Puotinen, 2016).

Using the data collected during the Barossa baseline studies program, AIMS (Heyward et al., 2017) were able to extend the benthic habitat model of the Oceanic Shoals Marine Park to develop a regional habitat map that encompassed the entire gas export pipeline corridor and the offshore development area. The regional habitat model was also subject to testing of random data points to assess the predictive accuracy (as per methods outlined in Radford and Puotinen, 2016) which demonstrated that ten benthic habitat classes were successfully modelled and mapped with a total accuracy of 82.97%.

With any modelling, consideration must be given to any limitations and AIMS (Radford and Poutinen, 2016) identified the following points to be considered:

+ The distribution of training data across the area of interest can affect the quality of the model and model quality may be lower in areas far from testing and training data points.
+ The spatial scale at which the habitat classes can be modelled, in other words, broader scale versus finer scale bathymetry data, can affect what features are identified and the implications of this need to be kept in mind; for example, the relative proportion of the different habitat types predicted to be present may vary and could influence the impact assessment.

When considering the accuracy of the model to predict the presence/absence of individual habitat classes, it is important to not only consider absolute accuracy, but also consider how the model misclassifies different classes and how this may affect decisions and conclusions that can be made.

In relation to the first point, the data collected through the Barossa baseline studies program provided data that were directly from the area of interest (**Figure 4-2**), providing confidence that the models will be of high quality and that the relationships between the physical and biological parameters identified by the model are representative of the area (compared to if the training data were further away). To the second point, the spatial scale of the mapping presented in the accepted OPP was the best available and reviewing the collected environmental and geophysical field data over the pipeline route (including multibeam bathymetry and side scan sonar which is collected over very fine spatial scales), provided confidence that the regional habitat map was accurately representing the benthic habitats present, particularly in deeper water where there is less topographic complexity. Despite having confidence in the interpretation of the modelling results, interpretations presented in the accepted OPP were made with caution and with the consideration that some finer scale features may not have be identified.

Following this, additional work was undertaken with the objective of providing a more robust impact assessment for this EP. There were two aspects that have been able to be combined which further address the modelling limitations above and provide greater confidence in the modelling outputs and the interpretation for the impact assessment. Firstly, a collaboration with AIMS to undertake an additional baseline survey of habitats inside and outside the Oceanic Shoals Marine Park (Radford et al., 2019). Secondly, higher resolution regional bathymetric data (30 m vs the previously used 250 m bathymetry grid) became available for use in the modelling (Beaman, 2018, see https://www.deepreef.org/publications/conference/236-nthaus-ausseabed.html).

Subsequently, the habitat models were revised to include both the additional field data collected in the area of interest and the newly available finer scale bathymetry data (Radford et al., 2019) which further addressed the limitations identified above in the following ways.

The additional data collected during the AIMS survey of the Oceanic Shoals Marine Park not only provided additional data for the area of interest and thus further increased confidence in the quality of the models, but it also included data from environments that were previously less well sampled; e.g. shallower waters, which further increases confidence that the models will be able to better define the environmental relationships between the physical and biological parameters that are used to predict the habitat distributions across the area.

Similarly, by using the finer scale bathymetry data, the rugosity and topographic complexity data used in the models was of a higher resolution and could better define smaller patches and identify features at a finer scale. Consequently, this provided the opportunity to more precisely define the environmental relationships between the physical and biological parameters as these data (rugosity and topographic complexity) along with depth are often responsible for driving patterns of habitat distribution in the area (Heyward et al., 2017).

Given it is the relationships between the physical and biological parameters that are used to predict the habitat distributions, using more data across the environmental gradients present and using finer scale data should also improve model predictive performance which would address the third consideration above.

To evaluate the predictive accuracy of the models developed using the additional data and finer scale bathymetry data, model error and accuracy statistics were calculated, as for previous versions of the models, using a confusion matrix and resulting Kappa statistic which is presented in **Table 4-4**. As shown, all habitat classes had very high predictive accuracy (more than 80%) with the exception of the 'Alcyon' class (74% due to the model overpredicting the presence of 'Gorgonians' and 'Hard Corals') and the 'Whips' class (64% due to overpredicting 'Gorgonians' and 'Alcyon' classes).

From discussion with AIMS (B. Radford, 2019, pers. comm., 7 Jan), the improved model accuracy is the result of both having additional data across the environmental gradient, and having the finer scale rugosity and topographic complexity data (derived from the bathymetry data) with which the modelling could better define the environmental relationships between the physical and biological parameters.

***Table 4-4: Confusion matrix showing the predicted habitat classes (x axis) versus hold-out in-field towed video classes (y axis) from the revised Oceanic Shoals model, modified to include the additional data from the Oceanic Shoals Marine Park study and a higher resolution 30 m bathymetry. 30% of all data was selected at random and retained from the modelling process to act as testing data. Overall, Kappa value for this matrix is 0.88 and global predictive accuracy is 91.0% (from Radford et al., 2019)***

| | Alcyon | Burrowers/ Crinoids | Filter Feeders | Gorgonians | Halimeda | Marcoalgae & Hard Corals | Macroalgae | Soft corals | Whips | None |
|---|---|---|---|---|---|---|---|---|---|---|
| Alcyon | 1352 | 6 | 33 | 179 | 0 | 164 | 8 | 22 | 24 | 194 |
| Burrowers/Crinoids | 0 | 5205 | 61 | 0 | 0 | 0 | 0 | 1 | 0 | 206 |
| Filter Feeders | 9 | 68 | 14650 | 6 | 15 | 576 | 53 | 49 | 3 | 939 |
| Gorgonians | 147 | 0 | 22 | 1536 | 0 | 17 | 0 | 0 | 43 | 193 |
| Halimeda | 0 | 0 | 9 | 0 | 875 | 134 | 2 | 16 | 0 | 138 |
| Macroalgae & Isolated Hard Corals | 122 | 0 | 394 | 1 | 84 | 43267 | 15 | 307 | 7 | 931 |
| Macroalgae | 0 | 0 | 23 | 0 | 0 | 17 | 1560 | 0 | 0 | 114 |
| Soft corals | 34 | 0 | 52 | 0 | 12 | 250 | 0 | 3545 | 0 | 164 |
| Whips | 15 | 0 | 4 | 80 | 0 | 38 | 0 | 0 | 173 | 38 |
| None | 141 | 91 | 706 | 114 | 73 | 1405 | 84 | 155 | 19 | 29939 |
| **Predictive Accuracy** | **74%** | **97%** | **92%** | **80%** | **83%** | **94%** | **91%** | **87%** | **64%** | **91%** |

#### 4.5.2.1 Coral reef

Coral reefs provide habitat for a high diversity of corals, associated fish and other species of both commercial and conservation importance. Within the Northwest Shelf Transition Province, waters are relatively clear, and the euphotic zone can extend to 100 m across the shelf (Rochester et al., 2007). Within offshore water of the NMR, coral reefs are generally confined to the shallower regions of banks, shoals and pinnacles which contain sufficient hard substrate for corals to establish communities on. Although none of these features exist within the operational area, there are shoals and banks in proximity which may sustain coral communities. The nearest features to the operational area which may support coral communities include Mesquite Shoal, Goodrich Bank, Marie Shoal and Shepparton Shoal, located 0.3 to 2 km from the boundary of the operational area (refer to **Section 4.5.6.3** for a summary of shoals and bank overlapping the EMBA).

Shoals are relatively shallow and isolated areas of built up unconsolidated material which are often associated with discrete coral patches and other important benthic habitats within the NMR. A study conducted as part of the Barossa marine studies program surveyed coral cover on submerged shoals within outer continental shelf waters of the NMR. The results showed maximum coral cover of three surveyed submerged shoals (Tassie, Evans and Blackwood shoals) to be varied; however, typical coral cover was 21 to 32% (Heyward et al., 2017).

The operational area and EMBA overlap a small portion of the Oceanic Shoals Marine Park which supports areas of coral communities. Results from further survey work by AIMS (Radford et al., 2018) within the Oceanic Shoals Marine Park and Shepparton Shoal were consistent with the predictions made for the extended benthic habitat modelling, with the distribution of corals restricted to relatively shallow areas where sufficient photosynthetically active radiation reaches the seabed. Of the six areas surveyed by Radford et al. (2018), only three contained light-dependent communities such as zooxanthellate corals; these areas were all less than 30 m water depth. Coral cover was less than 1% and none was observed in the operational area. Given the Oceanic Shoals Marine Park is representative of benthic habitats in similar depths within the region, the patterns of coral distribution across the region are likely to be similar (i.e. largely restricted to less than 30 m water depth) and therefore unlikely to be found along the proposed pipeline route which is in water depths greater than 30 m. Refer to **Section 4.5.3** for information on the Oceanic Shoals Marine Park.

Within shallow NT coastal waters, there are coralline fringing reefs and patch reefs, as well as rocky reefs that may support coral reef communities (DEWHA, 2008b). Several shoals and banks also overlap the EMBA, mainly between the Tiwi Islands and NT mainland.

#### 4.5.2.2 Seagrass and macroalgae

Seagrass and macroalgae communities provide important habitat for various marine species. Similar to coral reefs, seagrass communities are light restricted and generally occur only within shallow coastal areas. No seagrass communities have been identified in the operational area; however, small areas of macroalgae were identified within the extended AIMS benthic habitat model (**Figure 4-28**). The model results were verified by subsequent survey work by Radford et al. (2018). Results of this survey work were consistent with model predictions, with no seagrass observed within the Oceanic Shoals Marine Park or at Shepparton Shoal and isolated, sparse macroalgal communities in less than 30 m water depth. Within the NMR, seagrass communities are also restricted to sheltered waters where they are protected from strong tidal currents, high turbidity, and substantial sediment mobility characteristic of the region (Przeslawski et al., 2011a).

Within the Northwest Shelf Transition Province, high levels of turbidity restrict light penetration and as a result, significant seagrass communities do not occur within this region and are confined to the intertidal areas of the adjacent Northern Shelf Province (DEWHA, 2008b). Within NT coastal waters of the EMBA, significant seagrass communities are unlikely to occur; however, small discrete patches of seagrass may be present within shallow, sheltered areas of the Tiwi Islands, and potentially around shallow offshore shoals/banks.

#### 4.5.2.3 Mangroves and saltmarshes

Mangroves provide important habitat for multiple species, including nesting, feeding and staging areas for seabirds, waterbirds, waders, and migratory birds (DEWHA, 2008b). Mangroves and saltmarshes are confined to shoreline habitats and will not occur within the operational area. In the NMR, mangrove communities are concentrated mostly within the Gulf of Carpentaria (to the east of the EMBA), with more than 136 identified mangrove-line estuaries within NT coastal waters (DEWHA, 2008b) However, mangroves also occur across the NMR's shorelines, including the Tiwi Islands. Along the shoreline of the Tiwi Islands mangroves are predominantly within tidal creeks and not exposed along the shoreline. Within the EMBA, mangroves will occur within NT coastal waters.

There are no saltmarshes within the operational area or EMBA.

### 4.5.3 Other benthic communities

Benthic communities across the operational area and EMBA are expected to vary with distance offshore and substrate or benthic composition. Within the offshore areas of the Northwest Shelf Transition Province, the distribution of epibenthic and infauna communities are highly correlated with geomorphology and substrate type (Nichol et al., 2013). A survey of the Oceanic Shoals Marine Park found benthic communities within relatively featureless areas (terraces and plains) to be restricted to infauna communities, with almost no visible presence of epifauna (Nichol et al., 2013). Banks were found to have generally moderate to dense biological communities and were the only geomorphic feature found to support reef-forming corals; however, the types of communities and coverage were highly varied with some banks completely void of epifauna (Nichol et al., 2013). The study indicated variation in epibenthic biodiversity in the Oceanic Shoals Marine Park is a function of substrate, water depth, light and turbidity, with data showing banks in >45 m water depth supported the highest levels of biodiversity, while plains and terraces showed almost a complete absence of epibenthic communities (Nichol et al., 2013).

As described above, the habitat modelling undertaken demonstrates that most of the habitats present across the gas export pipeline route within the Oceanic Shoals Marine Park are abiotic (supporting no benthic habitats) and filter feeders. These habitat classes are well represented elsewhere in the Habitat Protection Zone and wider marine park (Radford et al., 2019). Filter feeder communities were frequently sparse, with decreasing density with depth. For the area in and surrounding the Habitat Protection Zone of the Oceanic Shoals Marine Park, there was limited and patchy distribution of filter feeding habitats, and points to associations with high spots and regions of steeper bathymetry (Radford et al., 2019).

The three sites where higher diversity was observed in the Oceanic Shoals Marine Park were all further north into the marine park (outside the operational area) and included site 3, the National Park Zone, which included some hard coral, soft coral and Halimeda, site 2, which had sparse areas of macroalgae and site 1 which had hard coral, soft coral in addition to filter feeders (refer **Section 4.5.3** for a description of the Oceanic Shoals Marine Park and its values).

Another study observing benthic habitats across the Northwest Shelf Transition Province identified dominant fauna groups based on geomorphic feature (Przeslawski et al., 2011a). The study found the same relationship between epifaunal communities and substrate, with highest species richness observed on banks, followed by medium richness at terraces and ridges, and lowest richness over plains and within valleys (Przeslawski et al., 2011a). A nearly reverse relationship with infaunal communities was found, with highest infaunal species richness observed over plains, and the lowest over terraces and ridges, with medium levels found on banks and within valleys (Przeslawski et al., 2011a). Infaunal communities within the operational area ranged from depauperate communities (two individuals per 0.1 m²) to more diverse communities with abundances of 10 to 20 individuals per 0.1 m², from 15 different taxa (Jacobs, 2017) The dominant fauna over banks were sponges, octocorals and hard corals; terraces and ridges comprised mainly sponges and octocorals, and plains and valleys comprised mainly polychaetes, amphipods and isopods (Przeslawski et al., 2011a).

The Oceanic Shoals Marine Park contains a range of benthic habitats including bare sand (84.0%), burrowers/crinoids (7.5%) and filter feeders (6.0%), with remaining habitat classes comprising ≤1% each). The benthic habitats within the operational area (**Figure 4-28**) predominantly support burrowers/crinoids

(6.2%), filter feeders (10.2%) and abiotic areas that support little biota (82.8%) with some small areas of Alcyon (0.3%).

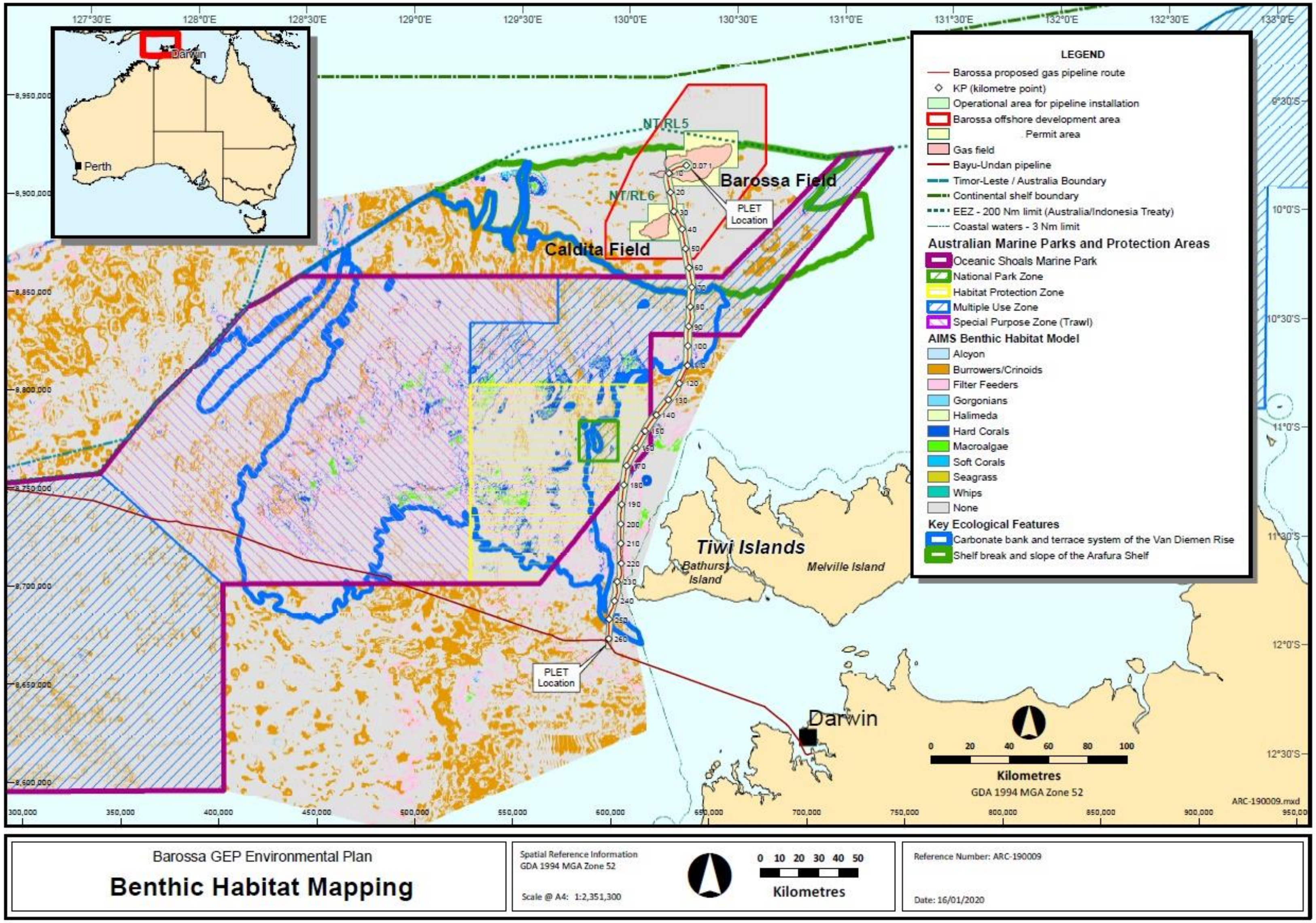



*Figure 4-28: Benthic habitats of the operational area (note: the Filter Feeders category includes sponges)*

### 4.5.4 Other communities

**Plankton**

Plankton distribution is often patchy and linked to localised and seasonal productivity that produce sporadic bursts in phytoplankton, zooplankton and tropical krill production (DEWHA, 2008). Fluctuations in abundance and distribution occur both horizontally and vertically in response to the tidal cycles, seasonal variation (light, water temperature and chemistry, rainfall, currents and nutrients) and cyclonic events. The seasonal cycles and spatial distribution and abundance of biological productivity remain largely unknown globally. However, in general, the mixing of warm surface waters with deeper, more nutrient-rich waters (i.e. areas of upwelling) generates phytoplankton production and zooplankton blooms.

Phytoplankton in the NMR is diverse (approximately 200 species) and Chlorophyll 'a' concentration and productivity are considered relatively high (Rochester et al., 2007), although recent field studies found Chlorophyll 'a' concentration and productivity within the gas export pipeline route were low (Jacobs, 2015b). Jacobs (2017) found that diatoms (*Bacillariophyceae*) were the most abundant marine phytoplankton. Other phytoplankton within the water column included silicoflagellates (*Dictyochophyceae*), dinoflagellates (*Dinophyceae*), euglenids (*Euglenophyceae*) and unicellular green algae (Prasinophyceae) (Jacobs, 2017). In offshore waters of the NMR (deeper than 50 m), plankton communities are dominated by dinoflagellates *Dinophysis*, *Ceratium*, *Prorocentrum* and *Caratocorys*, while shallower offshore waters support cyanobacterium *Trichodesmium* and the diatoms *Rhizosolenia* and *Thalassonema* and inshore NT coastal waters support diatoms *Rhizosolenia* and *Thalassonema* (DEWHA, 2008b).

**Pelagic and demersal fish communities**

Fish occupy a range of habitats, from coral reefs to open offshore waters, and play an important ecological role with many species being of conservation value and important for commercial and recreational fishing. Within the NMR, higher order predatory fish including snappers, emperors and groupers are common to rocky reef and coral habitats (DEWHA, 2008b). Commercially important demersal fish also occur across the NMR, such as trevallies, giant queenfish, barramundi, grunters, emperors, snappers, blue salmon, king threadfin and black jewfish, as well as 61 species of pelagic fish species (DEWHA, 2008b). Of the pelagic fish species approximately 90% of commercial catch in the NMR is from six species: longtail tuna, grey mackerel, Spanish mackerel, mackerel tuna, black pomfret, and spotted mackerel (DEWHA, 2008b). In the coastal areas of the NMR, fisheries trawl data have identified 460 teleost and 56 elasmobranch fish species (DEWHA, 2008b).

High species diversity is generally associated with more complex habitat and areas of upwelling which increase levels of productivity. Given this, offshore areas of high fish diversity within the EMBA will be restricted to shoals/banks. Refer to **Section 4.5.6** for further information on KEFs, shoals and banks, and **Section 4.6** for further information on commercial, indigenous and recreational fishing in the EMBA.

### 4.5.5 Marine fauna of conservation significance

#### 4.5.5.1 Threatened and migratory fauna

Reports from the EPBC Act PMST Database for the operational area and EMBA were run in February 2023 (**Appendix B**). The PMST results identified 20 species listed as `threatened' species and 42 species listed as `migratory' within the operational area. Within the EMBA, 46 species identified were as listed `threatened' and 52 species were identified listed as `migratory'.

**Table 4-5** summarises the species identified and differentiates between those which may occur within the operational area and EMBA. Note: terrestrial species (such as terrestrial mammals, reptiles and bird species) that appear in the EPBC search of the EMBA and do not have habitats along shorelines are not relevant to the activity impacts and have been excluded from **Table 4-5**.

Two additional species, Omura's whale and the grey nurse shark, have been added to **Table 4-5**, although they were not identified in PMST reports. The Omura's whale and grey nurse shark were observed during the

Barossa marine studies program. These species are described in the relevant species sections below. McPherson et al. (2016) distinguish Omura's whale (*Balaenoptera omurai*) as a distinct species from Bryde's whale (*B. edeni*); however, the taxonomy of Omura's whale is unclear. *B. omurai* is a recent description. Many authorities (including the DCCEEW) do not make any distinction between *B. omurai* and *B. edeni* or retain *B. edeni* as this species name has priority status. Note Omura's whales are not currently listed under the EPBC Act as threatened or migratory.

***Table 4-5: Environment Protection and Biodiversity Conservation Act listed threatened and listed migratory marine species potentially occurring within the operational area and environment that may be affected***

| Scientific name | Common name | EPBC listing status | | Relevance to gas export pipeline installation campaign | |
|---|---|---|---|---|---|
| | | Threatened Status | Listed as Migratory | Operational Area | EMBA |
| ***Mammals*** | | | | | |
| *Balaenoptera borealis* | Sei whale | Vulnerable | ✓ | ✓ | ✓ |
| *Balaenoptera musculus* | Blue whale | Endangered | ✓ | ✓ | ✓ |
| *Balaenoptera physalus* | Fin whale | Vulnerable | ✓ | ✓ | ✓ |
| *Megaptera novaeangliae* | Humpback whale | Vulnerable | ✓ | ✓ | ✓ |
| *Balaenoptera edeni* | Bryde's whale | | ✓ | ✓ | ✓ |
| *Dugong dugon* | Dugong | | ✓ | ✓ | ✓ |
| *Orcaella brevirostris* | Australian snubfin dolphin, Irrawaddy dolphin | | ✓ | ✓ | ✓ |
| *Orcinus orca* | Killer whale, orca | | ✓ | ✓ | ✓ |
| *Physeter macrocephalus* | Sperm whale | | ✓ | ✓ | ✓ |
| *Sousa chinensis* | Indo-Pacific humpback dolphin | | ✓ | ✓ | ✓ |
| *Tursiops aduncus* | Indo-Pacific bottlenose dolphin (Arafura/Timor Sea populations), spotted bottlenose dolphin | | ✓ | ✓ | ✓ |
| *Balaenoptera omurai* | Omura's whale* | | | ✓ | ✓ |
| ***Reptiles*** | | | | | |
| *Caretta caretta* | Loggerhead turtle | Endangered | ✓ | ✓ | ✓ |
| *Chelonia mydas* | Green turtle | Vulnerable | ✓ | ✓ | ✓ |
| *Dermochelys coriacea* | Leatherback turtle | Endangered | ✓ | ✓ | ✓ |
| *Eretmochelys imbricata* | Hawksbill turtle | Vulnerable | ✓ | ✓ | ✓ |
| *Lepidochelys olivacea* | Olive Ridley turtle | Endangered | ✓ | ✓ | ✓ |
| *Natator depressus* | Flatback turtle | Vulnerable | ✓ | ✓ | ✓ |
| *Crocodylus porosus* | Salt-water crocodile | | ✓ | ✓ | ✓ |

| Scientific name | Common name | EPBC listing status | | Relevance to gas export pipeline installation campaign | |
|---|---|---|---|---|---|
| | | Threatened Status | Listed as Migratory | Operational Area | EMBA |
| *Fish* | | | | | |
| *Carcharias taurus* | Grey nurse shark* | Critically endangered/ Vulnerable | ✓ | ✓ | ✓ |
| *Carcharodon carcharias* | Great white shark | Vulnerable | ✓ | ✓ | ✓ |
| *Glyphis garricki* | Northern river shark | Endangered | ✓ | ✓ | ✓ |
| *Glyphis glyphis* | Speartooth shark | Critically endangered | ✓ | ✓ | ✓ |
| *Pristis clavata* | Dwarf sawfish | Vulnerable | ✓ | ✓ | ✓ |
| *Pristis pristis* | Freshwater, largetooth sawfish | Vulnerable | ✓ | ✓ | ✓ |
| *Pristis zijsron* | Green sawfish | Vulnerable | ✓ | ✓ | ✓ |
| *Rhincodon typus* | Whale shark | Vulnerable | ✓ | ✓ | ✓ |
| *Anoxypristis cuspidata* | Narrow sawfish, knifetooth sawfish | | ✓ | ✓ | ✓ |
| *Isurus oxyrinchus* | Shortfin mako | | ✓ | ✓ | ✓ |
| *Isurus paucus* | Longfin mako | | ✓ | ✓ | ✓ |
| *Manta birostris* | Giant manta ray | | ✓ | ✓ | ✓ |
| *Manta alfredi* | Reef manta ray | | ✓ | ✓ | ✓ |
| *Carcharhinus longimanus* | Oceanic whitetip shark | | ✓ | ✓ | ✓ |
| *Sphyma lewini* | Scalloped hammerhead shark | Conservation dependant | | | ✓ |
| *Seabirds and Shorebirds* | | | | | |
| *Calidris canutus* | Red knot, knot | Endangered | ✓ | ✓ | ✓ |
| *Calidris ferruginea* | Curlew sandpiper | Critically endangered | ✓ | ✓ | ✓ |
| *Numenius madagascariensis* | Eastern curlew | Critically endangered | ✓ | ✓ | ✓ |
| *Actitis hypoleucos* | Common sandpiper | | ✓ | ✓ | ✓ |
| *Anous stolidus* | Common noddy | | ✓ | ✓ | ✓ |
| *Calidris acuminata* | Sharp-tailed sandpiper | | ✓ | ✓ | ✓ |
| *Calidris melanotos* | Pectoral sandpiper | | ✓ | ✓ | ✓ |
| *Calonectris leucomelas* | Streaked shearwater | | ✓ | ✓ | ✓ |
| *Fregata ariel* | Lesser frigatebird | | ✓ | ✓ | ✓ |
| *Fregata minor* | Great frigatebird | | ✓ | ✓ | ✓ |

| Scientific name | Common name | EPBC listing status | | Relevance to gas export pipeline installation campaign | |
|---|---|---|---|---|---|
| | | Threatened Status | Listed as Migratory | Operational Area | EMBA |
| *Thalasseus bergii* | Greater crested tern | | ✓ | ✓ | ✓ |
| *Phaethon lepturus* | White-tailed tropicbird | | ✓ | ✓ | ✓ |
| *Pandion haliaetus* | Osprey | | ✓ | ✓ | ✓ |
| *Limosa lapponica baueri* | Western Alaskan bar-tailed godwit | Vulnerable | ✓ | | ✓ |
| *Limosa lapponica menzbieri* | Northern Siberian bar-tailed godwit | Critically endangered | ✓ | | ✓ |
| *Acrocephalus orientalis* | Oriental reed-warbler | | ✓ | | ✓ |
| *Charadrius leschenaultii* | Greater sand plover | | ✓ | | ✓ |
| *Charadrius veredus* | Oriental plover | | ✓ | | ✓ |
| *Glareola maldivarum* | Oriental pratincole | | ✓ | | ✓ |
| *Thalasseus bergii* | Crested tern | | ✓ | | ✓ |

* The grey nurse shark and Omura's whale were included in this list given they was observed at an offshore seamount during the Barossa marine studies program and identified in noise monitoring, respectively. Each species is described in the relevant section below.

#### 4.5.5.2 Threatened species recovery plans

The species recovery plans and conservation advices have been considered to identify any requirements that may be applicable. Recovery plans are enacted under the EPBC Act and remain in-force until the species is removed from the threatened list. Conservation advice provides guidance on immediate recovery and threat abatement activities that can be undertaken to facilitate the conservation of a listed species or ecological community.

**Table 4-6** outlines the recovery plans and conservation advices relevant to those species identified as potentially occurring within or having habitat in the operational area and EMBA. The table summarises the key threats to those species, as described in relevant recovery plans and conservation advices, that are relevant to the gas export pipeline installation campaign. Species highlighted in red are those identified as potentially occurring in both the operational area and EMBA, while those in blue were identified as potentially occurring within only the EMBA.

The Recovery Plan for Marine Turtles in Australia (2017–2027) identifies habitat critical to the survival of a species for marine turtles based on the EPBC Act Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE, 2013). Areas considered 'habitat critical to the survival of a species' for two marine turtle species (flatback turtles and Olive Ridley turtles) were identified as overlapping the operational area and EMBA (Commonwealth of Australia, 2017a) (**Figure 4-29**). Habitat critical to the survival of Olive Ridley and flatback turtles around the Tiwi Islands overlap the southern section of the operational area, as identified in the Recovery Plan for Marine Turtles in Australia (2017–2027).

The identified habitat critical to the survival of a species overlapping the EMBA and operational area are broadly similar to established BIAs for these species. These are discussed under the relevant species sections below and presented in **Figure 4-29**.

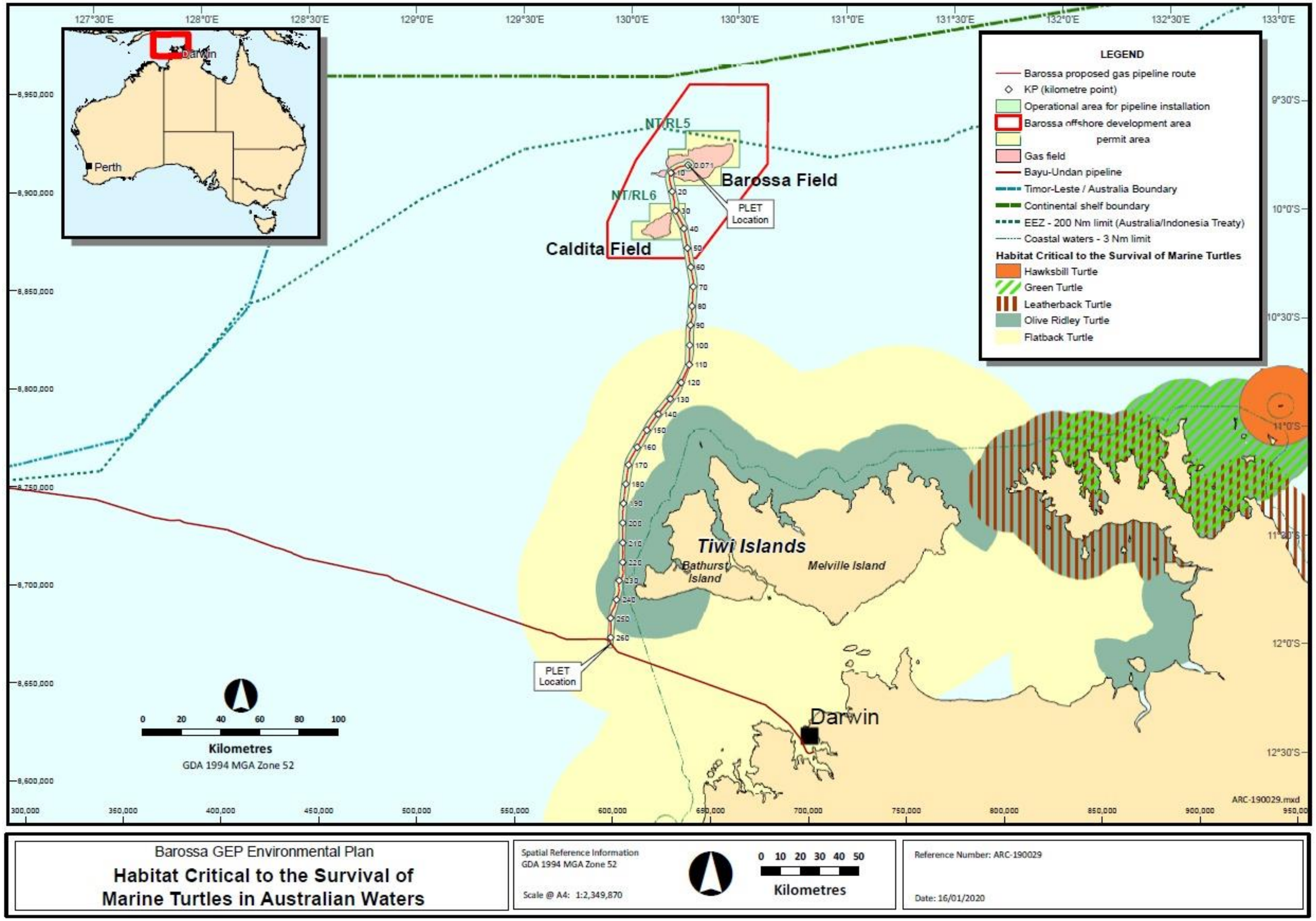



*Figure 4-29: Habitat critical to the survival of marine turtles*

***Table 4-6: Summary of environment protection and biodiversity conservation recovery plans relevant to the gas export pipeline installation campaign***

| Species | EPBC recovery plan/conservation advice (date issued) | Key threats identified in the recovery plan/conservation advice | EP risk assessment section |
|---|---|---|---|
| ***All*** | | | |
| All vertebrate fauna | Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018) | Marine debris | **Section 5.3.1** |
| ***Mammals*** | | | |
| Cetaceans and other marine megafauna | National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (Commonwealth of Australia, 2017b) | Vessel disturbance | **Section 5.3.3** |
| Sei whale | Conservation Advice for *Balaenoptera borealis* (sei whale) (October 2015) | Noise interference | **Section 5.2.3** |
| | | Vessel disturbance (vessel presence or collision) | **Section 5.3.3** |
| Blue whale | Conservation Management Plan for the Blue Whale (October 2015) | Noise interference | **Section 5.2.3** |
| | | Vessel disturbance | **Section 5.3.3** |
| | | Marine debris | **Section 5.3.1** |
| Fin whale | Conservation Advice for *Balaenoptera physalus* (fin whale) (October 2015) | Noise interference | **Section 5.2.3** |
| | | Vessel disturbance | **Section 5.3.3** |
| Humpback whale | Conservation Advice for *Megaptera novaeangliae* (humpback whale) (October 2015) | Noise interference | **Section 5.2.3** |
| | | Vessel disturbance | **Section 5.3.3** |
| ***Reptiles*** | | | |
| Leatherback turtle | Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (January 2009) | Vessel disturbance | **Section 5.3.3** |
| Loggerhead turtle, green turtle, hawksbill turtle, flatback turtle, Olive Ridley turtle | Recovery Plan for Marine Turtles in Australia 2017–2027 (June 2017) | Vessel disturbance | **Section 5.3.3** |
| | | Light pollution | **Section 5.2.4** |
| | | Acute chemical discharge | **Sections 5.2.7, 5.3.4, 5.3.5, 5.3.7, 5.3.8** |
| | | Noise interference | **Section 5.2.3** |
| | | Habitat modification | **Section 5.2.2** |

| Species | EPBC recovery plan/conservation advice (date issued) | Key threats identified in the recovery plan/conservation advice | EP risk assessment section |
|---|---|---|---|
| Loggerhead turtle, green turtle, hawksbill turtle, flatback turtle, Olive Ridley turtle | National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (CoA, 2020) | Light pollution | **Section 5.2.4** |
| ***Fishes*** | | | |
| Whale shark | Conservation advice for *Rhincodon typus* (whale shark) (October 2015) | Vessel disturbance | **Section 5.3.3** |
| Great white shark* | Recovery Plan for the Great White Shark (*Carcharodon carcharias*) (August 2013)) | No relevant threats identified (ex. marine debris) | **Section 5.3.6** |
| Dwarf sawfish, green sawfish, freshwater sawfish, narrow sawfish, northern river shark, speartooth shark | Sawfish and River Sharks Multispecies Recovery Plan (November 2015)<br>Conservation Advice: for dwarf sawfish (October 2009), green sawfish (2008), *Pristis pristis* (freshwater sawfish) (April 2014), speartooth shark (April 2014), and northern river shark (April 2014) | Marine debris (potential threat) | **Section 5.3.6** |
| | | Habitat degradation and modification | **Section 5.2.2** |
| ***Seabirds and Shorebirds*** | | | |
| All seabirds and shorebirds | National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2020) | Light pollution | **Section 5.2.4** |
| Seabirds | Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b) | Pollution (marine debris, light, acute pollution) | **Sections 5.2.4, 5.3.1, 5.3.7** |
| Red knot | Conservation Advice for *Calidris canutus* (red knot) (May 2016) | Habitat degradation/ modification (oil pollution) | **Section 5.3.7** |
| Curlew sandpiper | Conservation Advice for *Calidris ferruginea* (curlew sandpiper) (May 2015) | | |
| Eastern curlew | Conservation Advice for *Numenius madagascariensis* (eastern curlew) (May 2015) | | |

| Species | EPBC recovery plan/conservation advice (date issued) | Key threats identified in the recovery plan/conservation advice | EP risk assessment section |
|---|---|---|---|
| Greater sand plover, large sand plover | Conservation Advice *Charadrius leschenaultii* Greater sand plover (May 2016) | | |
| Western Alaskan bar-tailed godwit | Conservation Advice for *Limosa lapponica baueri* (bar-tailed godwit – western Alaskan) (May 2016) | | |
| Northern Siberian bar-tailed godwit | Conservation Advice *Limosa lapponica menzbieri* (bar-tailed godwit – northern Siberian) (May 2016) | | |
| Sharp-tailed sandpiper, pectoral sandpiper, common sandpiper, red knot, oriental plover, oriental pratincole, bar-tailed godwit | Wildlife conservation plan for migratory shorebirds (January 2016) | | |

** Although this species was identified in the EPBC PMST reports, they are highly unlikely to occur within the Operational Area or EMBA as they are located significantly outside the species range or preferred habitat*.

Note – red shading = Operational Area; blue shading = EMBA.

#### 4.5.5.3 Biologically important areas (BIAs)

BIAs are defined by DAWE as “spatially defined areas where aggregations of individuals of a regionally significant species are known to display biologically important behaviours such as breeding, foraging, resting or migration”. A review of the National Conservation Values Atlas determined that there is one listed BIA overlapping the operational area (an internesting area for flatback turtles) and BIAs for four different species overlapping EMBA, which are summarised in **Table 4-7** and presented in (**Figure 4-31** and **Figure 4-32**). The identified BIAs are discussed under the relevant species sections below.

*Table 4-7: Summary of biologically important areas overlapping the operational area and environment that may be affected*

| Species | Relevance to the gas export pipeline installation campaign | Type | Location |
|---|---|---|---|
| *Reptiles* | | | |
| Green turtle | 14 km south-east of the operational area | Internesting | North-west of Melville Island |
| Olive Ridley turtle | 5 km east of the operational area | Internesting | Bathurst Island/Melville Island – North-west |
| Flatback turtle | Overlapping the operational area | Internesting | Melville Island, Cobourg Peninsula |
| *Seabirds and Shorebirds* | | | |
| Crested Tern | 5 km west of the operational area | Breeding (high numbers) | Seagull Island, off North-west of Cape Van Diemen, Melville |

Note – red shading = operational area; blue shading = EMBA.

### 4.5.5.4 Seasonality

The presence of some of the identified fauna species is expected or known to be seasonal in nature. The key seasonal considerations of EPBC Act threatened and/or migratory species identified as potentially occurring within the operational area and EMBA is presented in **Table 4-8**.

*Table 4-8: Seasonal presence of listed threatened and/or migratory species likely to be in the operational area*

| Species | Month | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | J | F | M | A | M | J | J | A | S | O | N | D |
| Pygmy blue whales (northern migration – JASCO, 2016) | | | | | | | | | | | | |
| Humpback whales (northern migration – Environment Australia, 2002; Jenner et al., 2000) | | | | | | | | | | | | |
| Bryde's whales (JASCO, 2016) | | | | | | | | | | | | |
| Omura's whales (JASCO, 2016) | | | | | | | | | | | | |
| Flatback turtles (presence, nesting/breeding – Commonwealth of Australia, 2017) | | | | | | | | | | | | |
| Olive Ridley turtles (presence, nesting/breeding – Commonwealth of Australia, 2017) | | | | | | | | | | | | |
| Green turtles (presence, nesting/breeding – Commonwealth of Australia, 2017) | | | | | | | | | | | | |
| Hawksbill turtles (presence – Commonwealth of Australia, 2017) | | | | | | | | | | | | |
| Leatherback turtles (presence – Commonwealth of Australia, 2017) | | | | | | | | | | | | |
| Whale sharks (northern migration – DSEWPaC, 2012) | | | | | | | | | | | | |
| Streaked shearwater (DSEWPaC, 2012c) | | | | | | | | | | | | |
| Migratory shorebirds (aggregation, breeding – Bamford et al., 2008) | | | | | | | | | | | | |
| *Legend* | | | | | | | | | | | | |
| | Peak presence/occurrence (presence of animals reliable and predictable each year) | | | | | | | | | | | |
| | Species likely to be present in the region | | | | | | | | | | | |

### 4.5.5.5 Marine mammals

The EPBC Act PMST reports identified 11 migratory mammal species (four of these are also listed as threatened) that may occur within the operational area (**Table 4-5**). An additional unlisted species, the Omura's whale, was also identified as occurring within the area during the Barossa acoustic monitoring program and is, therefore, also described here. The operational area is not known to include any critical habitat or BIAs (i.e. foraging, breeding/calving, resting or restricted migratory pathway) for any of the identified mammal species. Each mammal species identified is further described in the following subsections.

**Sei whales**

Sei whales have a worldwide oceanic distribution, but have only been infrequently recorded in Australian waters (Bannister et al., 1996). Sei whales undertake seasonal migrations between low latitude wintering areas and high latitude summer feeding grounds (Bannister et al., 1996; Prieto et al., 2012). The species prefers deep waters, further offshore than other species of large whales, and typically occurs in oceanic basins and continental slopes (Prieto et al., 2012). Records of the species occurring on the continental shelf (less than 200 m water depth) are uncommon in all Australian waters (Bannister et al., 1996).

There are no known mating or calving areas, or other EPBC listed critical habitat or BIAs for sei whales in Australian waters. Given their known distribution and movements, it is considered possible that individual sei whales may be encountered in low numbers within the northern extents of the operational area and EMBA.

**Pygmy blue whales**

In the Southern Hemisphere, the blue whale has two distinct sub-species, the southern (or 'true') blue whale and the pygmy blue whale (DoEE, 2015). As southern blue whales are thought to only occur in waters south of 60 °S and pygmy blue whales distributed north of 55 °S, nearly all blue whales recorded in the NMR are likely to be pygmy blue whales.

Pygmy blue whales generally follow the continental shelf breaks during their migration, which are often characterised by increased productivity (McCauley, 2011; McCauley, RD, 2009). The species undertakes their northerly annual migration to potential breeding grounds in Indonesian waters from April to August, with a peak period past Exmouth and the Montebello Islands between May and June, and return south between October and January (peak period between late November to early December) (Double et al., 2014; McCauley and Duncan, 2011). During their northern migration pygmy blue whales follow the deep continental slope and offshore waters (500 to over 1,000 m) (DEWHA, 2008a). Once whales pass the shelf break off Exmouth they move north beyond the WA coastline in waters which can exceed 4,000 m, travelling past the Montebello Islands and Scott Reef (outside the EMBA) (Double et al., 2014).

A noise monitoring study conducted as part of their Barossa marine studies program (see **Section 4.2**) recorded pygmy blue whales moving in a northward direction in August 2014 and between late-May to early July 2015 (JASCO Applied Sciences, 2016a; McPherson, Craig et al., 2015). It was estimated that the whales were anywhere from 5 to 80 km from the operational area (based on the J2 station). The detections were recorded over 400 km north-east of the migration BIA for the species. No detections of the species were made during the period of their southward migration.

Pygmy blue whales are likely to carry out opportunistic feeding on ephemeral krill aggregations during their migrations (DEWHA, 2008a). Steep gradient features, such as Browse Island and Scott Reef (outside the EMBA), are likely to represent potential aggregation/foraging habitat as these features tend to stimulate upwelling and therefore, increased productivity (seasonally variable) (Jenner, KCS et al., 2009). The species appears to feed regularly along their migration route (i.e. at least once per week or more frequently).

No BIAs or other EPBC listed critical habitat exists for pygmy blue whales within the NMR. Given the known distribution, preferred feeding habitats and migration pathways of pygmy blue whales, and observation from the Barossa noise monitoring program, it is considered possible that individuals may be encountered in low numbers within the operational area, most likely within the northern most offshore section of the operational area; however, there are no significant upwelling or benthic habitat features within the area. Pygmy blue whales are expected to occur within the wider EMBA.

**Fin whales**

The fin whale is distributed across all ocean basins between 20 and 75 °S (DoEE, 2019). Fin whales undertake annual migrations between high latitude summer feeding grounds and lower latitude over-wintering areas (Bannister et al., 1996). In Australian waters there are few records of fin whales and their distribution is mainly known from stranding events and whaling records (DoEE, 2019).

Fin whales are thought to follow oceanic migration paths and are uncommonly encountered in coastal or continental shelf waters. The Australian Antarctic waters are important feeding grounds for fin whales but there are no known mating or calving areas, or other BIA or EPBC listed critical habitat, in Australian waters (Morrice et al., 2004). There are no confirmed records of fin whales within the NMR (DoEE, 2019), however, given their known distribution and movements, it is considered possible that individual fin whales may pass through the operational area in low numbers, most likely within the northern region of the operational area. Fin whales are expected to occur within the wider EMBA.

**Humpback whales**

Humpback whales have a wide distribution, with recordings throughout Australian Antarctic waters and offshore from all Australian states/territories (Bannister et al., 1996). They occur throughout Australian waters, as two genetically distinct, east and west populations. Both populations' distributions are influenced by migratory pathways and aggregation areas for resting, breeding and calving. In the west, humpback whales migrate north to breeding grounds in Camden Sound of the west Kimberley between May and November, with a peak period between late July and early August, after feeding in Antarctic waters during the summer months (Jenner et al., 2001). Calving typically occurs between June and early September, within nearer shelf waters of the Camden Sound (outside the EMBA) (DoEE, 2019). The whales' southern migration runs between August and November, with females and calves being the last to leave the breeding grounds.

No BIAs or other EPBC listed critical habitat exist for humpback whales within the NMR and relatively few humpback whales have been known to travel north of their calving grounds in Camden Sound (Jenner et al., 2001). No humpback whales were recorded during the 12 months of noise monitoring undertaken as part of the Barossa marine studies program (JASCO Applied Sciences, 2016a; McPherson, Craig et al., 2015). Given this, the species is considered unlikely to occur within the operational area but may infrequently occur in small numbers within the south-western portion of the EMBA.

**Bryde's whales**

Bryde's whales occur in temperate to tropical waters, between 40 °S and 40 °N year-round (Bannister et al., 1996; DoEE, 2019). The population of Bryde's whales appears to be split into coastal and offshore subpopulations. The offshore form is found in water depths between 500 and 1,000 m, while the coastal form appears to remain within the 200 m depth isobar where individuals move along the coast based on the availability of suitable prey (Best et al., 1984). Little is known about the population abundance of Bryde's whale and there are no estimates of the exact breeding and calving grounds (DoEE, 2019).

There are no listed BIAs or other EPBC listed critical habitat for this species in Australian waters. Historical records have suggested the inshore form of the Bryde's whale are resident in regions where there is year-round suitable prey, while the offshore form may migrate between subtropical and tropical waters during winter months (Best, 1977).

A few individuals of Bryde's whale were detected in the Barossa marine studies program from January to early October (JASCO Applied Sciences, 2015; McPherson, Craig et al., 2015). McPherson et al. (2015) commented that the presence of Bryde's whales would be expected based on the findings of several studies which noted the species' occurrence in the Timor Sea and surrounding waters. As the Barossa study area is in water depths between 120 and 350 m, it is likely these records were from the inshore form of the species. As such, it is possible the coastal form of Bryde's whales may also occasionally transit through the EMBA and operational area; however, they are not expected to be present in significant numbers.

**Omura's whales**

Omura's whales were only described as a new species basal to the Bryde's whale group in 2003 (Wada, et al., 2003) and remain poorly understood in terms of their spatial-temporal distribution. While distantly related to Bryde's whales (Cerchio, et al., 2015), the two species share some life history traits such as remaining in tropical waters, as opposed to undertaking large-scale seasonal migrations characteristic of other baleen whales (JASCO). Omura's whales are not listed under the EPBC Act but as listed on the International Union for Conservation of Nature (IUCN) Red List as Data Deficient (IUCN, 2017).

A scientific study undertaken by Cerchio et al. (2015), which assessed the ecology and behaviour of Omura's whales off the north-west Madagascar, has provided some valuable insight into the species. Omura's whales, when present in the Madagascar region (October to November), appears to be distributed solely on the shallow continental shelf habitat, within approximately 10 to 15 km of the shelf break and predominately in water depths of 10 to 25 m (however, they were observed in depths of up to 202 m) (Cerchio, et al., 2015). Cerchio et al. (2015) noted that other studies have suggested that the species also inhabits deeper waters, with observations made only off the Cocos Islands and eastern Indian Ocean from research whaling data.

Feeding in the shelf habitat was frequency observed and was thought to be related to patchy food resources that were most likely zooplankton (Cerchio, et al., 2015).

Omura's whales were recorded by the Barossa noise monitoring program during the autumn and winter months. The greatest call rate was recorded at the deepest station (J2), adjacent to the operational area, suggests Omura's whales find some benefit in the deeper waters (McPherson et al., 2016), Therefore, it is likely that Omura's whales may transit the operational area, mostly within the northern offshore section, and are expected to occur within the EMBA.

**Killer whales (or orca)**

The killer whale or orca is found in all the world's oceans and has been recorded in waters of all Australian states/territories; however, recordings are more frequent in lower latitudes and there have been few recordings in the northern region of Australia (DoEE, 2019). Killer whales are found in diverse habitat, but are most often found along the continental slope and shelf, particularly near prey seal colonies (DoEE, 2019). The nearest significant seal colony is located at the Abrolhos Islands (approximately 2,500 km south-west of the EMBA – straight-line distance). While killer whales are known to undertake seasonal migrations and follow regular migratory routes, little is known about these movements (DoEE, 2019).

No BIAs, EPBC listed critical habitat or verified migration routes have been identified for this species within the NMR (DoEE, 2019). Given the rare occurrence of sightings in northern Australia and the absence of pinnipeds within the EMBA, killer whales are unlikely to occur within the operational area, however, it is possible they may occur within the EMBA.

**Sperm whales**

Sperm whales are found worldwide in deep waters (more than 200 m) off continental shelves and shelf edges (Bannister et al., 1996). Sperm whale sightings have been recorded from all Australian states/territories. There are no BIAs for sperm whales within the NMR, however, in WA sperm whales have two BIAs recognised for foraging activities, located well outside the EMBA.

The species is known to migrate northwards in winter and southwards in summer but detailed information on the distribution and migration patterns of sperm whales. The operational area and EMBA are unlikely to represent important habitat for this species, and therefore, expected that only very low numbers of individuals may be present in the EMBA and operational area.

**Dugongs**

Dugongs are large herbivorous marine mammals, which generally inhabit coastal areas. Dugong distribution is correlated with seagrass habitats which dugong feed on, although water temperature has also been correlated with dugong movements and distribution (Preen, 2004; Preen et al., 1997). Dugong feeding aggregations tend to occur in large seagrass meadows within wide shallow protected bays, shallow mangrove channels and in the lee of large inshore islands. Dugongs spend most of their time in the neritic zone within shallow tidal and subtidal seagrass meadows, and generally remain within an area of tens of kilometres (DEWHA, 2008b); however, dugongs are known to migrate between seagrass habitats (hundreds of kilometres) (Sheppard et al., 2006) and have been observed in water depths of up to 37 m (DEWHA, 2008b).

An aerial survey of northern Australian coastal waters was undertaken in 2015 to assess the distribution and abundance of dugongs in NT coastal waters. While survey effort was affected by poor visibility (due to high turbidity), 151 dugong groups consisting of 229 individuals were identified (Groom et al., 2017). Dugong density in the waters surrounding Tiwi Islands were reported as $0.11/km^2$ with small group sizes (observed to be on average 1.29 to 1.36 individuals). Based on the survey results the dugong population in NT coastal waters was estimated at 8,176 individuals (Groom et al., 2017).

The north coast of the Tiwi Islands (located within the EMBA) is recognised as a key site for the conservation of dugongs. A well-known major dugong aggregation of approximately 4,400 individuals occurs in waters seaward (within approximately 50 km) of the Tiwi Islands and ranks in the top eight of dugong populations in Australia.

Dugongs have been tracked moving long distances of up to 300 km between the Australia mainland and the Tiwi Islands (Whiting et al., 2009). Satellite-tracking data from dugongs tagged as part of the INPEX Ichthys Project baseline surveys observed that dugongs around the Vernon Islands, south of Melville Island, spent time in Darwin Harbour and around the Tiwi Islands (INPEX, 2010). Routine sightings occur in various locations along the NT coastline, including within Darwin Harbour, to the south of Melville Island, within Shoal Bay to the north of Darwin Harbour (highest frequency of sightings) and within the vicinity of Grose Islands, Dum In Mirrie Island and Indian Island (south-west of Darwin Harbour) (Cardno, 2013).

Dugongs in the NT coastal waters have been observed foraging on intertidal rocky reef flats supporting sponges and algae as seagrass habitat is thought to be rare in the NMR bioregion (INPEX, 2010; Whiting et al., 2009). However, seagrass communities are known along the north coast of the Tiwi Islands.

There are no BIAs for dugongs within the NMR. As dugong's dietary preference is seagrass, dugongs will occur within shallow or nearshore waters of the EMBA. Dugongs may transit through the shallow, southern section of the pipeline route.

**Australian humpback dolphins (a subspecies of the Indo-Pacific humpback dolphin)**

The Indo-Pacific humpback dolphin's taxonomy was recently revised with evidence that there are multiple species under the Sousa genus which are distinguished by their morphology, genetics and biogeography (Jefferson and Rosenbaum, 2014). The species present in Australian waters is considered a newly described species, the Australian humpback dolphin. This species is defined mainly by a large distributional gap which corresponds with a long-standing boundary between faunal regions in Australia and much of Asia, also known as the Wallace Line (Jefferson and Rosenbaum, 2014).

The Australian humpback dolphin is distributed across the Sahul Shelf, from northern Australia to southern New Guinea (Jefferson and Rosenbaum, 2014). Distribution of the humpback dolphin in Australia is linked to the warm eastern boundary current with resident groups within Ningaloo Reef (Bannister et al., 1996). Humpback dolphins inhabit shallow coastal, estuarine habitats in tropical and subtropical regions generally in depths of less than 20 m (Corkeron et al., 1997; Jefferson, 2000; Jefferson and Rosenbaum, 2014).

This species of dolphin is known to have resident groups that forage, feed, breed and calve in coastal waters outside the EMBA. Within Darwin Harbour and Shoal Bay surveys have recorded 284 individuals from 88 schools; however, formal population estimates have not been developed (INPEX, 2010, and references therein). There are several BIAs listed for Australian humpback dolphins in the NMR, including a breeding/calving/foraging BIA in Darwin Harbour and surrounding waters and two breeding/foraging BIAs within the Van Diemen Gulf (both outside the EMBA). Given their preference for shallow coastal habitats, the species is expected to only occasionally transit the southernmost section of the operational area (in proximity to the Tiwi Islands).

**Indo-Pacific bottlenose dolphin (also referred to as spotted bottlenose dolphins)**

There are four known subpopulations of Indo-Pacific bottlenose dolphins, of which the Arafura/Timor Seas population was identified as potentially occurring within the operational area and EMBA. The species occurs in open NT coastal waters, primarily within the continental shelf, and around oceanic islands. The species forages in a wider range of habitats and within deeper waters than most dolphin species, but is generally restricted to water depths of less than 200 m (DSEWPaC, 2012). The Arafura/Timor Sea Indo-Pacific bottlenose population is considered migratory; however, their movement patterns are considered highly variable, with some individuals displaying year-round residency to a small area and others undertaking long-range movements and migrations (DoEE, 2019).

There are several BIAs listed for the Indo-Pacific bottlenose dolphin within the NMR, including a breeding/calving BIA in Darwin Harbour (outside the EMBA) during the dry season (approximately April to September) (**Figure 4-30**). Given the species' utilisation of relatively deeper waters and the potential for long-range migratory movements, it is likely this species will occasionally transit the operational area and offshore sections of the EMBA.

**Australian snubfin dolphins (also referred to as Irrawaddy dolphins)**

The Australian snubfin dolphin is known to occur within tropical NT coastal waters off northern Australia, extending north from Broome in Western Australia to the Brisbane River in QLD (DoEE, 2019). Surveys have indicated that the species is typically found in protected shallow nearshore waters, generally less than 20 m deep, adjacent to river and creek mouths and close to seagrass beds (DoEE, 2019). Most recordings are from river and creek mouths, and occasionally upstream tidal rivers, in waters of less than 10 m depth (DEWHA, 2008a, and references therein). Data also suggests this species occurs in small, localised populations (DSEWPaC, 2012).

There are a number of BIAs listed for the Australian snubfin dolphin within the NMR, including a foraging/feeding/breeding BIA in Darwin Harbour and two breeding/foraging BIAs within the Van Diemen Gulf (both outside the EMBA) where they are observed in small numbers year round (DSEWPaC, 2012). Given this species' preference for nearshore waters and apparent high site fidelity, individuals are likely to only rarely transit the operational area and offshore southernmost section of the EMBA; however, they are expected to be residents within the coastal waters of the NT.

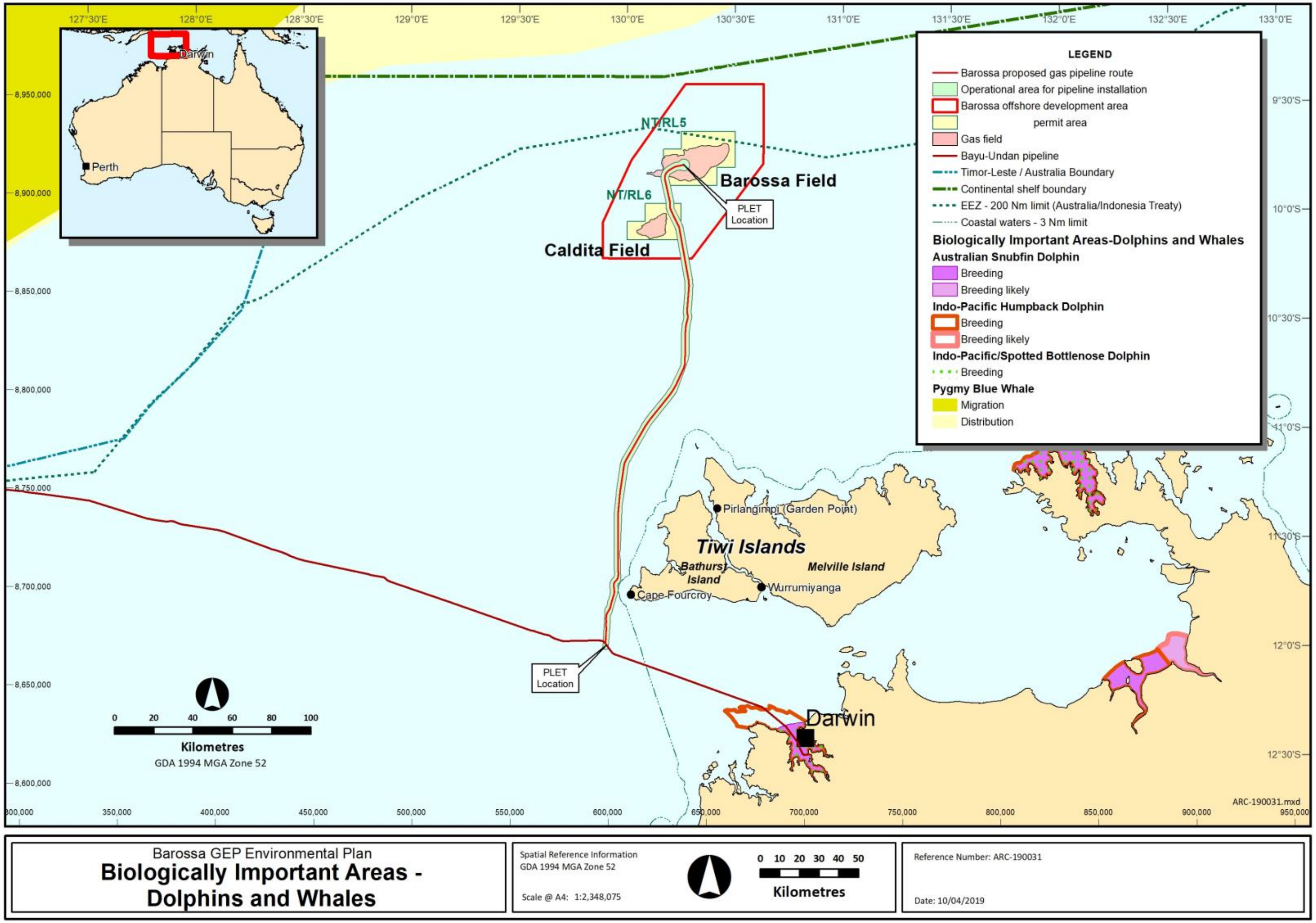



*Figure 4-30: Biologically important areas for dolphins and whales*

### 4.5.5.6 Marine reptiles

**Marine turtles**

The EPBC Act PMST reports identify six species of marine turtle that may occur within both the operational area and EMBA. Marine turtles are highly migratory and use widely dispersed terrestrial and marine habitats throughout their lifecycles (Commonwealth of Australia, 2017a). Marine turtles also show high levels of natal philopatry, where adults return to their birthplace to nest when reaching sexual maturity.

The NMR coastal region is considered particularly significant for marine turtle breeding, feeding and nesting aggregations. The sandy beaches of the Tiwi Islands, specifically the west coast of Bathurst Island and the north coast of Melville Island are nationally and internationally recognised important nesting areas (outside of the operational area) (Chatto and Baker, 2008a). The nesting season for marine turtles is species-dependent and varies within the NMR in response to the different seasonal conditions (Commonwealth of Australia, 2017a). Female turtles also generally exhibit an internesting phase where they spend two to three months in the vicinity of their nesting (Guinea, 2013a). During this time the turtles typically remain in shallow waters.

Marine turtles forage predominately on shallow benthic habitats, either nearshore or at offshore reefs (generally in waters up to approximately 50 m deep and including coral and rocky reefs), containing seagrass and/or algae, and inshore seagrass beds. Benthic habitats at shoals and banks near the operational area , which are present at water depths ranging from 10 to 30 m (at the top of the shoal/bank), represent important foraging grounds for marine turtles. Flatback turtles are primarily carnivorous and feed predominately on soft-bodied invertebrates, while green turtles are primarily herbivorous and forage on shallow benthic habitats (in depths less than 120 m) containing seagrass and/or algae, including coral and rocky reefs, and inshore seagrass beds. Loggerhead turtles are carnivorous and mainly feed on benthic invertebrates in habitats ranging from nearshore to 55 m in depth, Olive Ridley turtles have been known to feed in water depths between 15 to 200 m. Leatherback turtles feed on plankton and jellyfish in oceanic waters around Australia (DoEE, 2017).

*Aggregation, nesting and feeding*

There are several key aggregation/nesting/feeding areas and migration pathways for marine turtles within NMR. BIAs and habitat critical to the survival of marine turtle species overlapping the EMBA include internesting and foraging areas, as shown in **Figure 4-29** and **Figure 4-31**, and are summarised in **Section 4.5.5.3**. Key aggregation, nesting and feeding areas within the EMBA and overlapping the operational area can be summarised as:

The sandy beaches on the Tiwi Islands, specifically the west coast of Bathurst Island and the north coast of Melville Island are important areas for marine turtles with nesting dominated by flatback and Olive Ridley turtles (peak nesting in March to May) (Chatto and Baker, 2008a). While in this area, marine turtles feed in both benthic and pelagic habitats, from depths of several metres to over 100 m.

Green turtles have not been recorded nesting in the Bonaparte or Van Diemen Gulf bioregions, with the exception of two significant nesting sites; Black/Smith Point and Lawson Island, which are east of the Tiwi Islands and in the vicinity of Cobourg Peninsula, both outside of the EMBA (Chatto and Baker, 2008a). Some nesting has been recorded on the west coast of Bathurst Island (pers. Comm. M. Guinea, CDU, 2015). The nesting period varies along the NT coast. However, the Cobourg Peninsula genetic stock of green turtles, which is the closest to the Tiwi Islands, nesting between October and April with the peak nesting period occurring between December and January. Biologically important areas for green turtles occur on the north coast of the Tiwi Islands and in the vicinity of Cobourg Peninsula. An internesting buffer of 20 km from the Tiwi Islands has been defined for green turtles with internesting occurring between October and April (DoEE, 2017).

The NT sub-population of the hawksbill turtle is one of the few very large nesting populations remaining in the world, breeding year-round (Chatto and Baker, 2008a). However, there are no recorded nesting sites along the western NT coast.

Flatback turtles are the most widespread nesting turtle species in the NMR. Flatback turtles nesting within the NT are all from the Arafura Sea breeding stock (genetic stock). The long-term trend of this stock is unknown (Commonwealth of Australia, 2017a). Nesting has been recorded on the Tiwi Islands, with greatest proportion of activity occurring on the west coast of Bathurst Island (Chatto and Baker, 2008a). The number of nesting females (approximately 11 to 100 females per year (Figure 6 of Commonwealth of Australia, 2017a)) is comparable to, or smaller than, other nesting sites of the Arafura Sea genetic stock. Nesting and internesting occurs year-round with a peak during June and August, and hatchling emergence peaking between July and September (Commonwealth of Australia, 2017a). Internesting habitat critical to the survival of flatback turtles encompasses a large area of nearshore waters between approximately Daly River to the west and Endyalgout Island/west coast of Cobourg Peninsula to the east and surround the entire Tiwi Island coastline (Commonwealth of Australia, 2017a).

The Recovery Plan for Marine Turtles in Australia defines the internesting buffer around the Tiwi Islands as 60 km (Commonwealth of Australia, 2017a). However, it has been demonstrated via an extensive study tracking 47 internesting flatback turtles from five different mainland and island rookeries over 1,289 tracking days that flatback turtles remained in water depths of less than 44 m, favouring a mean depth of less than 10 m (Whittock et al., 2016). Whittock et al. (2016) defined suitable internesting habitat as water 0 to 16 m deep and within 5 to 10 km of the coastline, and unsuitable internesting habitat was defined as water more than 25 m deep and more than 27 km from the coastline. There is no evidence to date to indicate flatback turtles swim out into deep offshore waters during the internesting period (Pendoley, 2019). The seabed characteristics off Cape Fourcroy at the south-western tip of Bathurst Island (i.e. narrow continental shelf, steep seabed slope and relatively high current speeds) are not typical of the internesting habitat used by flatback turtles and consequently they are unlikely to internest in the operational area. Further to the north where the continental shelf is wider and slopes more gently offshore, the 10 m deep internesting groups are located approximately 10 to 20 km inshore of the pipeline corridor. Based on the outcomes of these studies, most of the nesting females in the area are not expected to internest within the operational area; however, it is possible some individuals will use waters extending into the operational area and EMBA.

Olive Ridley turtles of the NT genetic stock nest along the northern coast of the Tiwi Islands (Melville Island in particular), and in low density on the beaches of the west and south-west costs of the Tiwi Islands (Bathurst Island) (Chatto and Baker, 2008a). The long-term trend of the NT genetic stock is currently unknown (Commonwealth of Australia, 2017a). The number of females nesting here is considered significant at the genetic stock, national and international level. Due to the effects of nest predation and entanglement with ghost nets in the Arafura Sea and the Gulf of Carpentaria, both Olive Ridley genetic stocks are considered a priority for management action (Commonwealth of Australia, 2017a). Nesting of the NT genetic stock can occur year-round with a peak between April and June, with hatchling emergence peaking between June and August Commonwealth of Australia, 2017a). Internesting habitat critical to the survival of Olive Ridley turtles (NT stock) encompasses nearshore waters along the north, west and east coasts of the Tiwi Islands. The Recovery Plan for Marine Turtles in Australia defines the internesting buffer around the Tiwi Islands as 20 km which overlaps the operational area and EMBA (Commonwealth of Australia, 2017a) (**Figure 4-31**). Internesting Olive Ridley turtles remain relatively close to nesting beaches during the nesting period (in comparison to post-nesting movements); tagged turtles remained within 48 km of the nesting beach in waters typically <30 m water depth, although the turtles moved considerable distances within this radius (up to 200 km) (Hamel et al., 2008).

Leatherback turtles feed in NT coastal waters around northern Australia. However, nesting has only been confirmed at a single site, between the Cobourg Peninsula and Cape Arnhem, and only in small numbers (Chatto and Baker, 2008a). Within this area nesting occurs between December and January (Commonwealth of Australia, 2017a). There are potentially three genetic stocks foraging and nesting within Australian waters, although genetic linkages or distinctions are unclear (Commonwealth of Australia, 2017a).

Loggerhead turtles are found in the NMR and are known to forage in the Oceanic Shoals Marine Park, the Arafura Sea and the Gulf of Carpentaria; however, they have not been observed breeding in the region (DEWHA, 2008b). Loggerheads found within the EMBA are most likely to come from the Western Australian Population, which nest in the areas of Dirk Hartog Island, Murion Islands, Gnaraloo Bay, and the Ningaloo coast in November to May (outside the EMBA) (Commonwealth of Australia, 2017a).

*Migratory pathways*

Most species of turtles are known to migrate large distances between foraging and nesting areas. Key migratory pathways have been identified for the identified marine turtle species and include (Commonwealth of Australia, 2017a):

+ Olive Ridley turtles and green turtles are known to migrate up to 1,130 km and 2,600 km respectively, between their nesting and foraging grounds (DSEWPaC, 2012).
+ Flatback turtles that nest within the Pilbara region migrate to their foraging grounds in the Kimberley along the continental shelf at the end of the nesting season.
+ Surveys of green turtle movements after nesting in the Kimberley region show many turtles traveling north to the Tiwi Islands south coast (RPS 2009, cited in URS, 2010), in April/May (pers. comm. M. Guinea, CDU, 2015).
+ Hawksbill turtles migrate along the Dampier Archipelago and between Scott Reef and the Joseph Bonaparte Gulf.

Aside from the aforementioned BIAs and habitat critical to the survival of marine turtles (as defined in the Recovery Plan for Marine Turtles), a number of shallow features (i.e. shoals/banks) within the EMBA may be of importance for marine turtle foraging. Given this, the six marine turtle species identified are likely to be present within the EMBA year-round while foraging or moving between nesting beaches and foraging areas. A small number of individual turtles, including flatback, Olive Ridley and hawksbill (juvenile) turtles, were also opportunistically observed during the Barossa marine studies program in both open waters and in close proximity to shoal/banks and Bathurst Island. Given the operational area does not contain any emergent land or shallow features that may be of importance to nesting turtles, they are unlikely to be present in the area in significant numbers. However, marine turtles are likely to transit the area as they move between nesting beaches and offshore areas and may be present in higher numbers within the areas around Tiwi Islands (i.e. within areas defined as BIAs and or habitat critical to marine turtle species).

The Recovery Plan for Marine Turtles lists conservation advice for relevant key threats identified in **Table 4-5**. Conservation actions are listed for threats rated as high or very high. **Table 4-9** outlines relevant conservation advice for all marine turtles and their threat priority as assessed in the Recovery Plan (Commonwealth of Australia, 2017a).

*Table 4-9: Relevant conservation advice for key threats to marine turtles identified in the Recovery Plan for Marine Turtles in Australia 2017–2027 (Commonwealth of Australia, 2017a)*

| Action Areas | Threat Priority | Relevant Conservation Advice to the gas export pipeline Installation Campaign |
|---|---|---|
| Legal and management protection (see **Sections 5.2.2**, **5.2.3**, **5.2.4**, **5.2.7**, **5.3.3**, **5.3.4**, **5.3.6**, **5.3.7** and **5.3.8**) | Not applicable | + Maintain, implement and improve efficacy of existing management arrangements as listed at sections 2 and 4.3 (of the Recovery Plan for Marine Turtles in Australia 2017–2027).<br>+ Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival as per section 3.3 table 6 (of the Recovery Plan for Marine Turtles in Australia 2017–2027).<br>+ Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue. |
| Habitat modification – infrastructure (see **Section 5.2.2**) | Low to Moderate | + Manage infrastructure, coastal development, dredging and trawling to ensure ongoing biologically important behaviours for marine turtle stocks continues.<br>+ Use up-to-date information regarding nesting, internesting and foraging habitat to inform future development proposals and approval decisions. |
| Vessel disturbance (see **Section 5.3.3**) | Low to Moderate | No relevant conservation advice listed |
| Light pollution (see **Section 5.2.4**) | Low to Moderate | + 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.<br>+ Develop and implement best practice light management guidelines for existing and future developments adjacent to marine turtle nesting beaches.<br>+ Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution. |
| Noise interference – acute (see **Section 5.2.3**) | Low to Moderate | Understand the impacts of anthropogenic noise on marine turtle behaviour and biology. |
| Chemical discharge – acute (see **Sections 5.2.7**, **5.3.4**, **5.3.5**, **5.3.7** and **5.3.8**) | Low to High | + Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', such as nesting habitat, seagrass meadows or coral reefs.<br>+ Quantify the impacts of decreased water quality on stock viability.<br>+ Quantify the accumulation and effects of anthropogenic toxins in marine turtles, their foraging habitats and subsequent stock viability. |
| Marine debris – entanglement/ingestion (see **Section 5.3.6**) | Moderate to Very High | + Maintain and expand international and domestic partnership arrangements for the source reduction, collection and management of marine debris.<br>+ Compare marine debris hotspots with important foraging areas, post hatchling dispersal and adult migratory pathways to identify high priority areas for mitigation to reduce turtle/debris interactions.<br>+ Describe and quantify the impact of ingestion of debris on marine turtles, particularly those life phases using the open ocean.<br>+ Support the implementation of the EPBC Act Threat Abatement Plan for the impacts of marine debris on vertebrate marine life. |

**Saltwater crocodile**

The saltwater crocodile is primarily found in inland water ways, tidal creeks, coastal floodplains and channels, billabongs and swamps across northern Australia (DoEE, 2019). The species' recognised distribution extends from Rockhampton in QLD to King Sound WA (DoEE, 2019). There are no identified BIAs or EPBC listed critical habitat within the NMR for salt-water crocodiles. In the NT, most breeding sites are found on river banks or floating rafts of vegetation.

Within the NMR, the saltwater crocodile's distribution is suggested to have expanded since its protection in the early 1970s, with individuals occurring up to 150 km inland, further than any historical records or knowledge (DEWHA, 2008b). Although the species is considered recovered and no longer threatened, it is recognised that strict regulation is required to avoid the population becoming depleted again (DoEE, 2019). Nesting occurs within freshwater swamps which experience little tidal movement, between December and March, with a peak period between January and February (DEWHA, 2008b). Given crocodiles preferred habitat, they are likely to be encountered within the EMBA, mainly within inshore/coastal areas, but unlikely to occur within the operational area.

**Sea snakes**

All sea snakes in Australia are listed as marine protected species under the EPBC Act. PMST reports identified 18 species of sea snake within the EMBA, with 17 species listed as potentially occurring within the operational area. None of the sea snake species occurring within the operational area and EMBA are listed threatened species.

There are a number of recognised key aggregation/feeding areas for sea snakes including:

+ Sea snakes are typically distributed in shallow inshore regions and islands, which provide suitable seabed habitat and clear waters. However, they are also found at nearby islands and further offshore at atolls, including the shoals/banks in the Timor Sea (Guinea, 2013b).
+ The majority of sea snakes are observed in water depths ranging between 10 and 50 m (RPS, 2010) and generally have shallow, benthic feeding patterns. Some species are known to dive deeper than this, however, non-pelagic species seldom, if ever, diver deeper than 100 m (Heatwole, 1975). Very few species are known to inhabit deep pelagic environments, such as the environments occurring in the operational area, as they are air-breathing (Guinea, M.L., 2006).
+ Distribution and movements of sea snakes are largely species-dependent with some species, such as the pelagic yellow-bellied sea snake, known to travel large distances, while others, such as the olive sea snake, are usually resident in a particular area.
+ Sea snake species residing on reefs do not actively disperse or migrate between reefs. Sea snakes are found to be present year-round at most reefs on the Sahul Shelf (Guinea and Whiting, 2005).
+ For those sea snake species that do migrate between reefs, within their broader home range, migration is thought to be influenced by ocean current. However, there have been no studies undertaken to date on the migrations of open water sea snake species to determine their home ranges. Reef dwelling sea snakes appear to have very small home ranges (Guinea, 2013).
+ Research trawls indicate that sea snakes move to the southern shallow regions of the Gulf of Carpentaria in the summer month and into deeper waters at other time of the year (Redfield et al., 1978, cited in DSEWPaC, 2012a)).
+ Sea snakes are known to breed in shallow embayments along the NT coastline around December to February, with the exception of the spine-bellied sea snake which breeds during June to August (DSEWPaC, 2012a).

Santos

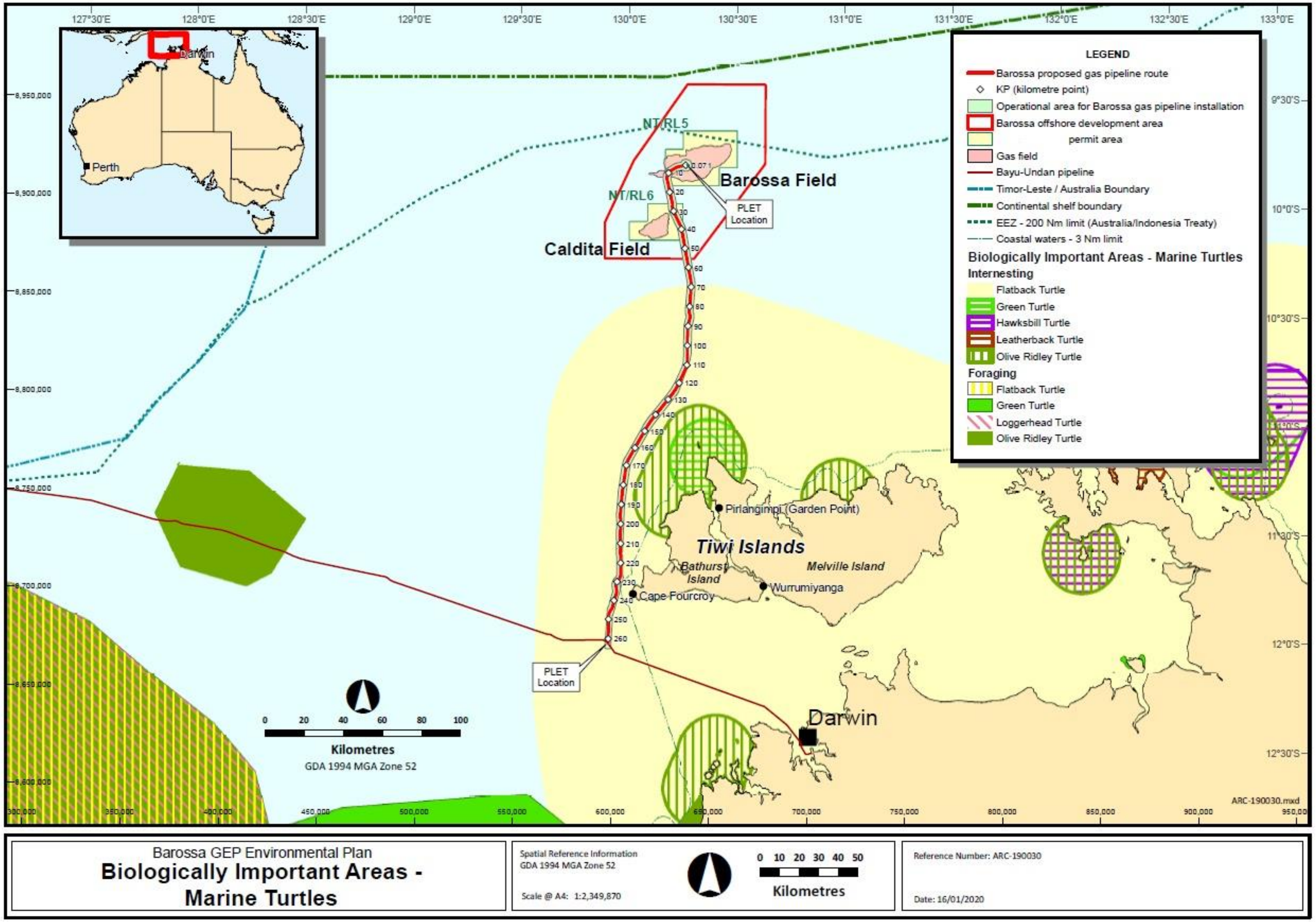



*Figure 4-31: Biologically important areas for marine turtles*

Recent surveys undertaken for the Barossa marine studies program observed several species of sea snake individuals at Evans Shoal, Tassie Shoal, Lynedoch Bank and a seamount to the north-west of the operational area. Opportunistic sightings (species unknown) were also made in open offshore waters in the Timor Sea. The individuals that could be identified were the olive sea snake and turtle-headed sea snake (Heywood et al., 2015; Jacobs 2016c). A study undertaken at Tassie Shoal and five surrounding shoals identified these same two species of sea snake at the surface and foraging on the seabed. Based on the known distribution, habitat preference and sightings during the Barossa marine studies program, sea snakes are considered likely to transit the operational area and EMBA.

#### 4.5.5.7 Fish

Fish communities occupy a range of habitats and play an important ecological role with many species being of conservation value and importance for commercial and recreational fishing. The current state of knowledge of fishing activities in a socio-economic and traditional use context is discussed further in **Section 4.6.7** and **4.6.8**.

The EPBC Act PMST reports identified 13 listed species, including seven threatened or migratory shark, four sawfish and two ray species that may occur in, or have habitat, in the operational area (**Table 4-5**). These species are all ray-finned fish of the family Syngnathidae (i.e. pipefish or seahorses). These species may pass through the offshore waters of the operational area and EMBA, however, are more likely to be associated with the shallow waters around the nearby shoals/banks (**Section 4.5.6.3**) and close to the NT coastline where benthic communities provide suitable shelter and foraging habitats.

**Whale sharks**

The whale shark is known to occur in both tropical and temperate waters and has a wide distribution in Australian waters (DSEWPaC, 2012). A seasonal aggregation of whale sharks occurs in waters off the Ningaloo coast (outside of the EMBA) each year between late March and November, with the highest frequency of sightings occurring in April and May (DSEWPaC, 2012; DEH, 2005). Whale sharks are highly migratory and generally depart Ningaloo Reef between May and June, travelling northeast along the continental shelf and then moving offshore into the north-eastern Indian Ocean (DEH, 2005). The timing of this aggregation has been reported to coincide with high levels of productivity associated with annual coral spawning, resulting in an increased planktonic biomass and a more active food chain in the waters adjacent to the Ningaloo Reef (Taylor, 1996).

Seasonal aggregation areas are also known off Christmas Island (outside the EMBA) between December and January and in the QLD Coral Sea (between November and December) (DEH, 2005). Aside from these aggregation periods, the distribution of whale sharks is largely unknown. Multiple surveys of whale sharks leaving the Ningaloo area suggest the group disperses widely and may follow three migration routes, moving either north-west into the Indian Ocean, directly north towards Sumatra and Java, or north-east travelling along the shelf break and continental slope (Meekan and Radford, 2010; Wilson et al., 2006).

Relevant conservation advice for the whale shark states requirements to minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations (Ningaloo Reef, Christmas Island and the Coral Sea) and along the northward migration route that follows the northern WA coastline along the 200 m isobath (Threatened Species Scientific Committee, 2015a). The closest foraging BIA for whale sharks is approximately 440 km west of the operational area and outside the EMBA. Given this and whale sharks' widespread distribution, occurrence of whale sharks within the EMBA is likely to be minimal, restricted to few individuals leaving Ningaloo, which are travelling towards the Coral Sea along the shelf break and will be restricted to only the north-western offshore section of the EMBA. It is possibly that very low numbers of whale sharks may occur within the northern extent of the operational area.

**Great white sharks**

Great white sharks are distributed widely in Australian waters; however, aggregations are focused in temperate waters around seal and sea lion colonies (DoEE, 2019). Their preferred habitat is inshore reefs and shallow coastal bays (up to the 100 m depth contour) (Bruce, 2008; Bruce et al., 2006), but individuals are known to make open ocean excursions of several hundred kilometres and can cross entire ocean basins (e.g. from South Africa to WA) (Weng et al., 2007). There are no BIAs or EPBC listed critical habitats for great white sharks within the NMR and there have been no confirmed sightings of great whites within the NT (DoEE, 2019). Given this, great white sharks are unlikely to occur within either the operational area, however, individuals may infrequently transit the broader EMBA.

**Sawfish**

Three EPBC threatened and migratory, and one EPBC migratory sawfish species were identified as potentially occurring within the operational area and EMBA.

Dwarf sawfish are found in coastal waters of the NMR extending north from Cairns around the Cape York Peninsula in QLD to the Pilbara coast (DoEE, 2019). Dwarf sawfish typically inhabit shallow (2 to 3 m) silty coastal and estuarine habitats, occupying relatively restricted areas and moving only small distances (Stevens et al., 2008). Juvenile dwarf sawfish utilise estuarine habitats in north-western WA as nursery areas (Thorburn et al., 2008), and migrate to deeper waters as adults (DoEE, 2019). The majority of capture locations for the species in WA waters have occurred within King Sound and the lower reaches of the major rivers that enter the sound, including the Fitzroy, Mary and Robinson rivers (Morgan et al., 2010). King Sound lies in the Kimberley region, west of the EMBA. Individuals are also occasionally taken as bycatch from considerably deeper water from trawl fishing (Morgan et al., 2010).

Green sawfish are also widely distributed in Australian waters and have been recorded in inshore marine waters, estuaries, river mouths, embankments and along sandy and muddy beaches (DoEE, 2019). While the species has predominantly been recorded in inshore coastal areas, it has been recorded hundreds of kilometres offshore in relatively deep waters (up to 70 m) (Stevens et al., 2005). Short-term tracking of movement patterns has shown that green sawfish appear to have limited movements that are tidally influenced, and it is likely to occupy a restricted range of only a few square kilometres in the coastal fringe, with a strong association with mangroves and adjacent mudflats (Stevens et al., 2008).

The freshwater, or largetooth sawfish, occurs in fresh or weakly saline waters, mainly within rivers and estuaries (Thorburn et al., 2007; Threatened Species Scientific Committee, 2014). Large mature adults have been recorded within coastal or offshore waters, up to 25 m depth (DoEE, 2019; Stevens et al., 2005); however, records are few. Riverine habitats are particularly important as pupping habitats.

The narrow sawfish occurs from the northern Arabian Gulf to Australia and north to Japan. The species inhabits inshore and estuarine waters and offshore waters up to depths of 100 m (Morgan et al., 2010), and are most commonly found in sheltered bays with sandy bottoms. They are not currently listed as threatened under the EPBC Act.

Based on the habitat preferences of sawfish within northern Australia, fishery data and information provided by stakeholders, these species are likely to occur within the EMBA and within the southern section of the proposed gas export pipeline.

**Northern river sharks and speartooth sharks**

Within Australia, northern river and speartooth sharks have predominantly been recorded in tidal rivers and estuaries in north and north-western Australia (DSEWPaC, 2012b). The northern river shark's known distribution within the NT includes the Adelaide River, South and East Alligator rivers and the Wessel Islands. The northern river shark appears to favour habitats that experience large tides, have fine muddy/silty substrates and high turbidity. The speartooth shark is currently distributed in two main regions including the Van Diemen Gulf drainage in the NT and Port Musgrave in QLD (both east of the EMBA), with historical populations in eastern Cape York Peninsula (DSEWPaC, 2012b). Only adults of both species have been sighted in offshore waters as either bycatch in offshore net fisheries (northern river shark) or unconfirmed sightings (speartooth shark) (DSEWPaC, 2012b).

Based on the habitat preferences of these species, the northern river shark and speartooth shark may occur within the EMBA, particularly within coastal waters. There is potential for these species to also occur within the operational area, however, only few individuals (adults) are expected and likely only within the southern extent of the area.

**Longfin and shortfin mako sharks**

Mako sharks are globally distributed pelagic species that undertake large-scale movements which can exceed 2,000 km (Bruce, 2013). Both species are often caught as bycatch or targeted by commercial fisheries. Commercial catch data in Australia show the majority of captures are focused on the eastern coast (Bruce, 2013).

Longfin mako sharks are uncommon in Australian waters relative to shortfin makos, but have been found in northern Australian waters, from Geraldton in WA to at least Port Stephens in New South Wales (Bruce, 2013; DEWHA, 2008). A study from southern California, documented juvenile longfin mako sharks remaining near surface waters, while larger adults were frequently observed at greater maximum depths of about 200 m (Sepulveda et al., 2004). Tagging studies on shortfin makos indicate this species spends most of its time in water less than 50 m deep, with occasional dives up to 880 m (Abascal et al., 2011; Stevens et al., 2010).

There is very little information about these sharks in Australia, with no available population estimates or distribution trends. Given information available on shortfin and longfin mako sharks, the species presence is likely to be infrequent and restricted to individuals transiting through mainly the southern section of the EMBA and operational area.

**Giant and reef manta rays**

The reef manta ray is commonly sighted in or along productive near-shore environments, such as island groups, atolls or continental coastlines (IUCN, 2015); however, the species has also been recorded around offshore coral reefs, rocky reefs and seamounts. Long term sighting records suggest that this species is mostly resident to tropical and subtropical waters (IUCN, 2015). Individuals have been documented making seasonal migrations of several hundred kilometres between well-established aggregation sites (IUCN, 2015).

The giant manta ray is common in tropical waters of Australia and primarily inhabits near-shore environments along productive coastlines with regular upwelling. However, they do appear to be seasonal visitors to coastal or offshore areas (e.g. islands, pinnacles and seamounts) (IUCN, 2015). The Ningaloo Reef, over 1,400 km south-west of the EMBA, is an important area for giant manta rays between March and August (Environment Australia, 2002; Preen et al., 1997); however, there are no spatially defined BIAs for either species within Australia or known aggregations within the NMR.

Given giant and reef manta rays apparent habitat preferences and information provided by stakeholders, it is possible they will occur within the operational area and EMBA, particularly near shoals/banks which support coral communities and along the south coast of Bathurst Island, but are not expected to be present in large numbers.

**Oceanic whitetip shark**

The oceanic whitetip shark (*Carcharhinus longimanus*) is listed as migratory under the EPBC Act. The oceanic whitetip shark is widespread throughout tropical and subtropical waters of the world (30° N to 35° S) (IUCN, 2019). They are an oceanic and pelagic species that regularly occurs in waters of 18 to 28°C, usually >20°C (IUCN, 2019). Within Australian waters, they are found from Cape Leeuwin (Western Australia) through parts of the Northern Territory, down the east coast of Queensland and New South Wales to Sydney (Last & Stevens, 2009). They are usually found in surface waters, though can reach depths of >180 m. They have occasionally been recorded inshore but are more typically found offshore or around oceanic islands and areas with narrow continental shelves (Last & Stevens, 1994).

It is considered possible that individuals may be encountered in low numbers within the operational area and EMBA

**Grey nurse sharks**

The grey nurse shark was not identified in the EPBC Act PMST reports, however, was recorded at a seamount (38 km west of the operational area) during the Barossa marine studies program (Jacobs, 2016), within the

EMBA. The species is believed to be uncommon in the region, however individuals have been recorded in northern Australia on a number of occasions (Last and Stevens, 1994; Momigliano and Jaiteh, 2015). During recent studies undertaken (**Table 4-2**), BRUVS were used to identify fish communities at shoals and banks; however, no grey nurse sharks were sighted (Radford et al., 2019).

Grey nurse sharks are typically found aggregating near the seabed in rocky caves around inshore rocky reefs and islands or in the mid-water column adjacent or above pinnacles (Otway et al., 2003; DoE, 2014). Research on the east coast of Australia has found that individual sharks may stay in these aggregation areas on average for 11 days (DoE, 2014). When not in residence at aggregation sites grey nurse sharks are known to migrate. Research on the movements of grey nurse sharks along the east coast of Australia has also shown a strong migratory pattern associated with seasons and linked to level of maturity and sex (DoE, 2014).

Based on the finding of the Barossa marine studies program, discussions with NT Department of Primary Industry and Resources (DPIR) (Fisheries) during the development of the Barossa Area Development OPP and the species' habitat preference, it is considered possible that individuals may swim through the EMBA.

**Scalloped hammerhead**

The scalloped hammerhead (*Sphyrna lewini*) is a relatively large, fusiform-bodied, moderately slender shark that is olive, bronze, or brownish-grey dorsally and pale on its underside (Last and Stevens, 2009). The primary threat to the species is historic and ongoing fishing pressure. The distribution extends from New South Wales (approximately from Wollongong, where it is less abundant), around the north of the continent into Indonesian waters and then south into WA to approximately Geographe Bay. The scalloped hammerhead shows substantial genetic population structuring across ocean basins as it rarely ventures into or across deep ocean waters but ranges quite widely over shallow coastal shelf waters (TSSC, 2018).

The scalloped hammerhead is EPBC Act listed as conservation dependent and under threatened listing assessment (at the time of writing this EP).

Based on the habitat preferences of scalloped hammerheads, it is considered unlikely to occur within the deeper offshore waters of the OA. However, the species or species habitat is known to occur within the EMBA.

#### 4.5.5.8 Seabirds and migratory shorebirds

Eighteen EPBC listed seabird and migratory shorebird species were identified as potentially occurring within the EMBA, of which a subset of 11 species may occur within the operational area (**Table 4-5**). Through consultation with recognised technical experts, it is noted that an additional 15 species are also likely to transit the operational area on an annual basis, these being the wedge-tailed shearwater, Bulwer's petrel, Matsudaira's storm-petrel, Swinehoe's storm-petrel, Wilson's storm-petrel, red-tailed tropicbird, white-winged black tern, bridled tern, common tern, roseate tern, lesser crested tern, little tern, masked booby, brown booby, and red-footed booby. The crested tern also has a defined BIA which overlaps the EMBA (see **Section 4.5.5.3** and **Figure 4-32**).

It is also understood that, based on current published information and advice from Dr Rohan Clarke (Monash University) an undescribed shearwater species ('Timor Sea shearwater, Puffinus sp.) may potentially occur or have habitat within the operational area and EMBA. The species was first detected in 2010 in the Timor Sea north-west of Darwin and West Papua (Menkhorst et al., 2017). Subsequent surveys have positively identified its occurrence, including near Adele Island and near Indonesia (Rohan Clarke, pers. comm.). The majority of sightings have been in proximity to shoals/banks and shorelines as the species is likely to forage in inshore waters as well as aggregate as flocks that rest on the sea surface in these areas (Rohan Clarke, pers. comm.). The species is more likely to breed in Indonesian waters based on observations to date, however, this remains inconclusive (Rohan Clarke, pers. comm.).

Conservation advice for the EPBC species identified lists the following conservation and management actions relevant to key threats identified in **Table 4-6** (Threatened Species Scientific Committee, 2016a, 2016b, 2016c, 2016d, 2016e, 2015b, 2015c):

+ Work with governments along the East Asian-Australasian Flyway to prevent destruction of key migratory staging sites.
+ Protect important habitat in Australia.
+ Support initiatives to protect, improve and manage habitat at key sites.
+ Maintain and improve protection of roosting and feeding sites in Australia.

An additional relevant action outlined for migratory shorebirds is to develop guidelines for wetland rehabilitation and the creation of artificial wetlands to support populations of migratory shorebirds (Commonwealth of Australia, 2015b).

**Seabirds**

Internationally significant populations of seabirds, particularly tern species, nest on offshore islands within the NMR and use waters within the region for foraging (DSEWPaC, 2012c). Few seabird species breed within the western portion of the NMR, with most species utilising the area for foraging.

Seabirds are bird species which forage predominantly in marine waters, either by flying or swimming. Some seabird species spend significant time resting on the ocean surface while others, such as the greater and lesser frigatebird, spend the majority of their time in the air or roosting on available land features (DoEE, 2019). Some seabirds plunge or dive through the ocean surface to catch their prey, such as the streaked shearwater which has been recorded diving up to 5 m, while others such as the lesser and great frigate bird scoop their prey just off the surface of the water (DSEWPaC, 2012c).

The distance seabirds travel from land also varies across species. The common noddy disperses up to 50 km into the pelagic zone to forage and is often found using buoys and ships to rest, while the little tern is generally found within 1 km of their sandy coastal and mangrove-mudflat resting areas (DSEWPaC, 2012c). The streaked shearwater is a migratory seabird that breeds on islands in the north-west Pacific Ocean near Japan. The bird migrates from this region into the tropical west Pacific during the non-breeding season. In Australia, the streaked shearwater has been recorded from Broome to the Timor Sea, and from Barrow Island to the Houtman Abrolhos Islands (outside the EMBA) (DSEWPaC, 2012c).

Many offshore islands in northern Australia are breeding areas for various seabird species. The great frigatebird breeds on islands across such as Adele Island and Ashmore Reef (outside the EMBA), and forages within 100 to 200 km during breeding season (mainly between March and November) (DSEWPaC, 2012a). Breeding seasons within northern Australia vary significantly for seabirds, with some species nesting year-round (e.g. brown booby), while others having specific breeding seasons (e.g. lesser frigatebird, great frigatebird, streaked shearwater, and crested terns) (DSEWPaC, 2012c).

Seabirds are expected to forage in low numbers across the operational area and EMBA throughout the year, particularly near coastal regions and the Tiwi Islands as they may be used as resting areas. Seabirds may be present in higher numbers near offshore areas supporting higher abundances of fish species (i.e. shoals/banks) or areas of upwelling (Pinnacles of Bonaparte KEF outside the EMBA).

**Migratory shorebirds**

The International Convention on Migratory Species considers shorebirds as migratory if "the entire population or any geographically separate part of the population cyclically and predictably crosses one or more national jurisdictional boundaries." In Australia, migratory shorebirds mainly utilise the East Asian-Australian Flyway, breeding in the northern hemisphere and migrating into the southern hemisphere during non-breeding periods (Bamford et al., 2008). Most migratory shorebirds rely on wetland habitats; however, some also use habitats such as dry grassland (Bamford et al., 2008).

Within the NMR, extensive mangroves and coastal wetlands provide essential nesting, feeding and staging areas for migratory shorebird species (Rochester et al., 2007). The east coast of the NMR, particularly the Gulf of Carpentaria, supports some of the largest breeding colonies of shorebirds in Australia (east of the EMBA) (Rochester et al., 2007). Additionally, an area between Roebuck Bay and Eighty Mile Beach is considered an internationally important site for migratory shorebirds which use the East Asian-Australasian Flyway (INPEX Browse, 2010) (over 600 km south-west of the EMBA). Overall, the NMR supports 41 species of migratory birds, including threatened and non-threatened species (DSEWPaC, 2012b).

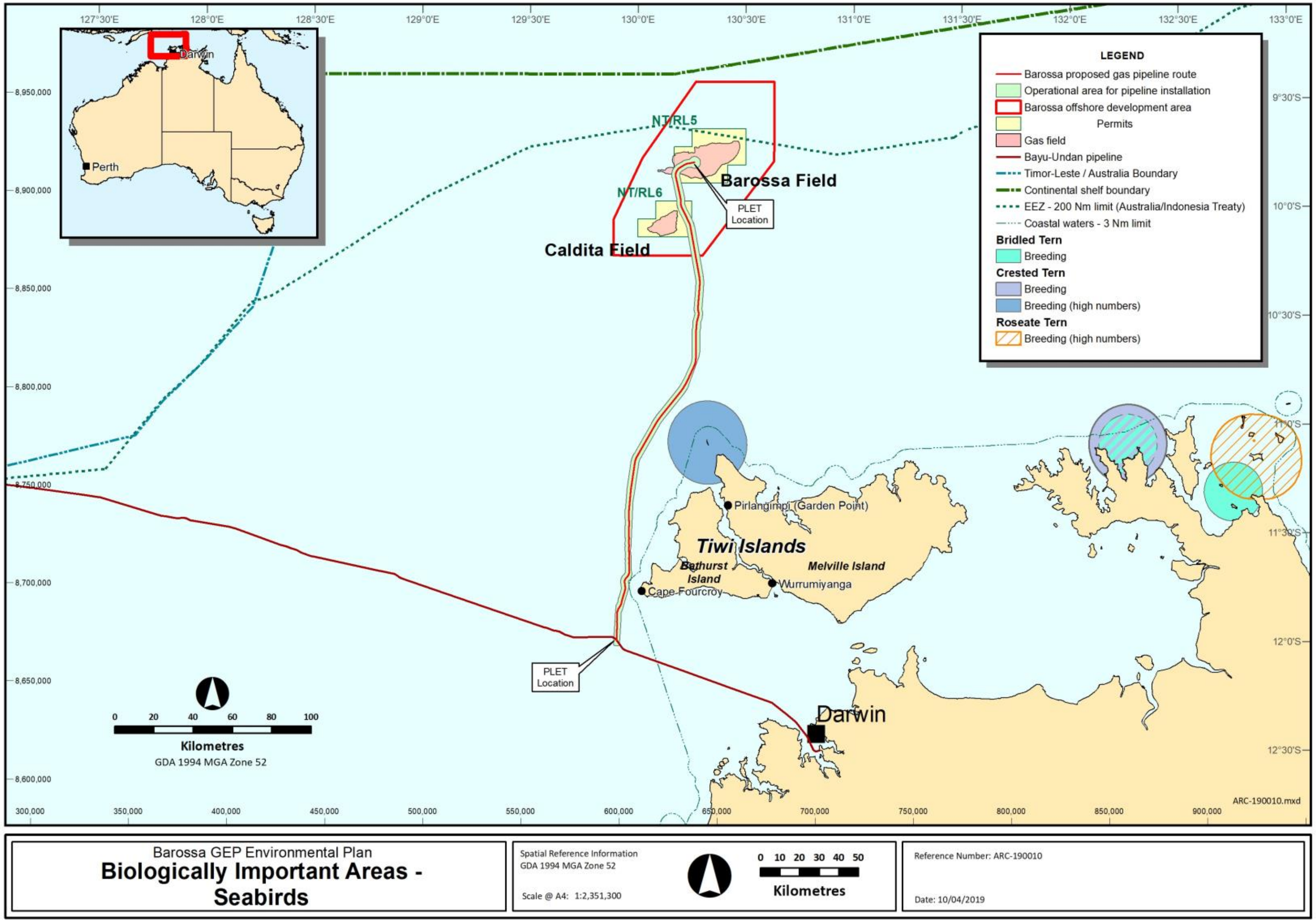



*Figure 4-32: Biologically important areas for seabirds*

Most species which migrate using the East Asian - Australasian Flyway arrive in Australia during their southern migration between August and November, with some birds remaining in the region to December or February, following the breeding season (Bamford et al., 2008). Exact migration routes and resting areas vary across species (INPEX Browse, 2010), and in some cases, species do not fit the pattern at all such as with the Australian pratincole which is one of two species which breed only within the southern hemisphere (Bamford et al., 2008).

In some cases, a portion of the population will not migrate and instead remain in non-breeding areas throughout during the breeding season, or complete partial migrations to suitable habitat (Bamford et al., 2008). This is particularly the case with young birds which may have not reached sexual maturity. The red knot is a shorebird which undertakes long distance migrations from breeding grounds in high northern latitudes, where it breeds during the boreal summer, to the southern hemisphere during the austral summer. Despite this, Australia and New Zealand both also host significant numbers of red knots during their non-breeding season (Bamford et al., 2008).

Within offshore waters of the operational area and EMBA, most shorebird activity will be restricted to birds flying over the area, particularly during annual migrations (northern migration between August and November, and southern migration between March and May). Within coastal waters, there are no recognised breeding areas within the operational area, however, species are expected to utilise shoreline and nearshore habitat within areas of the EMBA for resting and foraging throughout the year, with higher numbers during the general non-breeding period between December and February (Bamford et al., 2008).

### 4.5.6 Other values and sensitivities

#### 4.5.6.1 Key ecological features

KEFs are of regional importance for either the marine region's biodiversity or ecosystem function and integrity. A search was conducted of the DoEE Conservation Values Atlas to identify the KEFs that occur within the operational area and EMBA (**Figure 4-33**). The operational area and EMBA overlap two KEFs, as described in **Table 4-10**.

Based on the habitat modelling and mapping undertaken by AIMS (Radford et al., 2019 and detailed in **Section 4.5.3**), the species identified as part of the KEF; i.e. sponges, soft corals and other sessile filter feeders, had only limited presence in the operational area. The habitats present in the section of the operational area that overlapped the KEF are Abiotic (95%), Burrowers/Crinoids (3.9%) with the combined presence of filter feeders (including sponges), soft corals and Gorgonians present in less than 1% of the area. As can be seen from **Figure 4-34**, the species identified as part of the KEF are well represented beyond the operational area.

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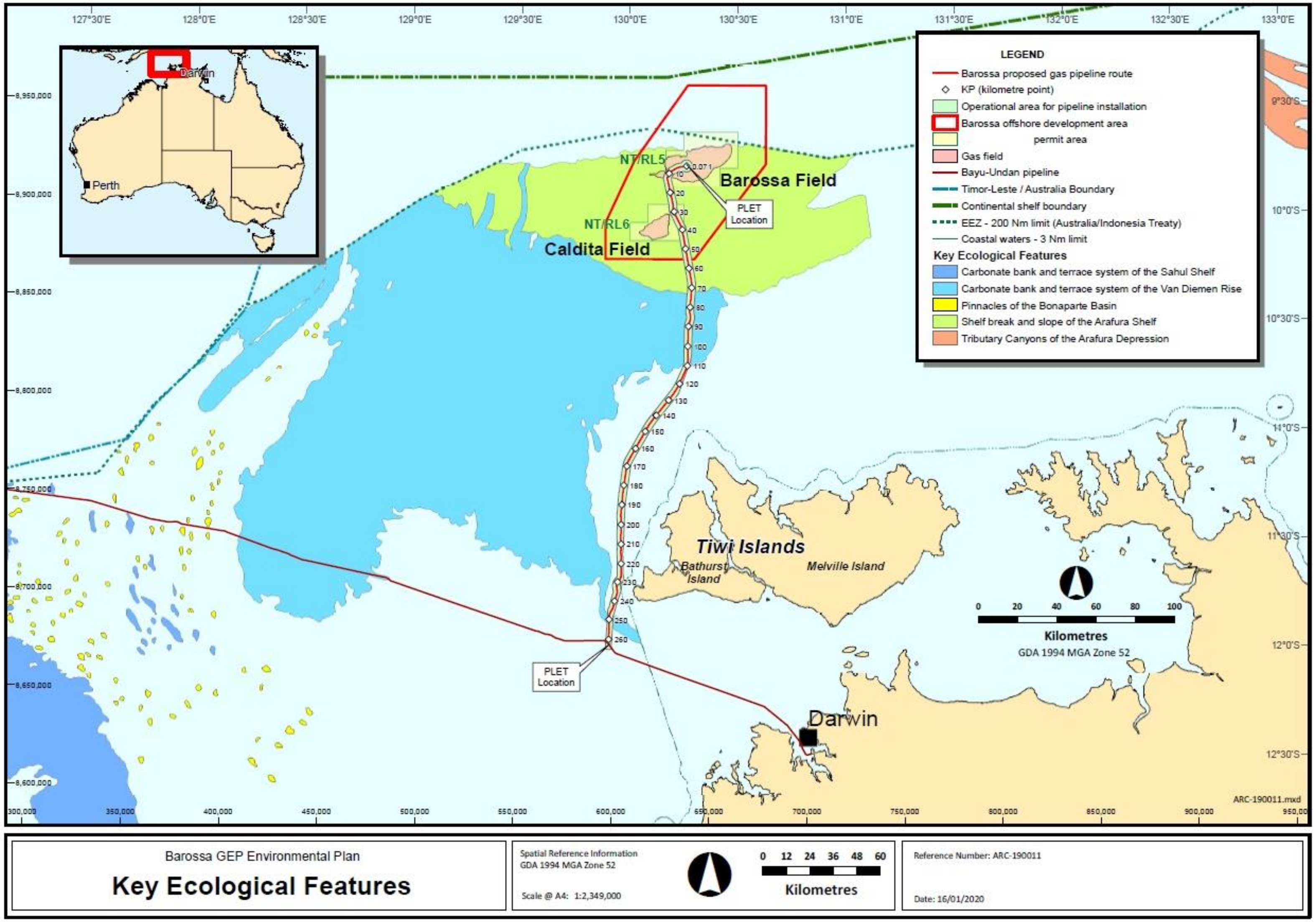


*Figure 4-33: Key ecological features*

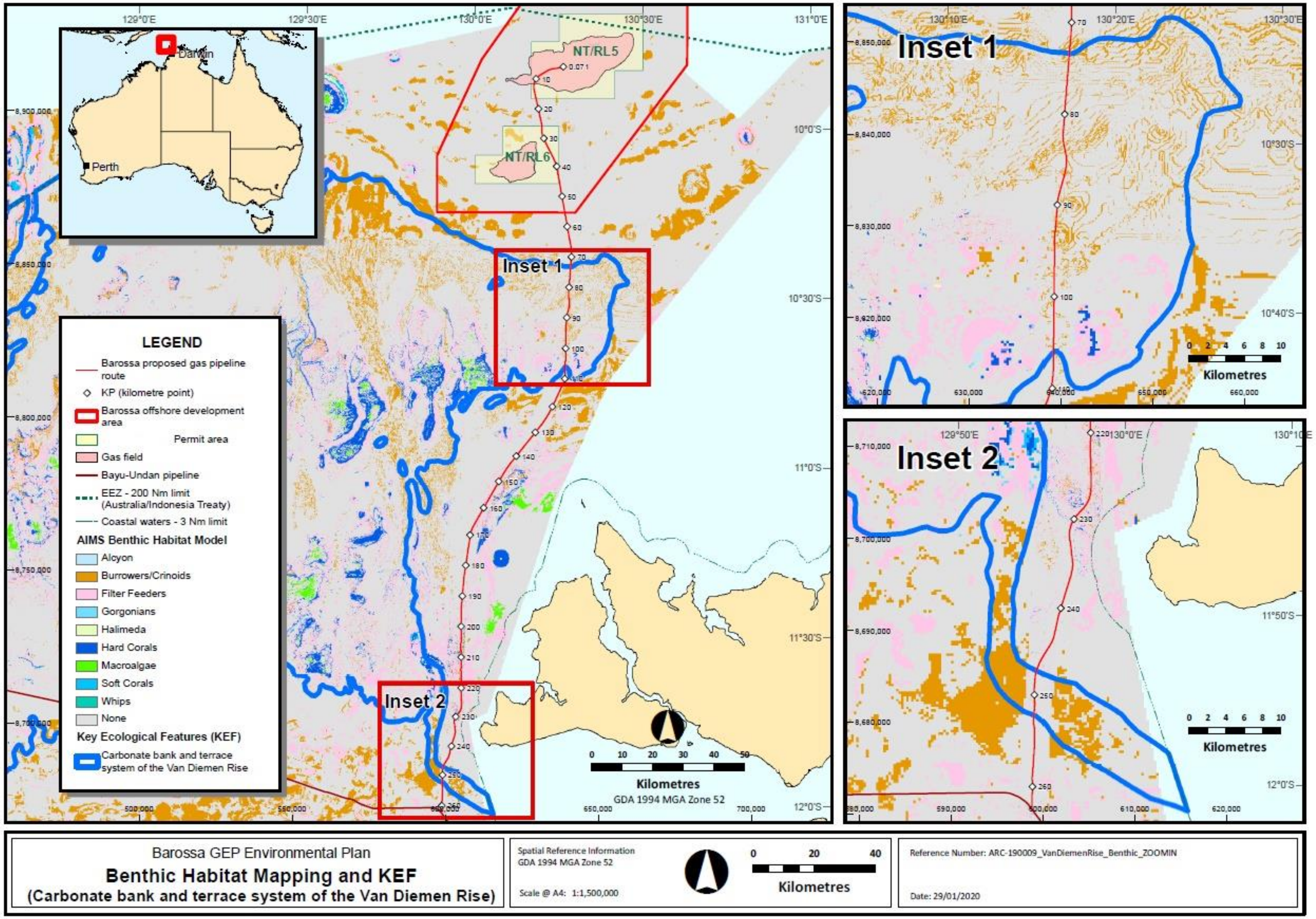


*Figure 4-34: Benthic habitats present in the section of the operational area that overlaps the key ecological features (only northern part of key ecological features shown)*

*Table 4-10: Key ecological features overlapping the operational area and environment that may be affected*

| KEF | Description including Area ($km^2$) and Percent of KEF overlapped by operational area, where relevant |
|---|---|
| Carbonate bank and terrace system of the Van Diemen Rise | The value of this KEF is "Unique seafloor feature with ecological properties of regional significance" (DSEWPaC, 2012a)) and it is considered important for its role in enhancing biodiversity and local productivity relative to its surrounds and for supporting relatively high species diversity.<br>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, 2012a).<br>The banks, ridges and terraces of the Van Diemen rise are raised geomorphic features with relatively high proportions of hard substrate which 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).<br>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, 2012a; DoEE, 2019).<br>The pipeline passes through the KEF twice, approximately 40 km to the north and 10 km in the south. This equates to a footprint of 3.3 hectares (0.033 $km^2$) or 0.0001% of the total area of the KEF. |
| Shelf break and slope of the Arafura Shelf | The value of this KEF is "Unique seafloor feature with ecological properties of regional significance" (DSEWPaC, 2012a) and it is considered important due to its ecological significance associated with productivity emanating from the slope.<br>The shelf break and slope of the Arafura Shelf covers approximately 10,844 $km^2$ and is characterised by continental slope and patch reefs and hard substrate pinnacles (DSEWPaC, 2012a). Upwelling associated with the topography of the shelf break lifts nutrient rich deep ocean water onto the edge of the shelf and into the euphotic zone, leading to enhanced biological productivity and attracting aggregations of pelagic organisms in the vicinity of the shelf break (at water depths of approximately 120m) (DSEWPaC, 2012a). A number of submerged reefs extend up into the euphotic zone from the shelf slope, providing structural habitat and focal points for diversity (DSEWPaC, 2012a).<br>Approximately, 70 km of the pipeline passes through this KEF, equating to a footprint of 6.4 hectares (0.064 $km^2$) which represents less than 0.001% of the total area of the KEF.<br>While the operational area occurs within the bounds of this KEF, the seafloor features associated with this KEF (i.e. the shelf break and patch reefs, hard substrate pinnacles and submerged reefs on the shelf slope) were not observed during the Barossa marine studies program, nor are these topographically distinct features evident from the bathymetry data derived from multiple seismic surveys undertaken across this area (**Section 4.4**). |

Commonwealth marine environment report cards for the NMR have analysed and prioritised anthropogenic pressures on KEFs overlapping the operational area and EMBA (DSEWPaC, 2012d, 2012e). Relevant pressures identified in these reports for the KEFs overlapping the operational area are outlined in **Table 4-11**. Note no pressures identified were above the rating 'of less concern' as outlined in the reports (DSEWPaC, 2012d, 2012e).

*Table 4-11: Relevant pressures to key ecological features overlapping the operational area and environment that may be affected*

| Key Pressures identified in Commonwealth marine report card | Overlapping the Operational Area and the EMBA | | EP Risk Assessment Section |
|---|---|---|---|
| | Shelf break and slope of the Arafura Shelf | Carbonate bank and terrace system of the Van Diemen Rise | |
| Chemical pollution/contaminants – vessels and offshore mining operations | Not of concern | | **Sections 5.2.7**, **5.3.4**, **5.3.5**, **5.3.7**, **5.3.8** |
| Marine debris – vessels | Less concern | | **Section 5.3.3** |
| Noise pollution – vessels and offshore construction | Not of concern | | **Section 5.2.3** |
| Light pollution – vessels and offshore mining operations | Not of concern | | **Section 5.2.4** |
| Physical habitat modification – offshore construction and installation of infrastructure | Less concern | | **Section 5.2.2** |
| Oil pollution – oil rigs | Potential concern | Not of concern | **Section 5.3.7** |
| Invasive species – vessels | Less concern | | **Section 5.3.2** |

#### 4.5.6.2 Nationally important wetlands

No nationally important wetlands overlap the operational area and EMBA.

#### 4.5.6.3 Shoals and banks

No shoals or banks overlap the operational area; however, a number of these features overlap the EMBA (**Figure 4-8**, **Table 4-12**). Historically, relatively few studies have been undertaken of these features with most of the understanding derived from the Big Bank Shoals study (Heyward et al., 1997) and PTTEP surveys initiated in response to the Montara incident (Heyward et al., 2012, 2010). The regional shoal survey effort undertaken by AIMS for the Barossa marine studies program has contributed significantly to the understanding of these shoals/banks (Heyward et al., 2016).

Within the NMR, shoals/banks share a 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., 2016). There is a high level of connectivity between the shoals and banks within the NMR based on larval development rates of many of the species inhabiting the various shoals and banks, current speeds (commonly 20 to 30 km/day in mild weather) and the distance between shoals, banks and reefs (Heyward et al., 2016). The distribution of more than 150 shoal/bank features across the Sahul Shelf, with individual shoals/banks separated by 5 to 20 km, suggest an extensive series of 'stepping stone' habitats are available to recruit larvae and connect these ecosystems at ecological time scales (Heyward et al., 2016). This region also sits within the strong Indonesian throughflow, providing a source of larva from tropical benthic habitats within the region.

An analysis, undertaken by AIMS, of benthic communities surveyed in the Barossa marine studies program showed that neighbouring shoals and banks (i.e. within hundreds of kilometres) frequently share approximately more than 80% of benthic community composition (Heyward et al., 2016). The most influential determinants of the benthic community composition observed to date include depth and light intensity, substrate type and complexity, hydrodynamic environment and position on the continental shelf (Heyward et al., 2016). In addition, cycles of natural disturbance and subsequent founder effects may also explain some of the variability between shoals (Heyward et al., 2016). Therefore, each of the shoals/banks are likely to have the potential to support the same types of benthic habitats, dependent on extent of these underlying variables with variability driven by variation in the dominance of key habitats and species (Heyward et al., 2016). Some shoal/banks may be notable for the abundance of particular biota (in terms of abundance and relative contribution key taxa make to the benthic community), but that status can be dynamic with a larger number of common species being shared in common across the region (Heyward et al., 2016). While temporal datasets for the region's shoals and banks are limited, observed changes from year to year are consistent with responses to natural disturbances such as thermal stress events, storms and cyclones.

Therefore, at the regional scale, the shoals and banks all support comparable levels of biodiversity but may vary in the abundance and diversity of dominant benthic species, with subsets of species featuring more prominently on some than others (Heyward et al., 2016). Similarly, the associated fish fauna is highly diverse but variable between shoals and banks, being influenced by depth, substrate and exposure to prevailing weather, though with all shoals/banks sharing many species (Heyward et al., 2016).

The submerged features within the area are characterised by abrupt bathymetry, rising steeply from the surrounding outer continental shelf at depths of 100 to 200 m. The shoals and banks tend to flatten at depths of 40 to 50 m, with horizontal plateau areas of several square kilometres generally present at 20 to 30 m depths (Heyward et al., 2010). The shoals/banks support a diverse and varied range of benthic communities, including algae, reef-building soft corals, hard corals and filter-feeders (Heyward et al., 2011, 1997). The plateau areas were dominated by benthic primary producer habitat, with interspersed areas of sand and rubble patches (Heyward et al., 2011).

Heyward et al. (2016) reported that bare sand and consolidate reef, often supporting turfing algae, are major features of all shoals in the Timor Sea. It was also noted that hard corals and macroalgae, while ubiquitous, were variable in abundance with soft corals and sponges often forming key components of the benthos (Heyward et al., 2016). The plateau areas are generally dominated by benthic primary producers, with intersperse areas of sand and rubble paths (Heyward et al., 2011).

Shoals and banks that occur within the EMBA have been grouped into broad groups based on their geographical location. The broad shoal/bank groupings are summarised in **Table 4-12**. The nearest shoals/banks to the operational area include Mesquite Shoal, Goodrich Bank, Marie Shoal and Shepparton Shoal. Goodrich bank is 0.3 km from the operational area and the others are all located between 1 and 3 km from the boundary of the operational area (**Figure 4-8**).

Survey results from an AIMS seabed biodiversity survey in 2015 at two mid-shelf seabed locations adjacent to Goodrich Bank and Cape Helvetius (Heyward et al., 2016) can be used to provide some insight into the potential types of benthic habitats that may occur at the shoals/banks closest to the operational area. The benthic habitat surrounding Goodrich Bank supported sparse to moderate density filter feeders (dominated by small sponges) on areas of bare rock or sand covered pavement, with larger organisms observed on outcropping low relief reef or rocks. Hard corals were rare in the water surrounding Goodrich Bank and were only encountered at depths less than 30 m. The extended benthic habitat map produced by AIMS suggests benthic communities at Goodrich Bank are dominated by filter feeders, with areas of hard corals, gorgonians, burrower/crinoids and alcyons.

A survey was undertaken in 2010 by Geoscience Australia and AIMS to map the seabed environments of the Van Diemen Rise (Anderson et al., 2011). The survey involved towed-video transects at 77 sites to characterise the benthic habitats and epibenthos in the four geomorphic environments (banks, terraces, valleys and plains) within the Van Diemen Rise survey area 784 km$^2$. The shallow banks sampled within the contained complex benthic features with diverse and often dense epibenthic assemblages. A total of 175 video characterisations were recorded from 13 bank sampling sites in the study area and sample from depths of 10.5 to 54.3 m (mean depth of 34 m). The sites were characterised by mostly low-lying rock outcrops that supported hard corals (18% occurrence) and octocorals (99% occurrence) along with smaller colonies of bryozoa and ascidians (Anderson et al., 2011). The rocky outcrops were interspersed by small areas of coarse-grained soft sediments that were relatively barren and supported few organisms (Anderson et al., 2011).

The AIMS extended benthic habitat map shows that burrowers/crinoids and filter feeder communities are expected at Marie and Shepparton Shoals (**Figure 4-28**). Given the expected connectivity between shoal features, it is anticipated that the ecological characteristics of the shoals in proximity to the operational area are broadly consistent with the above description.

*Table 4-12: Shoals and banks within the environment that may be affected*

| Grouping | Name of shoal/bank (distance from operational area) |
|---|---|
| Timor Sea – Commonwealth waters | + Mesquite Shoal (2.1 km)<br>+ Marie Shoal (2.3 km)<br>+ Goodrich Bank (0.3 km)<br>+ Moss Shoal (7.8 km)<br>+ Lynedoch Bank (58.2 km)<br>+ Parry Shoal (24.7 km)<br>+ Flat Top Shoal (40.5 km)<br>+ Mermaid Shoal (14.6 km)<br>+ Evans Shoal (61 km) |
| Timor Sea – Beagle Gulf (NT coastal waters) | + Afghan Shoal (10 km)<br>+ Shepparton Shoal (0.9 km) |

## 4.6 Socio-economic and cultural environment

### 4.6.1 Heritage

**World Heritage Properties**

No World Heritage Properties fall within the boundaries of either the operational area and EMBA. The closest World Heritage Property is the Kakadu World Heritage place, approximately 280 km south-east of the operational area and outside the EMBA.

**National Heritage Places**

No Commonwealth Heritage Places fall within the boundaries of the operational area or EMBA.

**Commonwealth Heritage Places**

No Commonwealth Heritage Places fall within the boundaries of the operational area of EMBA.

### 4.6.2 Commonwealth marine area

The operational area and EMBA are located within the Commonwealth marine area, which includes any part of the sea, including the waters, seabed and airspace, within Australia's EEZ and/or over the continental shelf of Australia, that is not State or NT waters. The Commonwealth marine area stretches from three to 200 nautical miles (nm) from the coast.

### 4.6.3 Australian marine parks

The operational area passes through the Oceanic Shoals Marine Park and therefore the EMBA also overlaps this marine park (**Figure 4-35**). Australian Marine Parks are recognised under the EPBC Act for protecting and maintaining biological diversity and contributing to a national representative network of marine protected areas. Management plans for marine park networks came into force 1 July 2018. Under these plans Australian Marine Parks are allocated conservation objectives (IUCN Protected Area Category) based on the Australian IUCN reserve management principles in schedule 8 of the EPBC Regulations. These principles determine what activities are acceptable within a protected area under the EPBC Act.

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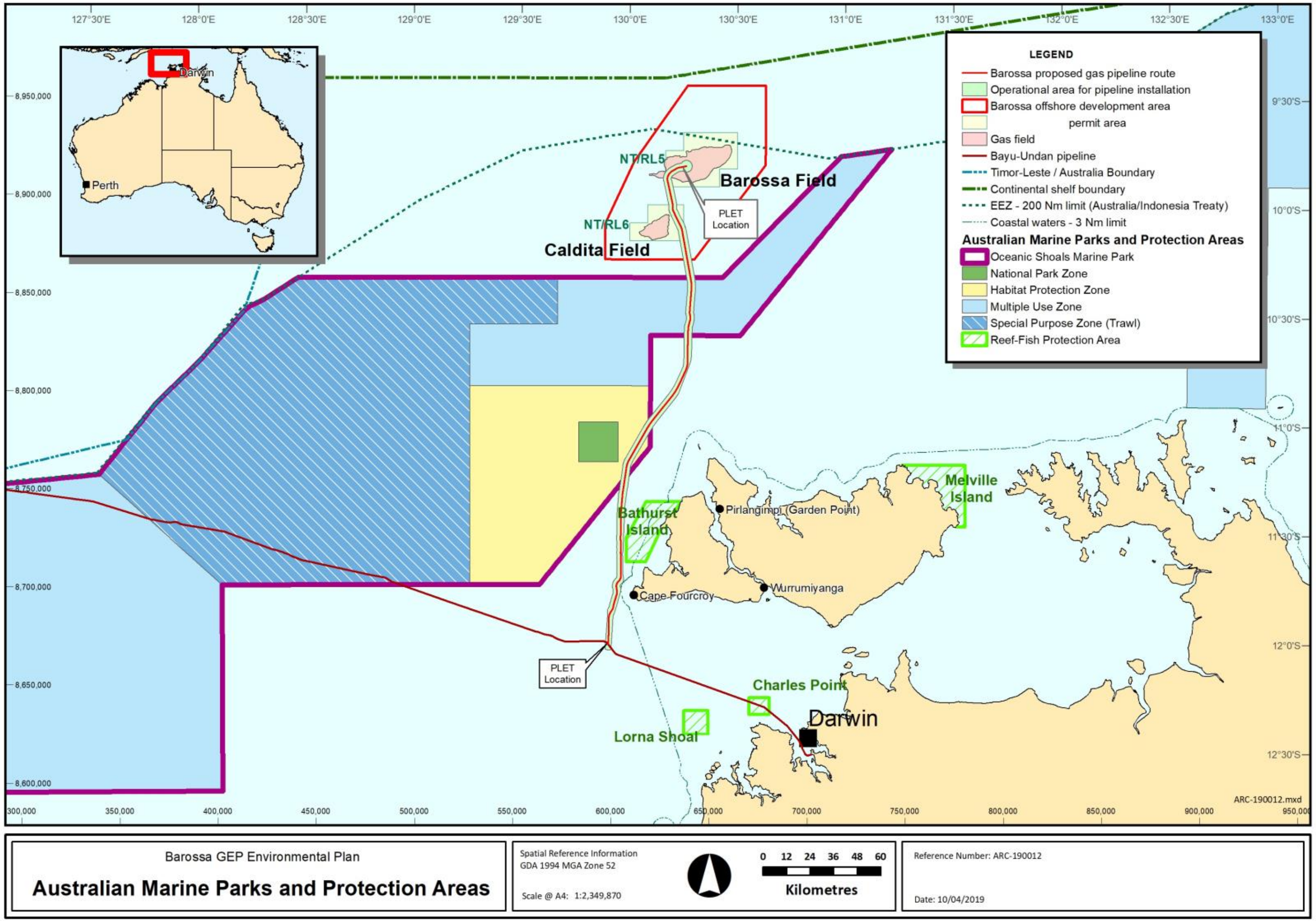



*Figure 4-35: Australian marine parks and protection areas*

#### 4.6.3.1 Oceanic Shoals Marine Park

The Oceanic Shoals Marine Park covers an area of 8,597 $km^2$ and is comprised of a Multiple Use Zone (VI), Special Purpose Zone (Trawl) (VI), National Park Zone (II) and Habitat Protection Zone (IV). The operational area overlaps Multiple Use (approximately 30 km) and Habitat Protection (approximately 31.5 km) Zones; however, the EMBA overlaps all zones comprising the Oceanic Shoals Marine Park.

Category VI (Multiple Use Zone – Managed resource protected area) are 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 (Director of National Parks, 2018).

Category IV (Habitat Protection Zone – Habitat/species management area) are 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 (Director of National Parks, 2018).

The Oceanic Shoals Marine Park is considered significant given it represents habitats, species and communities associated with the Northwest Shelf Transition Province, and includes four separate KEFs (see **Section 4.5.6.1**) (Director of National Parks, 2018). The Oceanic Shoals Marine Park is the largest Australian Marine Park within the North Marine Parks Network. The values of the Oceanic Shoals Marine Park (Director of National Parks, 2018) include:

+ threated and migratory marine species
+ BIAs for foraging and internesting marine turtles
+ Indigenous values for cultural identity health and wellbeing
+ commercial fishing and mining
+ Four KEFs which comprise features such as terraces, banks, channels, valleys and pinnacles which support benthic assemblages of sponges, soft coral, polychaetes, ascidians, sessile filter feeders, as well as diverse demersal fish species, turtles, snakes and sharks. These features also provide areas where local upwellings attract aggregations of fish, seabirds and turtles.

Benthic habitat modelling (Heyward et al., 2017; Radford et al., 2019) and field surveys (Radford et al., 2019) undertaken by AIMS within the Oceanic Shoals Marine Park identify benthic communities within the Oceanic Shoals Marine Park were broadly similar to benthic communities within the region (**Section 4.5.3**). Unconsolidated sediments were the most common benthic habitat type within the Oceanic Shoals Marine Park, with sparse filter feeding assemblages being the second most common habitat type (Radford et al., 2019). Benthic primary producers, such as corals, Halimeda spp. and macroalgae were restricted to relatively shallow areas (less than 30 m) within the marine park and comprised a small portion of overall benthic habitats. Sparse to moderate density filter feeders, dominated by small sponges, were observed on areas of bare or sand covered pavement, with larger organisms observed on outcropping low-relief reef or rocks where the seabed slope changed around the edge of deeper channels. In general, epibenthic biota was sparse and initial observations suggest the dominant species present are consistent with what has been observed during other surveys of similarly turbid waters in the region; e.g. Kelly & Prezlawski (2012).

AIMS also compared the proportion and diversity of habitats along the proposed pipeline route and broader pipeline corridor against the habitats in the Oceanic Shoals Marine Park (**Figure 4-36**, Radford et al., 2019). Statistical analysis revealed no significant difference between the proportion of habitats along the pipeline route (plus a 250 m buffer either side of the route) inside and outside the park. Generally, the habitats on the pipeline route were a proportional subset of the habitats found in the marine park and thus, any habitat present along the pipeline route in the marine park, including the Habitat Protection Zone (HPZ), is well represented elsewhere in the marine park.

Given the low presence of habitat types found along the proposed pipeline route, and as the pipeline route and the operational area (route plus 250 m buffer) is very narrow (i.e. limited data for analyses) analysis of diversity was undertaken using the pipeline corridor data (vs the pipeline route data) using a 10 sq km moving window Kernel (hotspot analysis). This analysis is considered conservative as the pipeline corridor includes a much larger area and has a greater habitat diversity compared to that of the proposed pipeline route making it more similar to the wider marine park. Despite this, the analysis showed that the marine park had a higher diversity of habitats than the pipeline corridor (suspected to largely be driven by water depth and topography characteristics, Heyward et al., 2017. While univariate statistical analysis suggested the difference in habitat diversity was not significant, Monte Carlo simulation (based on a random subset of data) suggests a 93% probability of significant difference between the habitat diversity in the marine park (higher diversity) and the pipeline corridor (lower diversity) (**Figure 4-37**). According to AIMS, Monte Carlo random subset data are likely to be more representative of the true nature of diversity because it is less biased to the distribution of habitat types within each area and bias due to the two areas being quite different in size (Radford et al., 2019).

It is worth noting that those areas within the pipeline corridor that have higher habitat diversity are located outside the marine park; e.g. at Goodrich Bank and Cape Helvetius (both of which AIMS had previously surveyed and reported on in Heyward et. al., 2017). Therefore, based on the targeted survey work and analyses undertaken by AIMS, the habitats present under both the proposed pipeline route and the wider pipeline corridor are well represented in both the HPZ and the wider marine park.

Fish diversity within the Oceanic Shoals is relatively low compared to other locations sampled in the Timor Sea (Radford et al., 2019). This is likely to reflect the absence of complex or rugose benthic habitats, which have been shown to support higher species richness (Radford et al., 2019). Analysis of baited remove underwater video systems (BRUVS) recordings within the Oceanic Shoals Marine Park highlighted the strong linage between benthic habitats and fish assemblage characteristics. The unconsolidated sediments hosted pelagic or mobile demersal species that were not closely associated with benthic habitats, such as sharks and trevallies. While relatively uncommon, commercially important demersal fishes such as snappers (*Lutjanidae*) and cod (*Serranidae*) were observed in filter feeder benthic habitats (Radford et al., 2019).

Indigenous values are discussed in **Section 4.6.6**.

### 4.6.4 Reef protection areas

Reef Protection Areas have been established in the NMR after stock analyses identified the downward trend of golden snapper and jewfish (Northern Territory Government, 2014). Two Reef Protection Areas overlap the EMBA, being the Bathurst Island and Lorna Shoal Reef Protection Areas (**Figure 4-35**). Bathurst Island and Lorna Shoal Reef Protection Areas are intended to protect fish stocks from overfishing (Northern Territory Government, 2014), and do not have conservation objectives relevant to activities outlined in this EP.

### 4.6.5 European heritage

A search of the Australian National Shipwreck Database (DoEE, n.d.) identified that there no listed historic shipwreck protection zones overlapping the operational area. Three listed shipwrecks exist within the EMBA, these being the I-124 submarine, SS Florence D and Don Isidro USAT. The SS Florence D is located approximately 9 km east of the operational area near the Tiwi Islands. The Don Isidro USAT is in shallow waters off the west coast of Bathurst Island and the I-124 submarine is south of Bathurst Island. No other areas of European heritage value were identified as occurring within or overlapping the operational area or EMBA.

A maritime archaeological heritage assessment was undertaken by Cosmos Archaeology (2022) who reviewed historical sources, databases, and marine geophysical information. The assessment concluded there are no located shipwrecks, aircraft wrecks, dump sites, maritime infrastructure or UXO within the study area, which was defined as a 500 m buffer around the GEP route. As recommended by Cosmos Archaeology, Santos will adhere to an Unexpected Finds Protocol (refer to Table 6-1).

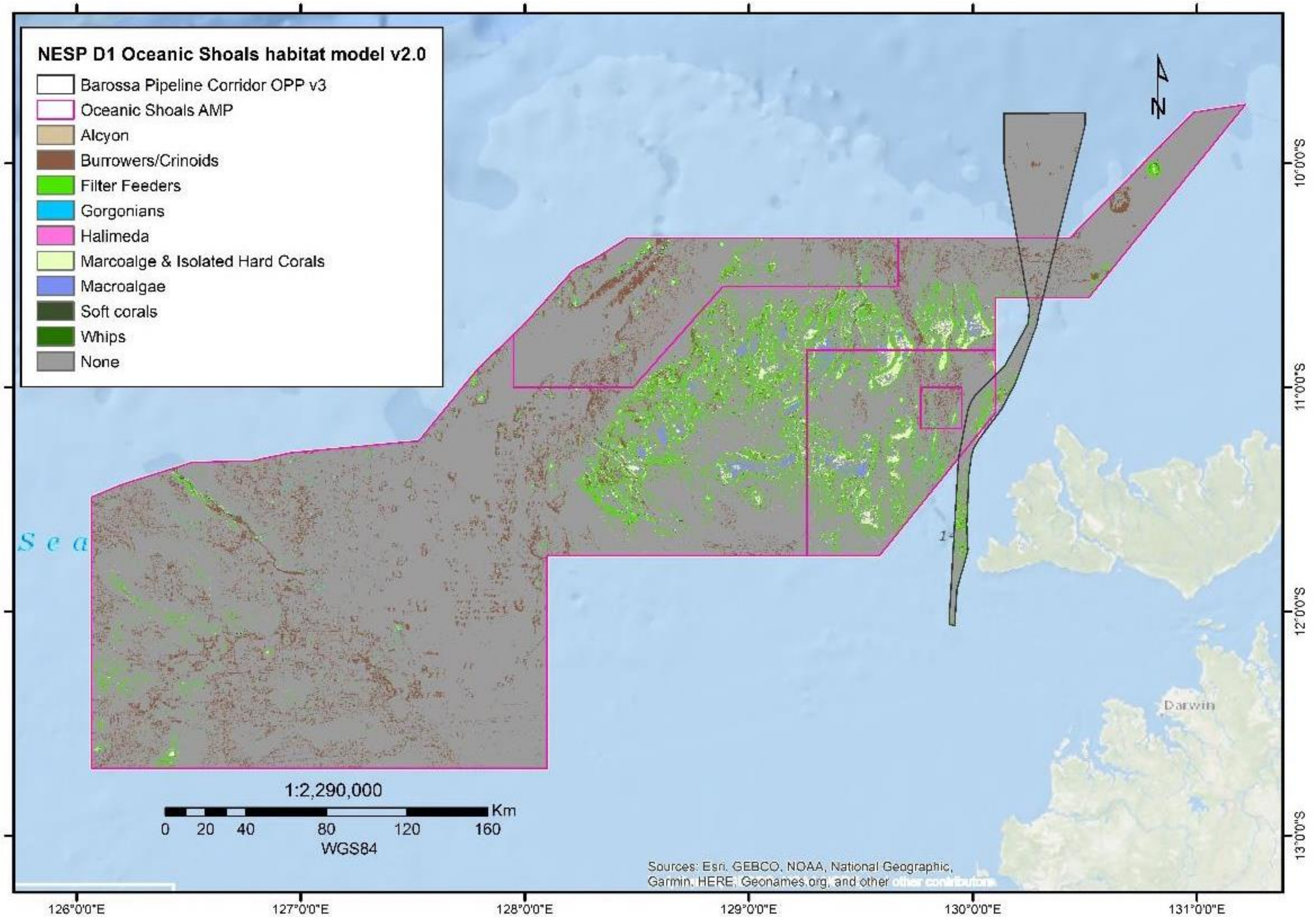



***Figure 4-36: Map showing the habitat types found in the Oceanic Shoals Marine Park and the Barossa pipeline corridor (revised from Radford et al., 2019). The pipeline corridor was used for the analysis given the low presence of habitat types along the pipeline route and as the pipeline route and the operational area is very narrow.***

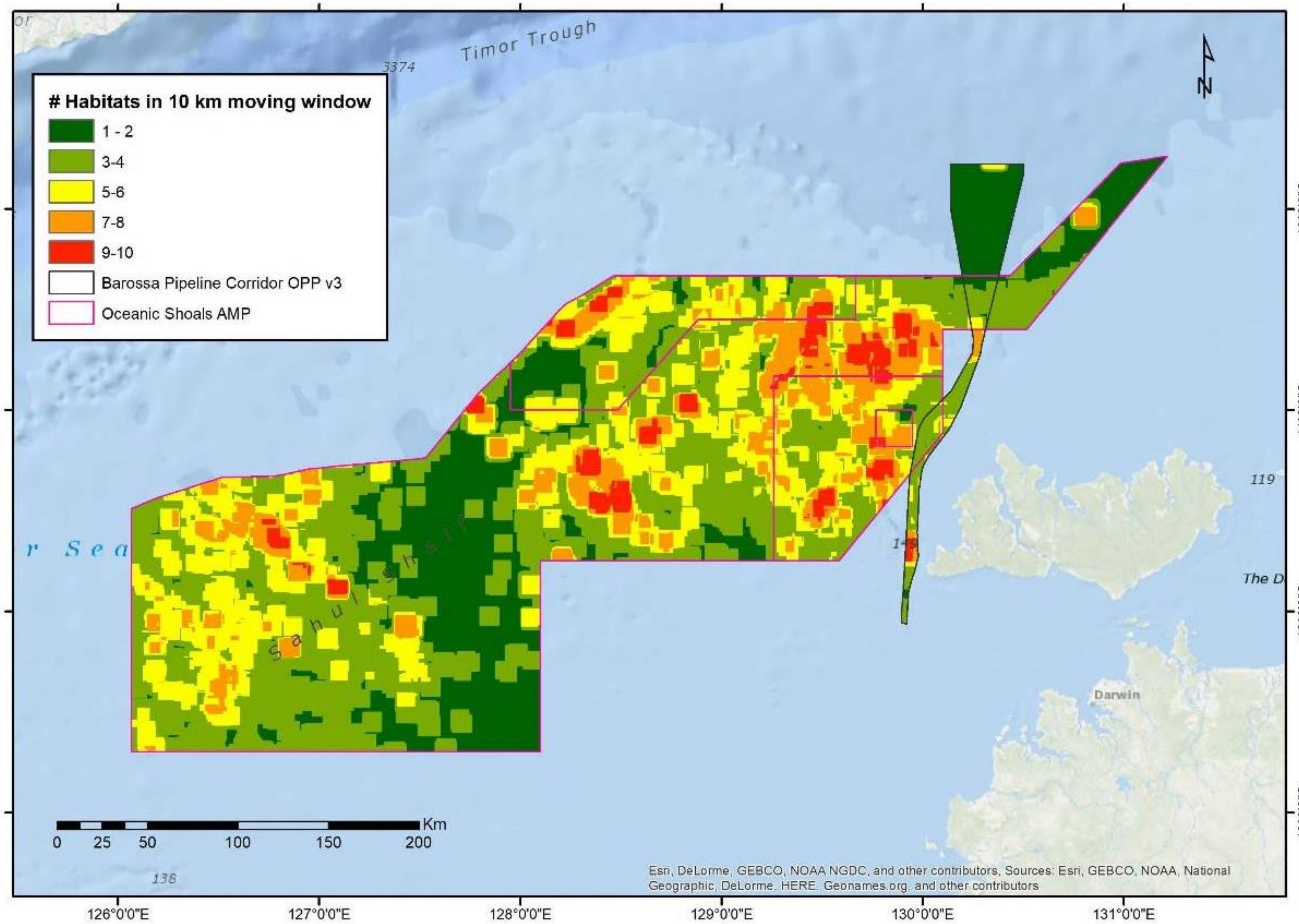



*Figure 4-37: Comparison of habitat diversity between the Oceanic Shoals Marine Park and the Barossa pipeline corridor. Map shows the number of habitats found in a 10 sq km moving window (presented in Radford et al., 2019). The pipeline corridor was used for the analysis given the low presence of habitat types along the pipeline route and as the pipeline route and the operational area is very narrow.*

## 4.6.6 Aboriginal heritage

### 4.6.6.1 Aboriginal spiritual and cultural heritage sites

There are no recorded Indigenous heritage sites within the operational area. The Tiwi Islands are a declared Aboriginal reserve and comprise a number of protected sacred sites under the *Northern Territory Aboriginal Sacred Sites Act*. Traditional practices (including fishing, which is addressed in **Section 4.6.8**) continue to take place on the islands. Most traditional fishing occurs within 3 nm of the shoreline.

A mapping exercise has been undertaken in collaboration with the Tiwi Island Land Council to identify environmental and socioeconomic values along the Tiwi Islands coastline (ConocoPhillips, 2019). The mapping exercise focussed on the northern, western and southern coastlines of the Tiwi Islands (within the EMBA). It included an initial desktop exercise to identify publicly available environmental, social, cultural and economic data sets. Preliminary maps were developed based on these datasets, and these maps were used during stakeholder engagement workshops held with Tiwi Islanders.

Two workshops were held, the objectives of which were to verify the preliminary maps and to gain a more thorough understanding of the environmental, social, cultural and economic sensitivities of the coastlines. Final maps were then developed and presented to the Tiwi Island Land Council.

The sensitivity mapping identified Aboriginal heritage sites along the northern, western and southern coastlines of the Tiwi Islands, including areas used for food collection, sacred sites, camping sites and a dreaming site. These coastlines are within the EMBA but outside the operational area.

In 2023, Santos commissioned an independent expert anthropologist, Dr Brendan Corrigan, to "*undertake and complete an assessment to identify any underwater cultural heritage places"* along the GEP route to which *"people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the future activities covered by the EP."* (NOPSEMA General Direction No. 1898 dated 13 January 2023.)

Dr Corrigan, having considered the information he obtained from the Tiwi people and relevant organisations, including the Aboriginal Areas Protection Authority, Tiwi Land Council and Northern Land Council, determined that there are no specific underwater cultural heritage places that have spiritual or cultural connections for the Tiwi people along the GEP route that may be affected by the activities covered by the EP (Corrigan, 2023).

### 4.6.6.2 Intangible Aboriginal spiritual and cultural heritage

Santos acknowledges the importance of the First Nations people of Australia to their lands and waters, including sea country.

Santos acknowledges that Tiwi Islands people maintain a continuing spiritual connection with sea country, and that sea country is valued by First Nations for cultural identity, health and wellbeing. While Dr Corrigan identified no specific "underwater cultural heritage places" along the pipeline route that may be affected by the activities under the GEP EP, his assessment identified that some Tiwi Islanders had "tradition, spiritual and cultural connections" to the sea country (the seas and seabed) surrounding the Tiwi Islands.

The intangible cultural and spiritual heritage recorded by Dr Corrigan included the following:

+ Ampitji (rainbow serpent) who some Tiwi Islanders said travels in the sea in the vicinity of the islands and the GEP EP and may disturbed by the laying of the pipeline, causing spiritual and physical harm to the Tiwi people. Some Tiwi Islanders said Ampitji travels within the waterholes of the island and surrounding the Tiwi Islands, others advised they do not believe Ampitji go into sea waters and restrict themselves to fresh water. Dr Corrigan accepted that Ampitji exists in the sea country surrounding the Tiwi Islands.

- Jirakupai (crocodile man) who patrols various waters in the vicinity of a cave on the sea water edge of Cape Fourcroy. Some Tiwi informants advised Dr Corrigan of other spirit crocodile beings who inhabit the seas in other parts of the Tiwi Islands.
- Imunka, the spiritual essence connected to all things. Some Tiwi Islanders believe Imunka would be affected by the proposed GEP, but this proposition was rejected by a wide range of Tiwi Islanders. On balance, Dr Corrigan rejected the proposition that the Imunka force is present in the sea and seabed in the vicinity of the proposed GEP.

Views as to the extent of these intangible cultural heritage features, and the impact the proposed pipeline would have on those features, differed among the Tiwi Islanders interviewed by Dr Corrigan, including the seven clients of the Environmental Defenders Office.

### 4.6.7 Commercial fisheries

The Timor and Arafura seas support a variety of shark, pelagic finfish and crustacean species of commercial importance. The operational area and EMBA overlap one Commonwealth and five NT managed fisheries areas which are listed below and described in **Table 4-13**, **Figure 4-38** and **Figure 4-39**:

- Commonwealth managed fisheries:
  - Northern Prawn Fishery.
- NT managed fisheries:
  - Demersal Fishery
  - Coastal Line Fishery
  - Offshore Net and Line Fishery
  - Spanish Mackerel Fishery
  - Timor Reef Fishery.

Three Commonwealth fisheries were excluded from the assessment, given the fishery is either inactive or does not operate within or in close proximity to the operational area and EMBA: the Western Tuna and Billfish Fishery, the Western Skipjack Fishery and the Southern Bluefin Tuna Fishery.

Consultation with the Australian Fisheries Management Association (AFMA), NT Department of Primary Industry and Resource (Fisheries) and appropriate fisheries associations and license holders are discussed in **Section 7.11.8**. Records of consultations are provided in **Appendix E**.

*Table 4-13: Commercial fisheries overlapping the operational area and environment that may be affected*

| Commercial Fishery | Description |
|---|---|
| *Commonwealth Managed* | |
| Northern Prawn Fishery | The Northern Prawn Fishery management area extends over the Australia's northern coast, between Cape York in QLD and Cape Londonderry in WA, from the low water mark to the outer edge of the Australian Fishing Zone (AFZ) (Patterson et al., 2016). The majority of the fishing effort within the Northern Prawn Fishery occurs in the area of the Gulf of Carpentaria, Joseph Bonaparte Gulf and along the Arnhem Land coast (Patterson et al., 2016). The highest catches come from areas adjacent to mangrove forests and coastal seagrass beds, which are juvenile nursery areas for target species of the fishery. The key target species are banana prawns, tiger prawns and endeavour prawns.<br>Fishing is conducted using bottom trawl nets and is managed through a number of standard fishery controls (Patterson et al., 2016). All vessels use electronic navigational aids including echo sounders and GPS systems and are required to have a vessel monitoring system installed (Laird, 2018). There are two fishing seasons, with the season end date dependent on catch rates (Laird, 2018):<br>+ Season 1 (mainly banana prawns caught): 1 April to 15 June<br>+ Season 2 (mainly tiger prawns caught): 1 August to 1 December.<br>The total NPF prawn catch for 2018 was 6,763 tonnes compared to 6,545 tonnes in 2017 (Laird, 2019). Catch and effort is partitioned into 15 statistical areas. The operational area lies within the defined Melville catch and effort area (Laird, 2019). Catch in this area for 2018 decreased from 2017 levels for banana prawns (509 to 287 tonnes) and increased for tiger and endeavour prawns (11 to 79 tonnes and 10 to 80 tonnes, respectively) (Laird, 2019). Effort for banana prawns decreased (408 to 288 days) while the combined effort for tiger and endeavour prawns increased from 66 to 262 days (Laird, 2019). The fishery is expected to be active around the operational area and wider EMBA during the permitted fishing seasons. |
| *NT Managed* | |
| Demersal Fishery | The Demersal Fishery boundary extends 15 nm from the NT coastal waters mark to the outer limit of the AFZ, excluding the area of the Timor Reef Fishery. The fishery employs trawl, hand and drop lines, and trap fishing methods. The main target species of the fishery are red snapper, goldband snapper, saddletail snapper, and crimson snapper. There are currently 18 licences issued for the fishery and it is managed through a number of standard fishery controls (Northern Territory Government, 2017a).<br>Within the fishery the majority of the effort occurs in deep offshore water, beyond the limit of most recreational fishers (Northern Territory Government, 2017b); the majority of effort occurs along the eastern boundary of the Timor Reef fishery in water depths of 80-100 m, to the east of the operational area (DEH, 2004). As such there is only a low potential for fishing to occur within the operational area but is expected to occur within the EMBA. |
| Coastal Line Fishery | The Coastal Line fishery extends 15 nm from the low water mark and covers the entire NT coastline. The fishery is divided into two zones, which divide the coastline at Vashon Head on the Cobourg Peninsula (Northern Territory Government, 2017a). The majority of fishing effort is focused around rocky reefs within 150 km of Darwin where black jewfish are targeted using mainly hook and line gear (Northern Territory Government, 2017a). Fish traps and droplines are also permitted beyond 2 nm from the coastline in the Eastern Zone of the fishery, and gillnets with a maximum drop of 5 m are also permitted (Northern Territory Government, 2017b). Catch from droplines and traps account for less than 7% of the total reported catch (Northern Territory Government, 2017a).<br>Given activity within the Coastal Line Fishery is concentrated in nearshore water, there is only low potential for fishing to occur within the operational area (within the southern extent of the area) but will take place within areas of the EMBA. |

| Commercial Fishery | Description |
| --- | --- |
| Offshore Net and Line Fishery | The Offshore Net and Line Fishery covers an area of over 522,000 $km^2$ and extends from the NT high water mark to the boundary of the AFZ (Northern Territory Government, 2017b). New management arrangements were implemented in 17 December 2018 to improve sustainability of the fishery (Department of Primary Industry and Resources, 2018).<br>The fishery permits both pelagic gillnets and longline gear and targets Australian and common blacktip sharks, spot tail sharks and grey mackerel; however, longlines have not been used since 2013 due to a drop in shark fin price (Northern Territory Government, 2017a). The majority of the fishing effort is in the coastal zone (within 12 nm of the coast) and immediately offshore in the Gulf of Carpentaria (Northern Territory Government, 2018). Limited effort is undertaken in the outer offshore area of the fishery.<br>The number of licences for the fishery is restricted to 17 and generally 11 licences are active in any given year (Northern Territory Government, 2017b). In 2015 there were 588 boat-days of fishing recorded, a significant decrease from 861 boat-days in 2012 and the peak of 1,538 in 2003 (i.e. before the introduction of precautionary fishing measures) (Northern Territory Government, 2017a). It is likely fishing will occur within the EMBA; however, the majority of the fishing effort is outside of the operational area. Stakeholder consultation identified one licence holder that may fish off the south-west end of the Tiwi Islands for small pelagic fish. |
| Spanish Mackerel Fishery | The Spanish Mackerel Fishery extends from the NT waters seaward off the coast and river mouths to the outer limit of the AFZ (Northern Territory Government, 2017a). The fishery employs troll lines, floating handlines and rods. The majority of the fishing effort occurs in the vicinity of reefs, headlands and shoals and includes waters near Bathurst Island, New Year Island, the Wessel Islands around to Groote Eylandt and the Sir Edward Pellew Group of islands (Northern Territory Government, 2017a). The target species of the fishery is the narrow-barred Spanish mackerel, however a small number of other mackerels are also taken.<br>In 2012, there were 16 fishery licences of which 12 were actively operating. The 2012 fishing effort was 719 boat-days; a decrease from 813 boat-days in 2011 but an increase from the 672 boat-days in 2010. Currently the fishery is restricted to 15 licences (Northern Territory Government, 2017a), and boat-days and spatial fishing intensity data have not been reported for recent years. Stakeholders have advised that there is the potential for fishing to occur within this area (**Section 7.11.8**; mainly within the southern extent of the operational area near banks/shoals), however fishing is likely to occur within the EMBA, particularly in waters off Bathurst Island. |

| Commercial Fishery | Description |
|---|---|
| Timor Reef Fishery | The Timor Reef Fishery operates in remote offshore waters in the Timor Sea in a defined area approximately 370 km north-west of Darwin. The fishery extends north-west of Darwin to the WA-NT border and to the outer limit of the AFZ and covers an area of approximately 28,811 $km^2$ (Northern Territory Government, 2017b).<br>The target species is goldband snapper, with other tropical snappers such as crimson snapper and saddletail snapper also consisting part of the catch. The majority of the fishing effort is undertaken using drop-lines and occurs primarily in the 100 to 200 m depth range. Data for the period 1995 to 2004 shows that the highest commercial productivity for drop-line catch is very localised and is predominately associated with the shelf geomorphic unit, in the 110 to 120 m depth range (Lloyd and Puig, 2009). The fishery overlaps the northern section of the operational area and EMBA.<br>There is no closed season for the Timor Reef Fishery, but normally, it is most productive between October and May. There is less activity during the dry season months of June to August when strong northerly winds often prevent fishermen going to sea. There are currently 15 licences issued for the fishery (DPIF, 2015) and only two active fishers currently operate in the fishery.<br>One fisher uses traps to target goldband snapper in water depths between 80 to 150 m (maximum of 250 m) along reef fronts and on sand flats located near pinnacles. The other active license holder is currently using trawl gear as part of a gear trial. Given the water depths where fishing takes place is consistent with sections of the operational area that overlaps the fishery, there is potential for fishing to occur within this area and within the EMBA. |

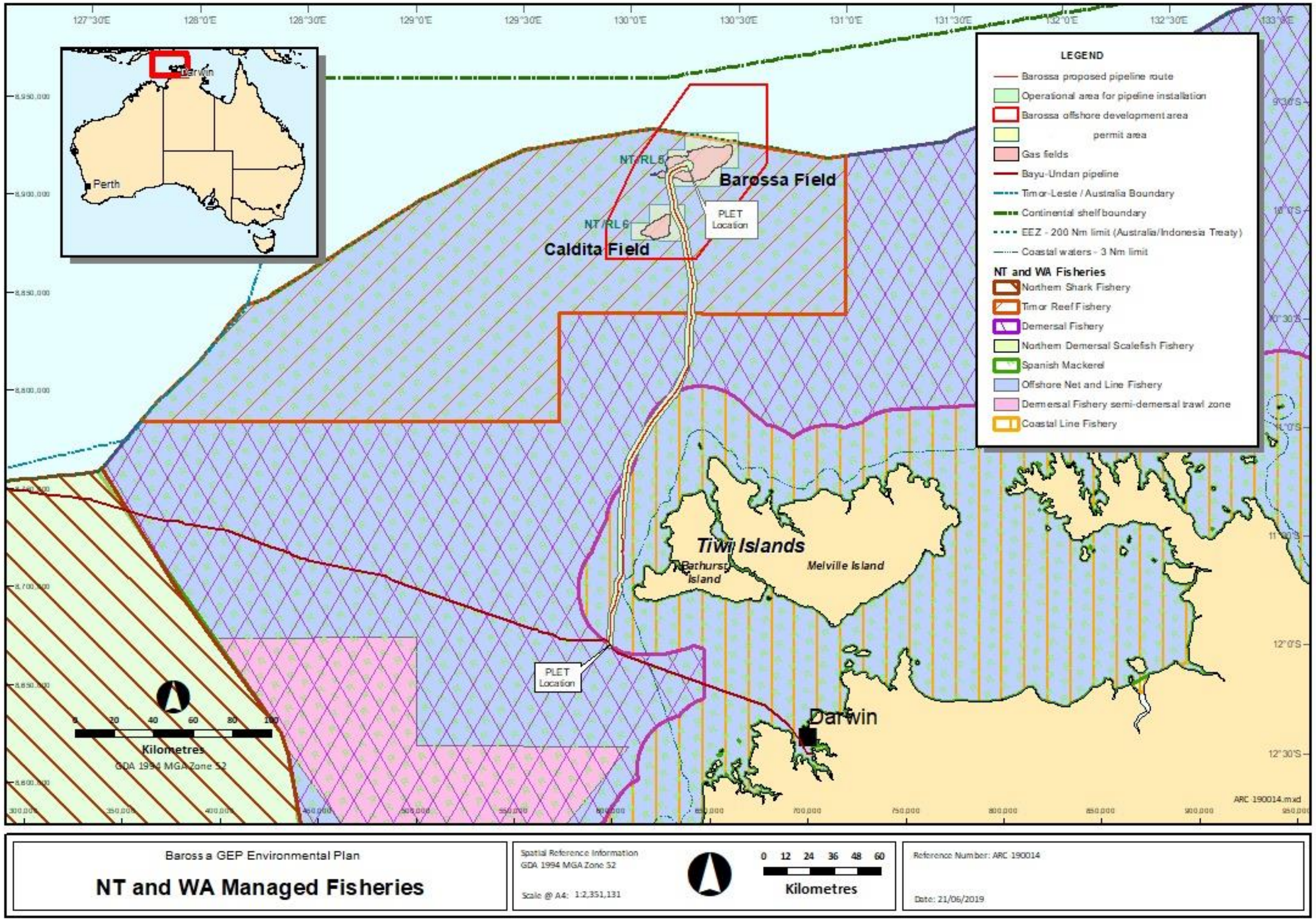



*Figure 4-38: Northern Territory and Western Australian State managed fisheries*

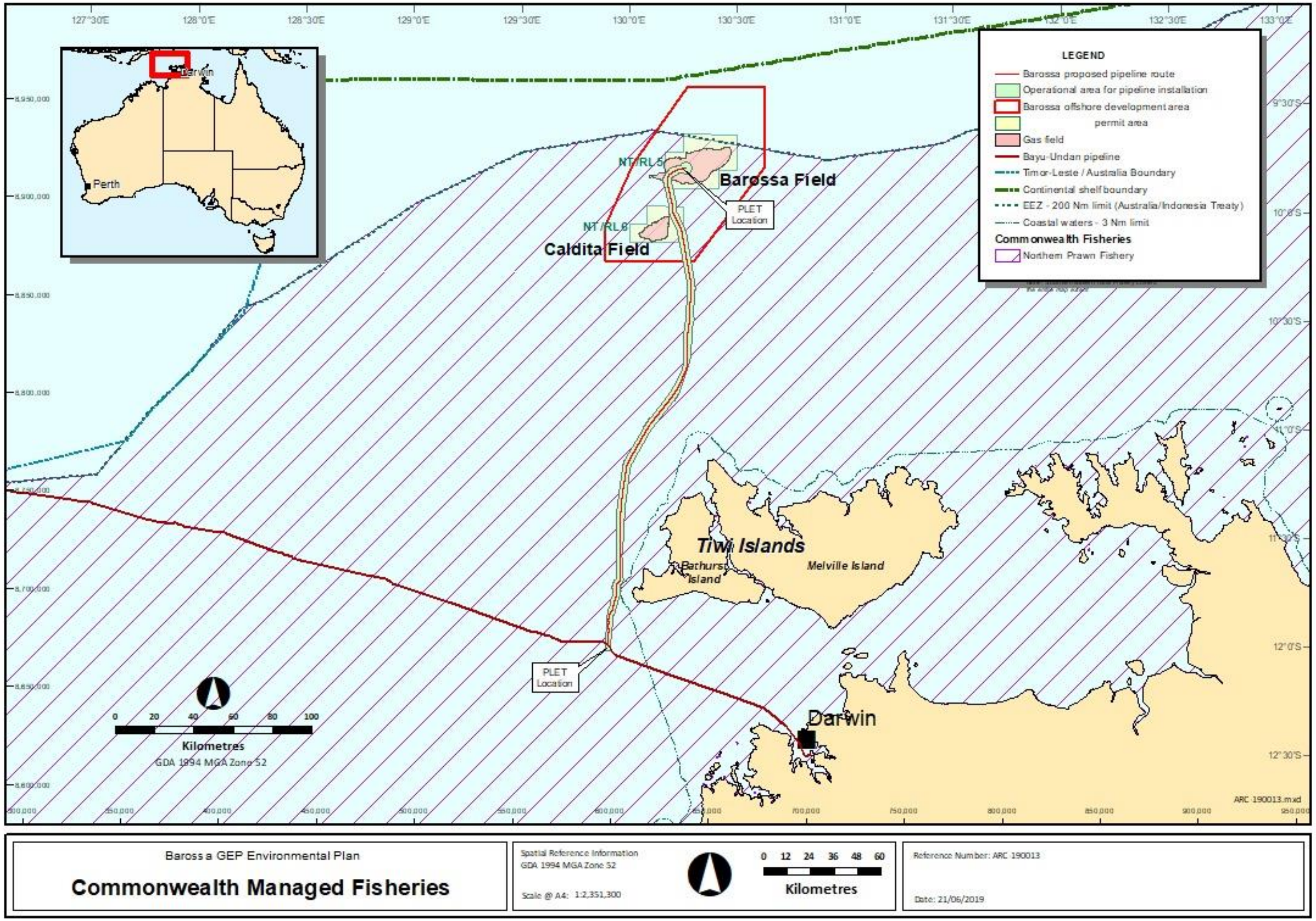



*Figure 4-39: Commonwealth managed fisheries*

### 4.6.8 Traditional fishing

Traditional Aboriginal fishing in NT waters predominately occurs within inshore tidal waters. Approximately 85% of NT's inter-tidal zone is recognised as Aboriginal land under the *Aboriginal Land Rights (Northern Territory) Act* (Department of Primary Industries and Fisheries, n.d.). In the NT, there are three generally recognised Aboriginal fishery zones, which extend to 3, 15, and 200 nm from the coast. Almost all Aboriginal fishing effort is concentrated within the 3 nm NT coastal waters boundary (93%), with fishing spanning the entire coastline (Northern Territory Government, 2017a) and is mostly focused around the Tiwi Islands. Sensitivity mapping carried out with the Tiwi Islanders (ConocoPhillips, 2019) indicated that Aboriginal activities within the coastal area of the Tiwi Islands includes, fishing, hunting (turtles and dugongs) and gathering (e.g. turtle eggs).

Indonesian and East Timorese traditional fishermen generally fish in the Timor Sea, usually in the vicinity of the Hibernia Reef (more than 700 km west of the operational area) and further south. Fishing occurs from April to December, with most activity occurring in September and October. The Big Bank shoals lie in the Indonesian Exclusive Economic Zone and Indonesian commercial vessels may fish in and around the shoals (Heyward et al., 1997). Species that are likely to be targeted by Indonesian fishers are shark, tuna, mackerel and reef fish such as snapper.

### 4.6.9 Tourism and recreational activities

During the 2016-17 financial year, more than 900,000 people visited the NT, with more than 400,000 of those designated holiday visitors (Department of Tourism and Culture, 2017). Within the NT tourism and recreation are a primary industry, particularly recreational fishing. The amount spent by tourists and locals on recreational fishing in the NT is estimated at nearly $35 million per year (INPEX Browse, 2010). This number excludes fishing-tour operators and therefore is likely to be much higher. Eighty-one per cent of recreational fishing occurs in marine waters, with the majority taking place in estuaries (54%), followed by inshore (22%) and offshore regions (15%) (West et al., 2012). Recreational catch is predominately mud crabs, barramundi and saddletail/crimson snapper (West et al., 2012).

Scuba diving is also a significant tourist attraction in the NT, with operators visiting the numerous shipwrecks, coral reefs and artificial reefs and embarking on day or multiday trips out to offshore islands and shoals in the region (INPEX Browse, 2010). The Tiwi Islands are a popular tourist destination offering cruises, fishing, sailing and water tours among other cultural activities. It was identified, during stakeholder consultation, that both recreational fishers and tourism operators use the southern section of the pipeline route. Tourism and recreational activities are likely to be more concentrated within coastal waters of the EMBA, but activities such as deep-water fishing and diving around offshore shoals and reefs may potentially take place in offshore areas of the EMBA and within the operational area; however, these activities will be limited and infrequent.

### 4.6.10 Aquaculture

There are no known open-water aquaculture activities occurring within the operational area or EMBA; however, there are government initiatives to encourage the development of aquaculture, particularly within Aboriginal communities (Northern Territory Government, 2017c). Should these be developed they are likely to be located within NT coastal waters (outside the EMBA).

### 4.6.11 Ports and commercial shipping

Darwin Port is a major shipping port in Australia. In 2014/15, there were a total 1,565 vessel calls to port (Ports Australia, 2016).

Darwin Port is also a major port of call for vessels servicing operations offshore from north-west Australia. The main preferred shipping routes that occur within the EMBA area are between Darwin and ports in South-East Asia. Average vessel displacements and speeds for shipping vessels transiting the EMBA and operational area include:

+ bulk carriers averaging 55,300 tonnes with speeds of 14 knots
+ livestock carriers averaging 2,800 tonnes with speeds of 12 knots

- general cargo vessels averaging 4,900 tonnes with speeds of approximately 12 knots.

Although Darwin Port remains the primary active port in the region, there is small-scale port activity to the south and east of the operational area, at the Tiwi Islands (**Figure 4-40**). Port Melville is located on Melville Island (122 km north of Darwin) and is situated on the Apsley Strait, immediately south of Parlow Point and the community of Pirlangimpi. The wharf infrastructure at Port Melville was constructed in 2013. Total projected monthly vessel movements (excluding pilot vessels) in 2015 is 23, increasing to 28.5 in 2019; however, this is subject to commercial arrangements in support of the plantation export and other future uses.

### 4.6.12 Offshore petroleum exploration and operations

Offshore petroleum projects in operation within the NMR include the Northern Endeavour FPSO (operated by Northern Oil and Gas) and the Bayu-Undan process facility (operated by Santos), both of which are outside the EMBA. No facilities are currently operating within the EMBA. There is considerable exploration activity within the NMR.

### 4.6.13 Defence activities

The EMBA intersects a practice area of the North Australian Exercise Area (NAXA), a maritime military zone administered by the Department of Defence (**Figure 4-41**). The NAXA comprises practice and training areas and extends approximately 300 km north and west from just east of Darwin into the Arafura Sea. The area is used for offshore naval exercises and onshore weapon-firing training.

The Australian Border Force also undertake civil and maritime surveillance (and enforcement) in Australian offshore maritime waters, which includes the EEZ. During their surveillance, Australian Border Force vessels may transit the operational area and EMBA.

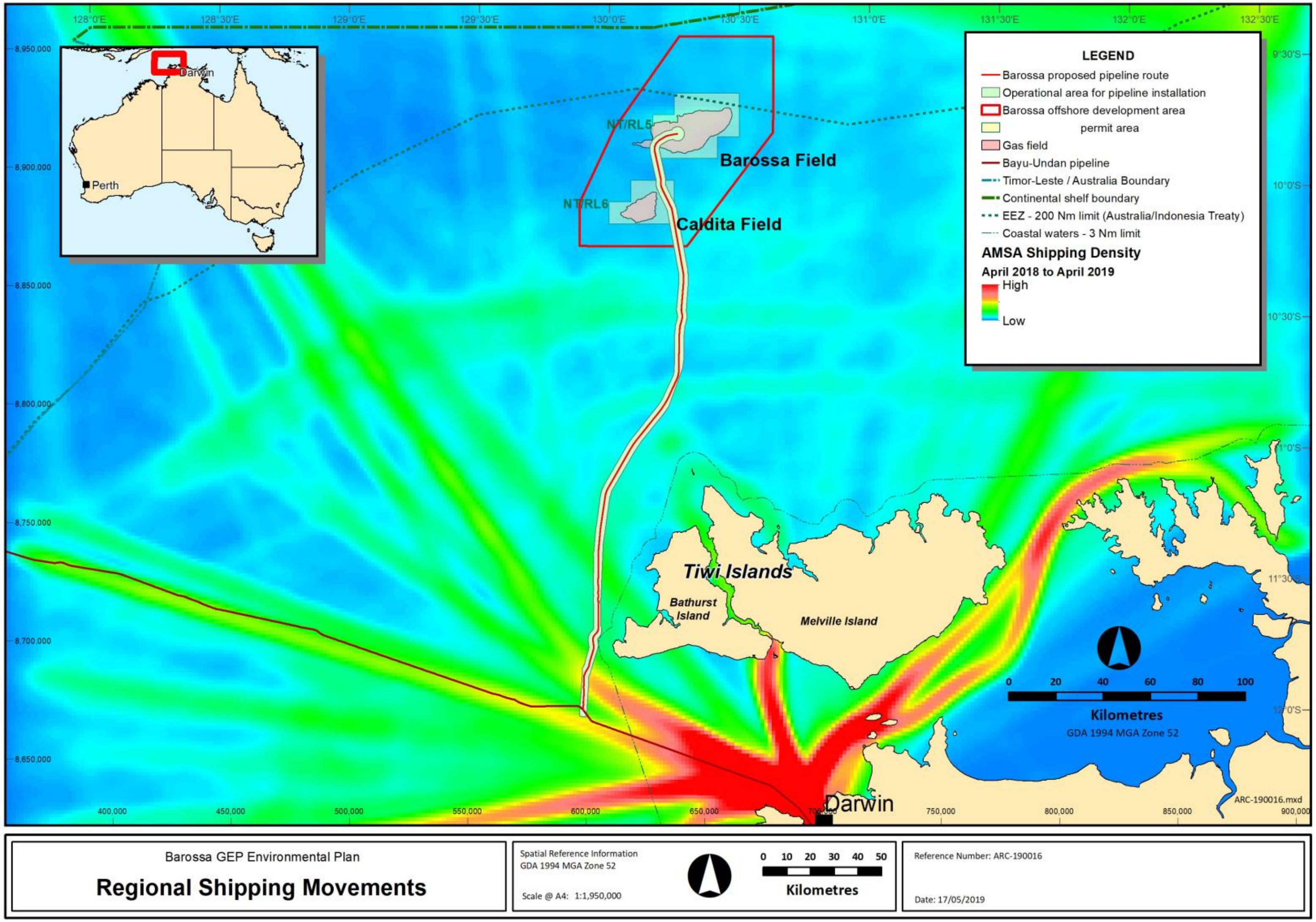



*Figure 4-40: Regional shipping traffic near the operational area and environment that may be affected*

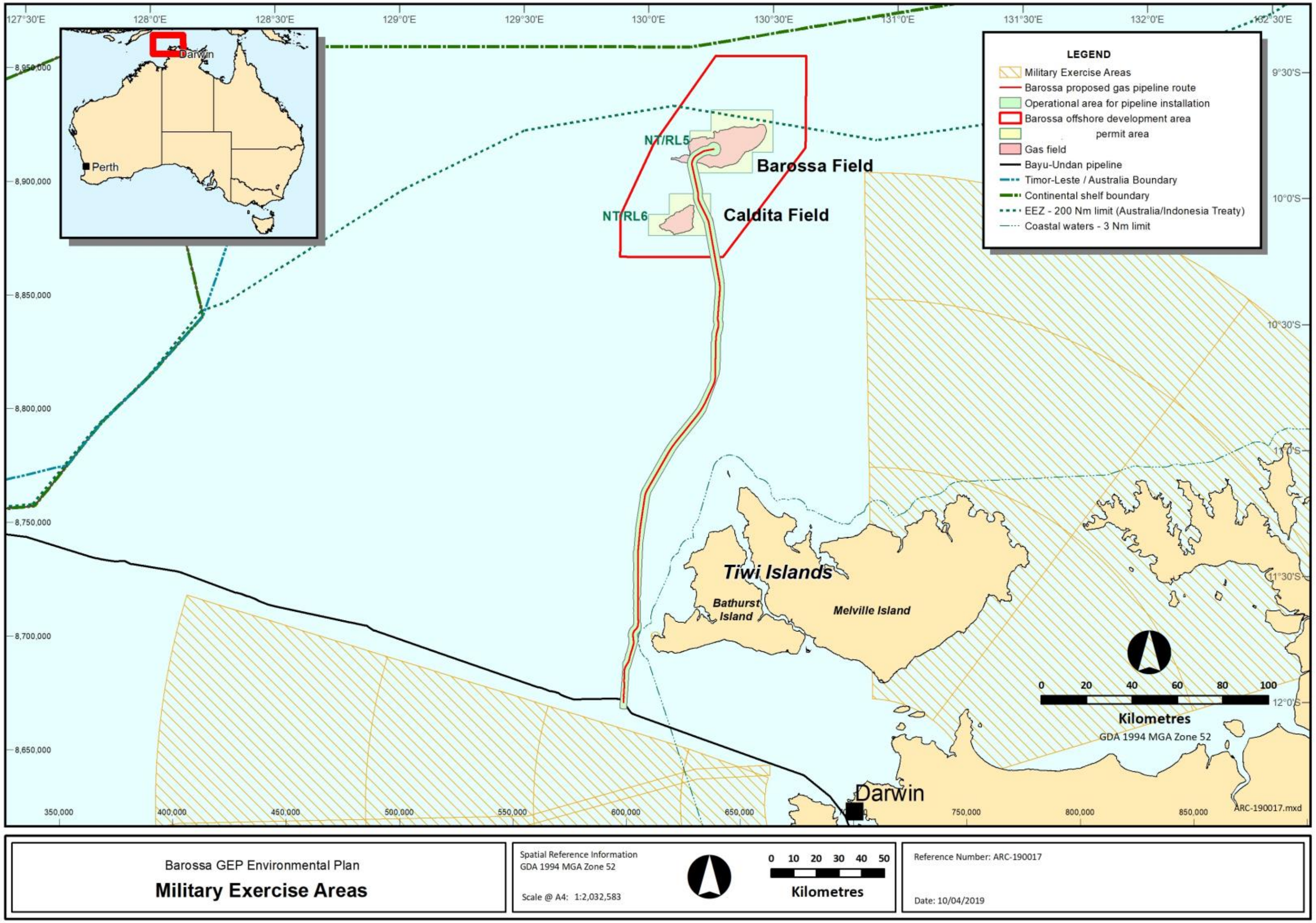



*Figure 4-41: Military exercise areas*

# 5. Description of environmental risks and impacts

## 5.1 Risk assessment process

### 5.1.1 Overview

In accordance with Regulation 13(5) and 13(6) of the OPGGS (E) Regulations, this section describes the environmental risks and impacts associated with the activity (including potential emergency situations).

Environmental impact and risk assessment refers to a process whereby planned and unplanned events that will or may occur during an activity are quantitatively and qualitatively assessed for their impacts on the environment (physical, biological, and socio-economic) at a defined location and specified period of time. In addition, unplanned events are assessed on the basis of their likelihood of occurrence which contributes to their level of risk.

Santos has performed environmental impact and risk assessments for the planned events (including any routine, non-routine and contingency activities) and unplanned events in accordance with the OPGGS(E)R.

Provided in this section of the EP is information relating to the environmental impact and risk assessment approach, specifically:

+ terminology used
+ summary of the approach.

A full description of the process applied in identifying, analysing and evaluating the impacts and risks relating to the planned activity is documented in Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004_5).

### 5.1.2 Impact and risk assessment terminology

Common terms applied during the impact and risk assessment process, and used in this EP, are defined in **Table 5-1**. For a more comprehensive listing of the terms and definitions used in environmental impact and risk assessment, refer to Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004_5).

***Table 5-1: Impact and risk assessment terms***

| Term | Definition |
|---|---|
| Acceptability | Determined for both impacts and risks. Acceptability of events is in part determined by the consequence of the impact following management controls. Acceptability of unplanned events is in part determined from its risk ranking following management controls. For both impacts and risks, acceptability is also determined from a demonstration of the ALARP principle, consistency with Santos Policies, consistency with all applicable legislation and consideration of relevant stakeholder consultation when determining management controls. |
| Activity | Specific tasks and actions performed throughout the life cycle of oil and gas exploration, production and decommissioning. |
| ALARP | As Low As Reasonably Practicable.<br>The term refers to reducing risk to a level that is As Low As Reasonably Practicable. In practice, this means showing through reasoned and supported arguments, that there are no other practicable options that could reasonably be adopted to reduce risks further. |
| Authorised Person | Person with authority to make the decision or take the action. Examples are Vessel Master, Field Superintendent, Supervisor, Person-in-charge, Company Authorised Representative, and Project Manager. |
| Control measure | Means a system, an item of equipment, a person or a procedure, that is used as a basis for managing environmental impacts and risks. |

| Term | Definition |
|---|---|
| Environment | Includes the natural and socio-economic values and sensitivities which will or may be affected by the activity.<br>Is defined by NOPSEMA and DMIRS as:<br>(a) ecosystems and their constituent parts, including people and communities<br>(b) natural and physical resources<br>(c) the qualities and characteristics of locations, places and areas<br>(d) the heritage value of places<br>(e) the social, economic and cultural features of the matters mentioned in paragraphs (a), (b), (c) and (d). |
| Environmental consequence | A consequence is the outcome of an event affecting objectives.<br>Note 1 An event can be one or more occurrences and can have several cases.<br>Note 2 An event can consist of something not happening.<br>(Reference ISO 73:2009 Risk Vocabulary) |
| Environmental impact | Defined by NOPSEMA as any change to the environment, whether adverse or beneficial, wholly or partly resulting from a planned or unplanned event1.<br>Defined by DMIRS as any change to the environment, whether adverse or beneficial, that wholly or partly results from a petroleum activity of an operator. |
| ENVID | Environmental hazard identification workshop. |
| Environmental risk | Applies to unplanned events. Risk is a function of the likelihood of the unplanned event occurring and the consequence of the environmental impact that arises from that event. |
| Hazard | A situation with the potential to cause harm. |
| Grossly disproportionate | Where the sacrifice (cost and effort) of implementing a control measure (CM) to reduce impact or risk, grossly exceeds the environmental benefit to be gained. |
| Impact assessment | The process of determining the consequence of an impact (in terms of the consequence to the environment) arising from a planned or unplanned event over a specified period of time. |
| Likelihood | The chance of an unplanned event occurring. |
| Non-routine planned event | An attribute of the planned activity that may occur or will occur infrequently during the planned activity. A non-routine planned event is intended to occur at the time. |
| Planned activity | A description of the activity to be performed including the services, equipment, products, assets, personnel, timing, duration and location and aspect of the activity. |
| Planned event | An event arising from the activity which is done with intent (in other words, not an unplanned event) and has some level of environmental impact. A planned event could be routine (expected to occur consistently throughout the activity) or non-routine (may occur infrequently if at all). Air emissions, bilge water discharge and drill cuttings discharge would be examples of planned events. |
| Receptor | A feature of the environment that may have environmental, social and/ or economic values. |
| Risk | The effect of uncertainty on objectives. |
| Risk assessment | The process of determining the likelihood of an unplanned event and the consequence of the impact (in terms of economic, human safety and health, or ecological effects) arising from the event over a specified period of time. |
| Routine planned event | An attribute of the planned activity that results in some level of environmental impact and will occur continuously or frequently through the duration of the planned activity. |

| Term | Definition |
|---|---|
| Senior Leadership Team | Senior Leadership Team. |
| Unplanned event | An event that results in some level of environmental impact and may occur despite preventative safeguards and control measures being in place. An unplanned event is not intended to occur during the activity. |

### 5.1.3 Summary of the environmental impact and risk assessment approach

#### 5.1.3.1 Overview

Santos operates under an overarching Risk Management Policy (QE-91-IF-10050). Company Risk Procedure (SMS-MS1-ST01) underpins the Risk Management Policy and is consistent with the requirements of AS/NZS ISO 31000:2018, Risk Management – Guidelines (ISO, 2018).

The key steps to risk management are illustrated in **Figure 5-1**. The forum used to undertake the assessment is the environmental hazard workshop, referred to as an ENVID, which is described in Section 4 of the Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004_5).

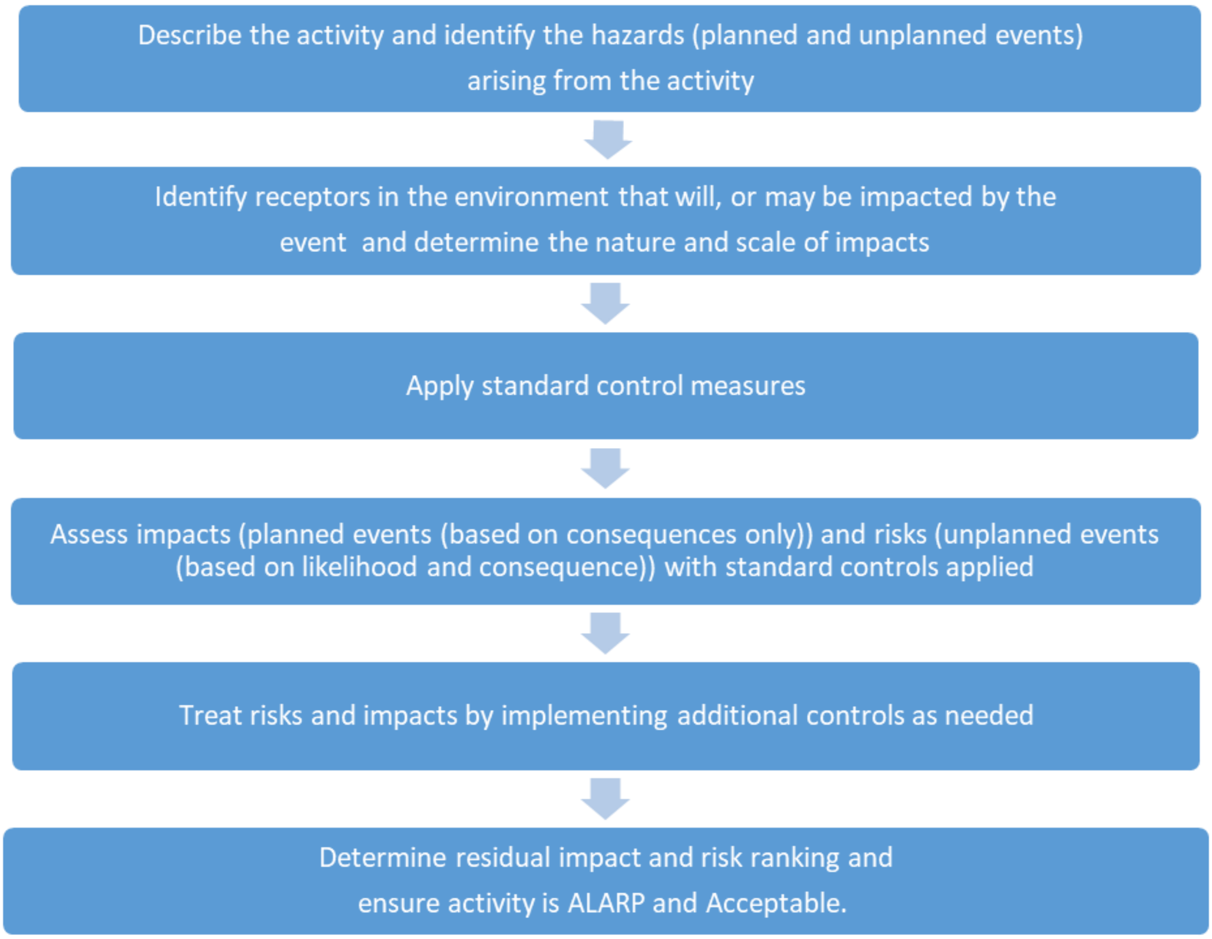



***Figure 5-1: Environmental risk and impact assessment and treatment process***

Environmental Hazard Identification and Assessment Guideline (EA-91-IG-00004) includes consideration of key areas in an impact and risk assessment, specifically:

- description of the activity (including location and timing)
- description of the environment (potentially affected by both planned and unplanned activities)

+ identification of relevant persons
+ identification of legal requirements ('legislative controls') that apply to the activity
+ Santos' policy and Safety Management System requirements
+ principles of ecologically sustainable development (ESD)
+ Santos' acceptable levels of impact and risk.

These factors were considered in an environmental impact and risk assessment workshop held in May 2021 in which environmental hazards were identified and assessed (ENVID workshop). The workshop involved participants from Santos' HSE, Projects and Operations departments and specialist environmental consultants.

### 5.1.4 Describe the activity and hazards (planned and unplanned events)

A description of the activity is required in order to determine the planned events that will occur and the credible unplanned events that may occur. The location, timing and scope of the activity must be described in order to determine the impacts from planned events, and the impacts and risks from unplanned events since these have a bearing upon the EMBA by the activity.

The outcome of this assessment is detailed in the relevant sub-sections of **Sections 5.2** and **5.3**.

### 5.1.5 Identify receptors and determine nature and scale of impacts

A description of the environment (natural and socio-economic) within which hazards from the activity will, or may occur, is required. This constitutes a crucial stage of the risk assessment, as an understanding of the environment that will or may be affected is required to determine the type and consequence of impacts from the activity being assessed. The environment must be understood with respect to the spatial and temporal limits of the activity and key resources at risk that will or could be impacted by planned and unplanned events. **Section 4** describes the existing environment that may be affected by Santos activities and is reviewed and updated annually.

The extent of actual impacts from each planned activity or risks from each unplanned activity, are assessed using, where required, modelling (for example, hydrocarbon spills) and scientific reports. The duration of the event is also described including the potential duration of any impacts should they occur. Receptors identified as potentially occurring within impacted area(s) are detailed in **Section 4**.

### 5.1.6 Describe the environmental performance outcomes and control measures

For each planned and unplanned event, a set of environmental performance outcome(s) (EPO), Controls, environmental performance standards (EPS) and measurement criteria (MC) are identified. The definitions of the EPO, controls, EPS and measurement criteria must be consistent with the OPGGS(E)R 2009, and the NOPSEMA EP Content Requirements Guidance Note (NOPSEMA, 2019).

For any hazard, additional controls, must also be considered and either accepted for use or rejected based on whether the standard controls reduce impacts and risks to levels that are ALARP and acceptable.

Controls are allocated in order of preference according to **Figure 5-2**.

| Control | Effectiveness | Example |
|---|---|---|
| **Eliminate** | | *Removal of the risk.*<br>Refueling of vessels at port eliminates the risks of an offshore refueling. |
| **Substitute** | | *Change the risk for a lower one.*<br>The use of low-toxicity chemicals that perform the same task as a more toxic additive. |
| **Engineering** | | *Engineer out the risk.*<br>The use of oil-in-water separator to minimise the volume of oil discharged. |
| **Isolation** | | *Isolate people or the environment from the risk.*<br>The use of bunding for containment of bulk liquid materials. |
| **Administrative** | | *Provide instructions or training to people to lower the risk.*<br>The use of Job Hazard Analysis to assess and minimise the environmental risks of an activity. |
| **Protective** | | *Use of protective equipment.*<br>Containment and recovery of spilt hydrocarbons. |

***Figure 5-2: Hierarchy of controls***

### 5.1.7 Determine the impact consequence level and risk rankings (on the basis that all control measures have been implemented)

This step looks at the causal effect between the aspect/hazard and the identified receptor. Impact mechanisms and any thresholds for impacts are determined and described, using scientific literature and modelling where required. Impact thresholds for different critical life stages are also identified where relevant.

The consequence level of the impact is then determined for each planned and unplanned event using the Santos Environment Consequence Descriptors (**Appendix H**), summarised in **Table 5-2**.

These detailed environmental consequence descriptions are based on the consequence of the impact to relevant receptors within the categories of:

+ threatened/migratory/local fauna
+ physical environment/habitat
+ threatened ecological communities
+ protected areas
+ cultural features.

This process determines a consequence level, based on set criteria for each receptor category, and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. The level of information required to complete the impact or risk assessment depends on the nature and scale of the impact or risk. This process determines a consequence level based on set criteria for each receptor category and takes into consideration the duration and extent of the impact, receptor recovery time and the effect of the impact at a population, ecosystem or industry level. Impacts to social and economic values are also considered based on existing knowledge and feedback from stakeholder consultation. As the result of historic consultation with stakeholders, the social and economic values in the region that are of interest are evident.

When assessing the consequence level of impact to cultural features, Santos considers the different types of cultural features and types of impacts. For impacts to cultural features in the form of impacts to marine species that are either a cultural food source or are considered culturally significant to First Nations people, Santos assesses impacts with reference to the consequence assessment for threatened/migratory/local fauna.

Similarly, where cultural features are linked to a specific place, impacts to cultural features are assessed with reference to the consequence assessment for physical environment/threatened ecological communities/protected areas as applicable.

Where there are concerns raised about cultural and spiritual beliefs that do not link to a specific place (or physical/tangible feature), Santos will evaluate impact and risk acceptability through the consideration of:

+ Impacts from other activities in the vicinity of the EP activities (e.g., historical drilling, trawl fishing activity, shipping, commercial developments).
+ Information provided from people and/or organisations who assert the cultural and spiritual connections.
+ Any expert assessment(s) from suitably qualified expert(s) with relevant experience and credentials.
+ Culturally appropriate control measures raised by relevant people, organisations or experts, or proposed by Santos and workshopped with relevant people, organisations or experts.

Impact and risk evaluation of cultural and spiritual beliefs will not form part of an ENVID workshop, and a consequence (or risk) ranking will not be assigned. Instead, a qualitative assessment demonstrating that impacts and risks of the activity will be reduced to as low as reasonably practicable and be of an acceptable level will be presented in the Environment Plan as informed by the above considerations.

As planned events are expected to occur during the activity, the likelihood of their occurrence is not considered during the risk assessment, and only a consequence level is assigned.

***Table 5-2: Summary environmental consequence descriptors***

| Consequence Level | Consequence Level Description |
|---|---|
| I | Negligible – No impact or Negligible impact |
| II | Minor – Detectable but insignificant change to local population, industry or ecosystem factors |
| III | Moderate – Significant impact to local population, industry or ecosystem factors |
| IV | Major – Major long-term effect on local population, industry or ecosystem factors |
| V | Severe – Complete loss of local population, industry or ecosystem factors AND/OR extensive regional impacts with slow recovery |
| VI | Critical – Irreversible impact to regional population, industry or ecosystem factors |

For unplanned events, the consequence level of the impact is combined with the likelihood of the impact occurring (**Table 5-3**), to determine a residual risk ranking using Santos' corporate risk matrix (**Table 5-4**). For oil spill events, potential impacts to environmental receptors are assessed where they occur within the EMBA using results from modelling.

***Table 5-3: Likelihood description***

| No. | Matrix | Description |
|---|---|---|
| f | Almost Certain | Occurs in almost all circumstances OR could occur within days to weeks |
| e | Likely | Occurs in most circumstances OR could occur within weeks to months |
| d | Occasional | Has occurred before in Santos OR could occur within months to years |
| c | Possible | Has occurred before in the industry OR could occur within the next few years |
| b | Unlikely | Has occurred elsewhere OR could occur within decades |
| a | Remote | Requires exceptional circumstances and is unlikely even in the long term |

***Table 5-4: Santos risk matrix***

| | | Consequence | | | | | |
|---|---|---|---|---|---|---|---|
| | | I | II | III | IV | V | VI |
| Likelihood | f | Low | Medium | High | Very High | Very High | Very High |
| | e | Low | Medium | High | High | Very High | Very High |
| | d | Low | Low | Medium | High | High | Very High |
| | c | Very Low | Low | Low | Medium | High | Very High |
| | b | Very Low | Very Low | Low | Low | Medium | High |
| | a | Very Low | Very Low | Very Low | Low | Medium | Medium |

### 5.1.8 Evaluating if impacts and risks are as low as reasonably practicable

For planned and unplanned events, an ALARP assessment is performed to demonstrate that the standard controls adopted reduce the impact (consequence level) or risk to ALARP. This process relies on demonstrating that further potential controls would require a disproportionate level of cost OR effort to reduce the level of impact or risk. If this cannot be demonstrated, then further controls are adopted. The level of detail included within the ALARP assessment is based upon the nature and scale of the potential impact or risk. For example, more detail is required for a risk ranked as `Medium' compared to a risk ranked as `Low'.

### 5.1.9 Evaluating impact and risk acceptability

Santos considers an impact or risk associated with the activities to be acceptable if:

+ the consequence of a planned event is ranked as I or II; or a risk of impact from an unplanned event is ranked Very Low to Medium
+ an assessment has been completed to determine whether further information or studies are required to support or validate the consequence assessment
+ assessment and management of risks have addressed the principles of ESD
+ that the acceptable levels of impact and risks have been informed by relevant species recovery plans, threat abatement plans and conservation advice can be demonstrated
+ performance standards are consistent with legal and regulatory requirements
+ performance standards are consistent with the Santos' Environment, Health and Safety Policy

- performance standards are consistent with industry standards and best practice guidance (for example, National Biofouling Management Guidance Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee, 2018))
- performance outcomes and standards are consistent with stakeholder expectations
- performance standards have been demonstrated to reduce the impact or risk to ALARP.

### 5.1.10 Presentation in the Environment Plan

A summary of the risk identification and analysis process is provided in **Table 5-5**. This provides a summary of:

- the sources of risk associated with routine/non-routine planned and unplanned activities that may have an impact or risk on the identified receptors
- the identified environmental, socio-economic and cultural receptors
- the residual risk rating for interaction between the activities and the receptors as determined through the risk assessment process.

The aspect-receptor cross references given in **Table 5-5** link to each of the hazards discussed in **Sections 5.2** and **5.3**.

The outputs of the risk identification, analysis and evaluation (including evaluation of controls, statements of ALARP and acceptability) process are presented in a summarised tabular form in the following sections. An example table describing the purpose of the key components of the summary tables (i.e. italicised text), with reference to the relevant sections of this EP, is provided in **Table 5-6**. Further detailed impact assessment and risk evaluation discussion is provided below each of the summary tables.

**Table 5-5: Activity aspect and receptor interaction matrix**

| Aspect and Sources of Risk | | Environmental, Socio-economic or Cultural Receptor (subsections of 4.5) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Physical Environment | | | | Biological Environment | | | | | | | | | Other Values and Sensitivities | | | Socio-economic and Cultural Environment | | | |
| | | Bathymetry and seabed features | Water quality | Sediment quality | Air quality | Intertidal primary producers | Benthic primary producers | Other benthic communities | Plankton | Pelagic and demersal fish communities | Marine mammals | Marine reptiles | Sharks and rays | Seabirds and migratory shorebirds | Key Ecological Features | Australian Marine Parks | Reef Protection Areas | Commercial fishing | Traditional fishing | Tourism and recreational activities | Ports and commercial shipping |
| | | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | T | U | V | W |
| *Routine/Non-routine Planned Activities* | | | | | | | | | | | | | | | | | | | | | |
| ***Physical Presence*** | | | | | | | | | | | | | | | | | | | | | |
| 1 | Interactions between Activity Vessels, the Gas Export Pipeline and Other Marine Users | | | | | | | | | | | | | | | | | 1T | 1U | 1V | 1W |
| 2 | Disturbance to Seabed from Pipeline installation | 2A | 2B | | | | 2F | 2G | 2H | | | 2K | | | 2N | 2O | | | | | |
| ***Underwater Noise Emissions*** | | | | | | | | | | | | | | | | | | | | | |
| 3 | Noise from Vessels and Activities | | | | | | | | | 3I | 3J | 3K | 3L | | | | | | | | |
| ***Light Emissions*** | | | | | | | | | | | | | | | | | | | | | |
| 4 | Artificial Light on Vessels and ROVs | | | | | | | | | 4I | | 4K | 4L | 4M | | | | | | | |
| ***Atmospheric Emissions*** | | | | | | | | | | | | | | | | | | | | | |
| 5 | Exhaust from Combustion Engines and Incinerators | | | | 5D | | | | | | | | | | | | | | | | |
| **Discharges** | | | | | | | | | | | | | | | | | | | | | |
| 6 | Vessel Utility Discharges | | 6B | | | | | | 6H | | | | | | | 6O | | | | | |
| 7 | Dewatering and Pre-commissioning Fluids | | 7B | 7C | | | | 7G | 7H | 7I | 7J | 7K | 7L | | | | | | | | |
| *Unplanned Activities* | | | | | | | | | | | | | | | | | | | | | |
| ***Physical Presence*** | | | | | | | | | | | | | | | | | | | | | |
| 8 | Dropped Objects | | | | | | 8F | 8G | | | | | | | 8N | 8o | | | | | |
| 9 | Introduction of Invasive Marine Species | | | | | | 9F | 9G | | | | | | | 9N | 9O | | | | | 9W |
| 10 | Collision with Marine Fauna | | | | | | | | | | 10J | 10K | 10L | | | | | | | | |
| ***Discharges*** | | | | | | | | | | | | | | | | | | | | | |
| 11 | Subsea release of treated seawater | | 11B | 11C | | | 11F | 11G | 11H | 11I | 11J | 11K | 11L | | 11N | 11O | | | | | |
| 12 | Deck and Minor Subsea Spills | | 12 B | | | | | | | | | | | | | | | | | | |
| 13 | Loss of hazardous and Non-hazardous waste | | 13 B | 13C | | | | | | | 13J | 13K | 13L | 13M | | | | | | | |
| 14 | Marine Diesel Release from Vessel Collision | | 14B | | | 14E | | | 14H | 14I | 14J | 14K | 14L | 14M | | 14O | 14P | 14T | 14U | | |
| 15 | Marine Diesel Release from Bunkering Incident | | 15B | | | | | | 15H | 15I | 15J | 15K | 15L | 15M | | 15O | | 15T | | | |
| 17 | Dry gas Release from Bayu-Undan Pipeline Loss of Containment | | | | 17D | | | | | | 17J | 17K | | 1M | | | | 17T | 17U | 17V | 17W |

| Aspect and Sources of Risk | | Environmental, Socio-economic or Cultural Receptor (subsections of 4.5) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Physical Environment | | | | Biological Environment | | | | | | | | | Other Values and Sensitivities | | | Socio-economic and Cultural Environment | | | |
| | | Bathymetry and seabed features | Water quality | Sediment quality | Air quality | Intertidal primary producers | Benthic primary producers | Other benthic communities | Plankton | Pelagic and demersal fish communities | Marine mammals | Marine reptiles | Sharks and rays | Seabirds and migratory shorebirds | Key Ecological Features | Australian Marine Parks | Reef Protection Areas | Commercial fishing | Traditional fishing | Tourism and recreational activities | Ports and commercial shipping |
| | | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | T | U | V | W |
| ***Oil Spill Response*** | | | | | | | | | | | | | | | | | | | | | |
| 16 | Implementation of Spill Response | | 16B | | | | | | | | 16J | 16K | 16L | 16M | | | | | | | |

| ***Key*** | |
|---|---|
| (blue) | Negligible consequence (planned) / very low residual risk (unplanned) |
| (green) | Minor consequence (planned) / low residual risk (unplanned) |
| (amber) | Moderate consequence (planned) / medium residual risk (unplanned) |
| (red) | Major or severe consequence (planned) / high residual risk (unplanned) |
| (dark red) | Critical consequence (planned) / very high residual risk (unplanned) |
| (white) | Interaction not reasonably expected |

*Table 5-6: Example risk assessment table*

| | |
|---|---|
| **Risk** | *Description of the risk (or source) that has the potential to result in impacts to the environment.* |
| **Aspect-receptor reference (Table 5-5)** | *Cross-reference to the interactions between environmental, socio-economic and cultural receptors and aspects of the seismic survey that are considered reasonably possible, as presented in* ***Table 5-5****.* |

| |
|---|
| **Description of the Source of Risk** |
| *Brief description of the source of risk associated with a hazard (i.e. the activity), including context around the nature and scale of the risk to adequately inform potential impacts.* |
| **Levels of Acceptable Impact** |
| *Levels of acceptable impact defined based on the EPBC Act significant impact guidelines, recovery plans and other statutory documentation.* |
| **Potential Impacts** |
| *Brief description of the key potential impacts (i.e. focus on relevant values and sensitivities) that may occur because of the risk being realised, as informed by a detailed understanding of the existing environment (****Section 4****).*<br>*Note, a more detailed impact assessment and risk evaluation discussion is provided below each of the risk assessment summary tables.* |
| **Risk Assessment**<br>*Presents the consequence, likelihood and overall risk ratings determined from the risk assessment process and ENVID workshop. As noted in* ***Section 5.1.7****, the inherent risk assumes existing standard controls are in place. The residual risk relates to the level of risk following risk treatment, such as the application of additional controls.* |

| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
|---|---|---|---|
| ***Residual risk*** | | | |

| |
|---|
| **Controls and Demonstration of ALARP**<br>*Identifies and details the appropriate existing management controls that will be implemented to reduce potential impacts and risks to ALARP and an acceptable level. Considers the effectiveness of the control in reducing the risk (i.e. by reducing likelihood). Provides an Environmental Performance Standard (EPS), which states the required level of performance of the control.* |
| ***Existing Controls*** |

| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
|---|---|---|---|
| | | | |

| |
|---|
| ***Additional Controls***<br>*Identifies the additional management controls that were considered, indicates whether they will be implemented, and provides a justification if they are not going to be applied. The controls are grouped based on the hierarchy of controls. Where an additional control is selected to be implemented, an EPS is provided.* |

| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
|---|---|---|---|---|
| ***Elimination*** | | | | |
| | | | | |
| ***Substitution*** | | | | |
| | | | | |

| *Engineering* | | | | |
|---|---|---|---|---|
| | | | | |
| ***Administrative*** | | | | |
| | | | | |

| **ALARP Statement** |
|---|
| *Summary statement of whether the potential risks and impacts are considered ALARP. This statement is based on the outcomes of the environmental risk assessment, as outlined in* ***Section 5.1.8*** *(Demonstration of ALARP).* |

| **Summary of Alignment with EPBC Management Plans (where applicable)** | | | |
|---|---|---|---|
| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| | | | |

| **EPOs (Table 6-1)** |
|---|
| *A measurable level of environmental performance in relation to the environmental receptors that may be impacted/ at risk. Verification of EPOs is used to confirm environmental impacts and risks are managed to a level that is ALARP and acceptable. EPOs, along with EPSs, set the level at which an incident becomes a "recordable incident' (i.e. a breach of an EPO is a recordable incident; refer to* ***Section 7.9****).* |

## 5.2 Routine/non-routine planned activities

### 5.2.1 Physical presence: interactions between activity vessels, the gas export pipeline and other marine users

| **Risk** | Interactions with/exclusion of other marine users |
|---|---|
| **Aspect-receptor reference (Table 5-5)** | 1T – Commercial fishing<br>1U – Traditional fishing<br>1V – Tourism and recreational activities<br>1W – Ports and commercial shipping |

| **Description of the Source of Risk** |
|---|
| The marine spread for pipelay includes:<br>+ the pipelay vessel, which will be operating along the pipeline route 24/7 for a period of nominally three months<br>+ a construction vessel, which will undertake discrete tasks along the pipeline route<br>+ up to six support vessels, which will transit to and from the pipelay and construction vessels daily.<br>A five hundred metre safety exclusion zones will be established around the pipelay and construction vessels to safeguard them while they are unable to manoeuvre.<br>During pipeline installation activities there is potential for the marine spread to interfere with other marine users, including:<br>+ commercial fishers<br>+ shipping vessels<br>+ tourism operators (including fishing charters)<br>+ traditional fishing.<br>The gas export pipeline, PLETs and supporting infrastructure (lateral buckling initiation mattresses, mattresses at the fibre optic cable crossing and PLET foundations) installed on the seabed may also present an ongoing hazard for other marine users in the area. |

| Potential Impacts |
|---|
| **Commercial Fishing**<br>Six commercial fisheries overlap with the pipeline installation operational area (**Section 4.6.7**):<br>+ Northern Prawn Fishery<br>+ Demersal Fishery<br>+ Coastal Line Fishery<br>+ Offshore Net and Line Fishery<br>+ Spanish Mackerel Fishery<br>+ Timor Reef Fishery.<br>The likely presence of commercial fishing vessels, within the operational area, was assessed based on fishing method and gear type, historical fishing effort, a fishing impact study and stakeholder consultation. The assessment identified that only three commercial fisheries (the Northern Prawn, the Offshore Line and Net, the Timor Reef and the Spanish Mackerel fisheries) may potentially occur within the operational area.<br>A review of vessel traffic from April 2017 to March 2018 identified a low level of fishing effort within 10 nm of the proposed pipeline route. The study identified a total of 154 fishing vessel days and 816 hours of fishing activity resulting in a fishing intensity of <0.01 days/km$^2$ (Intecsea, 2018). Based on vessel speed (<3.8 knots) it was determined that a number of these vessels were trawling and therefore likely to be trawling for prawns as part of the Northern Prawn Fishery. During stakeholder consultation for this EP, the Northern Prawn Fishery outlined that fishing effort occurs within the proposed pipeline route and expressed concern about displacement from this area.<br>Consultation with each of the fisheries identified that only the Northern Prawn, the Offshore Net and Line, and the Spanish Mackerel fisheries were active within the operational area. The primary efforts of the Timor Reef Fishery is over 50 km to the southwest. Both the Northern Prawn Fishery and the Spanish Mackerel Fishery raised concerns regarding exclusion from, or access to, fishing grounds while the Offshore Net and Line did not raise any concerns. Further the Northern Prawn Fishery requested that pipeline installation activity be undertaken outside of their fishing seasons (periods of sensitivities). The fishery is currently closed from 16 June to 31 July and from 1 December to 1 April each year.<br>The request from NPF for undertaking the activities outside fishing seasons has been considered, however, concluded that the proposed pipelay activities would not pose an unreasonable risk to – or burden on – fishers being excluded or accessing fishing grounds:<br>+ Fishing grounds are large, however, exclusion to any particular area will be limited to the 500 m diameter safety zones imposed around the pipelay and the construction vessels.<br>+ The pipelay vessel operates in a linear fashion moving slowly along the pipeline route (nominally 3 km/day) as it lays the pipe.<br>+ The construction vessel will work at locations along the pipeline route installing the PLETs and carrying out span rectifications. The time it will work at any one location will be no longer than a few days with the exception of pipeline hydrotesting activities (FCGT), which could take up to 14 days to complete (see **Section 5.2.7**).<br>+ Supply vessels will transit to and from the pipelay and construction vessel. While servicing the pipelay and construction vessel, they will be within the 500 m exclusion zone; while in transit will be subject to standard maritime rules.<br>Given the above and the controls that will be in place to inform marine users of our day-to-day location, the consequence of adverse impact with commercial fishers is considered negligible.<br>Should timing of the activity be scheduled to avoid fishing periods, as requested by the Northern Prawn Fishery, then this will extend the overall duration of the activity and increase the cost of pipelay substantially. It also elevates the risk of simultaneous operations (SIMOPS), where the pipelay vessel ends up interacting with other Barossa construction activities (spool installations, drilling or FPSO mooring installation). SIMOPS is highly undesirable mode of operation as it means vessels either being stood down for a period of time or operating in close proximity to one another. Apart from the additional cost, this could lead to increased collision risk and/or enhanced cumulative environmental impact for aspects such as light and noise.<br>The sequence of pre-lay activities, pipelay and post-lay activities shall be scheduled to occur in a single campaign in order to avoid the requirement to perform multiple mobilisations/demobilisations of the construction vessel(s). Performing the work in a single continuous campaign also enables pre-lay and post-lay activities to be performed in |

parallel with pipelay where practicable to further reduce the schedule and optimise the offshore campaign. Furthermore, once the pipeline is laid, spans must be rectified as soon as possible to avoid overstressing of the pipeline. If the campaign extends over two periods there is a risk that spans are left unrectified potentially resulting in the need install additional span supports to ensure pipeline integrity is maintained over the operational design life. Given the likely burden imposed on fishers, adjusting the timing of the activity was discounted.

On an ongoing basis, the subsea infrastructure may present a hazard to marine users due to the potential for snagging on subsea infrastructure. The risk of snagging was assessed during a fishing interactions survey undertaken for the gas export pipeline (Intecsea, 2018). Based on the frequency of trawling vessels crossing the pipeline and location of snagging hazards (e.g. pipeline spanning structures and downstream PLET) it was concluded that there is very low likelihood of trawling equipment becoming snagged on the gas export pipeline. To further reduce the risk, the downstream PLET will be installed with anti-snag protection.

**Tourism (including Recreational Fishing) and Traditional Fishing**

Recreational and traditional fishing (see **Sections 4.6.9** and **4.6.8**) may occur near a small number of shoals located near the operational area (e.g. Goodrich Bank, Marie Shoal, Moss Shoal, Mesquite Shoal and Shepparton Shoal – see **Section 4.5.6.3**). For the same reasons given above, any interactions with recreational fishing, fishing tours or traditional fishers are expected to be restricted to temporary avoidance of activity vessels while transiting through the area.

**Ports and Commercial Shipping**

The presence of activity vessels has the potential to cause temporary disruption to commercial shipping. Given all shipping vessels and activity vessels are required to comply with the COLREGS and associated Marine Orders, it is expected navigational and communicative aids are sufficient to preventing any negative interactions beyond basic avoidance during gas export pipeline installation activities.

**Acceptability Summary**

No adverse effect on other marine users is predicted; impact and risks are therefore deemed acceptable.

While there may be some minor impacts to where fishing activity can occur, no substantial adverse effects are considered likely given the small area and temporary nature of exclusion, especially when compared to the wider fishing area. The impact and risks are therefore deemed acceptable.

| Risk Assessment | |
|---|---|
| ***Consequence*** | II – Minor |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Activity vessels equipped and crewed in accordance with Australian maritime requirements. | This control is effective in avoiding unplanned interactions with other marine users. Crew qualifications and experience, along with communication and navigation equipment, allows activity vessels to detect, communicate with, and avoid interaction with other marine users. | **C 1.1** | **EPS 1.1.1**<br>Vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 21 (Safety and emergency procedures), including:<br>– safety measures such as manning and watchkeeping.<br>+ Marine Order 27 (Safety of navigation and radio equipment), including:<br>– radio equipment and communications<br>– navigation safety measures and equipment<br>– danger, urgency and distress signals and messages.<br>+ Marine Order 30 (Prevention of Collisions), including:<br>– lights and signals as applicable to vessel class per COLREGS requirements.<br>+ Marine Order 71 (Masters and Deck Officers), including:<br>– all master, mate and watchkeeper officer duties undertaken by crew certified as applicable to vessel class per STCW requirements. |
| Undertake consultation with relevant persons (including applicable notifications) to support the gas export pipeline installation campaign. | This control is effective in avoiding unplanned interactions with other vessels. Consultation with relevant persons allows all parties to be aware of activities associated with the gas export pipeline and its location. This allows Santos and other users to undertake activities in such a way as to minimise the potential for adverse interactions. | **C 1.2** | **EPS 1.2.1**<br>Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan. |
| | | | **EPS 1.2.2**<br>Australian Hydrographic Service (AHS) Notice to Mariners and AMSA Maritime Safety Information (MSI) will be notified prior to relevant gas export pipeline installation activities. |
| | | | **EPS 1.2.3**<br>Subsea infrastructure and the gas export pipeline will be clearly marked on Australian nautical charts published by the AHO. |

| | | | |
|---|---|---|---|
| Pipeline installation activities undertaken in accordance with Santos marine vessel vetting processes. | This control is effective in ensuring the safety of the activities and avoiding adverse interactions with other marine users. | **C 1.7** | **EPS 1.7.1**<br>Pipeline installed in accordance with Santos marine vessel vetting processes, including the establishment of a 500 m exclusion zone. |

***Additional Controls***

| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
|---|---|---|---|---|
| ***Elimination*** | | | | |
| Divide the pipeline installation scope into multiple campaigns to minimise work performed during the Northern Prawn Fishery season periods of sensitivity (2 April to 15 June and 1 August to 31 November). | No | No | See Justification below. | N/A |

Justification

Should timing of pipeline installation and associated activities be scheduled to avoid identified sensitivities including the Northern Prawn Fishery season and the peak internesting turtle periods this will impose impractically tight restrictions on the window for starting operations in order to ensure the activities can be completed outside of the various seasons, without the risk of the activities having to be split over multiple seasons. The start date for the pipelay operations is driven by the limited availability of pipelay vessels in region, prior commitments of pipelay vessels and the availability of associated equipment such as linepipe materials and PLET structures to support the activities. Due to the uncertainty on these elements it is standard practice to negotiate a large window for commencement of pipelay operations with a mechanism to reduce the window as the project progresses and the factors detailed above become more certain. The call down window is initially under the control of Santos before passing to the pipelay vessel operator in order that they can manage their prior vessel commitments. As a result of the call down mechanism for the pipelay vessel and the uncertainty on the pipelay start date it is impractical to guarantee that pipelay activities could be fully completed in a given season.

If seasonal exclusions are imposed and activities cannot be completed in a single season, then this will require the activities to be split over multiple seasons. This will result in an overall extension in the duration of the activity, additional vessel mobilisations and demobilisations and will considerably increase the cost of pipelay.

If the campaign extends over two seasons there is a risk that spans are left unrectified in the intervening period which may markedly increase the number of span corrections required or could result in unacceptable fatigue damage to the pipeline resulting in the need to replace a section of pipeline. It may also be counterproductive as multiple vessel mobilisations could increase the overall environmental impact.

It may also raise the risk of simultaneous operations (SIMOPS), where the pipelay vessel ends up interacting with other Barossa construction activities (spool installations, drilling or FPSO mooring installation). SIMOPS is highly undesirable mode of operation as it means vessels either being stood down for a period of time or operating in close proximity to one another. Apart from the additional cost, this could increase collision risk and result in enhanced cumulative environmental impact for aspects such as light and noise.

No obvious additional potential environmental benefits were identified when considering the NPF season and the peak turtle internesting seasons (April to September) together. Impacts to each are independent and have both been demonstrated to be acceptable. The costs in terms of financial, safety and pipeline integrity discussed above remain.

Santos has also assessed if certain activities associated with the pipelay operations, such as pre-lay and post-lay span correction, can be performed outside of fishing and peak turtle internesting seasons. However, the

<table>
<tr><td colspan="5">construction vessels used to support pipelay operations are also required throughout the full pipelay campaign and as such the sequence of pre-lay activities, pipelay and post-lay activities is more effectively performed in a single campaign in order to avoid the requirement to perform multiple mobilisations/demobilisations of the construction vessel(s). As highlighted above it is also necessary to ensure spans are corrected as soon as practicable and as such post-lay work cannot practically be separated from the pipelay activity. Performing the work in a single continuous campaign also enables pre-lay and post-lay activities to be performed in parallel with pipelay where practicable to further reduce the schedule, optimise the offshore campaign and minimise the extent of span correction required thus reducing the seabed footprint and environmental impact.<br>This control was discounted, as the costs of implementing seasonal control for parts or the whole activity were considered disproportionate to any environmental benefits gained. For fisheries, the identified impacts can be managed through ongoing consultation with the fishers. Impacts to turtles are assessed further in Section 5.2.2.</td></tr>
<tr><td colspan="5">Substitution</td></tr>
<tr><td colspan="5">No additional controls identified.</td></tr>
<tr><td colspan="5">Engineering</td></tr>
<tr><td>PLET at the downstream tie-in location has been designed with anti-snag protection.</td><td>Yes</td><td>Yes<br>C 1.3</td><td>Once the gas export pipeline installation campaign is completed, anti-snag protection on the PLET located at the downstream tie-in location will provide additional protection for fishers operating within proximity to the gas export pipeline.</td><td>EPS 1.3.1<br>PLET at the downstream tie-in Location is designed with anti-snag protection.</td></tr>
<tr><td>PLET at FPSO location designed with anti-snag protection.</td><td>Yes</td><td>No</td><td>It is not expected that trawling will occur at the FPSO PLET location as water depths are greater than 200 m and trawling does not typically occur at these depths. In addition, the PLET will be included within the 500 m Petroleum Safety Zone of the FPSO (once the overall Barossa Development is operational).</td><td>N/A</td></tr>
</table>

| | | | | |
|---|---|---|---|---|
| Anti-snag protection for mechanical support structures. | Yes | Yes<br>**C 1.6** | Should mechanical support structures be used, anti-snag protection will provide protection for fishers operating in proximity of the pipeline. | **EPS 1.6.1**<br>Anti-snag protection for any mechanical support structures installed shall be considered in detailed engineering and snagging potential mitigated accordingly. |
| ***Administrative*** | | | | |
| One vessel will act as a surveillance vessel within the immediate vicinity of the pipelay vessel during pipelay. | Yes | Yes<br>**C 1.4** | A vessel will be in the immediate vicinity of the pipelay vessel at all times to act as a surveillance and intervention vessel. The vessel will mitigate potential interactions between the pipelay vessel and other marine users. | **EPS 1.4.1**<br>An activity vessel will remain in proximity to the pipelay vessel to act as a surveillance vessel during pipelay. |
| Communications plan will be implemented for engagement with marine users. | Yes | Yes<br>**C 1.5** | Communications plan will improve awareness of the gas export pipeline installation campaign, encourage engagement with stakeholders, and provide up-to-date information regarding key activities. | **EPS 1.5.1**<br>Communications plan will be implemented for engagement with marine users. |
| **ALARP Statement** | | | | |
| Relevant legislative requirements and standard industry practices have been applied to control the risk. The controls selected for implementation are effective in reducing the risk of interactions between activity vessels and the gas export pipeline, and other marine users. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts.<br>Based on the outcomes of the risk assessment, the implementation of controls throughout the activity. Santos considers that the impacts and risks to other marine users due to the physical presence of activity vessels and the gas export pipeline are reduced to ALARP. | | | | |

| Summary of Alignment with EPBC Management Plans (where applicable) | | | |
|---|---|---|---|
| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| Not applicable. | | | |
| **Levels of Acceptable Impact** | | | |
| The impact caused by physical presence of the pipelay construction vessels and the pipeline once laid will be acceptable if there is no substantial adverse effect on other marine users. | | | |
| **EPOs (Table 6-1)** | | | |
| **EPO 1**<br>No substantial adverse effect on other marine users. | | | |

### 5.2.2 Physical presence: seabed disturbance

| | |
|---|---|
| **Risk** | Disturbance to the seabed from the installation of the gas export pipeline, PLETs and supporting structures |
| **Aspect-receptor reference (Table 5-5)** | 2A – Bathymetry and seabed features<br>2B – Water quality<br>2F – Benthic primary producers<br>2G – Other benthic communities<br>2H – Pelagic and demersal fish communities<br>2K – Marine reptiles<br>2O – Australian marine parks<br>2N – Key ecological features |
| **Description of the Source of Risk** | |
| A range of gas export pipeline installation activities may result in disturbance to the seabed. These activities include:<br>+ installation of underwater acoustic positioning transponders (**Section 3.5.2**)<br>+ installation of supporting structures (**Section 3.5.3**)<br>+ span rectification (**Section 3.5.4**)<br>+ concrete mattresses (**Section 3.5.4.1**)<br>+ grout bags (**Section 3.5.4.2**)<br>+ mass flow excavation (**Section 3.5.4.3**)<br>+ mechanical support structures (**Section 3.5.4.5**)<br>+ gas export pipeline initiation structure deployment (**Section 3.5.5**)<br>+ gas export pipeline installation (**Section 3.5.6**)<br>+ PLET installation at either end of the pipeline (**Section 3.5.7**).<br>**Direct Impacts**<br>The pipeline and associated structures (including mattresses and grout bags for span rectification) are lowered onto the seabed in a controlled manner with minimal disturbance to sediment. Habitat directly below structures will most likely be lost, however, over time the structures themselves will become colonised. In total, it is estimated that installation of the pipeline and associated structures (including span rectification) will result in direct impact to up to 28.7 ha of seabed (**Table 3-6**).<br>**Indirect Impacts**<br>Mass flow excavation (**Section 3.5.4.3**) may be used to facilitate burial of the pipeline in unconsolidated sediment (e.g. sand waves). The device works by drawing in seawater from side pipes then jetting it out through a vertical | |

down pipe liberating sediment into the water column (**Figure 3-8**), which is then relocated. Locations where mass flow excavation might be required are shown in **Figure 3-5**. Sediment at these locations is unconsolidated consisting mainly of sand but also contains a proportion of finer silt and clay size particles (**Figure 5-4**). Sands and gravels will redeposit rapidly (within hours), however, finer silts and clay size particles can remain in suspension for long periods under turbulent current flow.

Factors affecting the disturbance are:

- productivity rate, volume of soil requiring removal and duration of operation
- soil type
- prevailing currents at the time of operation (neap/spring tide).

Based on case studies provided by the manufacturer of mass flow excavation equipment (James Fischer, 2018) productivity rate for mass flow excavation ranges between 229 and 2,182 m$^3$/hr. Volumes of soil requiring excavating from the span locations identified range from 55 to 1,025 m$^3$. Larger volumes are associated with the sandwave and megaripple fields towards the south of the pipeline (between KP245 to KP250).

To predict the impact, sediment modelling was undertaken using a three-dimensional particle tracking advection-dispersion model (ConocoPhillips, 2019(b)). Hydrodynamics for the model were derived from a finite element tidal model of the Timor Sea. Dispersal in the direction of flow was provided by the shear action of an assumed logarithmic velocity profile while turbulent dispersion was modelled using a random walk method. The area of interest was discretised using a 25 m by 25 m rectilinear grid with vertical layers 1 m depth over which concentrations were calculated. Large numbers of particles were released each time step representing sediment discharged from the mass flow excavation operation. Each particle was assigned a mass and a grain size in accordance with the sediment discharge rate and particle size distribution (**Figure 5-4**). Stokes Equation was used to calculate the fall velocity for each particle size.

**Table 5-7** summarises model inputs. The model was set up to simulate worst case conditions. Location KP249.7 was modelled as geophysical data showed that this location potentially had the maximum volume of sediment requiring excavation (**Figure 5-3**). It was assumed that this volume could be removed in one hour giving a release rate of 1,025 m$^3$/hr. The release was therefore a batch discharge of one hour in duration. Two scenarios were undertaken, a low water and high water release both on a neap tide. This is considered worst case as suspended sediment builds up in during slack water and is then advected in a small, high concentration plume for the full tidal excursion. Density was set at 2,650 kg/m$^3$, which is conservative as it does not account for voids between particles and shell content of sediment.

***Table 5-7: Summary of model parameters used in the mass flow excavation modelling***

| Parameter | Value/design |
|---|---|
| Discharge location | KP249.7 (**Figure 5-3**) |
| Particle size distribution | See **Figure 5-4** |
| Discharge loading rate | 1,025 m$^3$/hour |
| Discharge volume | 1,025 m$^3$ |
| Discharge duration | 1-hour batch discharges |
| Model run duration | 48 hours |
| Discharge depth | Seabed discharge with initial plume 0 to 10 m above the seabed |
| Sediment density | 2,650 kg/m$^3$ (density of quartz) |

**Presentation of Results**

Results are presented as:

- Plan views showing the depth of sediment deposition around the discharge point.
- Plan views of maximum instantaneous suspended sediment concentration recorded within the plume for the duration of the model simulation. This figure plots the peak values attained at each grid point in the model over the course of the simulation. It is presented to illustrate the footprint of the plume down to 10 mg/L.

- Plan views of suspended sediment concentrations at distinct points in time throughout the simulation. These illustrate the actual behaviour of the plume.
- Time series of suspended sediment concentrations at 200 m from the discharge to show the ephemeral nature of plume at fixed points such as might be experienced by sessile organisms.

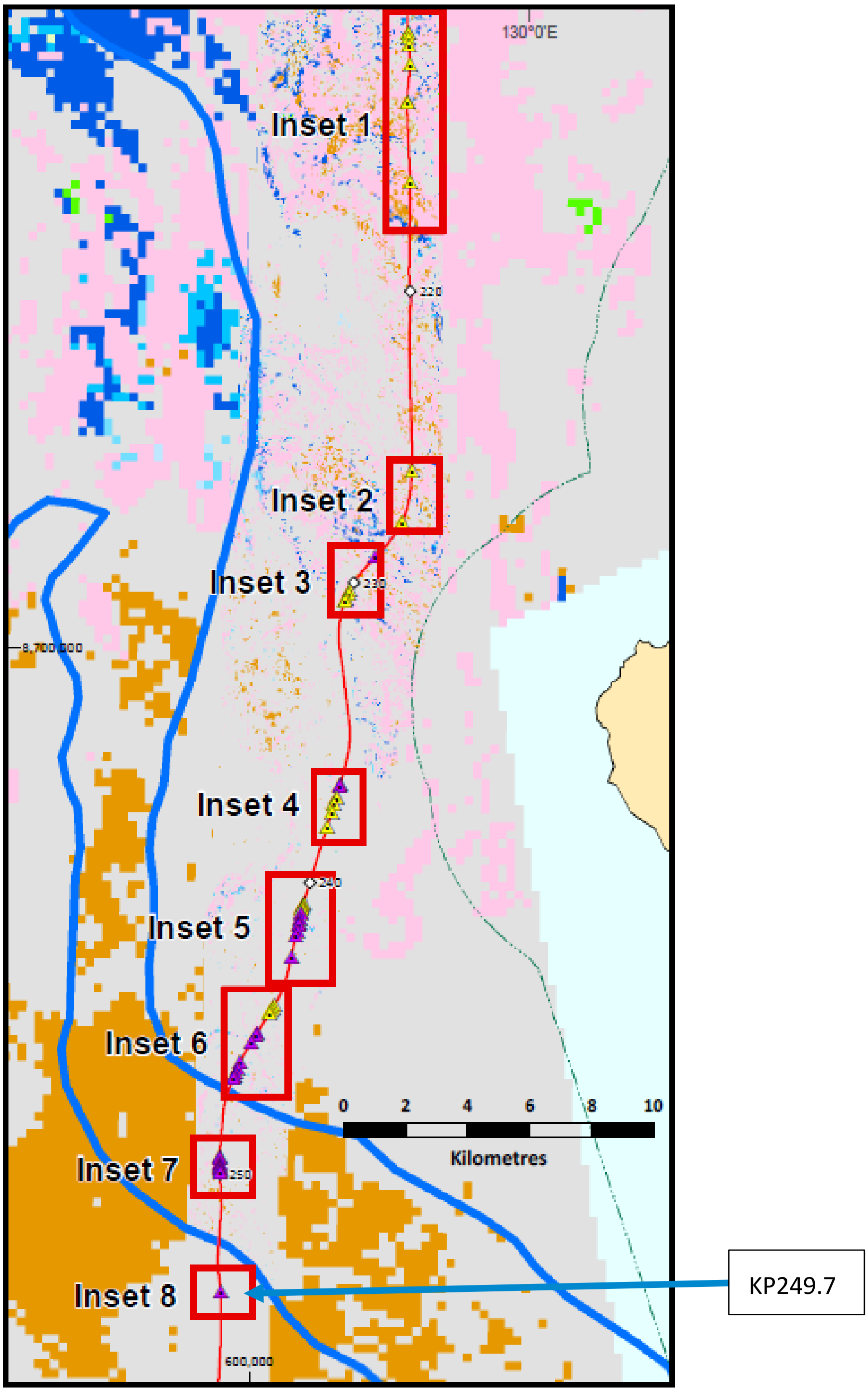



*Figure 5-3: Location of modelled release at KP249.7 (see Figure 3-3 for insets)*

**Figure 5-5** shows the predicted depth of sediment deposition for flood and ebb tide discharges on a spring tide. As expected, the courser sediment settles rapidly (minutes) within a short distance from the disturbance (tens of metres). Finer sands take longer to settle (up to two hours) and tail off up to 400 m in either direction from the zone of disturbance. Deposition in the near vicinity of the discharge is estimated at 5,000 mg/cm²/hr, reducing to 250 mg/cm²/hr at 100 m from the discharge.

Santos

Silts and clay particles remain in suspension for longer and are carried by ambient currents away from the zone of disturbance. **Figure 5-6** shows the maximum instantaneous suspended sediment concentrations for a low water sediment discharge (i.e. mass flow excavation occurring at low water). Tidal currents adjacent to Bathurst Island are strong with the plume travelling around 9 km towards the southeast on the flood tide.

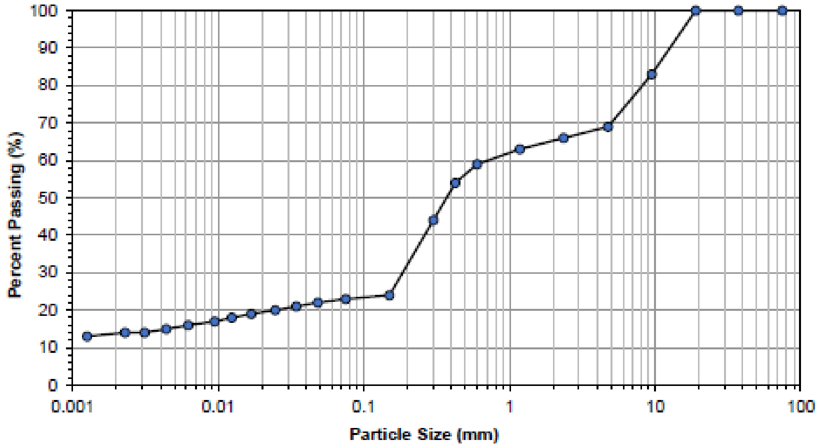
Within 200 m from the discharge, plume concentrations are up to 1800 mg/L above background levels. **Figure 5-7** shows such increases are confined to an area very close to the disturbance location, and **Figure 5-8** shows this peak occurs for a very short period of time (less than an hour). Sediment disperses rapidly with distance away from the discharge site with concentrations decreasing to 100 mg/l at the limit of the tidal excursion and approaching background within a single tidal cycle. Similar plots for the ebb tide are shown in **Figure 5-9** to **Figure 5-11**.

Noting that each case is unique, results appear conservative when compared with observations from studies related to cable laying operations for wind farms. During the construction of the Nysted Offshore Wind Farm in Denmark (BERR, 2008), measurements of turbidity 200 m from jetting (mass flow excavation) operations recorded mean and maximum sediment concentrations of 2 and 18 mg/L, respectively.

SmartWind (2013) provides predictions of suspended sediment concentrations from sandwave clearance using jetting (mass flow excavator) offshore of the Holderness and Lincolnshire coast. The scenario to clear a sandwave where there was 5 per cent fine sediment content was predicted to produce peak depth-averaged concentrations of approximately 900 mg/l above background levels. As in the modelling undertaken for Barossa, these levels were confined to an area very close to the sandwave location and occurred for a very short period of time (less than an hour). Increases of up to 200 mg/l were observed up to 18 km to the north of the sandwave and increases of 20 to 50 mg/l were observed in the southern extent of the plume.

In summary, modelling predicts short term elevations in suspended sediment concentrations (typically up to 100 to 200 mg/L with short term spikes of up to 1,800 mg/L) and low-level deposition, typically restricted to the near vicinity of operations (within 400 m). Suspended sediment will return to background levels within a single tidal cycle. While modelling has been undertaken only at a single location, maximum volume of sediment and excavation rates were applied so conditions at other mass flow excavation locations – where currents are equally strong – will be no worse. Similarly, worst case conditions for dispersion were modelled, that is, neap tide slack water discharges, so concentrations at any other stages of the tide should yield lower plume concentrations. Moreover, if operations extend beyond one hour it means that excavation rate is lower so suspended sediment concentrations would be lower but for a longer duration.

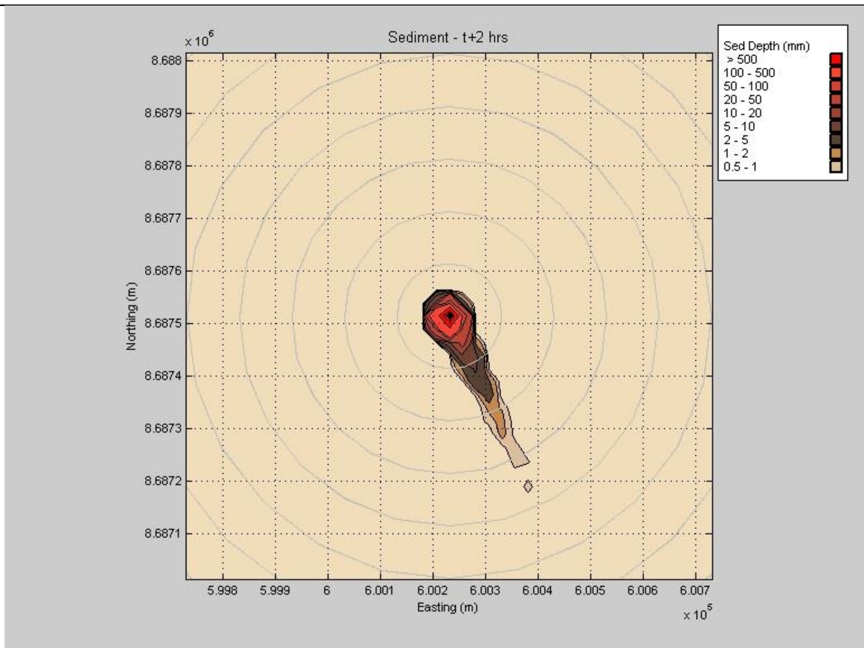
| | | | |
|---|---|---|---|
| **PO No.:** | 262132 | **GTI Perth Client Reference:** | C07-P01-T01 |
| **Client:** | Arup Pty Ltd | **Filename:** | 19-001-PSD-34-PFL |
| **Project:** | Barossa Project | | |
| **Location:** | Gas Export Pipeline and Infield Flowlines (PFL) | **Hydrometer Type:** | ASTM-152H |
| **Borehole:** | EP-41-BC | **Pretreatment :** | No |
| **Sample No:** | 01 | **Dispersion Method:** | Dispersion agent - 4g/L |
| **Depth:** | 0.15 m - 0.40 m | **Loss in Pretreatment:** | NA |
| **Tested By:** | LB | **Checked By:** | FL |
| **Date:** | 16/08/2018 | **Date:** | 24/08/2018 |



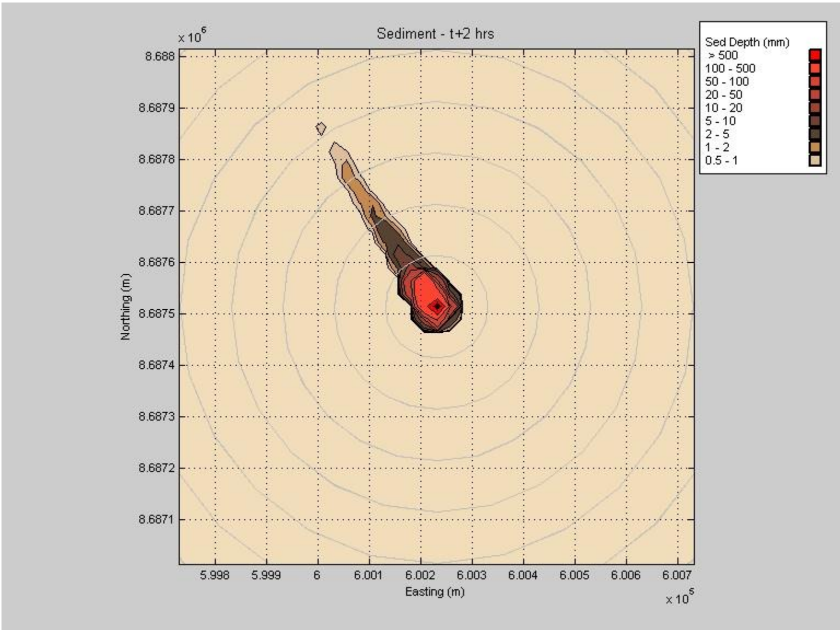

| Sieving | | Hydrometer | |
|---|---|---|---|
| Size mm | Passing % | Size mm | Passing % |
| 75.0 | 100 | 0.0483 | 22 |
| 37.5 | 100 | 0.0344 | 21 |
| 19.0 | 100 | 0.0246 | 20 |
| 9.5 | 83 | 0.0168 | 19 |
| 4.75 | 69 | 0.0124 | 18 |
| 2.36 | 66 | 0.0094 | 17 |
| 1.18 | 63 | 0.0062 | 16 |
| 0.600 | 59 | 0.0044 | 15 |
| 0.425 | 54 | 0.0031 | 14 |
| 0.300 | 44 | 0.0023 | 14 |
| 0.150 | 24 | 0.0013 | 13 |
| 0.075 | 23 | | |

| Summary Results | |
|---|---|
| Average Particle Size, $D_{50}$ (mm) | 0.364 |
| Effective Size, $D_{10}$ (mm) | NA |
| Max Size of the Smallest 30%, $D_{30}$ (mm) | 0.184 |
| Max Size of the Smallest 60%, $D_{60}$ (mm) | 0.755 |
| Uniformity Coefficient, $C_u = D_{60}/D_{10}$ | NA |
| Coefficient of Gradation, $C_g = D_{30}^2/(D_{60}xD_{10})$ | NA |
| Fines Content, <75µm (%) | 23 |
| Clay size Content, <2µm (%) | 13 |

***Figure 5-4: Sediment particle size distribution from a sediment sample collected in substrate in which mass flow excavation could be applied***



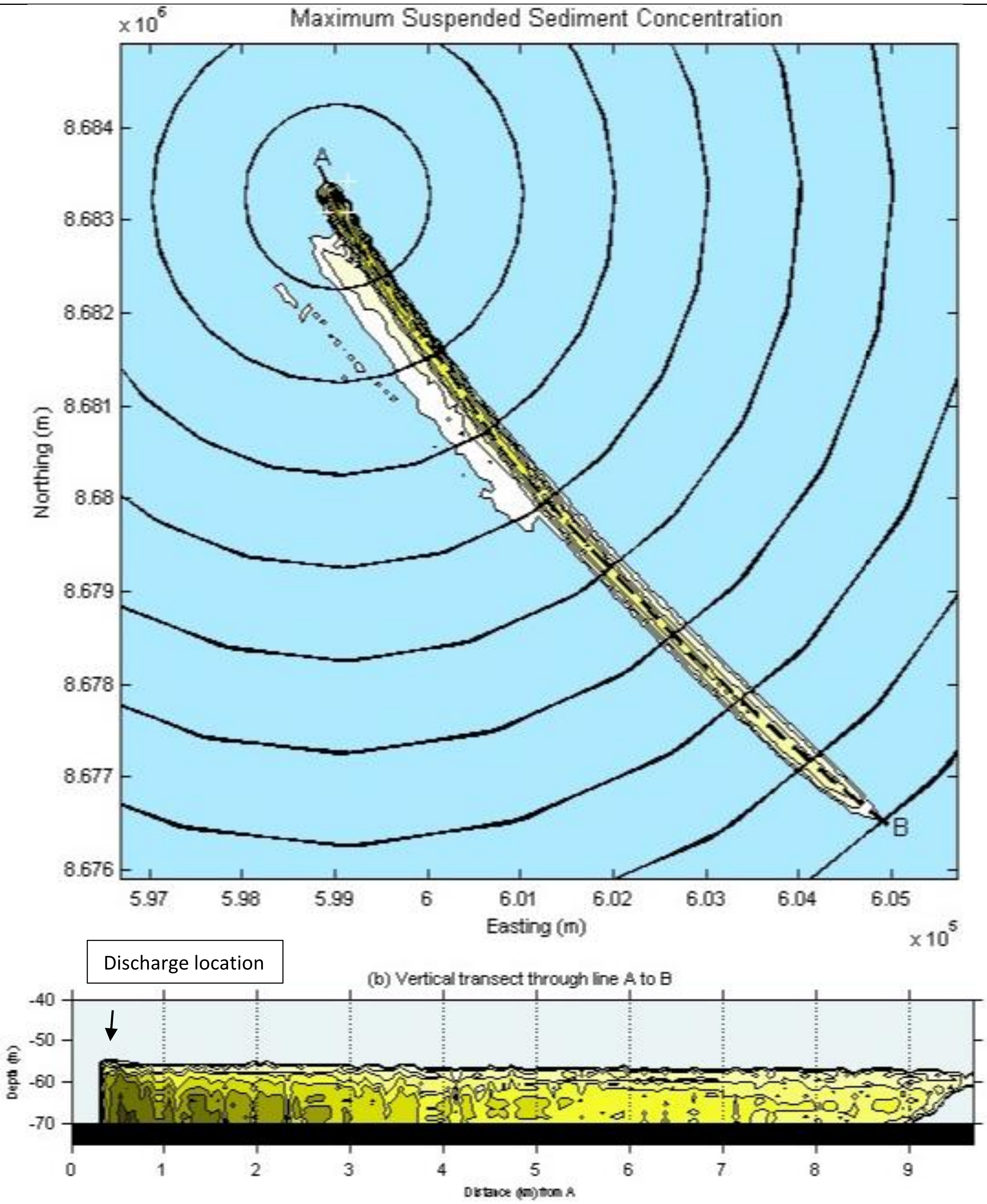

**(a) Flood tide**




**(b) Ebb tide**

| |
|---|
| Notes: (a) Concentric circles are range rings drawn at 100 m intervals around the discharge location. |

***Figure 5-5: Predicted depth of seabed sediment deposition from mass flow excavation at KP249.7 on (a) flood and (b) ebb tide***




Notes:

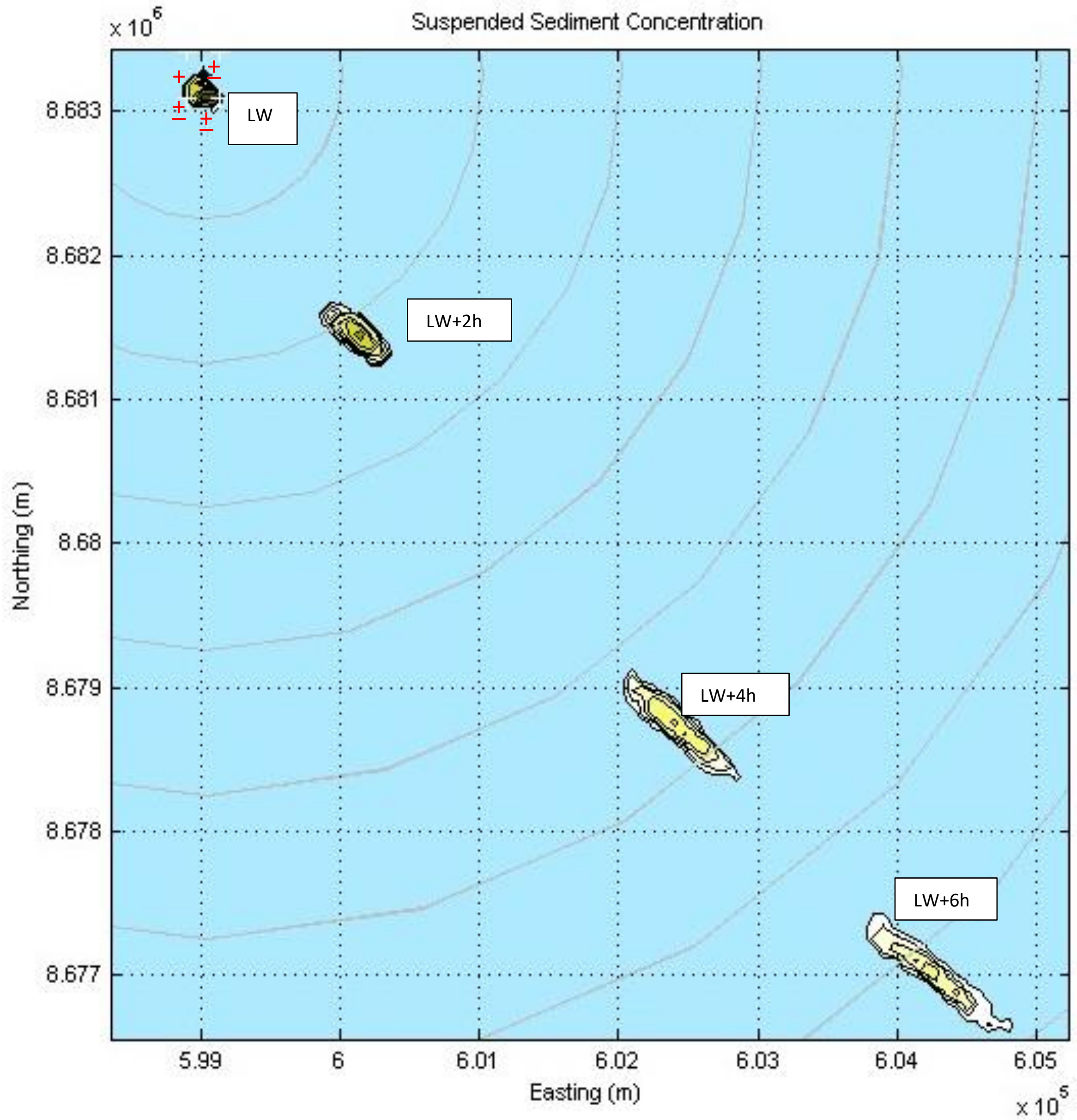
(a) Discharge rate is 1,025 m³/hr for a duration of 1 hour.

(b) Contours show maximum instantaneous concentration within the plume for the duration of the model simulation. **Figure 5-7** shows concentrations at a point in time.

(c) Concentric circles are range rings drawn at 1000 m intervals around the discharge location.

(d) Time series extracted 200 m from the discharge location shown as red crosses.

***Figure 5-6: Maximum instantaneous suspended sediment concentrations for mass flow excavation from KP249.7 – low water release on a neap tide***




Notes:

(a) Concentric circles are range rings drawn at 1000 m intervals around the discharge location.

(b) Concentrations averaged over bottom 10 m water depth.

(c) Discharge rate is 1,025 $m^3$/hr for a duration of 1 hour.

(d) Time series extracted from points 200 m from the discharge location shown as red crosses.

***Figure 5-7: Suspended sediment concentrations at various stages of the tide for mass flow excavation from KP249.7 – low water release on a neap tide***

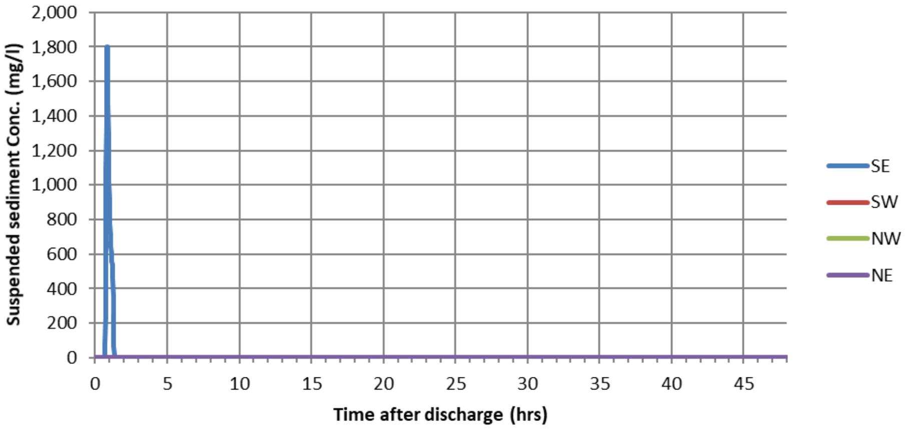
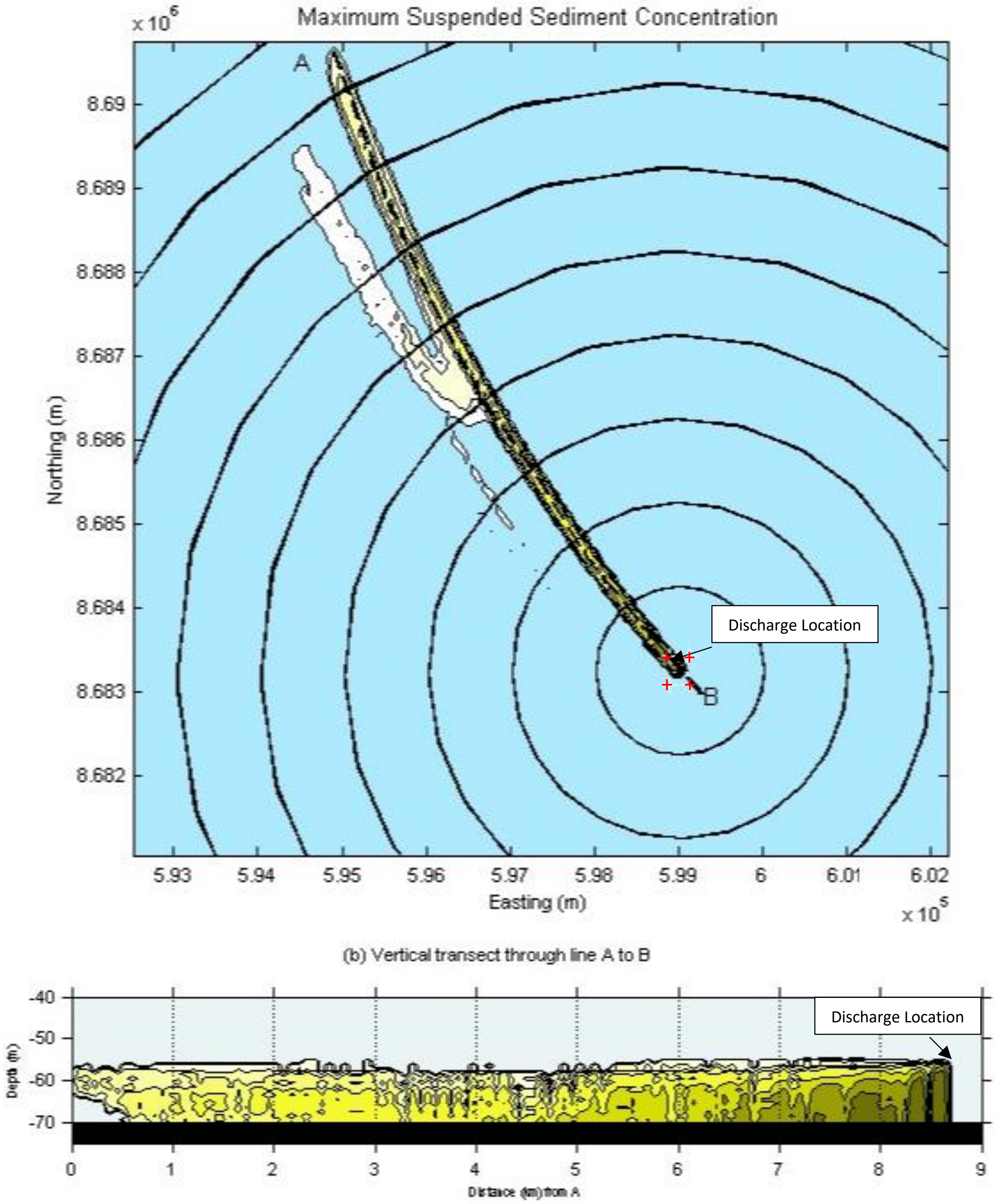



***Figure 5-8: Time series of predicted suspended sediment concentration at 200 m from the mass flow excavation site – low water release on a neap tide***




Notes:

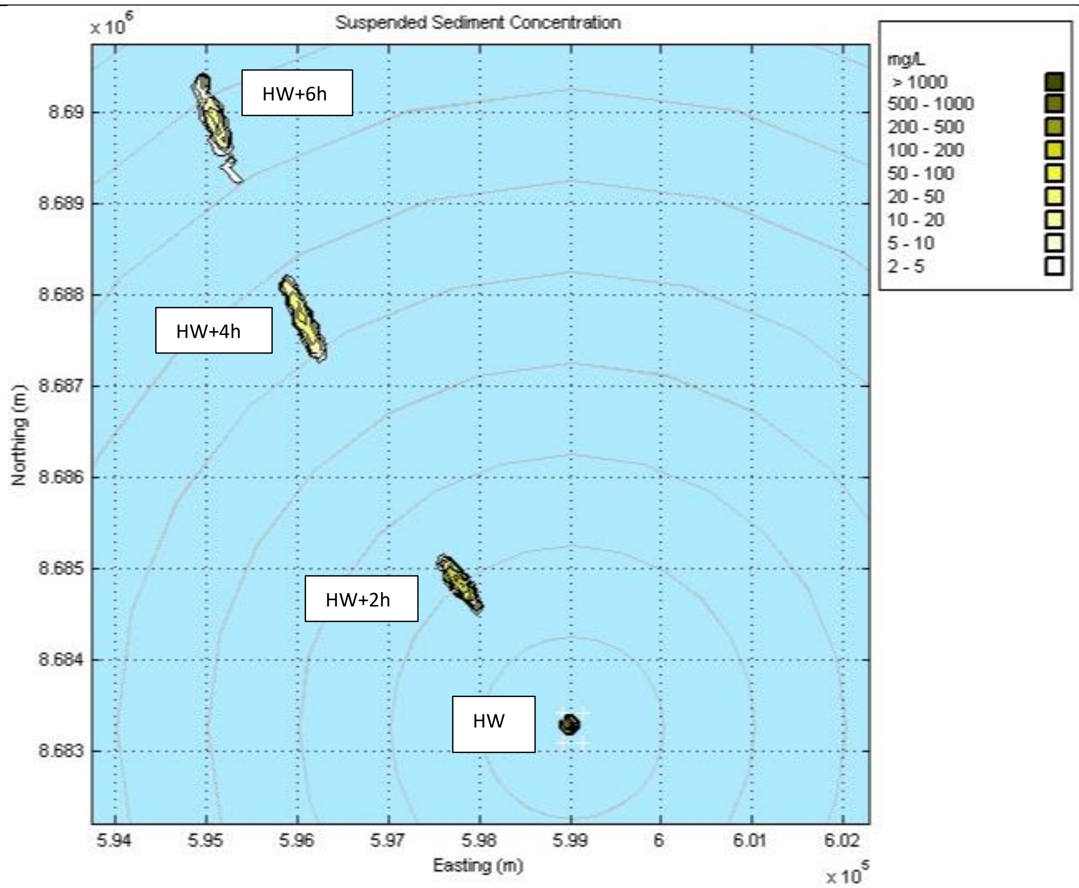
(a) Discharge rate is 1,025 m³/hr for a duration of 1 hour.

(b) Contours show maximum instantaneous concentration within the plume for the duration of the model simulation. **Figure 5-7** shows concentrations at a point in time.

(c) Concentric circles are range rings drawn at 1000 m intervals around the discharge location.

(d) Time series extracted from points 200 m from the discharge location shown as red crosses.

***Figure 5-9: Maximum instantaneous suspended sediment concentrations for mass flow excavation from KP249.7 – high water release on a neap tide***




Notes:

(a) Concentric circles are range rings drawn at 1000 m intervals around the discharge location.
(b) Concentrations averaged over bottom 10 m water depth.
(c) Discharge rate is 1,025 $m^3$/hr for a duration of 1 hour.
(d) Time series extracted 200 m from the discharge location shown as red crosses.

***Figure 5-10: Suspended sediment concentrations for mass flow excavation from KP249.7 – high water release on a neap tide***

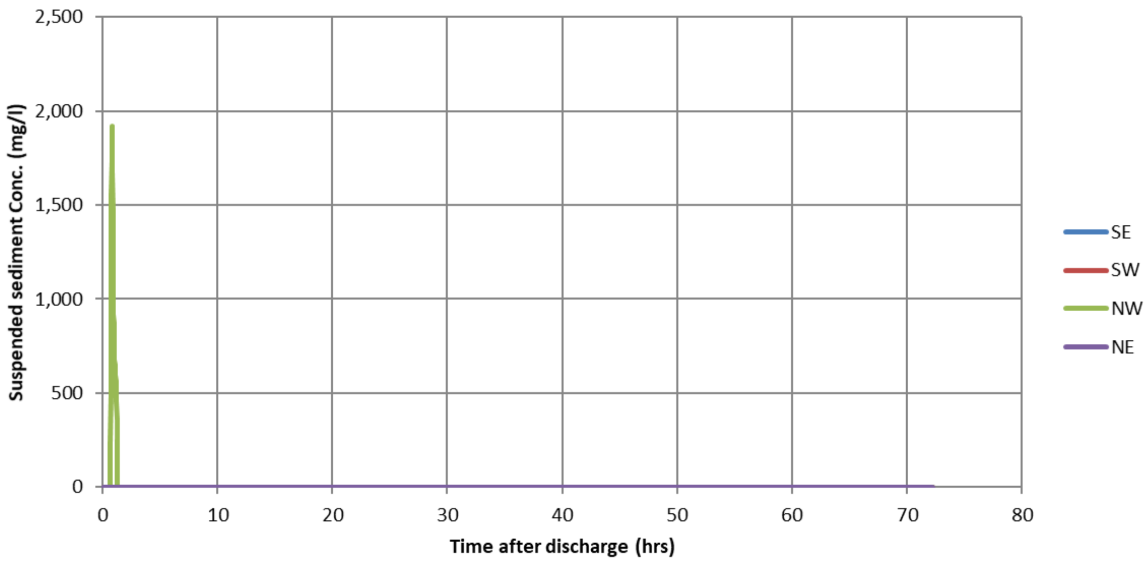



***Figure 5-11: Time series of predicted suspended sediment concentration at 200 m from the mass flow excavation site – high water release on a neap tide***

| Potential Impacts |
|---|

**Bathymetry and Seabed Features**

The pipeline route avoids banks, shoals and pinnacles in the region being laid on predominantly silty siliceous-calcareous habitats (**Section 4.4**). In areas of soft sediment, the pipeline and associated structures are expected to sink or become partially buried. There may also be sediment accumulation in some areas around the pipeline; this is expected to be highly localised and of low relief (i.e. no higher than the diameter of the pipeline) and will assist in stabilisation of the pipeline. The pipeline may also cause localised scouring; however, its design is intended to prevent this occurring due to the risk it may pose to its structural integrity.

Coarse sediment from mass flow excavation is predicted to travel up to 400 m from the disturbance location (**Figure 5-5**). Given the mobile nature of sediments and high current speeds, the seabed is expected to return to near its original state over time – no substantial changes to seabed features are predicted.

**Water Quality**

Impacts to water quality from pipelay activities are limited to elevated suspended sediment concentrations from mass flow excavation. The main effects from mass flow excavation are expected to be localised in nature and short term, with water column returning near to its original state within days. Impact on water quality is expected to be negligible so there will be no substantial change which could adversely impact biodiversity, ecological integrity, social amenity or human health. The impact is therefore deemed acceptable.

Biological communities, including threatened and migratory species

<u>Benthic Primary Producers</u>

The majority of proposed gas export pipeline route is in water depths of greater than 50 m. These parts of the proposed route are very unlikely to host benthic primary producer habitat (e.g. zooxanthellate corals, macroalgae, seagrasses etc.) as the seabed will receive low levels of photosynthetically active radiation (PAR). Some sections of the proposed route are in relatively shallow water (between 35 and 50 m water depth) to the west of Bathurst Island, approximately 7 km offshore at the closest point to the island. Water quality surveys along this part of the coastline have consistently shown high levels of turbidity, which reduces PAR penetration in the water column and consequently reduces the depths at which benthic primary producers may be found.

Habitat surveys support these conclusions, with no benthic primary producer habitats observed along the proposed route, however, the benthic habitat model predicts isolated outcrops of hard corals between KP210 to KP231 (**Figure 4-24**). These are assessed in the section below.

<u>Benthic Communities</u>

*Direct Impact*

It is expected that benthic habitat directly below the pipeline and supporting structures will be lost as a result of direct impact from installation. This will be limited to 875 mm width along the length of the pipeline and up to 18 $m^2$ at each support structure location (**Figure 3-3**), resulting in an overall direct impact of up to 28.7 ha of seabed (**Table 3-6**).

**Table 5-8** shows that 87.4% of the route is bare sediment, 8.5% filter feeders, 2.9% burrowers/crinoids and 0.65% hard corals. While communities below the footprint of the pipeline will most likely be lost, these habitats are well represented throughout the region with native flora and fauna likely to recolonise the pipeline once it has been laid.

***Table 5-8: Percentages of benthic habitat classes within the operational area of the proposed gas export pipeline route (derived from Heyward et al., 2017; Radford et al., 2019)***

| *Habitat Class* | *% Within Operational Area* |
|---|---|
| None (bare sediment) | 87.4 |
| Filter feeders | 8.5 |
| Burrowers/crinoids | 2.9 |
| Alcyon | 0.4 |
| Gorgonians | 0.0 |
| *Halimeda* | 0.0 |

| | |
|---|---|
| Hard corals | 0.65 |
| Macroalgae | 0.0 |
| Soft corals | 0.06 |
| Seagrasses | 0.0 |
| Whips | 0.0 |

*Indirect Impact*

Benthic communities (particularly corals and sponges) can be impacted by suspended sediment through three primary cause effect pathways: light reduction, increased suspended sediment concentrations, and sediment deposition (smothering). Studies undertaken as part of the WAMSI Dredging Science Node (WAMSI, 2019) report that both sponges and hard corals are well adapted to sediment and are resilient to increased suspended sediment loads for extended periods of time.

For sponges, adaptations include: incorporation of sediment into their tissue (skeleton reinforcement); forming sediment crusts (providing shade, camouflage and shelter from grazers and desiccation); ability to anchor in soft sediments (sometimes partially embedded); and passive or active cleaning mechanisms (including self-cleaning surfaces, mucus production and tissue sloughing). These tolerance mechanisms come at a cost (depletion of energy reserves, reduced sponge health), suggesting that longer term exposure to such extreme sediment disturbance conditions is likely to result in mortality.

Experiments undertake on both corals and sponges provide threshold concentrations; however, these are over extended periods, which are indicative but not directly comparable with a short-term discharge such as that for mass flow excavation. Heterotrophic sponges showed considerable resilience to light reduction and general resilience to high loads of suspended sediments (up to 100 mg/L) for 14 days. At exposure to suspended sediment concentration's >30 mg/L for 28 days, many sponges reduced in size, had fewer energy reserves, and (some) bleached. This indicates that exposure to high suspended sediment concentration for extended periods (28 days) can have negative effects on feeding behaviour and growth of sponges. However, most sponges recovered 14 days following cessation of the experimental treatments. Only two sponge species, *Carteriospongia foliascens* (phototrophic) and *Coscinoderma matthewsi* (heterotrophic), exhibited necrosis and mortality when exposed to >30 mg/L. These results were corroborated by findings from the field, which demonstrated that three sponge species (*Cliona sp., C. stipitata* and *Stylissa flabelliformis*) persisted throughout a recent two-year dredging program.

For corals, WAMSI (2019) reports light attenuation and sediment deposition leading to smothering as the key cause effects pathways that define zones of high impact (mortality). Most can tolerate a 3-fold decrease in light levels, and a combination of 10 mg/L and 2.3 mol photons/m²/day over a 42-day period. Light attenuation is directly proportional to suspended sediment concentrations. At the locations hard corals are shown in the habitat model (between KP210 and KP231), pipeline spans will be rectified using mattresses and grout bags with minimal sediment disturbance, so no indirect impact on corals is expected.

The seabed where mass flow excavation may be required is mostly bare sand with sparse outcrops of filter feeders consisting mostly of sponges (**Figure 3-5**). Modelling for mass flow excavation predicts short-term elevations in suspended sediment (typically up to 200 mg/L with short term spikes of up to 2,000 mg/L) and low-level deposition, typically restricted to the near vicinity of operations (within 400 m). As elevated suspended sediment concentrations (and reduction in light) are ephemeral and concentrations reduce rapidly within the plume (typically within a single tidal cycle), the duration and concentration of suspended sediment generated from mass flow excavation operations is unlikely to impact sponges. In terms of deposition, for the highest volume of sand requiring removal, the model predicts sand deposition (>0.5 m) is predicted to occur within tens of metres of the disturbance. This is considered insignificant given the mobile nature of the seabed in the area and the strength of the tidal currents, which will redistribute the sand over time. Strong currents will prevent deposition of fine sediments and remove any sediment that may deposit on the surface of sponges or corals at locations further afield.

With regards to potential cumulative impact from sequential mass flow excavation operations, modelling demonstrated that the suspended sediment plume is transported long distances while rapidly dissipating. Cumulative impacts from sequential operations are, therefore, unlikely.

Considering the low sensitivity and broad regional representation of the habitats within the pipeline route, it is concluded that direct or indirect impacts from the proposed activities will not substantially change or adversely impact on biodiversity or ecological integrity of benthic communities. The impact is therefore deemed acceptable.

**Pelagic and Demersal Fish Communities**

Span rectification and installation of supporting structures will disturb the seabed, which may make prey for predatory demersal fish (e.g. infauna) temporarily more available. This could result in a short-term attraction of demersal fish to the area due to increased prey availability.

Much of the seabed along the proposed gas export pipeline route is bare sediment habitat, which supports relatively low diversity and low abundance fish assemblages compared to more complex habitats (e.g. reefs). The installation of the gas export pipeline in these areas may create a more rugose seabed and provide substrate for attachment of organisms such as sponges and gorgonians. The resulting habitat will be relatively complex compared to much of the pre-existing habitat and will serve as an artificial reef. Recent survey work on the North West Shelf has highlighted the increased fish species richness and abundance associated with subsea pipelines (Bond et al., 2018; McLean et al., 2017). These studies noted that the fish assemblages associated with pipelines tended to have a relatively high portion of large, commercially important fish species that preferred complex habitats (Bond et al., 2018; McLean et al., 2017). The predicted increase in the fish assemblage diversity and abundance is not expected to have any negative environmental consequences.

Anecdotal evidence provided by stakeholders and bycatch data (Laird, 2018) indicated that the proposed gas export pipeline route west of Bathurst Island may host sawfish. The installation of the pipeline is unlikely to result in adverse impacts to sawfish based on:

+ the mobile nature of sawfish species
+ sawfish species' preference for shallow (relative to much of the proposed gas export pipeline route) coastal habitat
+ the wide representation of habitats found along the proposed pipeline route within the region
+ the localised seabed disturbance associated with the installation of the pipeline
+ the low profile of the gas export pipeline, which is expected to become buried over time and will not prevent the movement of sawfish over the pipeline.

**Marine Reptiles**

The Tiwi Islands host regionally significant nesting populations of flatback and Olive Ridley turtles. Internesting habitat critical for the survival of both flatback and Olive Ridley turtles overlaps the proposed pipeline route (**Figure 4-29**). Other species of marine reptiles, such as sea snakes and saltwater crocodiles, are not expected to be present in notable numbers along the proposed gas export pipeline route and are not considered further here.

**Juvenile Turtles**

Following the pelagic post-hatchling phase, juvenile flatback and Olive Ridley turtles may move into continental shelf waters to forage, although Olive Ridley turtles have been shown to undertake long duration oceanic migrations well beyond the continental shelf (Polovina et al., 2004). Juveniles are not thought to remain in the nearshore habitat around their natal beaches for long periods of time, nor are they thought to make extensive use of benthic habitats. On this basis, the seabed disturbance from gas export pipeline installation activities is not expected to result in significant impacts to juvenile turtles. Potential impacts from other aspects of gas export pipeline installation activities (artificial light and underwater noise) are discussed in **Sections 5.2.4** and **5.2.3**.

**Foraging Adult Turtles**

Flatback turtles forage in soft-bottom sub-tidal environments. Flatback turtles are carnivorous, and feed opportunistically on a range of benthic invertebrates such as soft corals, sea pens and holothurians; pelagic prey such as jellyfish may also be consumed (Limps, 2007). Like flatback turtles, Olive Ridley turtles are carnivorous and forage in soft bottom habitats on a range of prey. Benthic invertebrates such as molluscs and crustaceans are commonly eaten, along with pelagic fauna such as salps and neustonic molluscs (i.e. *Janthina* spp.) (Colman et al., 2014; Limpus, 2008; Polovina et al., 2004).

As described above in Benthic Primary Producer Habitat and Other Benthic Communities, the region contains a range of benthic habitats, several of which are expected to be turtle foraging habitats, including:

+ alcyon (soft coral)
+ filter feeders
+ gorgonians

+ soft corals
+ whips.

Of these potential foraging habitats, only filter feeding habitat lies within the proposed gas export pipeline route (**Figure 4-28**), primarily along the western coast of Bathurst Island. Most filter feeders (e.g. sponges, gorgonians, etc) typically require hard substrate to become established; hard substrate is often a limiting resource in benthic marine environment. The presence of the gas export pipeline is expected to increase the number of filter feeders due to the substrate it will provide, potentially increasing the availability of prey for foraging adult turtles. However, much of the gas export pipeline is below the depths foraging turtles typically dive to, particularly internesting females – see below for further discussion.

There are foraging area BIAs for marine turtles in the region beyond the operational area, including an Olive Ridley foraging area BIA within the Oceanic Shoals Marine Park. These BIAs lie >100 km from the operational area and will not credibly be impacted by seabed disturbance from the installation of the gas export pipeline and supporting structures.

**Nesting and Internesting Female Turtles**

Turtle nesting activity is seasonally variable around the Tiwi Islands. Of particular relevance are nesting beaches in relatively close proximity to the pipeline route and operational area including (as detailed in Chatto and Baker, 2008b):

+ Olive Ridley nesting is concentrated on northern parts of Bathurst Island and around Cape van Diemen on Melville Island, with lower density nesting on other beaches. These are the closest high-density Olive Ridley nesting beaches to the operational area and are the justification for the Olive Ridley internesting BIAs (which is 5 km east of the operational area).
+ Flatback turtle nesting around the southwestern tip of Bathurst Island (around Cape Fourcroy); flatback turtle nesting is also widespread throughout the region. The flatback turtle internesting BIA overlaps the operational area.

Nesting and hatchling activity around the Tiwi Islands is effectively year-round (**Table 5-9**), with peak hatchling activity between July and September for flatback turtles and between June and August for Olive Ridley turtles (Chatto and Baker, 2008b; Limpus, 2008, 2007; Pendoley, 2019).

***Table 5-9: Seasonal patterns in flatback and Olive Ridley turtle nesting, internesting and hatchling activity at the Tiwi Islands (after Pendoley, 2019)***

| Life Stage | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Flatback (Arafura stock, Tiwi islands)* | | | | | | | | | | | | |
| Nesting | | | | | | | | | | | | |
| Internesting | | | | | | | | | | | | |
| Hatchlings | | | | | | | | | | | | |
| *Olive Ridley (Northern Territory stock, Tiwi Islands)* | | | | | | | | | | | | |
| Nesting | | | | | | | | | | | | |
| Internesting | | | | | | | | | | | | |
| Hatchlings | | | | | | | | | | | | |

| | |
|---|---|
| Low level activity | |
| High level activity | |

Female turtles typically lay a series of clutches of eggs during a nesting season. The period between successive clutches is referred to as the internesting period. Female turtles typically remain in relatively close proximity to their nesting beach during the internesting period, showing high site fidelity. The nesting period for marine turtles is considered a critical stage in the life history of these species, and the aggregation of animals in a single area (e.g. nesting beaches, internesting habitat) may increase vulnerability to impacts. This is the basis for the establishment of the internesting habitat critical to the survival of flatback and Olive Ridley turtles in the Recovery Plan for Marine Turtles in Australia 2017–2027 (Commonwealth of Australia, 2017a), shown in **Figure 4-29**.

Internesting Olive Ridley turtles remain relatively close to nesting beaches during the nesting period (in comparison to post-nesting movements); tagged turtles remained within 48 km of the nesting beach in waters typically <30 m water depth, although the turtles moved considerable distances within this radius (up to 200 km) (Hamel et al., 2008). These behaviours are consistent with observations from other populations, which indicate internesting Olive Ridley turtles typically remain in relatively shallow waters within 30 km of the nesting beach (Maxwell et al., 2011; Rees et al., 2012).

Tagging studies of several flatback turtles have shown a range of average interesting dive depths, ranging from 5 to 9 m around Ashburton Island (RPS, 2010), less than 10 m around Barrow Island (Whittock 2017), to up to 20 m around Curtis and Bare Sand islands (Sperling et al., 2010). Suitable internesting habitat for flatback turtles is defined as water depths shallower than 16 m (Whittock et al., 2016 in Pendoley, 2019), which is shallower than the shallowest point of the gas export pipeline route.

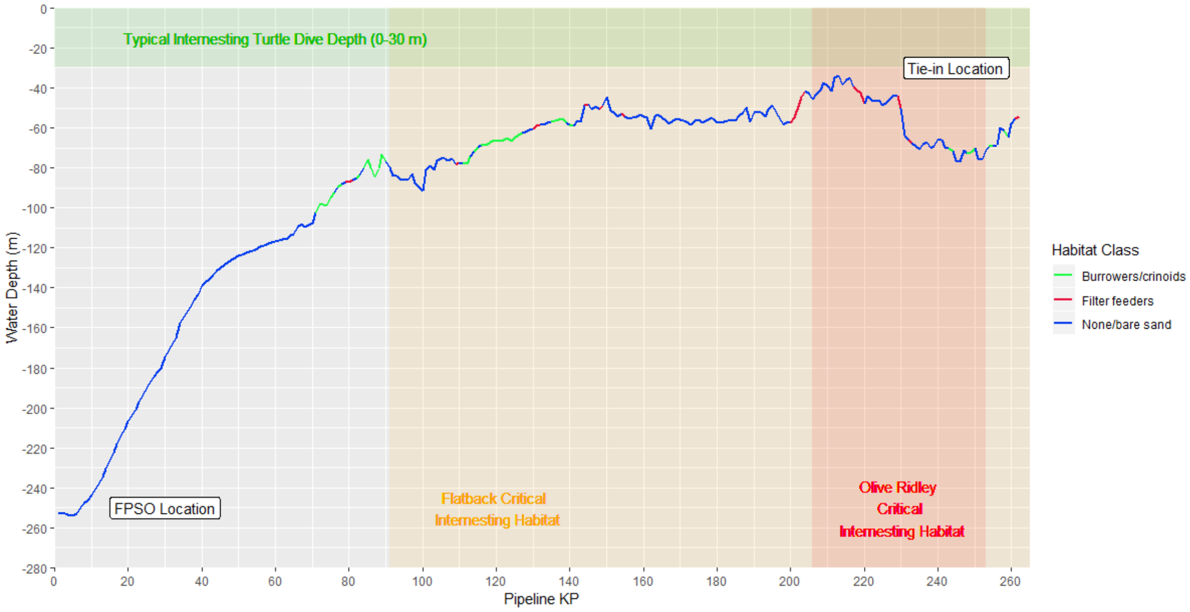



***Figure 5-12: Proposed gas export pipeline route depth profile with typical internesting turtle dive depth range (shaded green)***

As shown in **Figure 5-3**, the depth profile of the proposed gas export pipeline route is below the typical diving depths of internesting female flatback and Olive Ridley turtles. The shallowest point along the route, between KP210 and 220, is still greater than 30 m water depth.

On the basis of the available literature, internesting Olive Ridley and flatback turtles are expected to be concentrated in relatively shallow coastal waters (<30 m) around nesting beaches. Benthic habitat within the 30 m isobath around the Tiwi Islands is broadly represented and the entire pipeline route is deeper than 30 m (**Figure 4-2**). The proposed gas export pipeline route is deeper than the water depths that internesting flatback and Olive Ridley turtles typically occupy during the internesting phase; hence, disturbances to benthic habitats from the gas export pipeline installation are unlikely to affect internesting habitat.

Span rectification using mass flow excavation will result in sediment resuspension, however, as discussed above, sediments are predominantly coarse-grained sand and gravel, which settle rapidly. Given the relatively low levels of sediment that may potentially be advected into internesting habitats (water depths of less than 30 m), along with the very low levels of benthic primary producer habitat and high levels of background turbidity, potential impacts from suspended sediments to internesting habitats are negligible.

**Impact Acceptability Summary for Threatened and Migratory Species**

The proposed pipeline passes through areas designated as internesting habitat critical for the survival of both flatback and Olive Ridley turtles (**Figure 4-29**). Substantial adverse impact from the pipelay activities is not considered credible, given:

- turtle internesting habitat covers a large area compared to the pipeline operational area

- marine turtles are highly mobile and widely distributed
- internesting flatback and Olive Ridley turtles preferentially occupy coastal waters shallower than 30 m so are unlikely to frequent the operational area
- pipelay is a slow and controlled process so physical impact to marine biota is highly unlikely
- impact from suspended sediment is predicted to be negligible
- pipelay is short duration, taking approximately three months to complete. Time within the habitat critical areas adjacent to Bathurst Island is expected to be approximately 23 days for the Olive Ridley Turtle habitat critical area and up to 80 days for the Flatback Turtle habitat critical area.

Other protected species of marine reptiles (e.g. sea snakes) and fish (e.g. sharks and sawfish) are not expected to be affected due to their mobile nature, wide distribution (in the case of sea snakes and sharks) and preference for shallow coastal habitats (e.g. sawfish).

For the above reasons, no substantial change to threatened and migratory species is anticipated that may:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species
- displace threatened and migratory marine fauna from habitat critical areas
- disrupt biologically important behaviours of threatened and migratory marine fauna in biologically important areas
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- interfere with the recovery of the species.

**Australian Marine Parks**

The proposed gas export pipeline route overlaps two sections of the Oceanic Shoals Marine Park (**Figure 4-10**):

- the Multiple Use Zone (IUCN Category VI) to the south of the Barossa offshore development area
- the Habitat Protection Zone (IUCN Category IV) to the north-west of Bathurst Island.

The Oceanic Shoals Marine Park contains representative habitats from the region. Benthic habitat modelling and mapping along the proposed gas export pipeline route within the Multiple Use Zone and the Habitat Protection Zone indicated two benthic habitats were present - bare sediment (>82.8%), filter feeders (10.1%) and burrowers and crinoids (6.2%)). Potential impacts to these benthic habitats are considered above in Other Benthic Communities. Likewise, other environmental values of the Oceanic Shoals Marine Park, such as marine fauna and KEFs, are representative of the region. Refer to the preceding and following sections of this impact assessment.

The proposed gas export pipeline route and the installation of the pipeline, PLET and supporting structures are aligned with the IUCN principles and management objectives for the multiple use and habitat protection zones and are consistent with the objectives for these defined in the North Marine Parks Network Management Plan (Director of National Parks, 2018). The alignment with these principles and objectives is provided in **Table 5-9**.

For the above reasons, there is no substantial change that may modify, destroy, fragment, isolate or disturb the values of the Oceanic Shoals Marine Park.

**Key Ecological Features**

The pipeline passes through two KEFs:

1. Shelf break and slope of the Arafura Shelf (KP0 to KP73)
2. Carbonate bank and terrace system of the Van Diemen Rise (KP73 to KP107 and KP248 to KP252).

Defined values of the KEFs are:

- sponges, soft corals and other sessile filter feeders associated with hard substrate sediments of the deep channels
- epifauna and infauna
- Olive Ridley turtles, sea snakes and sharks (addressed above)

- continental slope, patch reefs and hard substrate pinnacles (addressed above).

The benthic habitat model predicts that habitat along the pipeline route within both KEFs between KP0 and KP107 are devoid of filter feeders (which includes sponges, soft coral, epifauna and infauna (**Figure 4-10** and **Figure 4-12**). This is confirmed by photographic observations taken during the geotechnical survey of the pipeline route, which showed bare sand on the seabed at all locations within the KEFs and along the whole of the pipeline. The closest sponge communities are located on Goodrich Bank; however, these were also sparsely distributed and found only in the shallow waters on top of the bank (see **Figure 4-16**). Accuracy of the model for the filter feeder class, which includes sponges, is high at 92% (**Table 4-4**).

BIAs for foraging turtles within the KEF are located more than 100 km from the operational area and the pipeline route avoids the banks, shoals and pinnacle seabed features, therefore, there will be no impact to these values.

Surface sediment along the pipeline route within the KEFs between KP0 and KP110 (**Figure 4-9** and **Figure 4-11**) are generally medium dense clayey and silty siliceous calcareous sands. The pipeline is expected to self-bury within these soft sediments. There is a span location at KP108 associated with a calcareous outcrop. This is just outside the boundary of the KEF and will be rectified using mattress or grout bags, with minimal liberation of sediment and no disturbance to the KEF.

Between KP248 and KP251 (**Figure 4-23**), sediments are fine to coarse gravel with an isolated area of hardground. There are eight span locations between KP249.5 and KP250, some of which may require mass flow excavation. The benthic habitat model predicts mostly bare sediment with outcrops of filter feeders, burrowers and crinoids in these locations (see **Figure 3-5**, Inset 7). Mass flow excavation has been assessed above with minimal impact to benthic communities predicted.

Potential impacts to Olive Ridley turtles, sea snakes and sharks are addressed above.

Impact to the environment within the KEFs are predicted to be minor, therefore, there will be no substantial changes that could modify, destroy, fragment, isolate or disturb their defined values. On this basis the impact is deemed acceptable.

**Cultural Features**

**Tangible Aboriginal Spiritual and Cultural Heritage**

Dr Corrigan, having considered the information he obtained from the Tiwi people and relevant organisations, including the Aboriginal Areas Protection Authority, Tiwi Land Council and Northern Land Council, determined that there are no specific underwater cultural heritage places along the Barossa GEP to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the future activities covered by the EP (Corrigan, 2023).

In relation to the potential for underwater cultural heritage along the pipeline route:

- The physical disturbance area of the pipeline is insignificantly small compared to the regional palaeo-landscape on which it would be placed.
- Much of the pipeline route is most likely comprised of sub-aqueously formed features of which no habitation of the sediment would have occurred, and consequently the issue of preservation potential of archaeological objects on the modern seafloor is irrelevant.
- It is highly unlikely that any archaeological object would have remained in situ taking in account post-LGM processes that affected the seafloor at that time.
- During the past 8,000 years, the seafloor has been layered over by carbonates (i.e., corals, sponges, etc.) and thin fine‐grained sediments (from sediment plumes) as well as coarse‐grained sediments from re‐deposition of tidal-current eroded sediments.
- Any archaeological artefacts are likely to have been eroded and removed, before being covered up by sediments later during the time of sea-level rise and shelf flooding.
- While certain archaeological objects (such as stone tools, like edge ground axes and other scaping tools etc) could remain intact, it is highly unlikely to ever be found (given the vast stretches of seabed with re-deposited sands and sediments of an unknown depth over transformed landscapes, all of which is covered by very deep seas (c.50-150 meters of water) the subject of intense tidal currents and usually of poor visibility).
- The seabed along the pipeline route has been, and will continue to be, physically disturbed by prawn trawling.

No Archaeological Exclusion Zone along the pipeline route has been recommended by the independent experts (Dr Corrigan, Wessex Archaeology and Dr Henry Posamentier).

Notwithstanding the assessment findings, the establishment of a Protocol for Archaeological Discoveries has been recommended by the independent expert Wessex, and this recommendation has been adopted by Santos, via the implementation of the Unexpected Finds Protocol, to manage any residual uncertainty and risk to tangible cultural features (in the highly unlikely event of a discovery) to ALARP. This protocol will be used to confirm the route of the pipeline during pre-lay surveys, which may require localised re-routing of the pipeline in the highly unlikely scenario of a discovery. The Unexpected Finds Protocol includes an annex specific to unexpected finds of First Nations Cultural Heritage (refer to Section 7.3.6).

**Intangible Aboriginal Spiritual and Cultural Heritage**

Santos acknowledges that Tiwi Islands people maintain a continuing spiritual connection with sea country and that sea country is valued by First Nations for cultural identity, health and wellbeing. Consequently, while Dr Corrigan's assessment concluded that no intangible spiritual or cultural heritage beliefs or connections were identified or linked to a specific place along the GEP route, Santos recognises the cultural and/or spiritual beliefs and connections expressed by some of the Tiwi Islanders to Dr Corrigan relating to the seas surrounding the Tiwi Islands. Santos has determined that the laying of the pipeline will have low impact and risk to cultural and/or spiritual beliefs because:

+ no underwater cultural heritage places have been identified by Dr Corrigan, which is consistent with the conclusions arrived at through consultation with Tiwi Islanders and through the examination of relevant records in the course of preparing the Environment Plan that has been accepted by NOPSEMA;
+ these intangible cultural and spiritual heritage interests and connections co-exist in the waters around the Tiwi Islands with other maritime traffic. The seas around the Tiwi Islands are high traffic commercial shipping lanes (and have been for centuries), including to the west of Bathurst Island where the proposed pipeline will be laid;
+ the seabed is already subject to disturbance from trawling and there are commercial fisheries close to the Tiwi Islands;
+ on the views of some Tiwi Islanders who provided information to Dr Corrigan, there are no cultural impediments to the laying of the GEP;
+ even taking the highest views of Tiwi Islanders as to significance, being those expressed by the EDO's clients, the impact and risk will be low, and not significant, having regard to the existing state of the environment because the pipeline will not meaningfully add to the level of disturbance currently experienced in the area;
+ the additional control measure proposed in this document to further ensure impacts are reduced to ALARP and an acceptable level (being the implementation of the First Nations Unexpected Finds Protocol and the cultural heritage control measure to implement the suggestions of Tiwi people reported by Dr Corrigan) do not require a significant modification to the activity.

In relation to these intangible spiritual and/or cultural heritage beliefs and connections to sea country, Dr Corrigan reported the suggestions of a number of senior and authoritative Tiwi Islanders who informed him regarding what would be culturally appropriate responses. Santos considers that control measures based on Dr Corrigan's recommendations will allow intangible impacts and risks to be reduced to as low as reasonably practicable and an acceptable level and has adopted these recommendations as Control 2.14 for this EP.

***Table 5-10: Demonstration of alignment with International Union for Conservation of Nature principles and North Marine Parks Network Management Plan objectives***

| Principle/Objective | Demonstration of Alignment |
|---|---|
| IUCN Category Management Principles – Multiple Use Zone (IUCN Category VI) | |
| The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term. | The biological diversity and other natural values, of the Oceanic Shoals Marine Park will not be affected by installation of the gas export pipeline due to:<br>+ the benthic habitats that exist within the proposed gas export pipeline route (including a 250 m buffer either side of the pipeline), both within the Habitat Protection Zone and the Multiple Use Zone of the marine park consist of burrowers/crinoids (approximately 19%) and filter feeders (approximately 4%), with the remaining area supporting bare sand habitat (approximately 76%). These habitats are well represented in both the Multiple Use Zone and the wider marine park as well as within the broader region (Heyward et al., 2017; Radford et al., 2019). |

| Principle/Objective | Demonstration of Alignment |
|---|---|
| Management practices should be applied to ensure ecologically sustainable use of the reserve or zone. | Installation of the gas export pipeline is consistent with the principle of ecological sustainable use of the Oceanic Shoals Marine Park. The natural processes and life support systems of the Multiple Use Zone of the Oceanic Shoals Marine Park will be sustained, and the potential for the marine park to meet the needs and aspirations for future generations will be maintained, due to the following:<br>+ The installation and operation of the gas export pipeline will not result in a significant impact to the ecological values associated with the marine park. Overall, the seabed disturbance resulting from the installation and operation of the proposed pipeline within the Oceanic Shoals Marine Park will cause very localised disturbance of benthic habitats and short-term changes to benthic communities in the immediate vicinity (within tens of metres). The representativeness of habitats and habitat diversity of the Oceanic Shoals Marine Park will be maintained.<br>+ There are no significant feeding, breeding or aggregation habitats for marine fauna within the proposed gas export pipeline route within the Oceanic Shoals Marine Park, except for internesting habitat critical to the survival of flatback turtles. However, internesting turtles are not expected to frequent the area of the proposed gas export pipeline due to water depth and the installation of the pipeline is not expected to modify any use of this habitat.<br>Santos will apply a series of management controls (detailed below in **Controls and Demonstration of ALARP**) to ensure the ecologically sustainable use of the Multiple Use Zone. |
| Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles. | Installation of the gas export pipeline is a central element of the Barossa Development that is expected to contribute to local, regional and national development, and seabed disturbance from these activities is not anticipated to impact on the biological diversity and other natural values of the Oceanic Shoals Marine Park. |

| Principle/Objective | Demonstration of Alignment |
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| **IUCN Category Management Principles – Habitat Protection Zone (IUCN Category IV)** | |
| Habitat conditions necessary to protect significant species, group or collections of species, biotic communities or physical features of the environment should be secured and maintained, if necessary, through specific human manipulation. | The proposed gas export pipeline route (including a 250 m buffer) overlaps approximately 0.0002% of the Habitat Protection Zone of the Oceanic Shoals Marine Park. The proposed pipeline route does not overlap any known burrower/crinoid habitat within the Habitat Protection Zone. The physical footprint of the pipeline and indirect impacts from installation (allowing a 250 m buffer either side) within the Habitat Protection Zone are expected to result in the loss of approximately 0.05% of the filter feeder habitat present in Habitat Protection Zone, or 0.009% of the total filter feeder habitat available within the Oceanic Shoals Marine Park.<br>It is highly unlikely that the physical presence of the gas export pipeline, installation activities and operations will result in a significant impact to the ecological values associated with the Habitat Protection Zone. Overall, the seabed disturbance resulting from the installation and operation of the proposed pipeline within the Oceanic Shoals Marine Park is expected to cause very localised disturbance of benthic habitats and short-term changes to invertebrate communities in the immediate vicinity (within tens of metres).<br>There are no significant feeding, breeding or aggregation habitats for marine fauna within the vicinity of the pipeline route within the Habitat Protection Zone, with the exception of internesting habitat critical to the survival of flatback turtles identified by the *Recovery Plan for Marine Turtles 2017–2027*. As discussed above, this habitat is likely to be too deep to be utilised as internesting habitat by flatback turtles. The physical presence of the gas export pipeline is considered highly unlikely to impact flatback turtle internesting use of the area, considering the area affected represents a very small portion of the internesting habitat critical to the survival of flatback turtles. Therefore, any impacts to marine turtles as a result of pipeline activities are aligned with the IUCN management principle. |
| Scientific research and environmental monitoring that contribute to reserve management should be facilitated as primary activities associated with sustainable resource management. | The data collected and analysed during the Barossa studies program, including those undertaken by AIMS have been used to support this EP. AIMS are also using the data to update its model/knowledge of the Oceanic Shoals Marine Park habitats and it is also being shared with Parks Australia to support the implementation of the management plan. In this way, the data and information used to assess potential impacts to the marine park is from a common source. |
| The reserve or zone may be developed for public education and appreciation of the characteristics of habitats, species or collections and for the work of wildlife management. | The Barossa studies program includes a collaborative study with AIMS, AIMS is able to use the data and information derived for non-commercial purposes and AIMS is planning to publish the results of the studies. |

| Principle/Objective | Demonstration of Alignment |
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| Management should seek to ensure that exploitation or occupation inconsistent with these principles does not occur. | Santos considers that the impacts and risks that the gas export pipeline installation activities may pose to the Habitat Protection Zone of the Oceanic Shoals Marine Park are demonstrated to be acceptable based on the following:<br>+ Habitats necessary to the survival of protected species will not be impacted.<br>+ Impacts to biotic species, including benthic habitats are expected to be minor and will not impact on the habitat representativeness or habitat diversity of the marine park.<br>+ Impacts to physical features considered values of the Oceanic Shoals Marine Park, such as the identified KEFs, are expected to be negligible.<br>Therefore, the gas export pipeline installation within the Habitat Protection Zone is consistent with the management principles of the Oceanic Shoals Marine Park. |
| People with rights or interests in the reserve or zone should be entitled to benefits derived from activities in the reserve or zone that are consistent with these principles. | Gas export pipeline installation activities are not expected to result in any benefits to people with rights or interests in the Oceanic Shoals Marine Park. |
| If the reserve or zone is declared for the purpose of a botanic garden, it should also be managed for the increase in knowledge, appreciation and enjoyment of Australia's plant heritage by establishing, as an integrated resource, a collection of living and herbarium specimens of Australian and related plants for study, interpretation, conservation and display. | Not applicable to the Oceanic Shoals Marine Park. |

| Principle/Objective | Demonstration of Alignment |
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| **Oceanic Shoals Marine Park Management Objectives – Multiple Use Zone (IUCN Category VI)** | |
| The objective of the multiple use zone is to provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species. | Installation of the gas export pipeline is consistent with the principle of ecological sustainable use of the Oceanic Shoals Marine Park:<br>+ It is highly unlikely that the physical presence of the gas export pipeline, installation activities and operations will result in a significant impact to the ecological values associated with the Oceanic Shoals Marine Park. Overall, the seabed disturbance resulting from the installation of the gas export pipeline within the marine park is expected to cause very localized disturbance of benthic habitats and short-term changes to invertebrate communities in the immediate vicinity (within tens of metres). The representativeness of habitats and habitat diversity of the Oceanic Shoals Marine Park will be maintained.<br>+ There are no significant feeding, breeding or aggregation habitats for marine fauna within the vicinity of the pipeline route within the Oceanic Shoals Marine Park, except for internesting habitat critical to the survival of flatback turtles. However, internesting turtles are not expected to frequent the area of the proposed gas export pipeline due to water depth and the installation of the pipeline is not expected to modify any use of this habitat.<br>Installation of the gas export pipeline is a central element of the Barossa Development that is expected to contribute to local, regional and national development. The impacts and risks from these activities is not anticipated to impact on the biological diversity and other natural values of the Oceanic Shoals Marine Park.<br>Therefore, the natural processes and life-support systems of the Multiple Use Zone of the Oceanic Shoals Marine Park will be sustained, and the potential for the Oceanic Shoals Marine Park to meet the needs and aspirations for future generations will be maintained. |
| The objective of the habitat protection zone is to provide for the conservation of ecosystems, habitats and native species in as natural a state as possible while allowing activities that do not harm or cause destruction to seafloor habitats. | The gas export pipeline installation activities are consistent with the management objective of the Habitat Protection Zone within the Oceanic Shoals Marine Park based on the following:<br>+ Although the presence of the gas export pipeline will result in a small direct loss of benthic habitat, there will be no impact on the habitat representativeness or habitat diversity of the Oceanic Shoals Marine Park.<br>+ Where the pipeline overlaps the Habitat Protection Zone, it is distant from seafloor features associated with the KEFs considered values of the marine park. Therefore, no impacts to KEFs are expected from pipeline activities within the Habitat Protection Zone.<br>+ Where the pipeline route overlaps the Habitat Protection Zone, it is outside the water depths (i.e. >30 m) where the majority of flatback turtle internesting activity is known to occur. Therefore, the gas export pipeline installation activities are not likely to have adverse impacts to seafloor habitat considered as internesting habitat critical to the survival of flatback turtles.<br>+ There are no sensitive or important benthic habitats, or feeding, breeding or aggregation areas for marine fauna in the vicinity of the pipeline route that could be impacted by gas export pipeline installation activities.<br>Therefore, gas export pipeline installation activities, including direct and indirect impacts from installation and operations, will not result in the destruction of seafloor habitats or impact the conservation of ecosystems within the Habitat Protection Zone of the Oceanic Shoals Marine Park. |

| Risk Assessment | | | |
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| *Installation of PLET, PLET foundations and pipeline initiation structure* | | | |
| ***Consequence*** | II – Minor | | |
| *Installation of Gas Export Pipeline and Span Rectification (except mass flow excavation)* | | | |
| ***Consequence*** | II – Minor | | |
| *Span Rectification – mass flow excavation* | | | |
| ***Consequence*** | II – Minor | | |

| Controls and Demonstration of ALARP | | | |
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| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Confirmation of proposed gas export pipeline route prior to and during installation. | This control ensures that the pipeline is laid along the planned route, which was determined taking into account (amongst other factors) environmental sensitivities that were identified during the design phase.<br>This control is very effective in avoiding sensitive habitats and span rectification by design.<br>It also provides an opportunity to identify any maritime or First Nations underwater cultural heritage articles or objects during the pre-lay survey per the Unexpected Finds Protocol (refer to Section 7.3.6). | **C 2.2** | **EPS 2.2.1**<br>Gas export pipeline route to be surveyed and confirmed prior to installation.<br>**EPS 2.2.2**<br>Gas export pipeline position to be continuously verified during installation.<br>**EPS 2.2.3**<br>Adherence to the Unexpected Finds Protocol when positioning the pipeline. |
| Dynamically positioned (DP) pipelay vessel will be used for installation of the pipeline. | The control is effective in eliminating seabed disturbance from an anchor spread for use by the pipelay vessel. The use of DP also provides high precision station-keeping, which ensures the gas export pipeline is installed along the designed route, reducing the need for span rectification. The use of DP will generate broadband underwater noise; refer to **Section 5.2.3** for the assessment of impacts from underwater noise. | **C 2.3** | **EPS 2.3.1**<br>Pipelay vessel will use DP at all times during pipelaying operations. |

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| DGPS for pipelay vessel to maintain accurate vessel position during installation. | The control is effective in ensuring vessels, in combination with DP systems, are positioned with high accuracy. This ensures the gas export pipeline is installed along the desired route. The proposed pipeline route has been designed to avoid sensitive benthic features and minimise the requirement for span rectification. | **C 2.4** | **EPS 2.4.1**<br>Pipelay vessel will use DGPS at all times during pipelaying operations. |
| Survey technology used to ensure that all structures are installed within designed tolerances. | This control is effective in ensuring that the PLETs are installed as designed at the intended locations. The selected locations do not host sensitive benthic habitats. | **C 2.5** | **EPS 2.5.1**<br>Checks prior to PLET installation to confirm:<br>+ DGPS used by pipelay vessel during installation<br>+ underwater positioning system (USBL/LBL) and ROV to confirm PLET installation location and positioning (within required location accuracy to reduce disturbance to the seabed). |
| Placement of pipeline initiation structure to avoid sensitive benthic habitats and mitigate initiation structure dragging. | This control is effective in ensuring the initiation structure avoids sensitive benthic habitats and minimises the potential for the structure to drag. | **C 2.6** | **EPS 2.6.1**<br>Initiation structure plan developed based on pre-lay survey information and include:<br>+ requirement for trained and experienced vessel crews<br>+ continuous monitoring of initiation wire tensions to prevent structure drag on seabed during pipelay<br>+ review of initiation structure plan to verify location avoids sensitive habitat. |
| No planned anchoring in the Habitat Protection Zone (IUCN IV) – Zone 2 of the Oceanic Shoals Marine Park or on named Shoals and Banks, unless it is required in an emergency. | This control is effective in preventing anchoring on sensitive benthic habitats associated with the named banks and shoals in the region. The proposed gas export pipeline route has been designed to avoid these features. | **C 2.7** | **EPS 2.7.1**<br>All anchoring restricted to the areas beyond named banks and shoals. |
| | | | **EPS 2.7.2**<br>Activity vessels shall not anchor in the Habitat Protection Zone (IUCN IV) -zone 2 of the Oceanic Shoals Marine Park, unless it is required in an emergency. |

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| No pipeline installation activities within Olive Ridley turtle internesting BIA. | This control is effective in avoiding the internesting BIA for Olive Ridley turtles, which may host turtles undertaking biologically significant behaviour. Given the behaviour of Olive Ridley turtles, they are unlikely to be encountered within the water depths of the proposed gas export pipeline route when internesting. | **C 2.8** | **EPS 2.8.1**<br>All gas export pipeline installation activities restricted to areas beyond the Olive Ridley turtle internesting BIA. |

| ***Additional Controls*** | | | | |
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| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| Eliminate rock dumping span rectification method. | Yes | Yes | An assessment of span rectification methods indicated that rock dumping is, overall, the least preferred span rectification method. Rock dumping shall be excluded and replaced by localised span correction mattresses and grout bags. | N/A |
| Eliminate mechanical trenching-based span rectification methods. | Yes | Yes | Mechanical trenching, either pre-lay or post-lay, can be used to locally lower the pipeline at span shoulders to reduce spans. Mechanical trenching shall be excluded and replaced by localised span correction mattresses and grout bags. | N/A |
| ***Substitution*** | | | | |
| Gas export pipeline route to avoid the Oceanic Shoals AMP Habitat Protection Zone. | No | No | See Justification below. | N/A |

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| Justification<br>Santos examined a preliminary route to the east of the Oceanic Shoals Marine Park that did not overlap the HPZ (IUCN Cat IV). Investigations along this preliminary route indicated the seabed was more rugose than the proposed route through the HPZ and would require considerably more seabed intervention and pipeline stabilisation (e.g. dredging/trenching). Benthic habitats along this preliminary route are also more diverse than those along the route within the HPZ and may support relatively diverse biological communities. Additionally, the preliminary route overlaps internesting habitat critical for the survival of the Olive Ridley turtle identified in the Recovery Plan for Marine Turtles (Commonwealth of Australia, 2017a). Therefore, the preliminary route east of the HPZ was identified as having greater environmental impacts than the proposed route through the HPZ.<br>Installation the gas export pipeline to the west of the Habitat Protection Zone (IUCN Cat IV) would result in the route overlapping the National Park Zone (IUCN Cat II), which has a higher level of protection. The Australian Marine Parks North Marine Park Management Plan (Director of National Parks, 2018) states construction of a pipeline is an allowable activity. However, routing the gas export pipeline through the National Park Zone is not acceptable as a route through an area with a lower level of protection (i.e. the proposed route) is available.<br>Based on the preceding points, Santos considers the proposed route through the Oceanic Shoals Marine Park HPZ is the only practicable route. The Director of National Parks has granted Santos a licence within the HPZ for the installation of the gas export pipeline. | | | | |
| ***Engineering*** | | | | |
| Additional stabilisation to prevent pipeline flex. | Yes | No | The gas export pipeline has been designed to allow some flexing (e.g. lateral movement on the seabed within design limits). This lateral movement is expected to be small due to the concrete weight coating but may result in disturbance to benthic habitats. The footprint of additional stabilisation required to restrain pipe movement is expected to exceed the footprint of sections of the gas export pipeline that may flex laterally, hence the pipeline shall be allowed to flex. | N/A |
| ***Administrative*** | | | | |
| Divide the pipeline installation scope into multiple campaigns to minimise work performed during the peak internesting periods within important habitat for listed marine turtles. | No | No | See Justification below. | N/A |
| Justification<br>Unlike other turtle populations (e.g. on the North West Shelf of WA), the Olive Ridley and flatback turtles nesting seasons on Bathurst Island do not exhibit discrete nesting seasons. Rather, there is low level nesting year-round, with a peak in nesting and internesting during winter months. A seasonal exclusion would not avoid all turtle nesting and internesting activity but may avoid the known peaks.<br>Should timing of pipeline installation and associated activities be scheduled to avoid peak interesting season this will impose impractically tight restrictions on the window for starting operations in order to ensure the activities can be completed outside of the peak internesting season, without the risk of the activities having to be split over multiple seasons. The start date for the pipelay operations is driven by the limited availability of pipelay vessels in region, prior commitments of pipelay vessels and the availability of associated equipment such as linepipe materials | | | | |

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| and PLET structures to support the activities. Due to the uncertainty on these elements it is standard practice to negotiate a large window for commencement of pipelay operations with a mechanism to reduce the window as the project progresses and the factors detailed above become more certain. The call down window is initially under the control of Santos before passing to the pipelay vessel operator in order that they can manage their prior vessel commitments. As a result of the call down mechanism for the pipelay vessel and the uncertainty on the pipelay start date it is impractical to guarantee that pipelay activities can be fully completed in a given season.<br>If seasonal exclusions are imposed and activities cannot be completed in a single season then this will require the activities to be split over multiple seasons. This will result in an overall extension in the duration of the activity, additional vessel mobilisations and demobilisations and will considerably increase the cost of pipelay.<br>If the campaign extends over two seasons there is a risk that spans are left unrectified in the intervening period which may markedly increase the number of span corrections required or could result in unacceptable fatigue damage to the pipeline resulting in the need to replace a section of pipeline. It may also be counterproductive as multiple vessel mobilisations could increase the overall environmental impact.<br>It may also raise the risk of simultaneous operations (SIMOPS), where the pipelay vessel ends up interacting with other Barossa construction activities (spool installations, drilling or FPSO mooring installation). SIMOPS is highly undesirable mode of operation as it means vessels either being stood down for a period of time or operating in close proximity to one another. Apart from the additional cost, this could increase collision risk and result in enhanced cumulative environmental impact for aspects such as light and noise.<br>Santos has assessed if certain activities associated with the pipelay operations, such as pre-lay and post-lay span correction, can be performed outside of peak internesting periods. However, the construction vessels used to support pipelay operations are also required throughout the full pipelay campaign and as such the sequence of pre-lay activities, pipelay and post-lay activities is more effectively performed in a single campaign in order to avoid the requirement to perform multiple mobilisations/demobilisations of the construction vessel(s). As highlighted above it is also necessary to ensure spans are corrected as soon as practicable and as such post-lay work cannot practically be separated from the pipelay activity. Performing the work in a single continuous campaign also enables pre-lay and post-lay activities to be performed in parallel with pipelay where practicable to further reduce the schedule, optimise the offshore campaign and minimise the extent of span correction required thus reducing the seabed footprint and environmental impact.<br>Given the likely low impact to turtles, implementing seasonal control for elements of the activity and the whole activity was discounted. | | | | |
| Sequence activities to minimise the time pipelay, and associated activities, are performed within peak internesting periods in important habitat for listed marine turtles. | Yes | Yes<br>**C 2.10** | While it is not practicable to time the start date of the activity due to scheduling constraints (that is, the Barossa pipelay must fit in with the overall pipelay vessel job sequence), it is possible to sequence activities to minimise the time pipelay, and associated activities, are performed within peak turtle internesting periods. For example, it is possible to select the direction of pipelay based on the start date in relation to peak internesting seasons, or sequence span rectification activities to prioritise certain regions over others (notwithstanding technical drivers to rectify critical spans in a timely manner).<br>No timing restrictions are proposed for the pre- and post-lay site survey due to their inherently low impact. | **EPS 2.10.1**<br>Planning for pipelay installation (including span rectification) shall consider turtle internesting season and activities shall be sequenced to avoid peak periods where the pipeline integrity is not compromised as a result. |

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| Pre-lay and post-lay surveys at initiation structure location. | Yes | Yes<br>**C 2.11** | Pre-lay surveys confirm the nature of the seabed within the initiation structure location to ensure the structure is installed on bare area of the seabed.<br>Post-lay surveys will allow verification of the impact assessment. | **EPS 2.11.1**<br>The pipeline initiation structure shall be placed on a bare area of seabed. |
| | | | | **EPS 2.11.2**<br>Pre- and post-lay surveys of anchoring locations will be undertaken. |
| Pre-lay and post-lay benthic habitat surveys along the full gas export pipeline route. | Yes | No | Habitats along the pipeline route are well known having been extensively studied (**Section 4.4**). The route has been shown to be devoid of sensitive habitat, including within the areas of the KEF and Oceanic Shoals Marine Park. Pre- or post-lay benthic habitat surveys would provide no further information or environmental benefit and have been ruled out. | N/A |
| Monitoring of the seabed to determine environmental impact during span rectification. | Yes | No | Preliminary span engineering has been carried out and rectification techniques will be limited to mattresses, grout bags, mechanical support structures and mass flow excavation (see **Section 3.5.4**). The seabed types at rectification locations are well understood and deemed to be well distributed throughout the region. The impact from span rectification has been demonstrated to be acceptable and no further environmental monitoring is considered necessary. | N/A |

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| Limiting duration for continuous mass flow excavation at any one location. | Yes | Yes<br>**C2.13** | Mass flow excavation may be used to locally reduce high spots at the span shoulders to lower the pipeline and control spans. Excavation will be limited to twelve hours in the event that the excavation rate is lower and to place boundaries on its use.<br>The impact assessment demonstrated minimal impact from suspended sediment for mass flow excavation at maximum excavation rate for one hour. If excavation is required for longer periods then sand is being excavated at a slower rate with less sediment liberated into the water column but for a longer duration. Under these conditions impact would be no greater than excavation at a higher rate for a shorter duration.<br>Procedures shall be developed if mass flow excavation is required limiting the duration excavation can occur at any one location in order to limit turbidity caused by sediment transfer. | **EPS 2.13.1**<br>Mass flow excavation procedures, shall include the requirement to limit mass flow excavation at any one location to no greater than 12 hours within a 24-hour period. |
| Cultural Heritage | Yes | Yes<br>C2.14 | In relation to intangible spiritual and/or cultural heritage beliefs and connections to sea country, Dr Corrigan reported the suggestions of a number of senior and authoritative Tiwi Islanders who informed him regarding what would be culturally appropriate responses. Santos considers that control measures based on Dr Corrigan's recommendations will allow intangible impacts and risks to be reduced to as low as reasonably practicable and an acceptable level. | **EPS 2.14.1**<br>• Cultural Heritage monitors to accompany the construction crew to conduct cultural training, ensure a culturally appropriate figure is present and introduce the Activity to the seas and the spiritual beings (unless recorded by Santos that relevant senior and authoritative Tiwi Islanders do not want the attendance of cultural heritage monitors for any or all of these purposes).<br>• Community benefits package. |

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| Using divers instead of or in addition to ROV to survey for underwater cultural heritage | No | No | Santos has considered but not adopted the option of using divers to survey for underwater cultural heritage. There are significant occupational health and safety (OHS) risks associated with saturation diving in ~30-120 metres of waters in Northern Australia (e.g., marine life, high currents, low visibility), significant financial costs (hundreds of thousands of dollars per day) and operational challenges attributable to a prolonged diving campaign (e.g. specialised offshore dive support vessels and commercial divers trained in First Nations archaeology). The procurement time for such vessels and commercial divers would be lengthy, as would the diving operations.<br>These OHS risks and financial costs are disproportionally high to the low likelihood of finding any underwater cultural heritage, which are largely avoidable by using an ROV. | N/A |

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| Additional geotechnical or geophysical surveys, or any other further underwater cultural heritage assessments | No | No | Having regard to the expert reports of Dr Corrigan and Dr Posamentier, Santos does not consider any additional geotechnical or geophysical surveys, or any other further underwater cultural heritage assessments to be warranted. Both Dr Corrigan and Dr Posamentier agreed that any landscape that people lived on thousands of years ago that was now submerged by the incoming seas would have most likely been substantially altered (by erosional and depositional forces and subsequent tides, cyclones and currents) and organic materials like fibrous nets, wooden spears and carved poles and bark dwellings would all be most likely removed from their original locations and disintegrated.<br>Further, additional geotechnical or geophysical surveys and taking target core samples, would come at a significant and disproportionate financial cost, with potential environmental impacts and risks (e.g., management of underwater noise associated with 3D marine seismic surveys). Further surveys and sampling would delay the project, measured in years, because of regulatory approvals and procurement of specialist survey vessels and equipment. This would result in a material impact to project capital cost and the commencement of gas production. Santos considers the high cost and additional environmental impacts and risks of acquiring the supplementary information to be disproportionate to the benefit of refining scientific understanding where the archaeological potential within the offshore study area has already been broadly established at a landscape scale by Wessex and Santos is implementing measures to identify any previously unidentified First Nations underwater cultural heritage articles or objects during pre-lay surveys. | N/A |
| The option of installing engineered pipe supports to minimise seabed disturbance | No | No | Santos has considered but not adopted the option of installing engineered pipe supports to minimise seabed disturbance. This is considered an impracticable engineering solution over such a long distance. | N/A |

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| The option of significant re-routing or relocation of the pipeline. | No | No | Santos has considered but not adopted the option of significant re-routing or relocation of the pipeline. The financial costs of additional engineering, pipe fabrication for a potentially longer route, surveys, regulatory approvals, contractual re-negotiations, and project delays would measure in the order of hundreds of millions to billions of dollars and be disproportionate to the potential benefits, given the findings of the independent experts. | N/A |
| The option of obtaining further information from people and /or organisations who have, in accordance with Indigenous tradition, spiritual and cultural connections to any underwater cultural heritage places along the pipeline route that may be affected by the activities. | No | No | Santos has considered and not adopted the option of obtaining further information from people and /or organisations who have, in accordance with Indigenous tradition, spiritual and cultural connections to any underwater cultural heritage places along the pipeline route that may be affected by the activities. Dr Corrigan and his team have completed sixty-one days of fieldwork, and demonstrably made considered effort over time to be available to all persons who wanted to provide input. Through his assessment it was found that Tiwi cultural knowledge is openly held without secrecy. It is highly unlikely that further fieldwork would result in the identification of any underwater cultural heritage places along the pipeline route, located on an ancient landscape that was submerged c.10,000 years ago. | N/A |

**ALARP Statement**

Based on the outcomes of the impact assessment and the implementation of controls throughout the activity, Santos considers that the impacts from seabed disturbance from installation of the gas export pipeline, PLETs and supporting structures are reduced to ALARP.

Relevant legislative requirements and standard industry practices have been applied to control the risk. Additional controls were evaluated; several were selected for implementation, three were rejected as the reductions in impacts were considered grossly disproportionate to the cost of implementation.

The controls selected for implementation re effective in reducing impacts to a range of environmental receptors. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts.

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
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| Australian Marine Park | North Marine Parks Network Management Plan | See **Table 5-10**. | See **Table 5-10**. |

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| Marine turtles | Recovery Plan for Marine Turtles 2017–2027 | Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival of the species.<br>Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue.<br>Manage infrastructure, coastal development, dredging and trawling to ensure ongoing biologically important behaviours for marine turtle stocks continue.<br>Use up to date information regarding nesting, internesting and foraging habitat to inform future development proposals and approval decisions. | There is no evidence to suggest that the proposed activity will result in marine turtles being displaced from habitat critical to their survival nor that important biological behaviour will be interrupted.<br>Pipelay is short duration taking approximately three months to complete. Time within the habitat critical areas adjacent to Bathurst Island is expected to be approximately 23 days for the Olive Ridley Turtle habitat critical area and up to 80 days for the Flatback Turtle habitat critical area.<br>Pipelay is a slow and highly managed process so physical impact to marine turtles is highly unlikely.<br>The footprint of the pipeline represents a small area of important habitat in this area.<br>The pipeline itself will form suitable habitat for colonisation by flora and fauna.<br>This EP and the literature review (Pendoley, 2020) summarises the most up-to-date information on turtle nesting, internesting and foraging habitat. |

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| Sawfish | Sawfish and River Shark Multispecies Recovery Plan | Reduce adverse impacts of habitat degradation and modification[2].<br><br>Ensure all future developments will not significantly impact upon sawfish and river shark habitats critical to the survival of the species, or impeded upon the migration of individual sawfish or river sharks. | The management of seabed disturbance from the installation of the gas export pipeline, PLETs and supporting structures are aligned to the objectives of the Sawfish and River Shark Multispecies Recovery Plan.<br><br>No habitat critical to the survival of the species has been identified in the operational area or EMBA and therefore adverse impacts from the modification of habitat is not predicted to result in adverse impacts to sawfish species, as described above. |

[2]Note that in the *Sawfish and River Sharks Multispecies Issues Paper* (Commonwealth of Australia, 2015) the habitat threats exist for sawfish and river shark species, particularly those species that rely to a greater extent on freshwater and inshore areas. The threats identified included coastal developments and the impacts on juveniles within those habitats.

| Levels of Acceptable Impact |
|---|
| Seabed impacts from installing the Barossa pipeline and supporting structures (including span rectifications) will be acceptable if there is:<br>+ no substantial change in water quality which may adversely impact biodiversity, ecological integrity, social amenity or human health<br>+ no substantial change that may 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<br>+ no substantial change to threatened and migratory species that may lead to a reduction in the area of occupancy of the species or in the size of a population:<br>– lead to a long-term decrease in the size of a population<br>– reduce the area of occupancy of the species<br>– adversely affect habitat critical to the survival of a species<br>– displace threatened and migratory marine fauna from habitat critical areas<br>– disrupt biologically important behaviours of threatened and migratory marine fauna in biologically important areas<br>– disrupt the breeding cycle of a population<br>– modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline<br>– interfere with the recovery of the species.<br>+ no substantial change that may modify, destroy, fragment, isolate or disturb the following values of the Oceanic Shoals Marine Park, being:<br>– KEFs of the marine park<br>– threatened and migratory marine species<br>– BIAs for foraging and internesting marine turtles.<br>+ no substantial change that may modify, destroy, fragment, isolate or disturb the following values of the Carbonate bank and terrace system of the Van Diemen Rise KEF:<br>– sponges, soft corals and other sessile filter feeders associated with hard substrate sediments of the deep channels<br>– epifauna and infauna including polychaetes and ascidians<br>– Olive Ridley turtles, sea snakes and sharks.<br>+ no substantial change that may modify, destroy, fragment, isolate or disturb the following values of the Shelf break and slope of the Arafura Self KEF:<br>– continental slope, patch reefs and hard substrate pinnacles.<br>+ Avoidance of any underwater cultural heritage if identified during pre-lay surveys, consistent with the *Underwater Cultural Heritage Act 2018* (Cth) objectives to identify, protect and conserve Australia's underwater cultural heritage. Any underwater cultural heritage discovered during pre-lay surveys will be notified to DCCEEW in accordance with the *Underwater Cultural Heritage Act 2018* (Cth) and disturbance avoided. |
| **EPOs (Table 6-1)** |
| **EPO 2**<br>Direct impacts to benthic habitats will be restricted to the footprint of the pipeline and supporting structures.<br>Beyond the footprint of the pipeline and supporting structures impact will be limited to localised, short term disturbance associated with suspension and deposition of surface sediment.<br>**EPO 18**<br>No significant impacts to cultural features from the Activity. |

Santos

### 5.2.3 Noise emissions

| | |
|---|---|
| **Risk** | Underwater noise from vessels, MBES, SBP Chirper, LBL and USBL resulting in:<br>+ masking of vocalisations and signals from predators and prey<br>+ modification of fauna behaviour (avoidance, attraction and disruption of normal behaviour)<br>+ physical injury to fauna from exposure to excessive noise (barotrauma, hearing loss) |
| **Aspect-receptor reference (Table 5-5)** | 3I – Pelagic and demersal fish communities<br>3J – Marine mammals<br>3K – Marine reptiles<br>3L – Sharks and rays |

**Description of the Source of Risk**

There will be a period of increased noise emissions during installation activities due to the operation of activity vessels, operation of survey and positioning equipment and from helicopters supporting the installation activity.

Underwater noise emissions will be temporary and will take place for a relatively short period of time in any one location, because the pipelay vessel is continuously moving at a speed of approximately nominally 3 km a day.

**Pipeline Installation Activities – Vessel**

Noise associated with vessel activity that could impact marine fauna includes noise generated by vessel thrusters, engines and propellers, as well as noise emitted onboard which is converted to underwater noise through the hull (e.g. from heavy machinery). The main source of vessel noise will be from propellers or DP thrusters.

Noise will also be generated during installation of the gas export pipeline from span rectification activities, placement of the pipeline on the seabed during gas export pipeline installation and use of ROVs. However, sound from the vessels themselves will be the primary source of sound during span rectification, pipeline placement and ROV use, and therefore vessel sound has been used to determine the noise emissions during gas export pipeline installation.

**Helicopters**

The main source of noise emissions from helicopters is the engines and the rotor blades. The landing and take-off of helicopters would be the only time noise emissions from helicopters would occur in the operational area as this is when helicopters are at their lowest (and therefore closest to the surface of the water). Helicopters are expected to land/take-off up to four times a day on the pipelay vessels and up to twice a day on other activity vessels.

**Survey Equipment**

Survey activities will be undertaken along the pipeline route to understand the seabed features and the location of relevant infrastructure. Survey methods will primarily involve:

+ MBES, such as the Reson SeaBat 7125 transmitting at 400 kHz. At 400 kHz it has a 1° beamwidth along the track, and a source level of 220 dB re 1 µPa (Coastal Frontiers, 2017)
+ compressed high intensity radar pulse (CHIRP) sub-bottom profiler (SBP) with a chirp frequency range from 2 to 50 kHz, with three chirp transducers for three frequency ranges, 2 to 9 kHz, 10 to 20 kHz and 20 to 50 kHz. The in-beam estimated maximum source levels are about 200 to 205 dB re 1 µPa @ 1 m (DOC, 2016)
+ SSS, which is generally considered a high acoustic density source and medium frequency generator. The level of sound pressure ranges from about 200–235 dB re 1µPa SPL. The frequency ranges from about 75 to 900 kHz (Jimenez-Arranz et al., 2017).

**Underwater Acoustic Positioning**

USBL or LBL acoustic positioning system will be utilised on board the pipelay vessel. This tool is used to locate the position of subsea transponders that have been placed on the seabed. The USBL and LBL system uses a vessel mounted transceiver to detect the range and bearing to a target using acoustic signals.

An acoustic pulse is transmitted by the transceiver and detected by the subsea transponder, which replies with its own acoustic pulse. This return pulse is detected by the shipboard transceiver. The time from the transmission of the initial acoustic pulse until the reply is detected is measured by the USBL or LBL system and is converted into a range. To calculate a subsea position, the USBL or LBL calculates both a range and an angle from the transceiver to the subsea beacon. Angles are measured by the transceiver, which contains an array of transducers. The transceiver head normally contains three or more transducers separated by a baseline of 10 cm or less. A method called "phase-differencing" within this transducer array is used to calculate the angle to the subsea transponder. The transducer will then send sound signals, typically at 19 to 33 kHz to a USBL transponder.

**Table 5-11** details the nominal specifications of likely acoustic positioning systems as detailed in McPherson, 2020.

***Table 5-11: Specifications of nominal acoustic positioning systems***

| Manufacturer | Model | Source Frequency (kHz) | Source Level (dB re 1 µPa @ 1 m) |
|---|---|---|---|
| Kongsberg | HiPAP 500 | 33 | 206 |
| Sonardyne | Ranger USBL | 18 to 36 | 204 |

**Potential Impacts**

Underwater noise emissions have the potential to affect marine fauna that may transit the operational area, including marine mammals, reptiles, sharks/rays and other fish. Marine fauna use sound for a range of functions such as social interaction, foraging and orientation. Marine fauna respond variably when exposed to underwater noise from anthropogenic sources, with effects dependent on a number of factors, including distance from the sound source, water depth and bathymetry, the animal's hearing sensitivity, type and duration of sound exposure and the animal's activity at time of exposure (JASCO Applied Sciences, 2016b). Broadly, the effects of sound on marine fauna can be categorised (JASCO Applied Sciences, 2016b) as:

+ Acoustic masking – Anthropogenic sounds may interfere with, or mask, biological signals, therefore reducing the communication and perceptual space of an individual. Auditory masking impacts may occur when there is a reduction in audibility for one sound (signal) caused by the presence of another sound (noise). For this to occur the noise must be loud enough and have a similar frequency to the signal and both signal and noise must occur at the same time.
+ Behavioural response – Behavioural impacts will depend on the audible frequency range of each potential receptor in relation to the frequency of the noise, as well as the intensity of the noise. Behavioural changes vary significantly and may include temporary avoidance, increased vigilance, reduction in foraging and reduced vocalisations.
+ Physiological impacts – Auditory threshold shift (temporary and permanent hearing loss) – marine fauna exposed to intense sound may experience a loss of hearing sensitivity, or even potentially mortal injury. Hearing loss may be in the form of a temporary threshold shift (TTS) from which an animal recovers within minutes or hours, or a permanent threshold shift (PTS) from which the animal does not recover.

Available threshold criteria associated with behavioural and physiological impacts for sensitive receptors have been derived from a number of studies (NMFS, 2018; NMFS, 2014; Popper et al., 2014; Southall et al., 2019). These criteria have been compared with measured and predicted sound levels for different sound sources to assess potential impacts.

**Marine Mammals**

No significant feeding, breeding or aggregation areas for marine mammals are known within the operational area. The only BIAs for marine mammals in the NMR are for the Indo-Pacific bottlenose dolphin (Darwin Harbour), Australian humpback dolphin (Darwin Harbour and Van Diemen Gulf) and Australian Snubfin Dolphin (Darwin Harbour and Van Diemen Gulf) (**Section 4.5.5.5**). These areas are located approximately 66km from the operational area at the closest point. However, as described in **Section 4.5.5.5**, several marine mammals may occur in the operational area.

A number of species of baleen whales may occur in the operational area, including Omura's, pygmy blue and Bryde's whale. Based on their hearing range these whales have been classified as low frequency (LF) cetaceans. A number of odontocetes (including dolphins and false killer whales) may also be present in the northern section of the operational area. Dolphins may also transit through the southern section of the operational area. Odontocetes have been classified as high frequency (HF) cetaceans (using the hearing group classification from Southall et al. (2019)). Previously these were classified as mid-frequency cetaceans (Southall et al., 2019; NMFS, 2018).

While dugongs may occur in the operational area, dugongs spend most of their time in shallow tidal and subtidal seagrass meadows. There are no assessments for impacts of vessel noise on dugongs (sirenians) using the Southall et al. (2019) criteria. As their frequency-weighting is most similar to HF cetaceans, and their thresholds are higher (as they are less sensitive), results for vessel noise impacts on HF cetaceans have been used as a proxy for those on dugong, noting that this is likely to be conservative.

**Table 5-12** and **Table 5-13** detail receptor noise impact and behavioural thresholds for continuous noise (vessels) and impulsive noises (survey equipment).

***Table 5-12: Impulsive noise: summary of marine mammal impact thresholds as derived from Southall et al. (2019) and NMFS (2014)***

| Potential Marine Fauna Receptor | PTS Onset Thresholds[3] | | TTS onset thresholds[3] | | Behaviour (SPL, dB re 1 µPa) |
|---|---|---|---|---|---|
| | Weighted $SEL_{24h}$ (dB re 1 µPa²·s) | PK (dB re 1 µPa) | Weighted $SEL_{24h}$ (dB re 1 µPa²·s) | PK (dB re 1 µPa) | |
| High-Frequency (HF) cetaceans | 185 | 230 | 170 | 224 | 160 |
| Low-Frequency (LF) cetaceans | 183 | 219 | 168 | 213 | |

***Table 5-13: Continuous noise: summary of marine mammal impact thresholds as derived from Southall et al. (2019) and NMFS (2014)***

| Potential Marine Fauna Receptor | Physiological (SEL, dB re 1 µPa²·s; weighted) | | Behaviour (SPL, dB re 1 µPa) |
|---|---|---|---|
| | PTS | TTS | |
| HF cetaceans | 198 | 178 | 120 |
| LF cetaceans | 199 | 179 | |

<u>Marine Mammals: Potential Impacts from Vessels</u>

The estimated distances to behavioural and physiological thresholds (as listed in **Table 5-13**) for marine mammals are provided in **Table 5-14**.

Zykov et al. (2013) considers a range of modelling scenarios for pipelay and support vessels in 23 to 80 m of water, with seafloor surface geology consisting of sand and silt. The depths and geology are similar to those within the Barossa Development area and along the pipeline route, and the sound speed profile is similar at the relevant shallow depths to that used in previous work for the Barossa Development (JASCO, 2016). The vessel referenced in Zykov et al. (2013) is the Allseas Solitaire, a similar vessel to the Allseas Audacia, which is proposed to be used for this project.

The Allseas Audacia has a similar total installed thruster power to the MODU considered in McPherson et al. (2019), 35,000 kW compared to 30,400 kW. McPherson et al. (2019) is one of the few limited studies available considering the most recent criteria for potential physiological effects (Southall (2019) (**Table 5-13**) and the equivalent NMFS, 2018) from vessels, in water depths less than 600 m. Therefore, it has been considered where there are similarities to the sound sources for the gas export pipeline installation.

***Table 5-14: Estimated distances to behavioural and physiological thresholds (as listed in Table 5-13) for marine mammals from vessels***

| Potential Marine Fauna Receptor | Estimated Distance (km) | Justification/ Reference |
|---|---|---|
| *PTS* | | |
| HF cetaceans | Not predicted to occur | McPherson et al. (2019), Offshore support vessel under DP, Mobile Offshore Drilling Unit (MODU) under DP<br>JASCO (2016), Barossa FPSO during offload (thrusters in use) |

[3] Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset.

| | | |
|---|---|---|
| LF cetaceans | <110 m | McPherson et al. (2019), Offshore support vessel under DP, MODU under DP |
| Sirenians (dugongs) | Not predicted to occur | HF cetaceans used as a proxy |
| *TTS* | | |
| HF cetaceans | <120 m | McPherson et al. (2019). Offshore support vessel under DP, MODU under DP |
| LF cetaceans | <1.5 km | McPherson et al. (2019). Offshore support vessel under DP, MODU under DP |
| Sirenians (dugongs) | <120 m | HF cetaceans used as a proxy |
| ***Behaviour*** | | |
| HF cetaceans | 1.3 – 9.8 km | JASCO (2016), Barossa FPSO during operations (1.3 km)<br>McPherson et al. (2019). Offshore support vessel under DP (1.3 km)<br>Zykov et al. (2013), Pipe-laying vessel under DP in 80m water (9.8 km) |
| LF cetaceans | | |
| Sirenians (dugongs) | | |

The modelling for the Barossa FPSO during normal operations (JASCO, 2016) has been included to provide context for sound levels likely when vessels are under idle/very low power. Two studies, JASCO (2016) and McPherson et al. (2019)., have been included in reference to HF cetaceans to demonstrate that in both the project location and for a reasonable surrogate using the latest criteria, PTS is not exceeded.

Auditory masking impacts may occur when there is a reduction in audibility for one sound (signal) caused by the presence of another sound (noise). For this to occur the noise must be loud enough and have a similar frequency to the signal and both signal and noise must occur at the same time. Therefore, the closer the marine mammal is to the vessel, and the more overlap there is with their vocalisation frequencies, the higher the probability of masking. The potential for masking and communication impacts is therefore classified as high near the vessel (within tens of metres), moderate within hundreds to low thousands of metres, and low at greater distances (Clark et al., 2009).

As outlined in **Table 5-14**, marine sound generated from vessel activities has the potential to cause behavioural responses, such as avoidance, in marine mammals who are within 1.3 to 9.8 km of the pipelay vessel.

While it is considered unlikely that transiting individuals would remain in close proximity to the sound source, PTS may occur in low frequency cetaceans within close proximity (<110 m) of the vessel. TTS may occur up to 1.5 km away for low-frequency cetaceans and within close proximity (<120 m) for high frequency cetaceans and dugongs).

The risk of impact is further reduced as the pipeline installation vessels will be slowly moving along the pipeline route at a rate of approximately 3 km per day. The likelihood of an individual remaining within the distances above for any length of time is highly unlikely.

<u>Marine Mammals: Potential Impacts from Helicopters</u>

Helicopter noise has been measured at a maximum received level of 109 dB re 1 uPa (SPL) and only detectable underwater for 11 to 38 seconds (based on transit speed), depending on water depth (Richardson et al., 1995). Therefore, the only credible impact would be behavioural impacts, limited to short term behavioural responses such as diving and/or increased swimming speed when the helicopter is landing or taking off. Such impacts are unlikely to result in substantial impacts to marine mammal populations or distribution.

<u>Marine Mammals: Potential Impacts from Survey Equipment and Positioning Equipment</u>

Modelling of survey geophysical equipment has been undertaken at a number of locations including the coast of Russia, Greenland, California and the Otway basin (Zykov et al., 2013; Austin et al., 2012; McPherson and Wood, 2017; Zykov et al., 2012). These studies, along with the example of accumulation provided in McPherson (2020) indicate that both peak and frequency-weighted SEL noise emissions from survey equipment such as MBES operating at 400 kHz or CHIRP SBP are typically below sound levels that could result in low and high-frequency marine mammal TTS or PTS from either PK or SEL criteria (**Table 5-12**) in a horizontal direction. The threshold for behavioural disturbance (**Table 5-12**) could be exceeded within 120 m (McPherson, 2020).

SSS impulses MBES sound levels are outside the auditory range of low frequency species / baleen whales (e.g. humpback and pygmy blue whales) but within the mid-frequency and high frequency cetacean marine fauna auditory range (e.g. sperm whales and dolphins). However, PTS and TTS thresholds for these species (**Table 5-12**) are only expected to be exceeded close to the source. Due to the lack of aggregating areas for these species, individuals are expected to be transitory only, displaying behavioural responses, and moving away from the source, before TTS and PTS thresholds are exceeded.

Measurements of vessel mounted CHIRP SBP operating at 3.5 kHz indicated that the threshold for behavioural disturbance could be exceeded within 22 to 30 m (Chorney et al., 2011; Warner et al., 2011).

Positioning equipment similar to that proposed to be used during the gas export pipeline installation have been considered. The source levels for the positioning equipment are below those for the MBES. As the MBES will not cause the thresholds for physiological impact to be exceeded (**Table 5-12**), neither will the positioning equipment. However, threshold for behavioural disturbance (**Table 5-12**) could be exceeded within 40 m (McPherson, 2020).

Survey and positioning equipment could cause masking of vocalisations of cetaceans due to the overlap in frequency range between signals and vocalisations. Masking will primarily apply to HF cetaceans, with all signals above 2 kHz. Higher frequency sounds have limited propagation, and attenuate rapidly, resulting in a relatively small area of influence. Therefore, the range at which masking impacts could occur would be limited to within hundreds of metres from the sound source.

The risk of impact is further reduced as the survey vessels will be moving along the pipeline route. The likelihood of an individual remaining within the distances above for any length of time is highly unlikely.

**Marine Reptiles**

The operational area traverses internesting habitat for flatback and Olive Ridley turtles. Therefore, flatback and Olive Ridley turtles in particular may transit the operational area in higher numbers, particularly during the peak internesting period (June to September for flatbacks and April to August for Olive Ridley turtles).

Marine turtles: potential impacts from vessels

No numerical thresholds have been developed for impacts of continuous sources (e.g. vessel noise) on marine turtles. However, Popper et al. (2014) have developed risk-based criteria, and these are presented in **Table 5-15**.

***Table 5-15: Criteria for vessel noise exposure for turtles, adapted from Popper et al. (2014)***

| Potential Marine Fauna Receptor | Masking | Behaviour | TTS | Recoverable Injury | Mortality and Potential Mortal Injury |
|---|---|---|---|---|---|
| Marine Turtle | (N) High<br>(I) High<br>(F) Moderate | (N) High<br>(I) Moderate<br>(F) Low | (N) Moderate<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low |

*Note: Relative risk (high, moderate, low) is given for animals 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.*

Based on the criteria detailed within **Table 5-15**, there is a low risk of any injury to marine turtles from vessel noise. Behavioural changes, such as avoidance and diving, are only predicted for individuals in close proximity to the activity vessels (high risk of behavioural impacts within tens of metres of a vessel and moderate risk of behavioural impacts within hundreds of metres of a vessel). There is a high risk of masking within hundreds of metres of the vessel, and a moderate risk of masking within thousands of metres from the vessel. Little is known regarding masking in marine turtles, and behavioural reactions have been found to be highly context specific, with behavioural sensitisation and habituation affecting the onset threshold for reactions and impacts (Ellison et al., 2012). However, given the relatively low-level increase in sound over a short-term period, it is unlikely that vessel noise will cause significant masking impacts in turtles.

Marine Turtles: Potential Impacts from Helicopters

Impacts to marine turtles from helicopter noise is expected to be limited to short term behavioural impacts (e.g. diving or swimming rapidly) when the helicopter is taking off, based on measurements of helicopter noise (maximum received level of 109 dB re 1 uPa and only detectable underwater for 11 to 38 seconds) (based on transit speed), depending on water depth (Richardson et al., 1995). Such impacts are unlikely to result in substantial impacts to marine turtle populations or distribution.

Marine Turtles: Potential Impacts from Survey Equipment and Positioning Equipment

Survey equipment and positioning equipment are considered impulsive sources for this assessment, therefore the criteria from Popper et al. (2014) for seismic airguns has been adopted **Table 5-16**).

*Table 5-16: Criteria for impulsive noise exposure for turtles, adapted from Popper et al. 2014*

| Potential Marine Fauna Receptor | Masking | Behaviour | TTS | Recoverable Injury | Mortality and Potential Mortal Injury |
|---|---|---|---|---|---|
| Marine Turtle | (N) Low<br>(I) Low<br>(F) Low | (N) High<br>(I) Moderate<br>(F) Low | (N) High<br>(I) Low<br>(F) Low | (N) High<br>(I) Low<br>(F) Low | >210 dB $SEL_{24h}$<br>or<br>>207 dB PK |

*Note: Relative risk (high, moderate, low) is given for animals 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.*

The sound levels of the survey equipment and positioning equipment are below those associated with the PK criteria for injury (**Table 5-16**) beyond a few metres (McPherson, 2020), and due to the low per-pulse SEL (McPherson, 2020), the SEL criteria will also not be exceeded. Recoverable injury and TTS could occur within tens of metres applying the relative risk criteria from Popper et al. (2014) (**Table 5-6**). Behavioural changes, such as avoidance and diving, are only predicted for individuals in close proximity to the activity vessels (high risk of behavioural impacts within tens of metres of source and moderate risk of behavioural impacts within hundreds of metres of the source).

Turtles are unlikely to experience masking even at close range to the source. This is in part because the sounds from survey and positioning equipment are all outside of the hearing frequency range for turtles (approximately 50 to 2000 Hz, with highest sensitivity to sounds between 200 and 400 Hz) (Ridgway et al., 1969; Bartol et al., 1999, Ketten and Bartol, 2005; Bartol and Ketten, 2006; Yudhana et al., 2010; Piniak et al., 2011; Lavender et al., 2012, 2014).

Impacts to marine turtles from underwater noise generated by survey and positioning equipment are unlikely to result in substantial impacts given that impacts are likely to be limited to physiological impacts in individuals located within tens of metres of the sound source, and behavioural impacts in individuals located within hundreds of metres of the sound source. The risk of impact is further reduced as the vessels will be moving along the pipeline route and is highly unlikely that any individual would remain within the distances above for any length of time.

<u>Sea Snakes</u>

There is limited information on the effects of noise on sea snakes. A current research project investigating the impacts of seismic surveys found that hearing sensitivity of sea snakes is similar to species of fish without a swim bladder (discussed below). Therefore, it is considered that there is a moderate risk in the near and intermediate distances (which extends hundreds of metres) of behavioural impacts to sea snakes, with the impacts being limited to temporary avoidance of the area. Such impacts are unlikely to result in substantial impacts to sea snake populations or distribution.

<u>Fish (including Pelagic and Demersal Fish Communities, Sharks and Rays)</u>

There are no known fish aggregation areas along the pipeline route, however, individuals or schools may pass through. The closest area that is considered likely to support site attached fish is Goodrich Bank, which is located approximately 300 m from the operational area (and approximately 2.3 km from the pipeline) (**Figure 4-14**).

<u>Fish: Potential Impacts from Vessels</u>

The criteria defined in Popper et al. (2014) for continuous noise sources has been adopted (**Table 5-17**). This indicates that vessel noise has a low risk of resulting in mortality and a moderate risk of TTS impacts when fish are within tens of metres of a vessel. The most likely impacts to fish from noise will be behavioural responses. Popper et al. (2014) identified a moderate risk of behavioural impacts to fish in near (tens of metres) and intermediate distances (hundreds of metres) from the noise source. Masking in fish could also occur within thousands of metres under a worst-case scenario.

Impacts to fish from underwater noise generated by vessel operations are unlikely to result in substantial impacts to populations or distribution given that impacts are likely to be limited to physiological impacts in individuals located within tens of metres of the vessel, behavioural impacts in individuals located within hundreds of metres of the vessel and masking of fish within thousands of metres. Fish are considered unlikely to remain in proximity to vessels and are therefore unlikely to be exposed to sound at the above thresholds. Site attached fish at Goodrich Bank, which is located approximately 2 km from the pipeline and 300 m from the boundary of the operational area, are unlikely to be exposed to these thresholds. Given the pipelay vessel is moving at approximately 3 km/day, vessel noise will not impact Goodrich Bank or any other one location for an extended duration.

Fish: Potential Impacts from Survey Equipment and Positioning Equipment

The criteria defined in Popper et al. (2014) for impulsive noise sources has been adopted (**Table 5-18**). Impulsive noises from survey equipment could result in physiological impacts to fish located within metres of the sound source considering the results presented in McPherson (2020). The likelihood of fish being close enough to the sound source for physiological impacts to occur is considered remote.

***Table 5-17: Criteria for continuous noise exposure for fish, adapted from Popper et al. 2014***

| Potential Marine Fauna Receptor | Mortality and Potential Mortal Injury | Impairment | | | Behaviour |
|---|---|---|---|---|---|
| | | Recoverable Injury | TTS | Masking | |
| Fish:<br>No swim bladder (particle motion detection) | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Moderate<br>(I) Low<br>(F) Low | (N) High<br>(I) High<br>(F) Moderate | (N) Moderate<br>(I) Moderate<br>(F) Low |
| Fish:<br>Swim bladder not involved in hearing (particle motion detection) | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Moderate<br>(I) Low<br>(F) Low | (N) High<br>(I) High<br>(F) Moderate | (N) Moderate<br>(I) Moderate<br>(F) Low |
| Fish:<br>Swim bladder involved in hearing (primarily pressure detection) | (N) Low<br>(I) Low<br>(F) Low | 170 dB SPL for 48 h | 158 dB SPL for 12 h | (N) High<br>(I) High<br>(F) High | (N) High<br>(I) Moderate<br>(F) Low |
| Fish eggs and fish larvae | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) High<br>(I) Moderate<br>(F) Low | (N) Moderate<br>(I) Moderate<br>(F) Low |

*Note: Relative risk (high, moderate, low) is given for animals 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.*

*Table 5-18: Criteria for impulsive noise exposure for fish, adapted from Popper et al. 2014*

| Potential Marine Fauna Receptor | Mortality and Potential Mortal Injury | Impairment | | | Behaviour |
|---|---|---|---|---|---|
| | | Recoverable Injury | TTS | Masking | |
| Fish:<br>No swim bladder (particle motion detection) | >219 dB $SEL_{24h}$<br>or<br>>213 dB PK | >216 dB $SEL_{24h}$<br>or<br>>213 dB PK | >>186 dB $SEL_{24h}$ | (N) Low<br>(I) Low<br>(F) Low | (N) High<br>(I) Moderate<br>(F) Low |
| Fish:<br>Swim bladder not involved in hearing (particle motion detection) | 210 dB $SEL_{24h}$<br>or<br>>207 dB PK | 203 dB $SEL_{24h}$<br>or<br>>207 dB PK | >>186 dB $SEL_{24h}$ | (N) Low<br>(I) Low<br>(F) Low | (N) High<br>(I) Moderate<br>(F) Low |
| Fish:<br>Swim bladder involved in hearing (primarily pressure detection) | 207 dB $SEL_{24h}$<br>or<br>>207 dB PK | 203 dB $SEL_{24h}$<br>or<br>>207 dB PK | 186 dB $SEL_{24h}$ | (N) Low<br>(I) Low<br>(F) Moderate | (N) High<br>(I) High<br>(F) Moderate |
| Fish eggs and fish larvae | >210 dB $SEL_{24h}$<br>or<br>>207 dB PK | (N) Moderate<br>(I) Low<br>(F) Low | (N) Moderate<br>(I) Low<br>(F) Low | (N) Low<br>(I) Low<br>(F) Low | (N) Moderate<br>(I) Low<br>(F) Low |

*Note: Relative risk (high, moderate, low) is given for animals 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.*

Behavioural impacts to fish from survey equipment noise may occur in individuals located within hundreds of metres of the source. None of the survey equipment has energy below 1 kHz, and therefore it is unable to be heard by most fish, which further reduces the risk of impact (Ladich and Fay, 2013). The impact of masking is low at all ranges, apart from fish who specialise in pressure detection, which can be impacted in a moderate way at thousands of metres. However, as these signals are outside the hearing range of most fish in the region, the risk of impact is reduced.

Impacts to fish from underwater noise generated by survey or positioning equipment are unlikely to result in substantial impacts to populations or distribution given that impacts are likely to be limited to behavioural impacts within hundreds of metres and masking within thousands of metres. Fish are considered unlikely to remain in proximity of the sound source for long periods of time, and are therefore unlikely to be exposed to sound at the above thresholds. Site attached fish are more at risk of impacts. Goodrich Bank is located approximately 2km from the pipeline and 300 m from the boundary of the operational area. Given the survey vessels are constantly moving, noise from survey or positioning equipment is not expected to impact Goodrich Bank or any other one location for an extended duration.

**Impact Acceptability Summary for Threatened and Migratory Species**

Impacts to marine mammals from underwater noise generated by pipelay activities are unlikely to result in substantial impacts given there are no significant feeding, breeding or aggregation areas in the vicinity of the operational area. The closest marine mammal BIA's are located approximately 66 km away from the operational area, which is outside the area predicted to exceed thresholds for behavioural, masking or physiological impacts. Therefore, any responses will be limited to transiting individuals, which is unlikely to result in substantial impacts to marine mammal populations or distribution.

The proposed pipeline passes through areas designated as important habitat for both flatback and Olive Ridley turtles (**Figure 4-29**).

Impacts to marine turtles from underwater noise are unlikely to result in substantial impacts to populations or distribution given that impacts are likely to be limited to behavioural and masking impacts within a relatively small area of important turtle habitat. The risk of impact is further reduced as the pipeline installation vessels will be slowly moving along the pipeline route at a rate of approximately 3 km per day, therefore vessel noise will not

| | | | | |
|---|---|---|---|---|
| impact any one location for an extended duration. Based on this, the pipelay vessel will take approximately 23 days for the Olive Ridley Turtle habitat critical area and up to 80 days for the Flatback Turtle habitat critical area. Construction vessels may be in the operational area for the duration of offshore operations; however, these will generally be in one location for less than 3 days unless performing flood/gauge/testing operations where the vessels will be stationary up to 14 days. The survey vessel will travel at about 25 km/day and traverse the turtle internesting habitat within about 2 days. Other activity vessels (e.g. supply vessels) will only be in the operational area for very limited durations (less than 24 hours).<br>Other protected species of marine reptiles (e.g. sea snakes) seabirds and fish (e.g. sharks and sawfish) are not expected to be affected given their wide distribution (in the case of sea snakes and sharks), distances to seabird breeding colonies, and preference for shallow coastal habitats (sawfish).<br>For the above reasons, no substantial change to threatened and migratory species is anticipated that may:<br>+ lead to a long-term decrease in the size of a population<br>+ reduce the area of occupancy of the species<br>+ fragment an existing population into two or more populations<br>+ adversely affect habitat critical to the survival of a species<br>+ displace threatened and migratory marine fauna from habitat critical areas<br>+ disrupt biologically important behaviours of threatened and migratory marine fauna in BIAs<br>+ disrupt the breeding cycle of a population<br>+ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline<br>+ interfere with the recovery of the species. | | | | |
| **Risk Assessment** | | | | |
| ***Consequence*** | II – Minor | | | |
| **Controls and Demonstration of ALARP** | | | | |
| ***Existing Controls*** | | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** | |
| Note Santos implements EPBC Regulations– Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles) to reduce the risk of a collision with marine fauna (**Section 5.3.3**). This control may result in a minor ancillary reduction in the potential for noise impacts to cetaceans and turtles; however, the control is considered ineffective in managing the impacts of noise from subsea infrastructure installation and activities to marine fauna. | | | | |
| Maintaining helicopter separation from cetaceans as per EPBC Regulations. | Control is effective as it maintains a separation distance between the helicopter and cetaceans thus reducing noise levels received at the sea surface. | **C 3.1** | Helicopters will comply with EPBC Regulations– Part 8 Division 8.3 Interacting with cetaceans, specifically:<br>+ Helicopters shall not operate lower than 1650 feet or within a horizontal radius of 500 m of a cetacean known to be present in the area, except for take-off and landing. | |
| ***Additional Controls*** | | | | |
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |

| | | | | |
|---|---|---|---|---|
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |
| ***Administrative*** | | | | |
| Cease noise generating activities (e.g. DP) when near marine fauna. | No | No | Ceasing activities that generate underwater noise when near sensitive fauna may reduce the potential for impacts. However, the potential for impacts beyond behavioural disturbance are very low. Engine/DP thruster noise cannot reliably be ceased due to the safety critical role of vessel propulsion. It is also not practical to cease pipelay or other critical construction activities in a short timeframe as safely abandoning such operations can often take a number of hours (namely laying down the pipeline or disconnecting from a structure), during which time the impacted fauna will have left the area. Therefore, this control is not deemed feasible. | N/A |

**ALARP Statement**

Based on the outcomes of the risk assessment and the adoption of controls throughout the activity, Santos considers that the impacts and risks from vessel light emissions are reduced to ALARP.

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
|---|---|---|---|
| Blue whale | Blue Whale Conservation Management Plan (October 2015) (DoE, 2015a) | Assess and address anthropogenic noise. | + The impacts from anthropogenic noise have been assessed as minor, given: |

| | | | |
|---|---|---|---|
| Humpback whale | Humpback Whale Recovery Plan 2005–2010 (May 2005) (under review) (DEH, 2005a)<br>Conservation advice (October 2015) (DoE, 2015b) | Assess and address anthropogenic noise. | – there are no significant feeding, breeding or aggregation areas for marine mammals within the predicted area of impact for underwater noise<br>– assessment of underwater noise from pipeline installation activities predicts that the extent of underwater noise that cause impacts in marine mammals is limited to approximately 10 km from the vessels. This represents a very small portion of the offshore waters which may be traversed by marine mammals.<br>+ Any potential impacts in the operational area are likely to restricted to a small number of individuals that may be travelling through the area and does not present a significant risk to these species at a population level.<br>+ This is consistent with the Blue Whale Conservation Management Plan that assessed shipping and industrial noise as 'minor - individuals are affected but no affect at the population level'.<br>+ Based on the assessment detailed above, Santos has demonstrated that the management of the installation of the gas export pipeline will be aligned with the objectives of the relevant management plans and conservation advice. |
| Sei whale | Conservation advice (October 2015) (DoE, 2015c) | Assess and address anthropogenic noise. | |
| Fin whale | Conservation advice (October 2015) (DoE, 2015d) | Assess and address anthropogenic noise. | |

| | | | |
|---|---|---|---|
| Marine turtle | Recovery Plan for Marine Turtles in Australia 2017–2027 | Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival turtles.<br>Manage anthropogenic activities in BIAs to ensure that biologically important behaviour can continue.<br>Chronic noise was identified as a threat to marine turtles. | There is no evidence to suggest that the proposed activity will result in marine turtles being displaced from habitat critical to their survival nor for important biological behaviour to be interrupted.<br>Based on Popper (2014), moderate risk for behaviour is limited to hundreds of metres from the vessel. This is a fraction of the habitat available for internesting turtles. Any behavioural impact will be limited to short term and is not expected to effect biologically important behaviour.<br>Nesting beaches are beyond the distance at which any impacts are likely so displacement or disruption of biologically important behaviour (nesting and hatchling emergence) is not considered a credible impact or risk.<br>On this basis, impacts from the proposed activity are not inconsistent with the Recovery Plan for Marine Turtles in Australia. |

**Levels of Acceptable Impact**

The impact caused by sound emissions from pipelay installation activities will be acceptable if there is no substantial change to threatened and migratory species that may:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- adversely affect habitat critical to the survival of a species
- displace threatened and migratory marine fauna from habitat critical areas
- disrupt biologically important behaviours of threatened and migratory marine fauna in BIAs
- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- interfere with the recovery of the species.

**EPOs (Table 6-1)**

**EPO 3**

No significant impacts to marine fauna from noise generated during the gas export pipeline installation campaign

No displacement of marine turtles from habitat critical to the survival of marine turtles during the pipelay installation activities and biologically important behaviour to continue in BIAs.

### 5.2.4 Light emissions

| | |
|---|---|
| **Risk** | Change in fauna behaviour due to light emissions from vessels |
| **Aspect-receptor reference (Table 5-5)** | 4I – Pelagic and demersal fish communities<br>4K – Marine reptiles<br>4M – Seabirds and migratory shorebirds<br>4L – Sharks and rays |

**Description of the Source of Risk**

Light is perceived differently by humans and fauna. To humans, light is visible between wavelengths of approximately 380 to 780 nm while for fauna it is visible between 300 to over 700 nm, depending on the species (Commonwealth of Australia, 2019). The source of impact from light is therefore not only related to the amount of artificial light, but also the types of light and the wavelengths that the different light types emit.

Activity vessels will have external lighting to provide a safe working environment and to comply with relevant maritime navigation requirements, at night. Light from the pipelay vessel will be the most visible as it is the largest vessel and therefore has been used to determine the worst-case distance that light may be visible for activity vessels.

**Figure 5-13** provides photographs of the Allseas pipelay vessel Audacia with lights on at dusk. Lights include:

+ regular halogen light bulbs (60 to 75 Watts) and fluorescent lights (18 to 36 Watts) that provide illumination for the various gangways throughout the vessel and will be on all night for safety reasons
+ floodlights of various power rating (250 to 500 Watts) that provide illumination of working areas, which are sometimes directed outward to assist crew transfer or loading of supplies
+ helideck lights, including floodlight (35 Watts) and LEDs (3W) that provide lighting for the helicopter platform, which are obligatory but will be illuminated only for safe landing and take-off of helicopters
+ navigation LEDs, which are located at various locations around the vessel and are obligatory
+ search lights, which are very bright but used only in emergency situations so turned off under normal operation.

Light modelling was undertaken for the proposed pipelay and construction vessels to predict the extent of biologically relevant light spill. Specifics of the respective vessel's lighting design and luminaire specifications were applied to the Illumina Artificial Light At Night (ALAN) model (Aube et al., 2005). The Illumina model is a 3D model that accounts for both line of sight and atmospheric scattering, allowing the attenuation of light over distance and extent of light glow to be modelled.

Since light sources (i.e. individual luminaires) can be placed individually with the area of interest, the model is able to replicate specific lighting designs in terms of light type, spectral distribution, height and orientation of individual luminaires, including any shielding, increasing model accuracy. This information was extracted from lighting layout drawings and light manufacturer data sheets for both the Audacia pipelay vessel and Oceanic construction vessel. Both models assumed that all lights on the vessels were turned on (apart from search lights which are only used in an emergency situation) with no additional shielding (other than that provided inherently by the vessel structures). Vessels were also orientated north-south. As typical for the Timor Sea, cloud cover was zero, and therefore, the simulation has no contribution of light from cloud reflectance. Model outputs are provided in radiance ($W/m^2/sr$, where W = watts, $m^2$ =metres squared and sr = steradian).

In the absence of any published or generally accepted units of measurement, or scale, for measuring the impact of artificial light at night on turtle hatchlings, moonlight is used as a proxy. Output from the light model (radiance, units of $Watts/m^2/sr$) was converted to units of full moon equivalents to provide biological relevance to the radiance output.

**Table 5-19** presents potential impact criteria for marine turtles related to the proportion of radiance of a full moon. This was derived by Pendoley Environmental using their extensive experience observing marine turtles and their response to light in field settings. The range of moon brightness across a whole lunar cycle provides a realistic scale representative of ambient light levels that turtle eyes are adapted to. The scale is logarithmic to represent the nature of light decay with distance (a function of the inverse square law). At the lower end of the scale the radiant output is equivalent to no light in the sky (a new moon) while the upper limit is equivalent to the brightness of ten full moons. The upper limit was selected to try to account for the increase in radiance levels that can be caused when light is reflected from clouds. Extending the scale beyond this limit was deemed unnecessary.

***Table 5-19: Artificial light impact potential criteria (marine turtles) (Pendoley, 2020)***

| Proportion of radiance of a full moon* | Impact potential to marine turtles |
|---|---|
| 1 to 10 | Light or light glow visible and impact likely |
| 0.1 to 1 | Light or light glow visible and behavioural impact possible, depending on moon phase |
| 0.01 to 0.1 | Light or light glow visible but behavioural impact unlikely (i.e. not biologically relevant) |
| <0.01 | Light or light glow is considered ambient and no impact expected |

**Where 10 equals the radiance of ten full moons and 0.01 equals 100th the radiance of one full moon.*

**Model Results**

Pipelay Vessel

Results from the llumina model undertaken for the pipelay vessel are summarised in **Table 5-20** and presented in **Figure 5-14** (Pendoley, 2020). Model results are independent of location so are representative all along the pipeline route. The location shown in the figure is the closest point that the vessels will sail to the nesting beaches. Applying the potential impact criteria in **Table 5-19**, the results show that at ~11 km light levels have reduced to ambient. At ~ 3.3 km from the source, radiance is equivalent to 0.1 radiance of a full moon and, therefore, light will be visible but unlikely to result in a behavioural impact (i.e. biologically relevant). Impacts may occur within ~3.3 km of the pipelay vessel. At the closest point to land (6 km), radiance is equal to 0.03 (3%) that of a full moon.

***Table 5-20: Distance of equivalent moon radiances for the pipelay vessel (from Pendoley, 2020)***

| Proportion of radiance of a full moon* | Distance from source (m) |
|---|---|
| 10 | 332 |
| 1 | 1,050 |
| 0.1 | 3,335 |
| 0.01 | 11,073 |

**Where 10 equals the radiance of ten full moons and 0.01 equals 100th the radiance of one full moon.*

Construction Vessel

Results for the construction vessel are summarised in **Table 5-21** and presented in **Figure 5-15** (Pendoley, 2020). At ~1.6 km light levels have reduced to ambient. At ~ 0.5 km from the source, radiance is equivalent to 0.1 radiance of a full moon and, therefore, light will be visible but unlikely to result in a behavioural impact (i.e. biologically relevant). Impacts may occur within 0.5 km of the construction vessel. At the closest point to land (6 km), radiance is equal to 0.0007 (0.07%) that of a full moon.

***Table 5-21: Distance of equivalent moon radiances for the construction vessel (from Pendoley, 2020).***

| Proportion of radiance of a full moon* | Distance from source (m) |
|---|---|
| 10 | 51 |
| 1 | 162 |
| 0.1 | 512 |
| 0.01 | 1,622 |

**Where 10 equals the radiance of ten full moons and 0.01 equals 100th the radiance of one full moon.*

Cumulative Impact When Pipelay Vessel and Construction Vessel are in Proximity

**Table 5-22** presents results of the Illumina model when including both the pipelay and construction vessel located side by side. Modelling of both vessels resulted in negligible increases in the distance at which the same level of radiance was reached, compared to the model results for the pipelay vessel alone. Applying the potential impact criteria in **Table 5-19**, impacts may occur within ~3.4 km of the pipelay and construction vessel when they are simultaneously positioned adjacent to one another. At the closest point to land (6 km), radiance is equal to 0.03 (3%) of a full moon.

***Table 5-22: Distance of equivalent moon radiances for the pipelay and construction vessel (from Pendoley, 2020)***

| Proportion of radiance of a full moon* | Distance from source (m) | Difference to pipelay vessel alone (m) |
|---|---|---|
| 10 | 336 | +4 |
| 1 | 1,062 | +12 |
| 0.1 | 3.375 | +40 |
| 0.01 | 11,226 | +153 |

**Where 10 equals the radiance of ten full moons and 0.01 equals 100th the radiance of one full moon.*

***Figure 5-13: Photographs of a typical pipelay vessel at dusk***

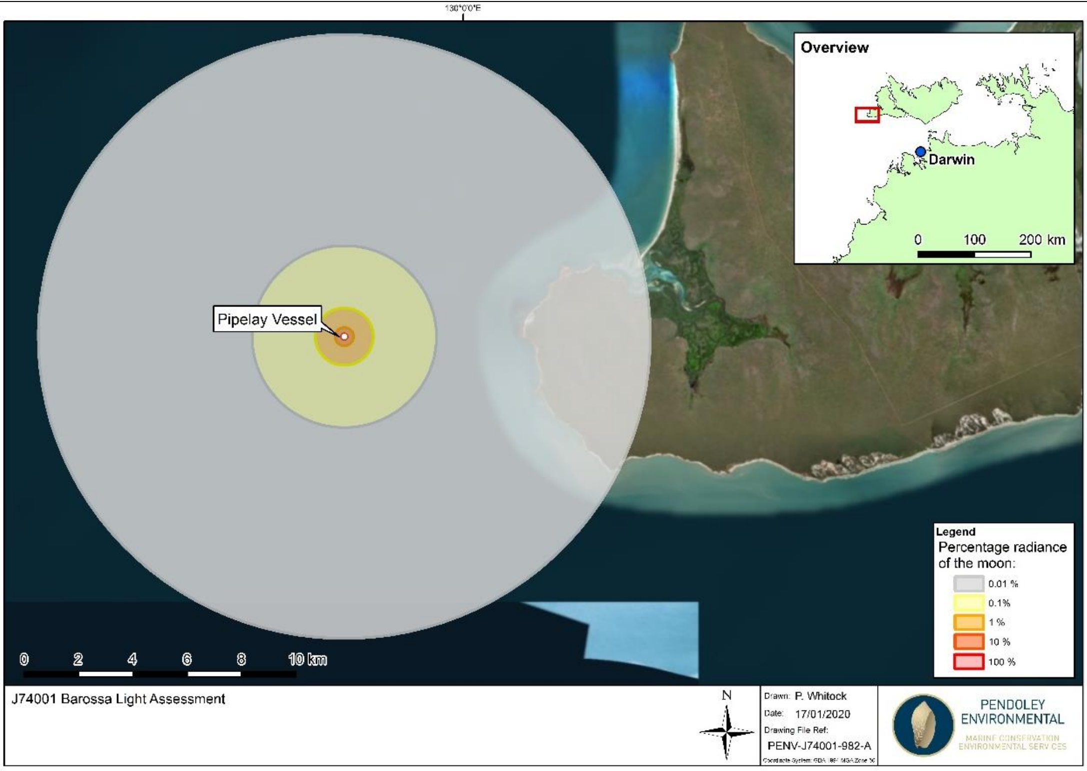


***Figure 5-14: Light emissions from the pipelay vessel, measured as the proportion of radiance of one full moon***

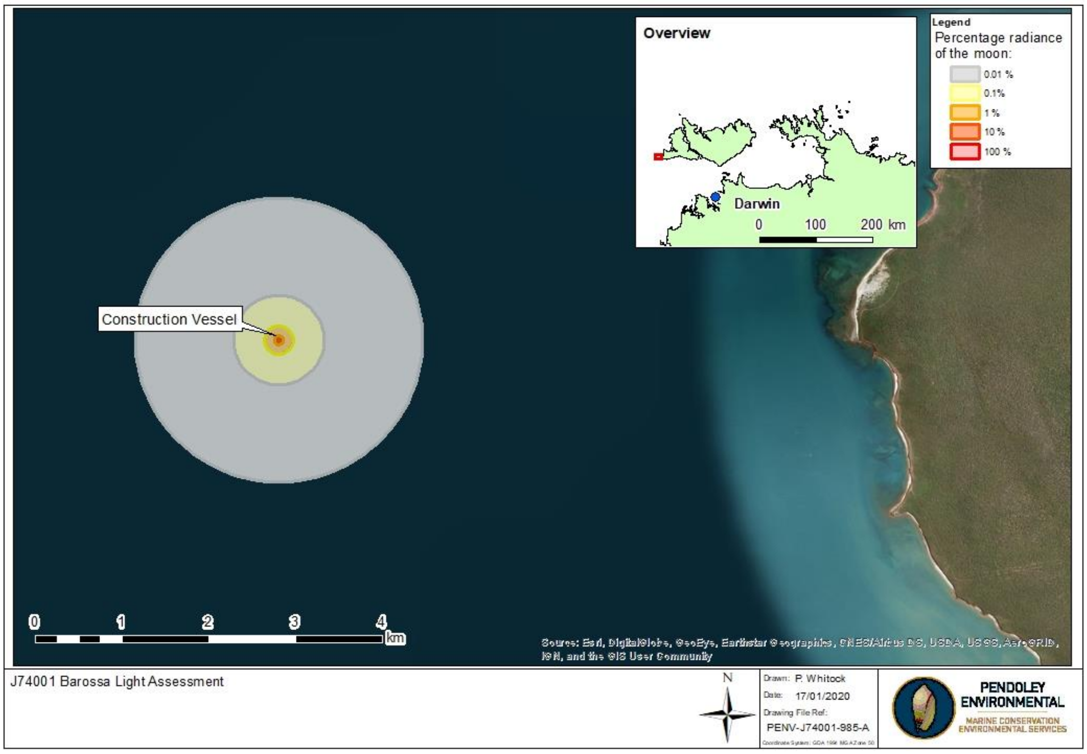


***Figure 5-15: Light emissions from the construction vessel measured as the proportion of radiance of one full moon***

*Notes: Model results are independent of location so are representative all along the pipeline route. The location shown in the figures is the closest point to the nesting beaches.*

**Potential Impacts**

Light emissions associated with the gas export pipeline installation campaign may present a potential risk to marine fauna in the open waters and cause a temporary change in movement patterns and/or behaviour, such as the attraction or disorientation of individuals. Artificial lighting can affect several marine fauna including seabirds and migratory shorebirds, marine turtles as well as sharks/rays and other fish.

The extent of biologically relevant light intensity is predicted to extend out to 3.3 km and 0.5 km from the pipelay and construction vessels, respectively. During the installation period, the pipelay vessel will travel along the pipeline route at a rate of nominally 3 km per day (i.e. it is not a stationary vessel), therefore the small extent of biologically relevant light will not impact any one location for an extended duration. Based on this, the pipelay vessel will take approximately 23 days for the Olive Ridley Turtle habitat critical area and up to 80 days for the Flatback Turtle habitat critical area.

Construction vessels may be in the operational area for the duration of offshore activities; however, these will generally be in one location for less than three days unless performing flood/gauge/testing operations where the vessels will be stationary up to 14 days. When performing flood/gauge/testing operations, the construction vessel will be located at either end of the pipeline. The southernmost point of the pipeline is located >24 km from the nearest turtle nesting beach, a distance greater than at which visible light at intensities considered biologically relevant to nesting turtles and/or hatchlings in any scenario.

The survey vessel will travel at about 25 km/day and traverse the turtle internesting habitat within about two days. Other activity vessels (e.g. supply vessels) will only be in the operational area for very limited durations (less than 24 hours).

**Marine Reptiles**

Marine Turtles

The operational area traverses internesting habitat for flatback and Olive Ridley turtles. Significant numbers of Olive Ridley turtles (at the genetic stock, national and international level) nest at beaches along the west coast of Bathurst Island and are the priority stock for protection. Flatback turtles also nest here, though numbers are not significant when compared to other nesting sites of this genetic stock (see **Section 4.5.5.6**). Unlike other turtle populations (e.g. on the North West Shelf of WA), the Olive Ridley and flatback turtles on Bathurst Island do not exhibit discrete nesting/hatching seasons. Rather, there is low level nesting year-round, with a peak in nesting, internesting and hatching during winter months.

Artificial lighting on or near beaches is known to disrupt nesting behaviour (see Witherington and Martin, 2003 for review) and has the potential to deter nesting activity. On completion of laying, nesting females use light cues in order to return to open ocean, orientating towards the brightest light (Witherington and Martin, 2003). However, observations of nesting females and emerging hatchlings at the same beach showed that females were disorientated much less often than hatchlings (Witherington, 1992a) indicating that nesting females are less vulnerable to impacts of artificial light on sea finding than hatchlings.

Hatchlings emerging from the sand are known to locate the ocean using a combination of topographic and brightness cues, orienting towards the lower, brighter oceanic horizon and away from elevated silhouettes of dunes and/or vegetation bordering the beach on the landward side (Limpus, 1971; Limpus and Kamrowski, 2013; Pendoley and Kamrowski, 2016; Salmon et al., 1992). Salmon (2003) identified two distinct behavioural responses of hatchling turtles exposed to artificial light after emerging from the nest:

+ misorientation - misorientation occurs when hatchling turtles orientate towards artificial light sources instead of directly towards the ocean and
+ disorientation - disorientation occurs when turtle hatchlings crawl in circuitous paths, often near artificial light sources.

Hatchlings disoriented or misoriented by artificial lighting may take longer, or fail, to reach the sea. This may result in increased mortality through dehydration, predation or exhaustion (Salmon and Witherington, 1995).

During normal operations, the greatest light intensity from the pipeline installation vessel at the closest point to shore is equivalent to 3% radiance of a full moon, which is not considered biologically relevant to adults or hatchlings (Pendoley, 2020). As such, behavioural impacts to nesting females and emerging hatchlings at nesting beaches are not expected.

Although the operational area overlaps important internesting habitat, the number of individuals likely to be present is expected to be limited. Suitable internesting habitat for flatback turtles is defined as water depths shallower than 16 m (Whittock et al., 2016 in Pendoley, 2019). Internesting Olive Ridley turtles remain relatively close to nesting beaches during the nesting period (in comparison to post-nesting movements); tagged turtles remained within 48 km of the nesting beach in waters typically <30 m water depth (Hamel et al., 2008). Water depths along the pipeline route are below 35 m (**Figure 5-12**) leading Pendoley (2019) to conclude that the majority of flatback and Olive Ridley turtles are not expected to use waters along the pipeline route for internesting, although some individual turtles may be encountered. Internesting may occur year-round with a peak expected between April and June with increased potential for internesting females to occur in the operational area during this time. However, the pipelay vessel would be within critical habitat for approximately 23 days for the Olive Ridley Turtle habitat critical area and up to 80 days for the Flatback Turtle habitat critical area.

If individual turtles are present, light emissions from any of the vessels are unlikely to be of concern. There is no evidence, published or anecdotal, to suggest internesting turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this as a plausible threat (Pendoley, 2019; Witherington and Martin, 2003).

Once hatchlings enter the ocean, they are thought to employ a survival strategy that involves rapid dispersal away from predator rich nearshore habitats to reach deeper waters where they develop into juveniles. An internal compass set while crawling down the beach, together with wave cues, are used to reliably guide them offshore (Lohmann & Lohmann, 1992; Stapput & Wiltschko, 2005; Wilson et al., submitted). In the absence of wave cues however, swimming hatchlings have been shown to orient towards light cues (Lorne & Salmon, 2007; Harewood & Horrocks, 2008) and in some cases, wave cues were overridden by light cues (Thums et al., 2013, 2016). The speed and direction of at-sea dispersal is substantially influenced by currents; the offshore trajectory of flatback hatchlings at Thevenard Island was displaced by tidal currents which ran parallel to the beach, an effect that increased as the hatchlings moved further offshore (Wilson et al., 2018, 2019).

However, when light was present this effect was diminished, showing that hatchlings actively swam against currents and towards the light source, which slowed their offshore dispersal from 0.5 m/s when no light was present, to 0.35 - 0.44 m/s, depending on the type of light (Wilson et al., 2018). The mean swimming of flatback hatchlings under natural light conditions (0.5 m/s) were similar to speeds of green turtle hatchlings (0.49 m/s) (Thums et al., 2016). The swimming speed of Olive Ridley hatchlings has not been measured; however, since they are smaller than both flatback and green turtle hatchlings, swimming speeds are expected to be lower (Pendoley, 2020).

These results suggest that hatchlings can move in any direction when their swimming speed is greater than the speed of the nearshore current, although the speed at which currents can no longer be overcome by hatchlings will be species specific and related to swimming speeds. Wilson et al (2018) reported that when flatback hatchlings were within 150 m of the beach, they were able to swim against currents up to 0.3 m/s, although, 0.3 m/s was the maximum current speed recorded during the study and, therefore, whether flatback hatchlings can swim against stronger currents is currently untested. Even if Olive Ridley hatchlings respond to light cues in the same way flatback hatchlings do, their smaller size suggests reduced capability to swim against currents compared to flatback turtles.

Attraction of dispersing hatchlings to vessel light emissions and spill could result in two main impacts, being:

1. increased energy expenditure as hatchlings swim against currents towards light sources and when entrapped in light spill, with potential effects to individual fitness
2. increased risk of predation while silhouetted in areas of light spill.

At the C4 current meter location, located approximately 20 km northwest of Cape Fourcroy, currents were strongly rectilinear, flooding towards the south and ebbing towards the north. On the spring tide, maximum current speeds were around 1.1 m/s reducing to around 0.3 m/s on the neaps (**Section 4.3.2**). Statistical analysis showed that current speed was greater than 0.3 m/s for approximately 66% of the deployment time (Fugro, 2015). Dispersal studies at Thevenard Island (Wilson et al., 2018) suggest that hatchlings will enter the ocean and disperse in the direction of the predominant current, which could be either north or south.

There is potential for hatchlings at sea to be attracted to light emissions if they are carried by currents to within ~3.3 km of the pipelay vessel, ~500 m of the construction vessel, or 3.4 km of both vessel when they are operating simultaneously (when light emissions are equivalent to between one full moon and 1/10th of a full moon). However, the likelihood of attraction would be lower during periods of full moon, further reducing the proportion of the activity duration within critical habitat (23 days for the Olive Ridley Turtle habitat critical area and up to 80 days for the Flatback Turtle habitat critical area) where attraction is most likely to occur. If attraction did occur it is likely that individuals would remain entrapped in light for short periods (Wilson et al., 2018; Thums et al., 2010). At worst case individuals would be trapped until dawn.

If hatchlings are attracted to vessel light, they may attempt to swim against the current increasing energy expenditure and depleting energy reserves. If current speed is less than the hatchling swimming speed, they may become entrapped in light spill from the vessel. The proportion of time that currents were above 0.3 m/s was 66%, meaning that for one third of the deployment time, flatback hatchlings could swim against the current (and potentially stronger currents) and become entrapped in light spill. Owing to their smaller size, it is considered likely that Olive Ridley hatchlings will be carried away by weaker currents.

In summary, vessel light emissions are not expected to impact nesting females or emerging hatchings at nesting beaches since modelling predicts that light or light glow at the closest point shore is not expected to exceed intensities considered biologically relevant (Pendoley, 2019). Additionally, vessel light emissions are not expected to impact individual internesting turtles since there is no evidence, published or anecdotal, to suggest internesting turtles are impacted by light from offshore vessels.

Any disruption to hatchling dispersal behaviour is expected to represent an insignificant proportion of the total annual number of hatchlings emerging from the Tiwi Islands for the following reasons:

+ Hatchlings would need to be carried to within ~3.3 km of the pipelay vessel, ~0.5 km of the construction vessel, or 3.4 km of both vessels when they are operating simultaneously, for light intensities to be great enough to lead to attraction.
+ For this to occur, currents would need to be aligned with the orientation of the vessels from the nesting beach. Adjacent to Bathurst they run north-south, which means it would be virtually impossible for hatchlings to actively reach the vessels.
+ It might be possible for individuals to be passively carried to within environmentally significant light intensity around the vessel, however, this is only likely to occur for a small proportion of the overall peak hatchling emergence season given that the pipelay vessel will only be within 20 km (a precautionary distance recommended in the National Light Pollution Guidelines for undertaking an EIA) of nesting beaches for ~23 days (23 days for the Olive Ridley Turtle habitat critical area) and construction vessel activities will be restricted to discreet three day activities.
+ Further, since nesting occurs year-round, there will be a significant proportion of hatchlings originating from the Tiwi Islands that are not exposed to potential light sources.
+ Of the hatchlings that are exposed and attracted to light sources, it is not credible that every hatchling will be attracted to vessel light given individual variability in swimming speed and direction, and localised water movements.
+ Of the small proportion of hatchlings that may become entrapped in light spill, the worst-case scenario is death from predation which is unlikely to occur in every instance (for example, none of the entrapped hatchlings anecdotally observed from a pipeline vessel were predated (Pendoley pers ob., 2003 in Pendoley, 2019).
+ Considering the above, any increased mortality from predation or increased energy expenditure will likely be limited to a negligible proportion of the annual number of hatchlings for the given genetic stocks.
+ Once daylight emerges the impacts of artificial light will cease allowing dispersal behaviour of any entrapped hatchlings to resume. It is not credible that the same hatchlings will be entrapped in light spill on subsequent nights since they will be carried away from the vessels by currents. Therefore, any attraction to vessel lighting by hatchlings is not expected to displace individuals from important habitat.

<u>Sea Snakes</u>

Studies have shown that sea snakes display varying responses to light. For example, Hydrophine species appear to be attracted to light and have been observed floating on the sea surface and swimming up to light (pers. comm. M. Guinea, CDU, 2014). However, the Aispysurus species of sea snake do not appear to be attracted to light and are not seen on the surface at night (pers. comm. M. Guinea, CDU, 2014). Most sea snakes are likely to be associated with the offshore shoals/banks in the Timor Sea, with the closest bank being Goodrich Bank, which is 250 m from the operational area.

It is recognised that some pelagic sea snake individuals (*Pelamis genus*) may occur in the operational area and may be attracted to the light from the gas export pipeline installation campaign. However, while such individuals may come to investigate the light source, it is considered unlikely that they will stay within the area (pers. comm. M. Guinea, CDU, 2014). In addition, as mentioned above, there are no permanent light sources proposed along the gas export pipeline.

**Seabirds and Shorebirds**

A number of migratory bird species may transit the operational area along their migratory pathway, as outlined in **Section 4.5.5.8**. Research indicates that seabirds may be attracted to artificial light, thereby possibly affecting migration patterns, and could potentially collide with infrastructure.

In general, the impacts are considered to be dependent on weather conditions. During clear weather conditions, well-lit structures have minimal or no impact on avifauna. During conditions of persistent light rain fog or mist, which are unusual events in the Timor Sea, the reflectance of light is increased, compounding the disorientation effects of avifauna and potentially resulting in high mortalities due to collision with structures. The likelihood and frequency of such events leading to significant mortalities in the Timor Sea are considered low as such events are unusual and generally localised.

Migratory shorebirds are unlikely to interact with the pipelay vessels during the installation of the gas export pipeline given of the low levels of light emissions and temporary nature of the activity (e.g. pipelay vessel constantly moving).

Fledgling seabirds can be affected by lights up to 15 km away (Commonwealth of Australia 2019). Light emissions from the pipelay installation vessels are not anticipated to impact the breeding population of crested terns located on the shoreline of Seagull Island given its distance from vessel light sources (>19 km). Impacts to species foraging are unlikely to be disorientated by light emissions given the scale of lighting required for pipelay vessels and the relatively short-term nature of the activity.

**Fish (including Pelagic and Demersal Fish Communities, Sharks and Rays)**

Vessel lighting may result in the localised aggregation of fish (including sharks/rays) below the vessel. These aggregations are considered localised and temporary due to the nature of the activity (e.g. pipelay vessel constantly moving).

Sharks and rays identified as potentially occurring in the operational area typically inhabit nearshore coastal waters (e.g. green sawfish, largetooth sawfish, dwarf sawfish, speartooth shark, northern river shark and reef manta ray). While individuals (e.g. giant manta ray, great white, whale sharks and mako sharks) may transit the open ocean environments surrounding the northern portion of the operational area, impacts from light will not result in population level effects and will not extend to any areas of biological importance for these species.

**Cumulative Impacts**

There are both offshore and onshore light sources currently in the region of the operational area. Existing onshore light sources near the operational area are the lights at the Tiwi Islands, such as the Cape Fourcroy lighthouse and lights from Wurrumiyanga on Bathurst Island and lights from Port Melville and the community of Pirlangimpi on Melville Island. These light sources are approximately 5 km (Cape Fourcroy lighthouse), 50 km (Pilangimpi and Port Melville) and 70 km (Wurrumiyanga) from the gas export pipeline. Cumulative impacts from the project vessels and onshore lighting are not anticipated, due to distances between the onshore light sources and the operational area, as well as the land mass (Tiwi Islands) acting as a light barrier between most of the onshore light sources (except Cape Fourcroy lighthouse) and project vessels within the operational area.

Offshore lighting in the region is mainly associated with commercial shipping, although commercial fishing and recreational vessels also contribute to offshore lighting. The main shipping routes are south-east of the gas export pipeline, between the Tiwi Islands and Darwin, and there are also moderate levels of shipping density as commercial vessels travel north-west from Darwin to south-east Asia through the operational area (**Figure 4-40**). The project vessels will add to the overall amount of offshore lighting in the region for the duration of the gas installation pipeline campaign, however cumulative impacts are not predicted due to the following reasons:

- Lighting at any one location will be temporary.
- There will only be a small increase in the number of vessels in the region. The installation campaign will add up to 15 vessels to the overall shipping activity, although these will not all be in the same area at the same time.
- The activity vessels will be in the southern portion of the gas export pipeline route where higher density commercial shipping occurs for a short duration.
- Very few commercial shipping vessels or other marine users are expected further north along the gas export pipeline route.
- Modelling indicates that when both the pipelay and construction vessel are operating simultaneously, only negligible increases in light levels (measures as the distance at which radiance relative to that of the moon) occur, compared to when the pipelay vessel was modelled independently.
- Lighting during simultaneous operation of the pipelay and construction vessel is expected to reach levels considered not biologically relevant within ~3.4 km. Generally, third party vessels are expected to be further than 1.5 km from the project vessels and are not expected within the 500 m safety exclusion zone (e.g. commercial shipping vessels that travel past the activity). Furthermore, activity vessels will only come within proximity of each other for short durations to undertake specific tasks due to safety reasons (i.e. activity vessels are generally expected to be greater than 1.5 km away).

With regards to other activities associated with the Barossa Development, as described in the Barossa OPP, simultaneous operations will be avoided where practicable and therefore cumulative impacts are not anticipated.

**Impact Acceptability Summary for Threatened and Migratory Species**

The proposed pipeline passes through areas designated as internesting habitat and within 8 km of nesting habitat critical to the survival of both flatback and Olive Ridley turtles (**Figure 4-29** and **Figure 4-31**). Substantial adverse impact from artificial light associated with the pipelay activities is not considered credible.

There is no evidence, published or anecdotal, to suggest internesting turtles are impacted by light from offshore vessels (Pendoley, 2019).

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| Modelling shows that direct light or light glow from the activity vessels does not exceed intensities considered biologically relevant at the closest nesting beaches (Pendoley, 2019) so impact to nesting females or emerging hatchings is not expected to occur.<br>In the unlikely event that hatchlings do become entrapped in light spill from vessels, the proportion impacted is considered negligible when compared to the total number of hatchlings emerging from Tiwi Island beaches across the year. It will also be a temporary phenomenon, occurring during hours of darkness only. Following sunrise, hatchling dispersal behaviour will resume. Displacement of individuals from habitat critical areas is therefore not a credible outcome.<br>Other protected species of marine reptiles (e.g. sea snakes), seabirds and fish (e.g. sharks and sawfish) are not expected to be affected, given their wide distribution (in the case of sea snakes and sharks), distances to seabird breeding colonies, and preference for shallow coastal habitats (in the case of sawfish).<br>For the above reasons, no substantial change to threatened and migratory species is anticipated that may:<br>+ lead to a long-term decrease in the size of a population<br>+ reduce the area of occupancy of the species<br>+ fragment an existing population into two or more populations<br>+ adversely affect habitat critical to the survival of a species<br>+ displace threatened and migratory marine fauna from habitat critical areas<br>+ disrupt biologically important behaviours of threatened and migratory marine fauna in BIAs<br>+ disrupt the breeding cycle of a population<br>+ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline<br>+ interfere with the recovery of the species. |
| **Risk Assessment** |

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|---|---|
| ***Consequence*** | II – Minor |

| | | | |
|---|---|---|---|
| **Controls and Demonstration of ALARP** | | | |
| ***Existing Controls*** | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| No pipeline installation activities within Olive Ridley turtles internesting BIA. | This control is effective in avoiding the internesting BIA for Olive Ridley turtles, which may host turtles undertaking biologically significant behaviour. Given the behaviour of Olive Ridley turtles, they are unlikely to be encountered within the water depths of the gas export pipeline route when internesting. | **C 2.8** | **EPS 2.8.1**<br>Refer to **Section 5.2.2**. |
| The pipelay vessel will have an enclosed pipe welding deck. | An enclosed pipe welding deck is highly effective in preventing light emissions from a highly lit working zone. | **C 5.9** | **EPS 5.9.1**<br>The pipelay vessel shall have an enclosed pipe welding deck to shield light emissions. |

| Additional Controls | | | | |
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| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| Avoidance of night work. | No | No | The gas export pipeline will be laid using a continuous assembly pipe-welding installation method. Stopping pipelay during the hours of darkness would require the vessel to remain stationary on DP, leading to:<br>+ unnecessary fatigue loading on the pipeline from vessel motion; the alternative would be to lay the pipeline down every night and recover each morning, which are both regarded as high-risk activities<br>+ significant increase in installation schedule with associated increase in project costs<br>+ significant increases in environmental discharges and emissions.<br>This control was rejected as the cost of implementing far exceeds the benefit gained. | N/A |
| Do not undertake gas export pipeline installation during peak turtle nesting and hatchling emergence season. | No | No | See Justification below. | N/A |

<u>Justification</u>

Unlike other turtle populations (e.g. on the North West Shelf of WA), the Olive Ridley and flatback turtles on Bathurst Island do not exhibit discrete nesting/hatching seasons. Rather, there is low level nesting year-round, with a peak in nesting, internesting and hatching during winter months. Even if pipelay activities occurred within peak nesting season, the pipelay vessel will only be within 20 km (the distance specified in the National Light Pollution Guidelines for undertaken an EIA) of nesting beaches for 23 days for the Olive Ridley Turtle habitat critical area and up to 80 days for the Flatback Turtle habitat critical area. During this time, impacts to nesting females, emerging hatchlings and dispersing hatchlings at sea are not expected to result in changes at the individual, population or genetic stock level. A seasonal exclusion would not avoid all turtle nesting, internesting and hatchling activity but may avoid the known peaks. The impact assessment determined the risk to hatchlings from light emissions is low and not inconsistent with the requirements of the Recovery plan for marine turtles in Australia 2017–2027.

Should timing of pipeline installation and associated activities be scheduled to avoid identified sensitivities including the Northern Prawn Fishery season (see **Section 5.2.1**) and the peak internesting turtle periods this will impose impractically tight restrictions on the window for starting operations in order to ensure the activities can be completed outside of the various season, without the risk of the activities having to be split over multiple seasons. The start date for the pipelay operations is driven by the limited availability of pipelay vessels in region, prior commitments of pipelay vessels and the availability of associated equipment such as linepipe materials and PLET structures to support the activities. Due to the uncertainty on these elements it is standard practice to negotiate a large window for commencement of pipelay operations with a mechanism to reduce the window as the project progresses and the factors detailed above become more certain. The call down window is initially under the control of Santos before passing to the pipelay vessel operator in order that they can manage their prior vessel commitments. As a result of the call down mechanism for the pipelay vessel and the uncertainty on the pipelay start date it is impractical to guarantee that pipelay activities could be fully completed in a given season.

If seasonal exclusions are imposed and activities cannot be completed in a single season then this will require the activities to be split over multiple seasons. This will result in an overall extension in the duration of the activity, additional vessel mobilisations and demobilisations and will considerably increase the cost of pipelay.

If the campaign extends over two seasons there is a risk that spans are left unrectified in the intervening period which may markedly increase the number of span corrections required or could result in unacceptable fatigue damage to the pipeline resulting in the need to replace a section of pipeline. It may also be counterproductive as multiple vessel mobilisations could increase the overall environmental impact.

It may also raise the risk of simultaneous operations (SIMOPS), where the pipelay vessel ends up interacting with other Barossa construction activities (spool installations, drilling or FPSO mooring installation). SIMOPS is highly undesirable mode of operation as it means vessels either being stood down for a period of time or operating in close proximity to one another. Apart from the additional cost, this could increase collision risk and result in enhanced cumulative environmental impact for aspects such as light and noise.

No obvious additional potential environmental benefits were identified when considering the NPF season and the peak turtle internesting seasons together. Impacts to each are independent and have both been demonstrated to be acceptable.

Santos has also assessed if certain activities associated with the pipelay operations, such as pre-lay and post-lay span correction, can be performed outside of fishing and peak turtle internesting seasons. However, the construction vessels used to support pipelay operations are also required throughout the full pipelay campaign and as such the sequence of pre-lay activities, pipelay and post-lay activities is more effectively performed in a single campaign in order to avoid the requirement to perform multiple mobilisations/demobilisations of the construction vessel(s). As highlighted above it is also necessary to ensure spans are corrected as soon as practicable and as such post-lay work cannot practically be separated from the pipelay activity. Performing the work in a single continuous campaign also enables pre-lay and post-lay activities to be performed in parallel with pipelay where practicable to further reduce the schedule, optimise the offshore campaign and minimise the extent of span correction required thus reducing the seabed footprint and environmental impact.

Based on the points outlined above, the cost of implementing this control is considered grossly disproportionate to the benefit gained – specifically to the impact on marine turtles and the NPF, which have already been demonstrated to be negligible.

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| Crew transfers or loading of supplies (not including linepipe deliveries) which require direction of floodlights outside vessel will not occur during hours of darkness within 10 km of turtle nesting beaches during peak hatchling season. | Yes | Yes<br>**C 5.10** | Vessel transfer activities at night may require additional lighting, or lights being directed away from the vessel resulting in light spill on the ocean surface and potentially increasing overall light emissions and sky glow.<br>Avoiding vessel transfer activities at night within 10 km of nesting beaches, within peak hatchling emergence, will eliminate additional light spill on the ocean surface, preventing addition risk of hatchlings being attracted to the vessel and becoming entrapped.<br>10 km is applied as a conservative distance, noting that the modelling predicted that biologically relevant light extended to 3.3 km from the pipelay vessel, 0.5 km from the construction vessel and 3.4 km combined. | **EPS 5.10.1**<br>From KP224 to KP240 between 01 April to 31 October, activities within the operational area that require direction of floodlights outside the vessels (crew transfers or loading of supplies but excluding linepipe deliveries) shall not be undertaken during hours of darkness. |
| Do not perform pipe transfer operations at night when operating within 10 km of marine turtle nesting habitat during peak hatchling emergence season. | No | No | If pipe transfer is restricted to day light hours, the pipelay vessel will run out of pipe and it will have to slow lay, stop laying or lay down the pipe (the impacts of which are discussed above).<br>Slowing down pipelay will result in an increase in the amount of time that the pipelay vessel is operating within 10 km of marine turtle nesting habitat. Light spill during pipe transfer will be minimal as floodlights will be directed onto the deck of the PSV and not the surface of the water. It is also temporary. | N/A |

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| In the event that linepipe deliveries are undertaken during the hours of darkness within 10 km of marine turtle nesting habitat during peak hatchling emergence season, the operation shall be undertaken on the westward side of the vessel to limit light spill in the direction of the Bathurst Island. | No | No | The side of pipeline transfer is dictated by prevailing weather conditions for safety and operational reasons. While this control was rejected, winds during peak turtle internesting season are predominantly from an easterly direction so transfer will most likely be undertaken on the westward side of the vessel. | N/A |
| Vessel searchlights will only be operated in an emergency situation. | Yes | Yes<br>**C 5.11** | Searchlights are the most significant source of light from project vessels. Not operating these lights during planned activities will eliminate potential behavioural impacts at the nesting beaches and reduce the likelihood of attraction of hatchings at sea. | **EPS 5.11.1**<br>Vessel searchlights shall only be operated in an emergency situation. |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |

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| ***Engineering*** | | | | |
| Replace some or all lights on vessels with luminaire types considered appropriate for use near marine turtle nesting habitat. | Yes | No | There is a considerable financial cost with replacing lighting for turtle friendly lights. Other costs include the safety risk to personnel carrying out the task and environmental impact in terms of wastage and disposing of old lighting fixtures.<br>Although application of luminaires with spectral output of longer wavelengths have been shown to reduce impacts to turtles, this does not eliminate the risk of impact entirely. Redirecting and shielding lights to prevent light spill is considered a much more effective control than changing luminaries (K Pendoley pers comm).<br>Since the light modelling and impact assessment has predicted the impact to marine turtles is negligible at all life stages, the costs of replacing lights on the vessel is considered grossly disproportionate to any benefits gained. | N/A |
| Identify highest intensity lights and replace with luminaire types considered appropriate for use near marine turtle nesting habitat. | No | No | As discussed above, light emissions from existing luminaries are not expected to result in an adverse impact to marine fauna, including marine turtles.<br>Light modelling was carried out assuming all lights on the vessels were turned on with no particular luminaire identified as having a notably greater effect on overall light emissions.<br>As discussed below, unnecessary light will be turned off and/or shielded when operating within 10 km of nesting beaches and awareness of the importance of minimising light pollution will be implemented. These controls are more | N/A |

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| | | | appropriate given the predicted impact. | |
| Restrict lighting to navigation lights only. | No | No | Operational lighting, including lighting of work areas and decks, is required for safe working conditions. | N/A |
| Minimise direct light spill on the ocean surface by adjusting orientation of lights and installing shielding when operating vessels within 10 km of marine turtle nesting habitat during peak hatchling emergence season. | Yes | Yes<br>**C 5.12** | If in peak turtle season, qualitative assessment of lighting shall be performed on the vessels. Prior to entering within 10 km of marine turtle nesting beaches the orientation of lights resulting in light spill overboard shall be adjusted where it does not impact the ability of light to safely illuminate the work area. Shielding shall be added to lights whose orientation results in excessive glare where it does not impact the ability of light to safely illuminate the work area. | **EPS 5.12.1**<br>Vessels operating (excluding transiting vessels) between KP224 and KP240 within the operation area between 01 April to 31 October require a qualitative assessment of vessel lighting to be undertaken to identify any lights causing light spill overboard from the vessel.<br>**EPS 5.12.2**<br>Prior to entering (excluding transiting vessels) between KP224 and KP240 within the operation area between 01 April to 31 October, direct light spill on the ocean surface shall be minimised by adjusting orientation of lights and installing shielding where it does not impact safety. |
| ***Administrative*** | | | | |
| Sequence activities to minimise the time pipelay, and associated activities, are performed within peak internesting periods in important habitat for listed marine turtles. | Yes | Yes<br>**C 2.10** | While it is not practicable to time the start date of the activity due to scheduling constraints (that is, the Barossa pipelay must fit in with the overall pipelay vessel job sequence), it is possible to sequence activities to minimise the time pipelay, and associated activities, are performed within peak turtle internesting periods. For example, it is possible to select the direction of pipelay based on the start date in relation to peak internesting seasons, or sequence span rectification activities to prioritise certain | **EPS 2.10.1**<br>Planning for pipelay installation (including span rectification) shall consider turtle internesting season and activities shall be sequenced to avoid peak periods where the pipeline integrity is not compromised as a result. |

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| | | | regions over others (notwithstanding technical drivers to rectify critical spans in a timely manner).<br>No timing restrictions are proposed for the pre- and post-lay site survey due to their inherently low impact. | |
| Marine fauna observers specifically looking out for turtle hatchlings entrapped within light spill with adaptive management measures should a significant number be spotted. | No | No | The pipelay and construction vessels have high freeboards. There is no suitable vantage point on the pipelay vessel from which an object the size of a hatching could be spotted, particularly during the hours of darkness.<br>To effectively observe turtles, lights would need to be shone on the water surface, which would present an additional light source.<br>Given the low risk of hatchlings becoming entrapped around vessels the use of a dedicated turtle observers and the requirement for adaptive measures were ruled out. | N/A |
| Communicate the requirement and implement light management measures when operating vessels within 10 km of marine turtle nesting habitat during peak nesting and hatchling emergence season. | Yes | Yes<br>**C 5.13** | Light management measures shall be implemented on vessels operating within 10 km to marine turtle nesting habitat in peak nesting/hatchling emergence season to minimise lighting impacts.<br>Lighting management measures shall include the switching off of lights not required to safely operate the vessel and the closing of curtains in sleeping accommodation.<br>Lighting management measures shall be posted onboard the vessels and discussed at toolbox talks and prestart meetings when operating within 10 km of marine turtle nesting habitat in peak nesting/hatching season. | **EPS 5.13.1**<br>Light management measures shall be implemented when operating vessels (excluding transiting vessels) between KP224 and KP240 within the operation area between 01 April to 31 October. Lighting management measures includes crew awareness through inductions and dailyHSE meetings, the switching off of lights not operationally critical and the closing of curtains in sleeping accommodation. |

| ALARP Statement |
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| Based on the outcomes of the risk assessment and the adoption of controls throughout the activity, Santos considers that the impacts and risks from vessel light emissions are reduced to ALARP. |

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
|---|---|---|---|
| Marine turtle | Recovery Plan for Marine Turtles in Australia 2017–2027 | 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.<br>Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival turtles.<br>Manage anthropogenic activities in BIAs to ensure that biologically important behaviour can continue. | There is no evidence to suggest that the proposed activity will result in marine turtles being displaced from habitat critical to their survival nor for important biological behaviour to be interrupted.<br>The impact assessment predicts that light emissions from the pipelay and construction vessels will not occur at intensities considered biologically relevant at any of the nearby nesting beaches so displacement or disruption of biologically important behaviour is not considered a credible impact or risk.<br>Moreover, there is no evidence that suggests internesting turtles are impacted by light from offshore vessels, and nothing in their biology would indicate this is a plausible threat.<br>Management measures will be put in place to ensure that artificial light from the vessels will be managed and risks reduced to ALARP.<br>On this basis, Santos believes impacts from the proposed activity are not inconsistent with the Recovery Plan for Marine Turtles in Australia. |

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| | | Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution. | Cumulative impacts on turtles from multiple sources of onshore and offshore light pollution has been assessed and deemed to be acceptable. |
| Marine turtles and seabirds | National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Commonwealth of Australia, 2020) | These Guidelines should be followed to ensure all lighting objectives are adequately addressed.<br>Where there is important habitat for listed species that are known to be affected by artificial light within 20 km of a project, species specific impacts should be considered through an Environmental Impact Assessment (EIA) process. | An EIA has been undertaken or the activity (as described in **Section 5.2.4**).<br>As per the guidelines (Commonwealth of Australia 2019), identification of the project lighting, identification of species, an assessment of the risk of impact of artificial light to wildlife, and an assessment of additional mitigation and management controls has been undertaken.<br>Based on the impact and risk assessment, Santos has demonstrated that the management of the installation of the gas export pipeline will be aligned with the recommendations of the national light pollution guidelines. |

<table>
<tr><td>Seabirds</td><td>Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b)</td><td>The relevant objective is to protect and manage seabirds and their habitats with no explicit relevant management actions.</td><td>The impact assessment predicts that light emissions from the pipelay and construction vessels will not occur at biologically relevant intensities at nearby beaches, so seabirds, including fledglings, are not considered a credible impact or risk. In addition, the GEP route is greater than 20 km from the closest seabird breeding BIA (crested tern).<br><br>Management measures will be implemented to ensure that artificial light from the vessels will be managed and risks reduced to ALARP.<br><br>On this basis, Santos believes impacts from the proposed activity are not inconsistent with the Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b).</td></tr>
<tr><td colspan="4">Levels of Acceptable Impact</td></tr>
<tr><td colspan="4">The impact caused by light emissions from pipelay installation activities will be acceptable if there is no substantial change to threatened and migratory species that may:<br>+ lead to a long-term decrease in the size of a population<br>+ reduce the area of occupancy of the species<br>+ adversely affect habitat critical to the survival of a species<br>+ displace threatened and migratory marine fauna from habitat critical areas<br>+ disrupt biologically important behaviours of threatened and migratory marine fauna in BIAs<br>+ disrupt the breeding cycle of a population<br>+ modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline<br>+ interfere with the recovery of the species.</td></tr>
<tr><td colspan="4">EPOs (Table 6-1)</td></tr>
<tr><td colspan="4">EPO 4<br>No significant impacts to marine fauna from the gas export pipeline installation campaign<br>No displacement of marine turtles from habitat critical to the survival of marine turtles during the pipelay installation activities and biologically important behaviour to continue in BIAs.</td></tr>
</table>

### 5.2.5 Atmospheric emissions

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| **Risk** | Atmospheric emissions from vessels combustion engines and incinerators impacting on air quality |
| **Aspect-receptor reference (Table 5-5)** | 5D – Air quality |
| **Description of the Source of Risk** | |
| Emissions to atmosphere from vessels will be primarily from the combustion of fossil fuels, and potentially from the incineration of waste. The main emissions identified are carbon dioxide ($CO_2$), carbon monoxide (CO), oxides of nitrogen ($NO_X$), sulphur dioxide ($SO_2$), particulate matter, non-methane volatile organic compounds (VOCs) and BTEX (benzene, ethylbenzene, toluene and xylenes). The actual expected volumes will depend on the size of vessel, the types and duration of the vessel's activities in the operational area and whether the vessel uses a waste incinerator.<br>ODS may be found onboard activity vessels in old air-conditioning and refrigeration systems. | |
| **Potential Impacts** | |
| The operational area is in a remote offshore environment where there are no other permanent sources of air pollution and the air quality is expected to be nearly pristine. Atmospheric emissions from activity vessels can result in deterioration of local air quality, while emissions of greenhouse gas emissions (GHG) can cause an incremental increase in global GHG concentrations. Given the nature and scale of gas export pipeline installation activities (low frequency and relatively short duration), both risks are considered to have a negligible impact on air quality in Commonwealth waters.<br>The impact from atmospheric emissions is considered minor given the location of the gas export pipeline installation campaign in the open ocean, which is well- removed from nearest residential or sensitive populations of the Tiwi Islands or NT coast and the duration of the gas export pipeline installation campaign. There are no relevant requirements within any EPBC management plans/recovery plans or conservation advices that are of direct relevance to atmospheric emissions.<br>**Impact Acceptability Summary**<br>For the above reasons, there will be no substantial change in air quality that may adversely impact biodiversity, ecological integrity, social amenity or human health. The impact is therefore acceptable. | |
| **Risk Assessment** | |
| ***Consequence*** | I – Negligible |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Atmospheric emissions from combustion, incinerators and ODS managed in accordance with standard maritime practice. | This control is consistent with standard maritime practices which have been developed through international consensus. The control is consistent with relevant requirements (including fuel sulphur content restrictions) and implements the MARPOL convention and Australian Marine Order 97. | **C 5.1** | **EPS 5.1.1**<br>Vessels will comply with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 97 (Marine Pollution Prevention - Air Pollution) including (as required by vessel class):<br>– a valid International Air Pollution Prevention (IAPP) Certificate and/or Engine International Air Pollution Prevention (EIAPP) Certificate and/or International Energy Efficiency (IEE) Certificate<br>– a Ship Energy Efficiency Management Plan (SEEMP)<br>– use of low sulphur fuel<br>– use of incinerators in accordance with Annex VI of the MARPOL Convention<br>– ODS record book. |

| *Additional Controls* | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |

| ALARP Statement |
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| Based on the outcomes of the risk assessment and the implementation of the control throughout the activity, Santos considers that the impacts and risks to air quality from the gas export pipeline installation campaign are reduced to ALARP.<br>Relevant legislative requirements and standard industry practices have been applied to control the risk. Santos considers the controls adopted are commensurate to the nature and scale of the impacts. |

| Summary of Alignment with EPBC Management Plans (where applicable) | | | |
|---|---|---|---|
| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| No relevant management plans identified. | | | |
| **Levels of Acceptable Impact** | | | |
| The impact from vessel emissions will be acceptable if there is no substantial change in air quality which may adversely impact biodiversity, ecological integrity, social amenity or human health. | | | |
| **EPOs (Table 6-1)** | | | |
| **EPO 5**<br>No substantial change in air quality during the pipeline installation campaign that may adversely impact biodiversity, ecological integrity, social amenity or human health. | | | |

## 5.2.6 Planned discharges: activity vessels

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| **Risk** | Impacts to the marine environment from planned discharges |
| **Aspect-receptor reference (Table 5-5)** | 6B – Water quality<br>6H – Plankton<br>6O – Australian marine parks |

**Description of the Source of Risk**

During the gas export pipeline installation campaign, activity vessels will discharge the following to the marine environment:

- sewage, grey water and putrescible (e.g. food scraps) waste, which are treated on board the vessel (e.g. sewage treatment plant or macerator) before being discharged
- small periodic discharges of bilge water which can contain water and small volumes of oil, detergents, solvents and chemicals; bilge water that cannot comply with the discharge limits of 15 parts per million (ppm) oil concentration is stored on vessels for disposal onshore
- discharge from decks during rainfall events or during cleaning/wash down of decks which may contain small quantities of oil and grease
- cooling water used to cool down vessel machinery
- brine from reverse osmosis plants used to generate potable water by desalinating seawater (the process removes minerals from seawater).

The actual expected volumes will depend on the size of vessels.

**Potential Impacts**

**Water Quality and Plankton**

Impacts from the discharge of sewage, grey water and putrescible waste are associated with eutrophication, where an increase in nutrients within the water column leads to a depletion of dissolved oxygen and dissolved oxygen and an increase in phytoplankton (i.e. phytoplankton bloom). Considering the relatively small volumes and the location, open offshore waters (and large-scale currents), no significant impacts to the marine environment are expected from the planned discharge of sewage, grey water and putrescible waste due to rapid dilution.

Deck drainage and bilge generally contain small quantities of hydrocarbons and other chemicals (e.g. detergents). The impact of these substances can vary depending on the types of contaminants, volumes discharged and sensitivity of the receiving environment. If discharged in large enough quantities or for a significant time period, many of these chemicals can have toxic effects to marine organisms (e.g. plankton). However, at small quantities and over short durations (as expected during the gas export pipeline installation campaign as the vessels will be moving continuously along the pipeline route) chemicals are expected to disperse rapidly to levels below those which would cause adverse impacts.

Any potential impacts from planned discharges from activity vessels are expected to be highly localised and temporary decreases in water quality, with a negligible increase in cumulative discharges from other vessels in the area and minor impacts to any plankton.

**Australian Marine Park**

In more sensitive environments impacts from planned discharges may be more significant, such as in protected areas. Although the operational area overlaps the Oceanic Shoals Marine Park, given the physical environmental characteristics (i.e. open, relatively deep offshore environment with significant current and tidal action) of the section of the Oceanic Shoals Marine Park that lies within the operational area, no impacts to the Oceanic Shoals Marine Park from vessel discharges is expected.

In summary, the potential impacts to the marine environment from routine discharges described above are considered minor.

**Risk Assessment**

| | |
|---|---|
| ***Consequence*** | II – Minor |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Routine discharges of treated sewage, grey-water, putrescible waste, deck drainage, and bilge water managed in accordance with standard maritime practice. | This control is consistent with standard maritime practices which have been developed through international consensus. The control is consistent with relevant requirements, including the MARPOL convention and Australian Marine Orders. | **C 6.1** | **EPS 6.1.1**<br>Vessels shall be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 91 (Marine Pollution Prevention – Oil), including (as required by vessel class):<br>– 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<br>– a deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination<br>– waste oil storage available<br>– valid International Oil Pollution Prevention (IOPP) Certificate<br>– vessel-specific Shipboard Oil Pollution Emergency Plan (SOPEP)<br>– oil record book maintained. |

| | | | |
|---|---|---|---|
| | | | **EPS 6.1.2**<br>Vessels shall be equipped and crewed in accordance with the *Navigation Act 2012* and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 96 (Marine Pollution Prevention – Sewage), including (as required by vessel class):<br>– a valid International Sewage Pollution Prevention (ISPP) Certificate<br>– a MARPOL approved sewage treatment plant<br>– a sewage comminuting and disinfecting system<br>– a sewage holding tank sized appropriately to contain all generated waste (black and grey water)<br>– discharge of sewage which is not comminuted or disinfected will only occur more than 12 nm from the nearest land<br>– discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at more than 3 nm from the nearest land. |
| | | | EPS 6.1.3<br>Vessels shall be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 95 (Marine Pollution Prevention - Garbage), including:<br>– putrescible waste and food scraps are passed through a macerator prior to discharge so that it can pass through a screen with no opening wider than 25 mm<br>– garbage management plan in place<br>– garbage record book maintained onboard. |

| *Additional Controls* | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| Storage and transport of sewage, putrescible and waste for disposal onshore. | No | No | Waste are managed in accordance with required legislative controls and the discharge of sewage, greywater and putrescible results in a negligible impact. The additional costs for transport and disposal, increased health and safety risks (e.g. hygiene) and increased environmental impact (e.g. atmospheric emissions from vessels transporting waste) outweigh any environmental benefit gained. | N/A |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |

| **ALARP Statement** |
|---|
| Based on the outcomes of the risk assessment and the implementation of the control throughout the activity, Santos considers that the impacts and risks to water quality, plankton and the Oceanic Shoals Marine Park from activity vessel discharges are reduced to ALARP.<br>Relevant legislative requirements and standard industry practices have been applied to control the impact. The control selected for implementation is effective in reducing the risk to water quality and plankton from vessel utility discharges. Santos considers the control adopted is commensurate to the nature and scale of the potential impacts. |

| **Summary of Alignment with EPBC Management Plans (where applicable)** | | | |
|---|---|---|---|
| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| Marine Park | North Marine Parks Management Plan | Waste from vessel operations must be compliant with MARPOL and IMO. | **C 6.1**<br>Implements MARPOL requirements for vessel discharges. |

| Levels of Acceptable Impact |
|---|
| Impacts from vessel discharges will be acceptable if there is:<br>+ no substantial change in water quality which may adversely impact biodiversity, ecological integrity, social amenity or human health<br>+ no substantial change that may modify, destroy, fragment, isolate or disturb the values of the Oceanic Shoals Marine Park. |
| **EPOs (Table 6-1)** |
| **EPO 6**<br>No substantial change in water quality during the pipeline installation campaign that may adversely impact biodiversity, ecological integrity, social amenity or human health. |

## 5.2.7 Planned discharges: pipeline hydrotest and dewatering

| | |
|---|---|
| **Risk** | Impacts to the marine environment from planned treated seawater discharges during pipeline hydrotesting and dewatering |
| **Aspect-receptor reference (Table 5-5)** | 7B – Water quality<br>7C – Sediment quality<br>7H – Plankton<br>7G – Other communities<br>7J – Marine mammals<br>7I – Pelagic and demersal fish communities<br>7K – Marine reptiles<br>7L – Sharks and rays<br>7N – Key ecological features |

**Description of the Source of Risk**

Hydrotest water is filtered seawater with biocide and oxygen scavenger added to control microbiologically induced corrosion. Concentrations are configured to provide protection of up to two years protection. Fluorescein dye (50 ppm) is also added to aid with leak detection in the event that the pipeline fails the test.

Hydrotest of the pipeline will lead to the discharge of the quantities of treated water shown in **Table 5-23**.

***Table 5-23: Volumes of treated water discharged and the proposed locations and depth***

| Activity | Discharge Volume ($m^3$) | Discharge Locations (see Figure 3-1 and Table 3-2) | Discharge Depth |
|---|---|---|---|
| Flooding | 12,000 (if flooded from the FPSO PLET); or<br>15,000 (if flooded from the downstream PLET) | Downstream tie-in PLET<br>FPSO PLET | Either 1 m below the surface or approx. 3 m above the seabed |
| Hydrotest depressurising | 2,000 | Either the FPSO PLET or downstream tie-in PLET | Either 1 m below the surface or approx. 3 m above the seabed |
| Dewatering | 85,000 | FPSO PLET | Approx. 3 m above the seabed |

**Table 5-24** presents the chemical composition of Hydrosure 0-3670R, which is the proposed biocide and oxygen scavenger mixture to be used in the Barossa pipeline.

***Table 5-24: Chemical composition of the hydrotest chemical treatment package equivalent to that required in the Barossa pipeline***

| Function | Chemical | Formula | CAS No. | Composition | Pipeline concentration (mg/L)1 |
|---|---|---|---|---|---|
| Biocide | Alkyl dimethyl benzyl ammonium chloride | $C_{22}H_{40}ClN$ | 68424-85-1 | 10 to 30 % | 55 to 165 |
| Oxygen Scavenger | Ammonium bisulphite | $NH_4HSO_3$ | 10192-30-0 | 10 to 30 % | 55 to 165 |
| Solvent | Dipropylene glycol methylether | $C_7H_{16}O_3$ | 34590-94-8 (mixture of isomers) | 1 to 10 % | 5.5 to 55 |
| Solvent | Ethylene glycol | $C_2H_6O_2$ | 107-21-1 | <1 % | <5.5 |
| Solvent | Water | $H_2O$ | 7732-18-5 | 30 to 50 % | 165 to 275 |

*Note: 1 mg/L is essentially equivalent to ppm.*

On completion of FCGT, the flooded pipeline will be dewatered, conditioned with MEG and purged with nitrogen. The gas export pipeline will be dewatered using a train of dewatering pigs separated by MEG slugs. Approximately 1,000 $m^3$ will be discharged.

The impact being assessed is toxicological effects to marine organisms in the receiving water for the discharge.

**Potential Impacts**

**Chemical Additives**

Biocide

The biocide is an alkyl dimethyl benzyl ammonium chloride (ADBAC), which is a mixture of alkylbenzyl dimethylammonium chlorides of various alkyl chain lengths. It is a nitrogenous cationic surface-acting agent belonging to the quaternary ammonium group. The mechanism of microbicidal action is thought to be due to disruption of intermolecular interactions that cause dissociation of cellular membrane bilayers. This compromises cellular permeability controls and induces leakage of cellular contents.

ADBAC is reported to have a half-life of between eight and 15 days in seawater and is considered to be highly biodegradable. This indicates that the potential persistence in marine water and sediments is unlikely.

Bioconcentration factor testing reported values for fish of 79 L/kg (Centre for Environment, Fisheries & Aquaculture Science). Substances with a bioconcentration factor reported below 1000 L/kg are considered to not bioconcentrate (Champion Technologies, 2013).

Alternatives to ADBAC are glutaraldehyde and THPS. These were ruled out for reason provided in the ALARP section.

Oxygen Scavenger

The oxygen scavenger is ammonium bisulphite, a pale-yellow liquid with a pungent sulphur smell. It is soluble in water and readily reacts with oxygen to form sulphate salts and acids:

$$2NH_4HSO_3 + O_2 \rightarrow (NH_4)2SO_4 + H_2SO_4$$

Neither the product component nor its by-products are classified as hazardous. It is listed on the Oslo and Paris Commission (OSPAR) list of substances which are considered to pose little or no risk (PLONOR) to the environment. It is therefore considered safe to discharge to the marine environment.

Approximately 8 mg/L of $NH_4HSO_3$ are required to react with 1 mg/L of dissolved oxygen. Hence, 64 mg/L of NH4HSO3 are required to react with the dissolved oxygen levels in seawater at 8 mg/L.

Solvents

Dipropylene glycol methyl ether and ethylene glycol (see also MEG below) are organic compounds used in a variety of industrial products, including paints, pastes, dyes, resins, brake fluids and inks, and cosmetics.

Fluorescein Dye

Fluorecein dye is dark greenish liquid, 60 to 90% aqueous solution of xanthene. Apart from its significant visual effect in the water, it is not hazardous to the environment. The ecological information in the Fluorescein MSDS report the product is not expected to be hazardous to the environment (Champion Technologies, 2011).

Monoethylene Glycol

Monoethylene Glycol (MEG) (CAS number 107-21-1) is a colourless, odourless, involatile, hygroscopic liquid. It is characterised by two hydroxyl groups, which contribute to its high water solubility, hygroscopicity and reactivity with many organic compounds. MEG is on the OSPAR PLONOR list and is therefore deemed safe to discharge to the marine environment.

MEG is soluble in water, does not volatilise or undergo photodegradation, and is not adsorbed on to soil particles (Hook and Revill, 2016). Studies on a green alga (*Chlorella tusca*), a freshwater crayfish (*Procambarus* sp.) and a golden orfe carp (*Leuciscus idus melanotus*) revealed low potential for bioaccumulation in the marine environment (International Programme on Chemical Safety, 2000). Ethylene glycols biodegrade readily when released to the environment, and several strains of micro-organisms can use them as an energy source. Given the low residual concentrations expected, rapid biodegradation and low toxicity, no significant impacts from the release of treated seawater are expected to the marine environment.

**Ecotoxicity**

**Table 5-25** presents Whole Effluent Testing (WET) for Hydrosure 0-3670R. Testing was undertaken according to protocols recommended by ANZECC and ARMCANZ (2000) and included five locally relevant species from a range of trophic levels (primary producer, herbivore and carnivore). Results show that NOECs ranged from 0.13 mg/L for the crustacean to 12.5 mg/L for the fish. In general, simpler life forms (algae and species in their larval stage) exhibited higher sensitivity compared to more complex life forms such as the fish.

Species protection levels calculated from statistical distribution of the NOECs are presented in **Table 5-26**. For long-term continuous discharges (e.g. sewage outfalls), ANZECC and ARMCANZ (2000) recommend that the 99% species protection concentrations should be applied to develop environmental criterion for high conservation ecosystems. For chemicals with negligible potential for bioaccumulation the 95 % level of species protection may also be applied.

Taking into consideration that the hydrotest discharge is short term with negligible risk of bioaccumulation, the following environmental criteria is presented as a threshold for comparison with model results:

- Beyond the mixing zone, the chemical concentration in the receiving environment is not to exceed a median (50th percentile) concentration of 0.06 mg/L.

This is in line with recent pipeline projects undertaken in Australian Waters (e.g. Wheatstone (see Chevron, 2015)). The mixing zone is an area within which environmental criteria may be exceeded. For the purpose of presenting results, we have nominally set this distance at 200 m.

***Table 5-25: Ecotoxicological testing results for Hydrosure (from Chevron, 2015)***

| Species | Test | Type | EC10 ppm (or mg/L) | EC50 ppm (or mg/L) | LOEC ppm (or mg/L) | NOEC ppm (or mg/L) |
|---|---|---|---|---|---|---|
| *Nitzschia Closterium* (algae) | 72-hr growth inhibition | Chronic | 1.5 * | 3.3 (3.0 to 3.58) | 2.50 | 1.30 |
| *Saccostrea echinate* (mollusc) | 48-hr larval abnormality | Chronic | 0.29 (0.24 to 0.33) | 0.54 (0.52 to 0.56) | 0.50 | 0.250 |
| *Heliocidaris tuberculate* (echinoderm) | 72-hr larval development | Chronic | 1.30 (1.27 to 1.32) | 1.71 (1.70 to 1.74) | 2.50 | 1.25 |
| *Melita plumulosa* (crustacean)# | 96-hr acute toxicity | Acute | 0.08 (0.04 to 0.11) | 0.14 (0.10 to 0.16) | 0.25 | 0.13 |
| *Lates calcifer* (fish)# | 96-hr acute toxicity | Acute | 13.5 (12.3 to 18.0) | 17.5 (17.1 to 18.0) | 25.0 | 12.5 |

**95% confidence limits are not reliable; Numbers in brackets represent the 95% fiducial limits.*

*# Toxicity test is defined as an acute test.*

***Table 5-26: Species protection concentrations for Hydrosure 0-3670R based on the no observed effect concentrations from whole effluent toxicity testing (from Chevron, 2015)***

| | PC99% (ppm or mg/l) | PC95% (ppm or mg/l) | PC90% (ppm or mg/l) | PC80% (ppm or mg/l) |
|---|---|---|---|---|
| Hydrosure (based on NOEC) | 0.06 | 0.10 | 0.15 | 0.23 |

**Biodegradation and Bioaccumulation Potential**

As described above, the constitute components of the hydrotest chemical package do not persist or accumulate within the marine environment. The mixture is therefore considered biodegradable with negligible potential for bioaccumulation.

**Dispersion Modelling**

Near and far field dilution modelling were undertaken for the possible 12,000 m$^3$ discharge at the downstream tie-in PLET and 85,000 m$^3$ discharge at the FPSO PLET (RPS, 2019b). The smaller volume of 2,000 m$^3$ associated with depressurising after the hydrotest was not modelled as flooding and dewatering volumes are much higher and therefore present a worst-case scenario. Similarly, the possible 5,000 m$^3$ volume associated with flooding from the downstream PLET end was not modelled as this is covered by the larger dewatering discharge. Results are presented below for scenarios of weak ambient currents, which constitutes worst case mixing conditions for the hydrotest release.

**Presentation of Results**

Results are presented as:

- Plan views of maximum instantaneous concentration recorded within the plume for the duration of the model simulation. This figure plots the peak values attained at each grid point in the model over the course of the simulation. It is presented to illustrate the footprint of the plume down to the 99% species protection level (PC99) given in **Table 5-26**.
- Plan views of concentrations and vertical transects through the centre of the plume at distinct points in time throughout the simulation. These illustrate the actual behaviour of the plume.
- Time series of concentrations at two points through which the plume passes to show the ephemeral nature of plume at fixed points.
- 50th percentile (median) concentration calculated at each grid point in the model over the course of the model simulation. This is for comparison with the environmental criteria threshold and provides a better assessment of impact as it represents duration of exposure at any one location and not just the peak which could occur for a just a single time step in the model (60 secs).

**Hydrotest Flood Discharge at the** downstream **Tie-In PLET**

**Table 5-27** presents the modelling parameters applied. The discharge volume of 12,000 m³ was simulated over 21.5 hours. Surface and subsea discharges through a four-inch diameter orifice were modelled. The surface release was assumed to discharge horizontally at 1 m below the sea surface and the seabed release assumed to discharge 3.5 m above the seabed orientated vertically upwards.

***Table 5-27: Summary of model parameters used in the modelling of the discharge from the downstream tie-in pipeline end terminal***

| Parameter | Value/design |
|---|---|
| Maximum discharge volume | 12,000 m³ |
| Discharge duration | 21.5 hours |
| Model duration | 48 hours |
| Discharge depth | Scenario 1: Surface discharge: 1 m below the sea surface orientated horizontally<br>Scenario 2: Seabed discharge: 3.5 m above the seafloor orientated vertically upwards |
| Outlet pipe internal diameter | 4 inches |
| Hydrotest water temperature | As per ambient seawater |
| Hydrotest water salinity | As per ambient seawater |
| Initial chemical treatment concentrations | 550 mg/L |

Surface Discharge at the downstream Tie-In PLET

**Figure 5-16** presents the maximum instantaneous concentration during the model simulation, **Figure 5-17** presents predicted concentrations and vertical transects through the centre of the plume at distinct points in time; and **Figure 5-19** presents time series at two locations through which the centre of the plume passes (**Figure 5-18**). The discharge is neutrally buoyant and disperses horizontally, with no appreciable vertical movement. Advection is towards the southeast on the flood tide and northwest on the ebb. Maximum tidal excursion is over 10 km, reflecting the strong tidal currents in the area.

Pooling occurs at slack waters during which time concentrations build up over the release point. At 200 m from the discharge, concentration peak at 8.4 mg/L, while the 95th percentile and 50th percentile (median) concentrations over the model simulation (48 hours) are 1.95 and <0.06 mg/L, respectively (**Figure 5-19**).

At the furthest point from the discharge, the concentration peak is up to 0.2 mg/L (**Figure 5-16**), however, both the 95th and 50th percentile are below 0.06 mg/L. **Figure 5-20** shows the median (50th percentile) concentration. This metric is <0.06 mg/L over the whole grid, even in the near vicinity of the discharge, so, on this basis, the environmental criterion given above is comfortably met.

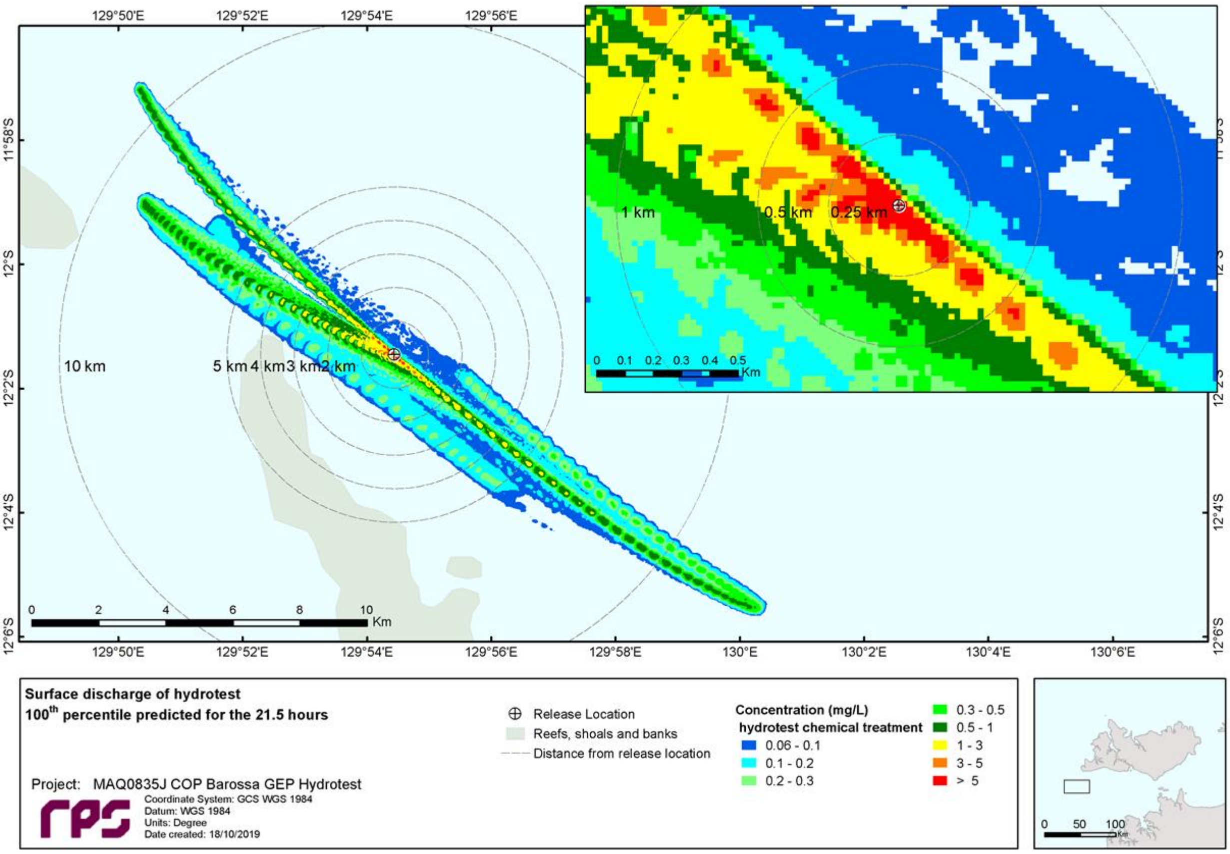
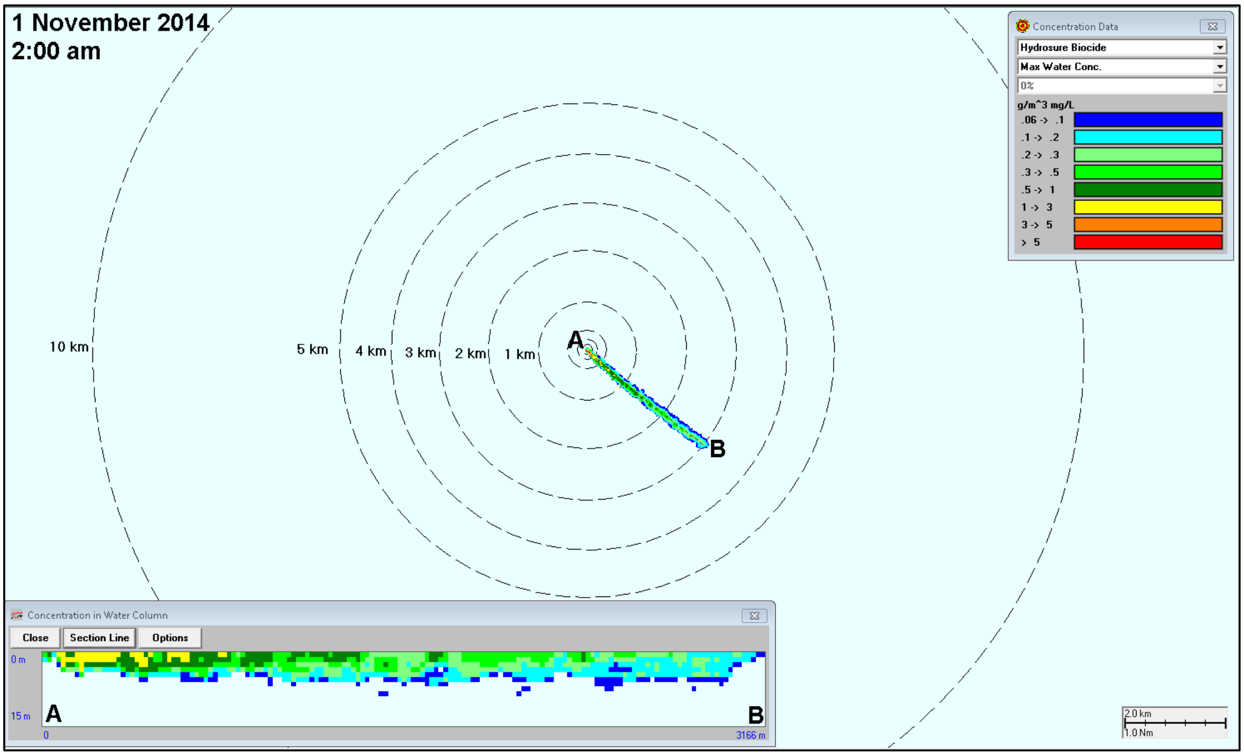
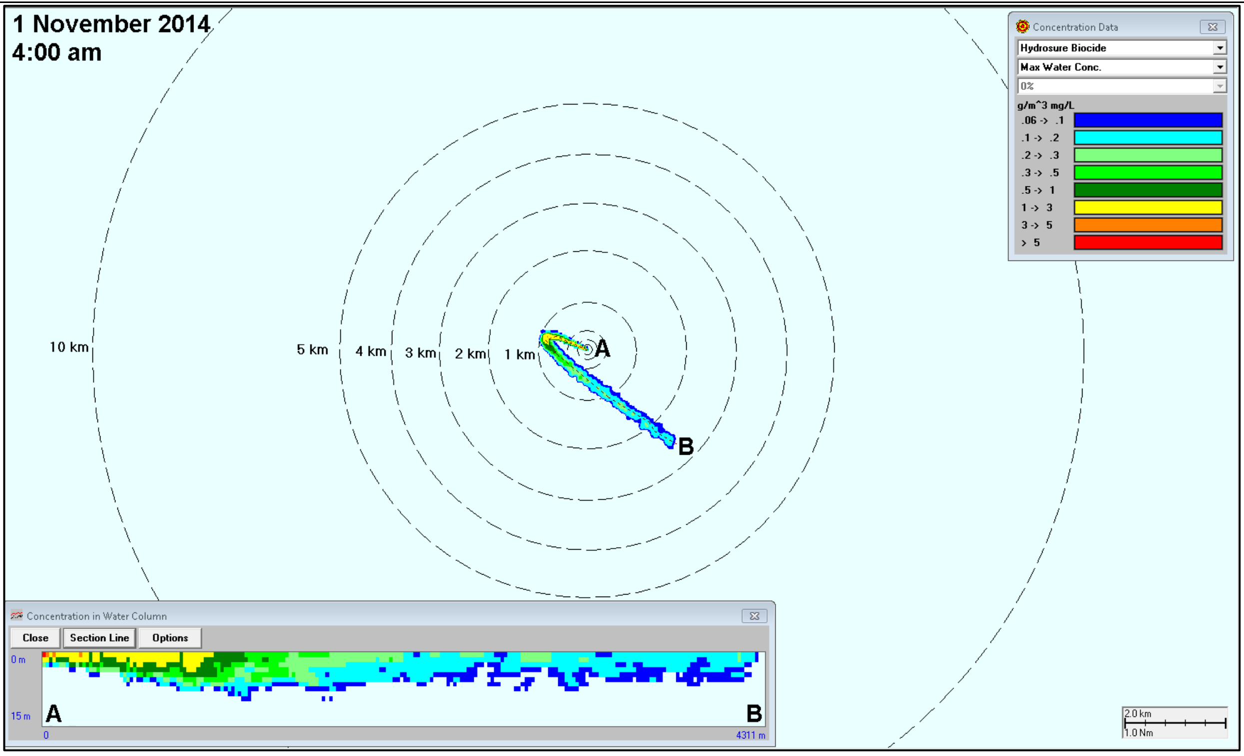
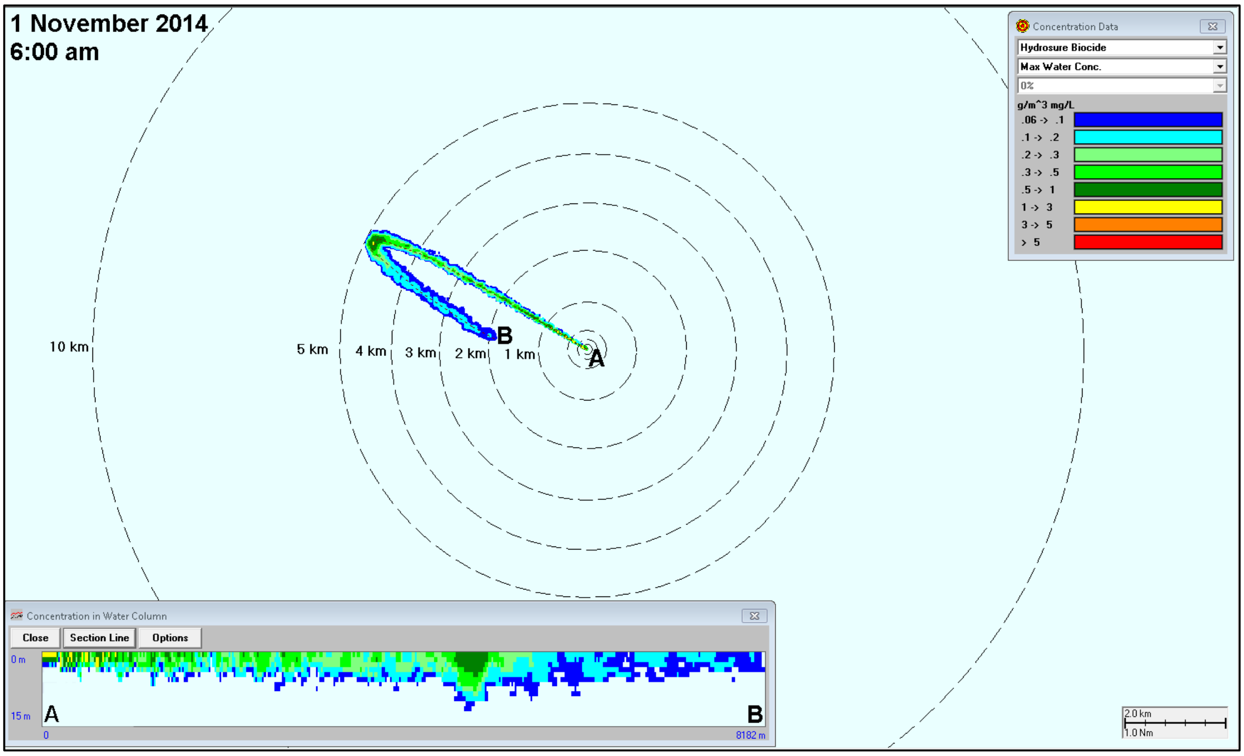



*Figure 5-16: Downstream tie-in pipeline end terminal surface discharge: predicted maximum concertation of the hydrotest chemical over the course of the simulation*




1 November 2014
4:00 am
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
Concentration in Water Column
Close
Section Line
Options
0 m
15 m
0
4311 m
2.0 km
1.0 Nm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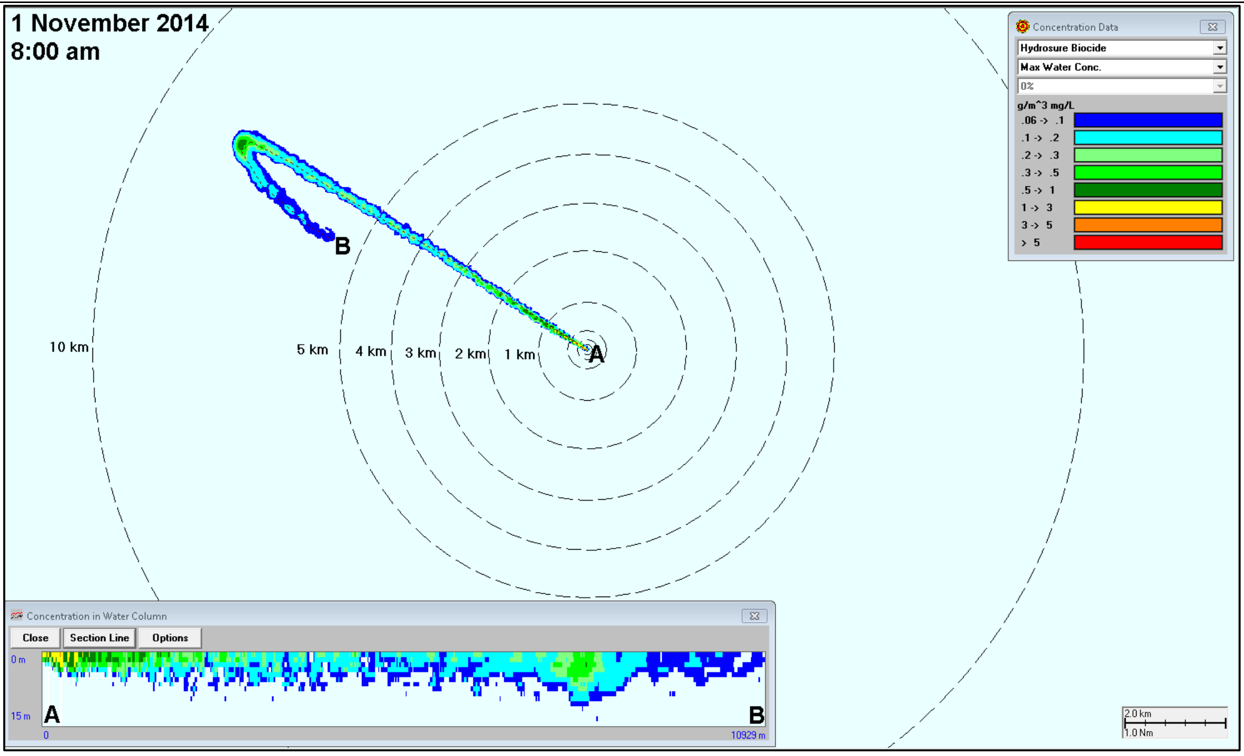
6:00 am
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
Concentration in Water Column
Close
Section Line
Options
0 m
15 m
0
8182 m
2.0 km
1.0 Nm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8:00 am
Concentration Data
Hydrosure Biocide
Max Water Conc.
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g/m^3 mg/L
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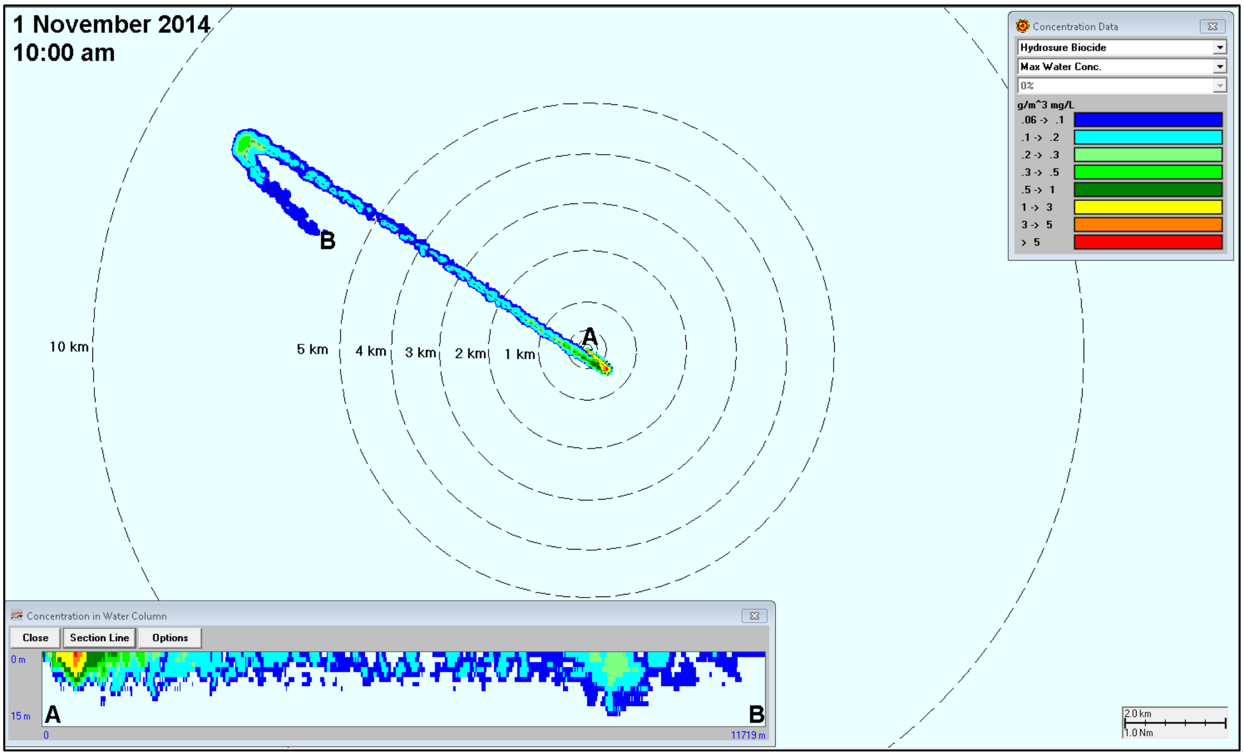
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration in Water Column
Close
Section Line
Options
0 m
15 m
0
10929 m
2.0 km
1.0 Nm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10:00 am
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
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.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration in Water Column
Close
Section Line
Options
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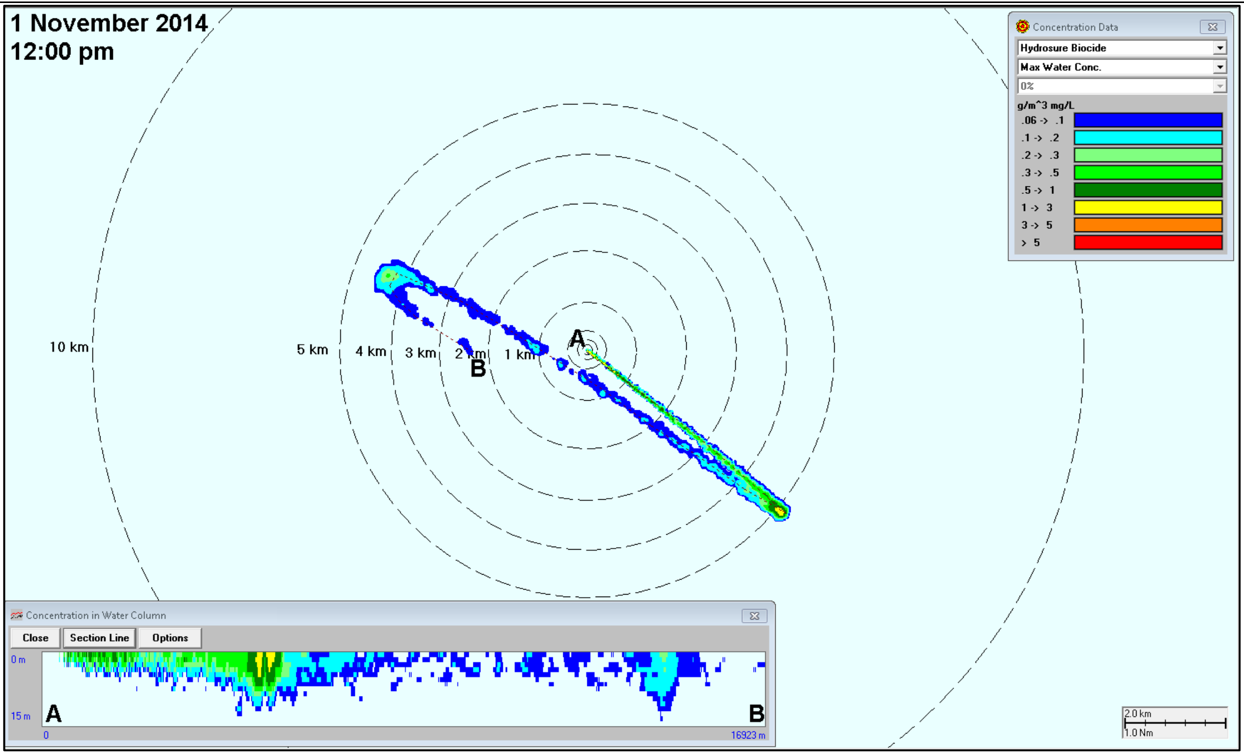
15 m
0
11719 m
2.0 km
1.0 Nm



1 November 2014
12:00 pm
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
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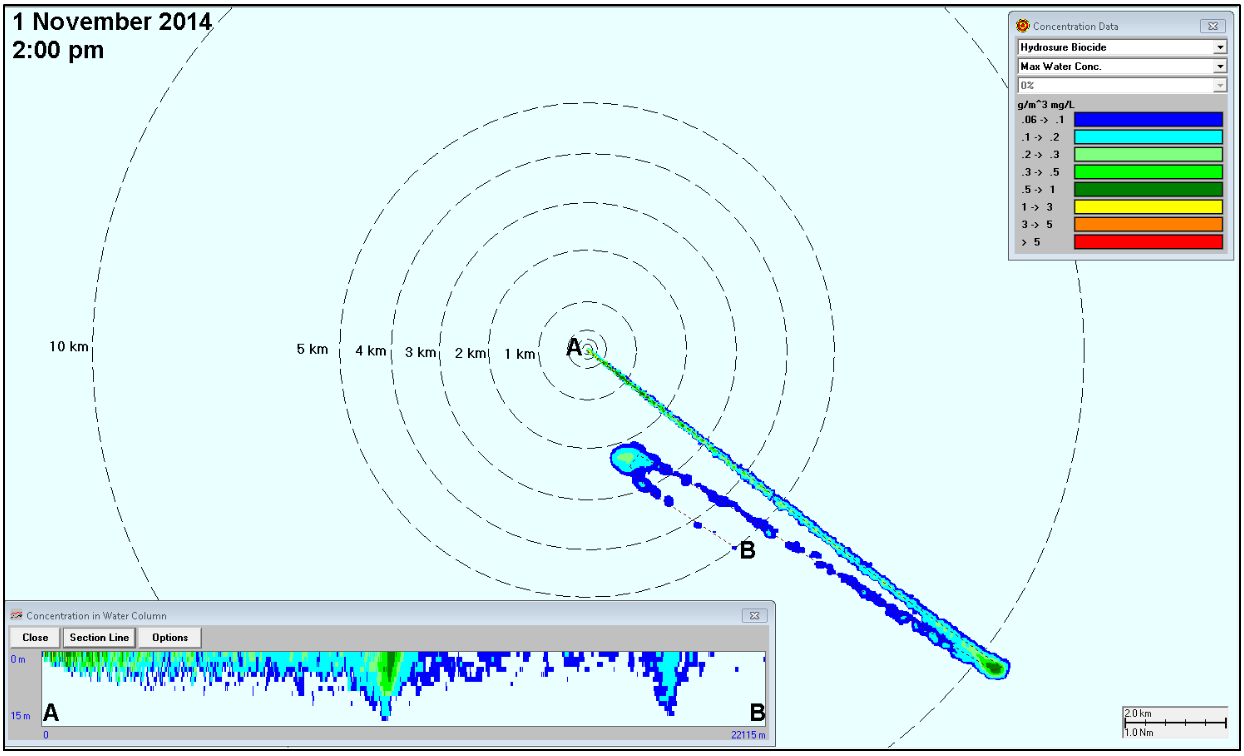
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration in Water Column
Close
Section Line
Options
0 m
15 m
0
16923 m
2.0 km
1.0 Nm

1 November 2014
2:00 pm
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
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.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration in Water Column
Close
Section Line
Options
0 m
15 m
0
22115 m
2.0 km
1.0 Nm

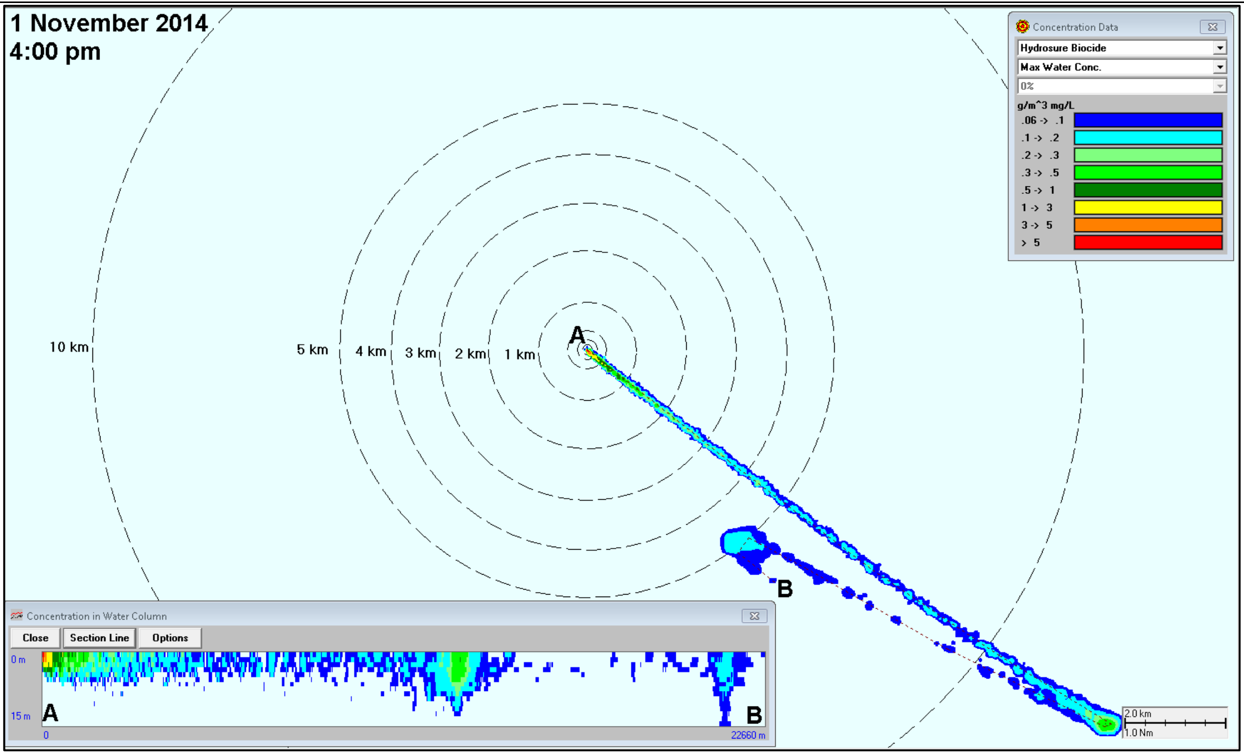



*Figure 5-17: Downstream tie-in pipeline end terminal surface discharge: predicted dispersion of the hydrotest chemical on a neap tide*

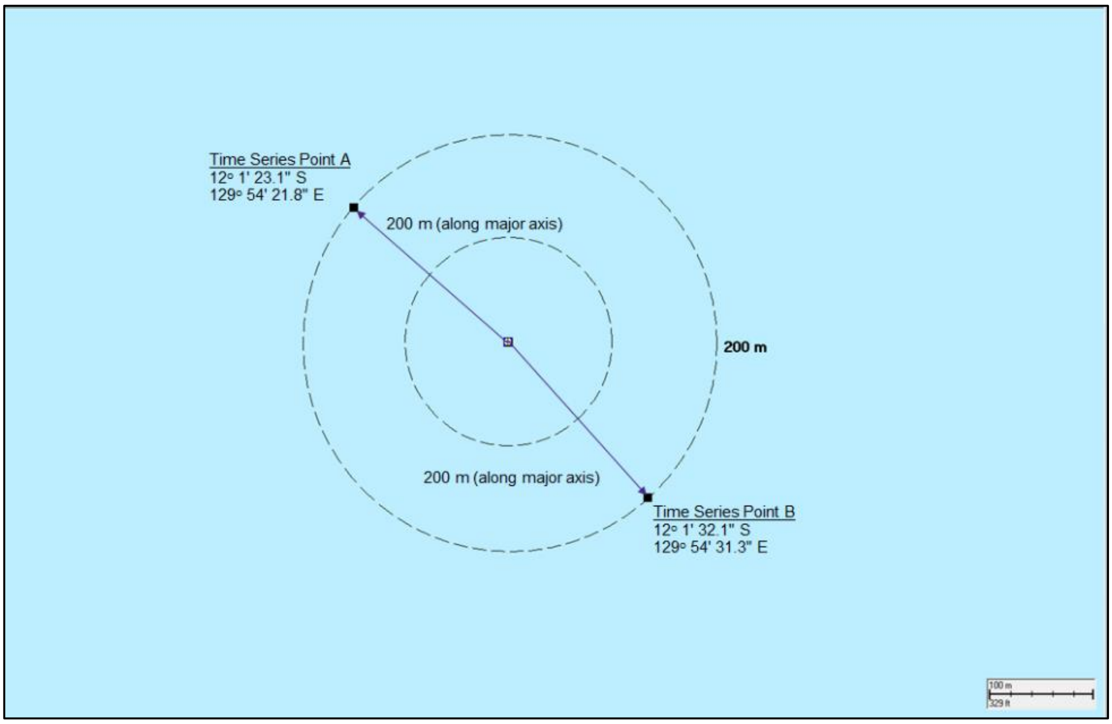



*Figure 5-18: Hydrotest discharge time series locations*

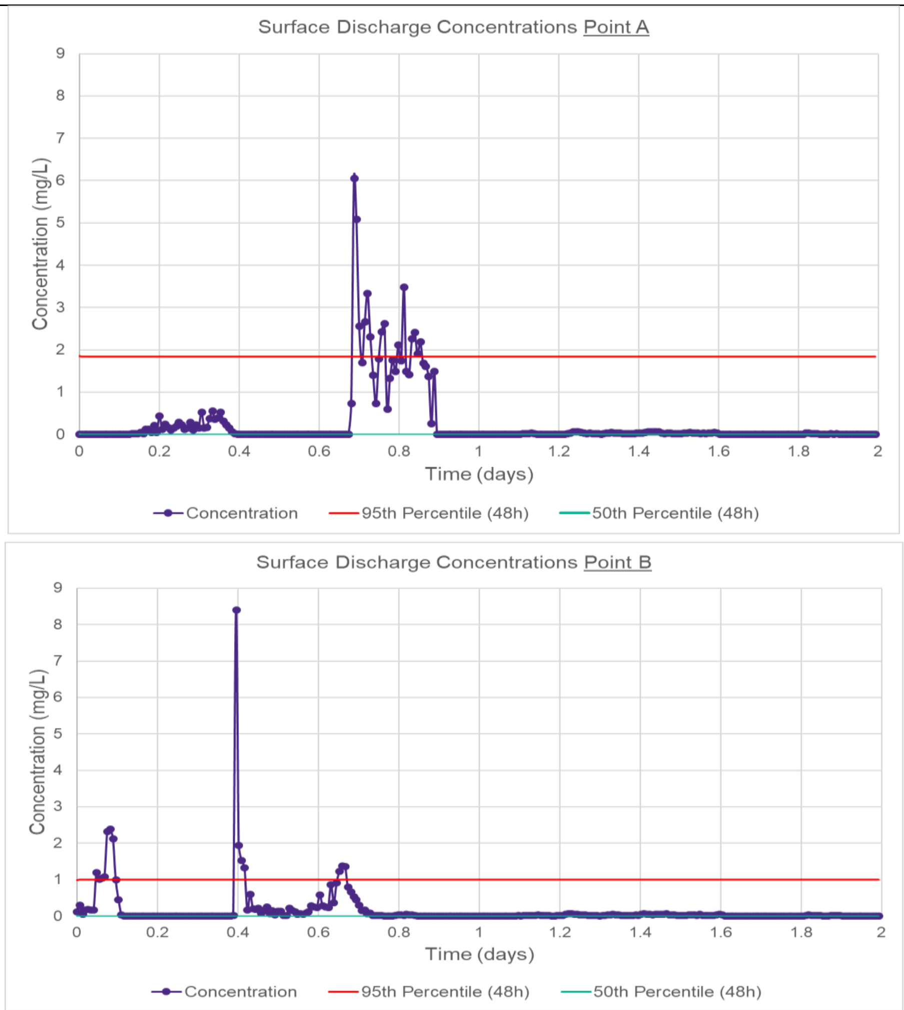
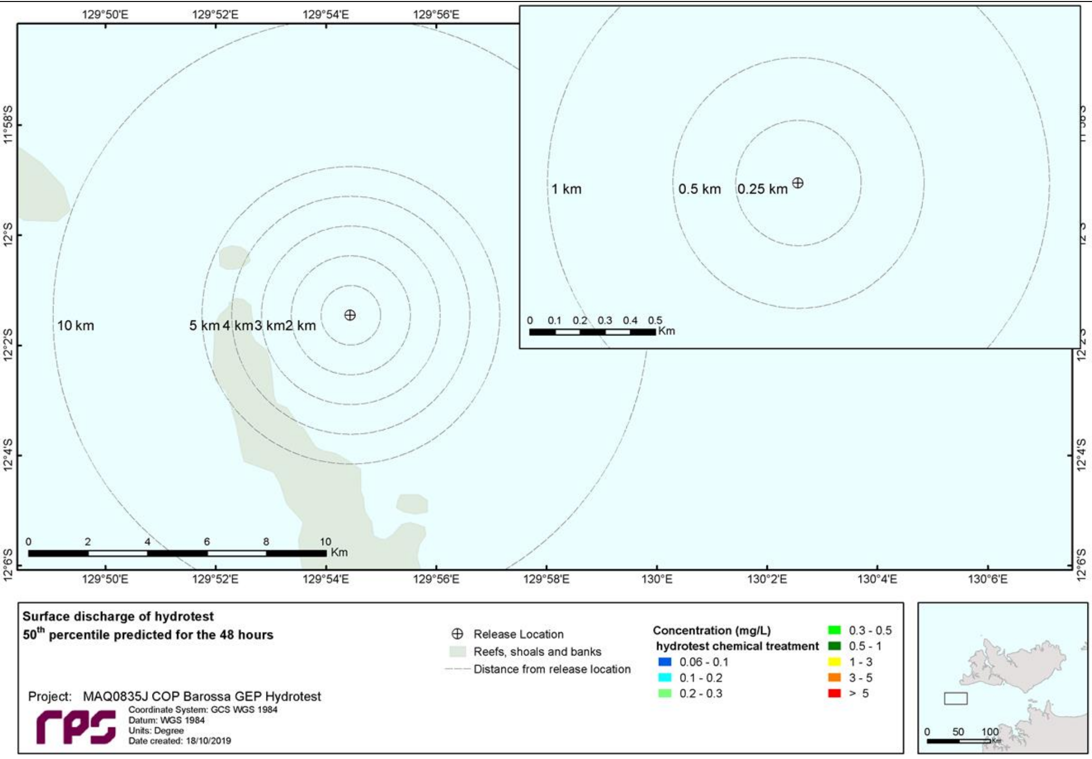



***Figure 5-19: Downstream tie-in pipeline end terminal surface discharge: time series of the hydrotest chemical concentration at 200 m from the discharge***




*Note: median hydrotest chemical concentration below 0.06 mg/L so below the minimum contour level which was set at the environmental criteria for the discharge.*

***Figure 5-20: Downstream tie-in pipeline end terminal surface discharge: median hydrotest chemical concentration on a neap tide***

Seabed Discharge at the downstream Tie-In PLET

**Figure 5-21** and **Figure 5-22** present modelling results for the subsurface discharge. As for the surface discharge, the plume is advected towards the southeast on the flood tide and northwest on the ebb; however, in this case, the plume travels along the seabed. At 200 m from the discharge (within the centre of the plume), concentration peak at 6.2 mg/L, while the 95th and 50th percentile (median) concentrations over the duration of the discharge are 0.5 and <0.06 mg/L, respectively (**Figure 5-23**). At the furthest point from the discharge, the concentration peak is up to 1 mg/L, however, both the 95th and 50th percentile are below 0.06 mg/L. Once again, the 50th percentile (median) concentration over the whole grid is below 0.06 mg/L (**Figure 5-24**) thus meeting the environmental criterion.

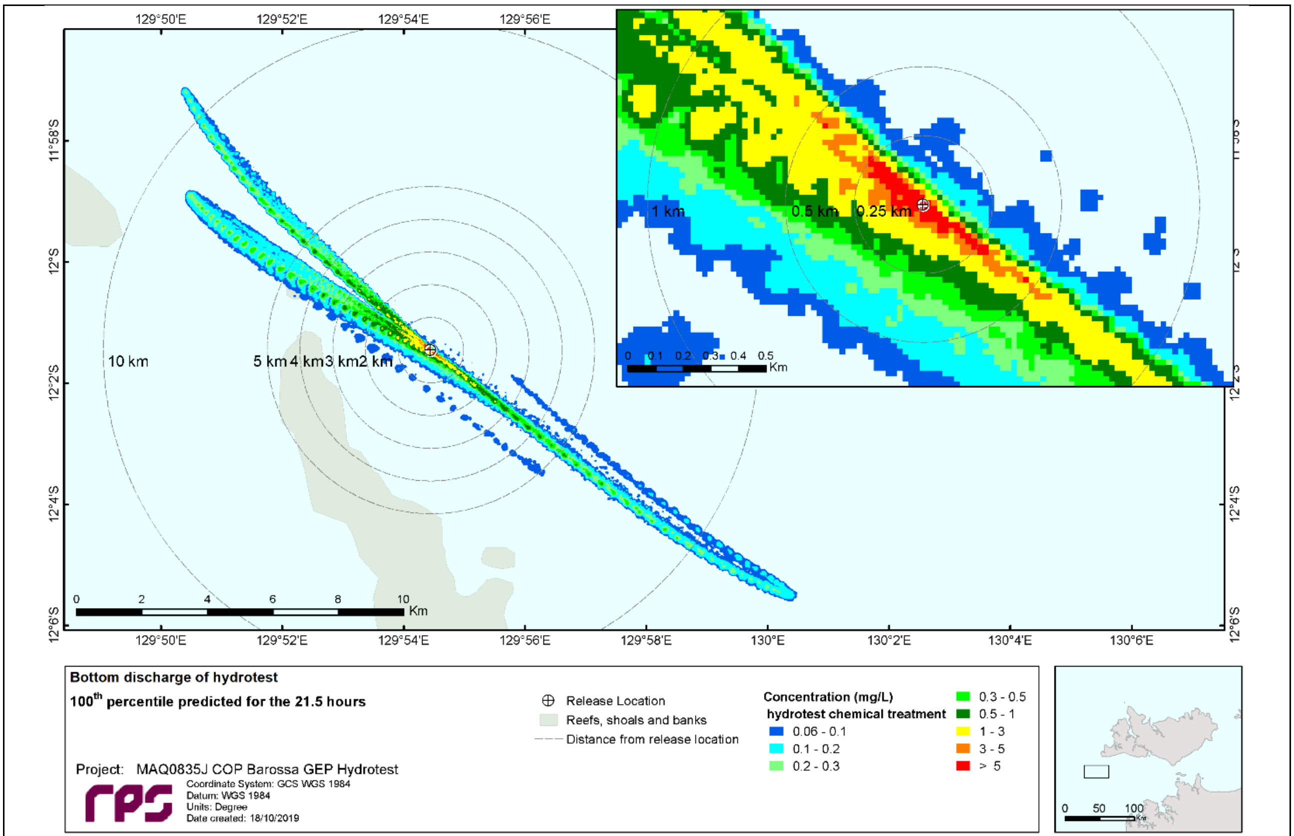
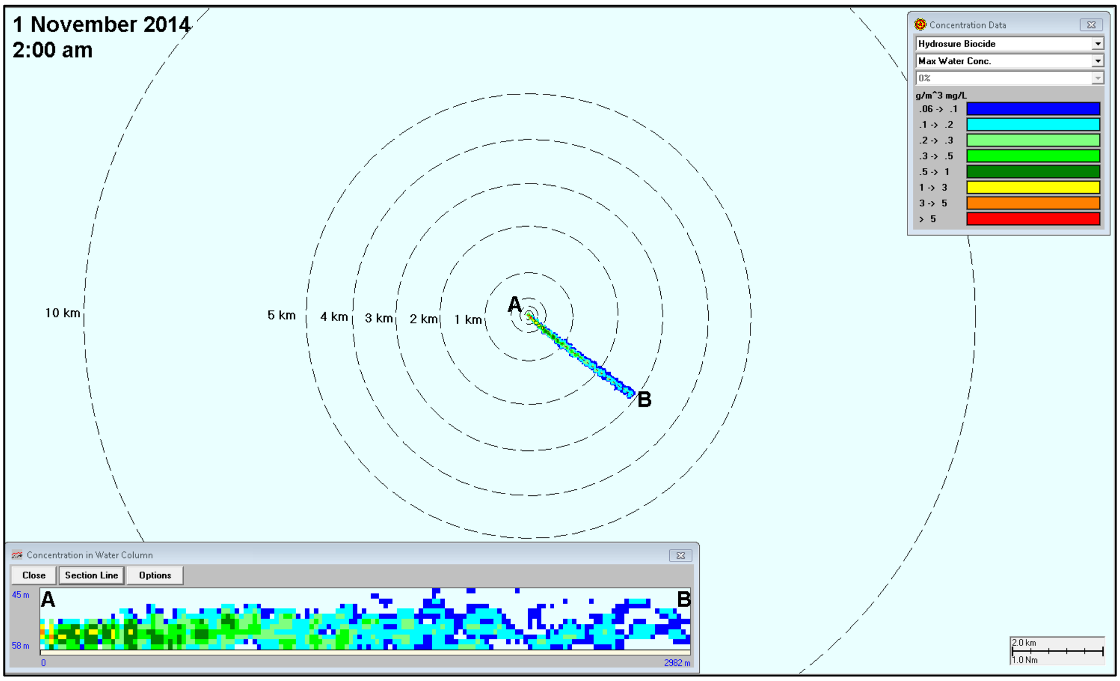
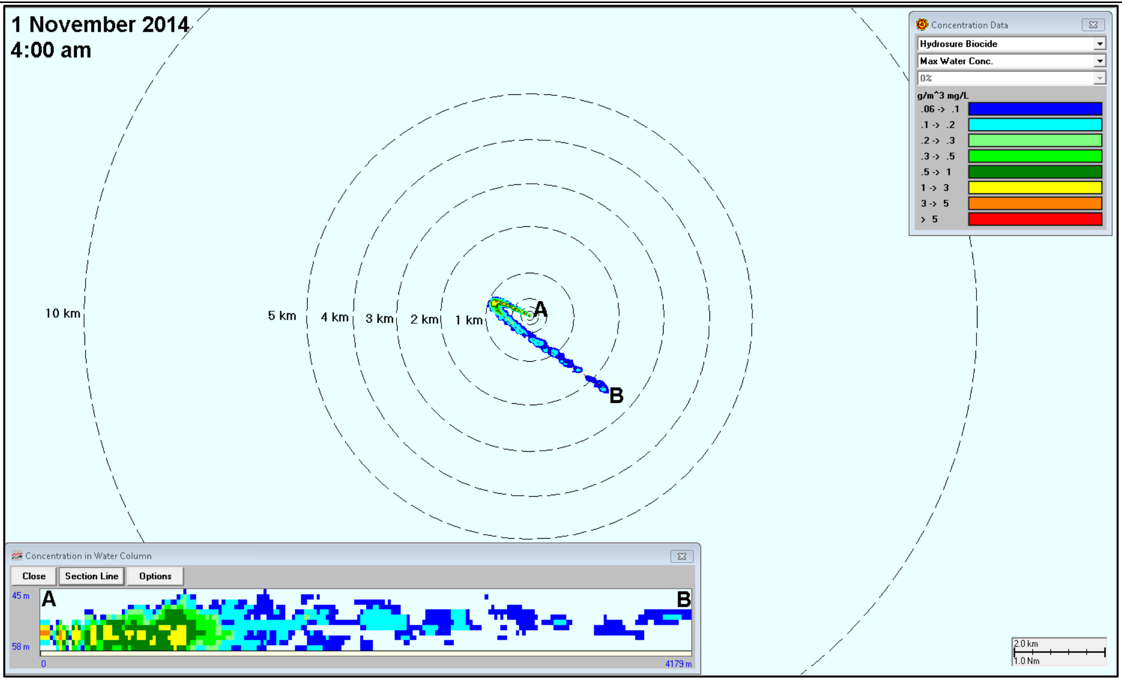
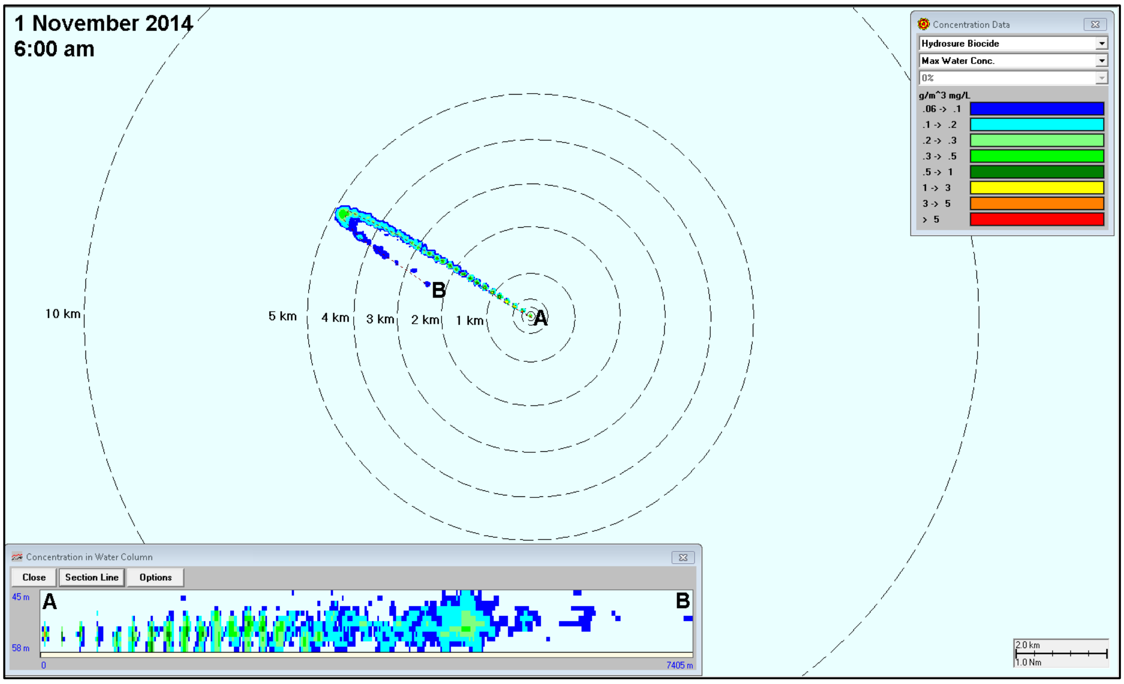
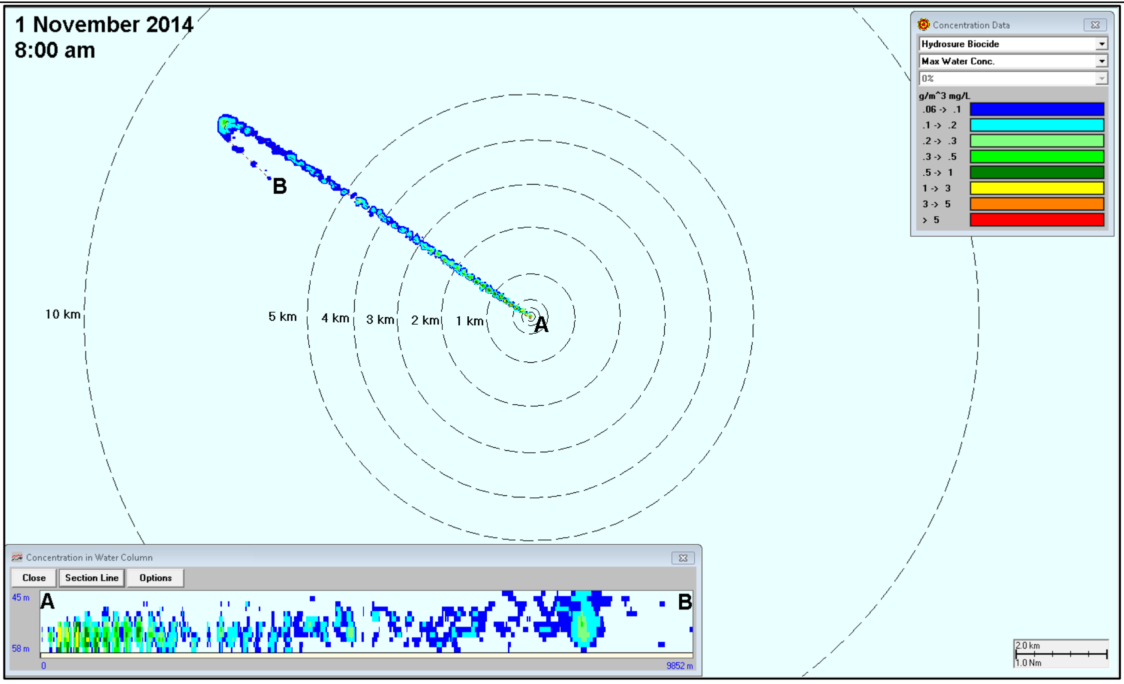


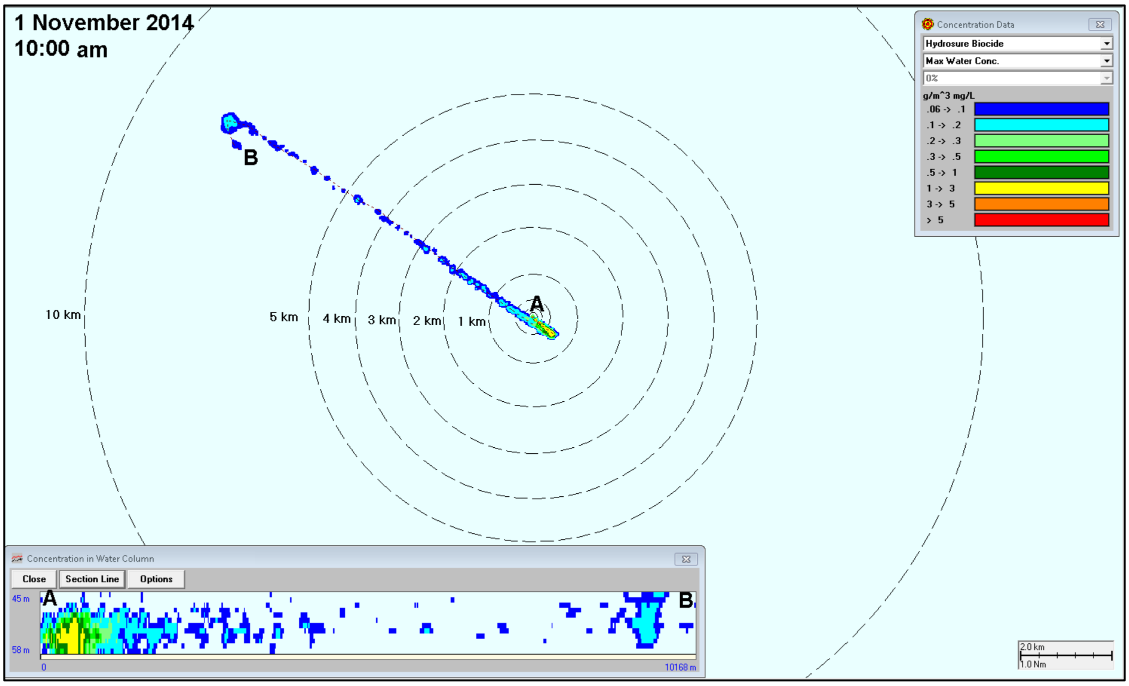

*Figure 5-21: Downstream tie-in pipeline end terminal bottom discharge: predicted maximum concertation of the hydrotest chemical over the course of the simulation*




1 November 2014
4:00 am
Concentration Data
Hydrosure Biocide
Max Water Conc.
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration in Water Column
Close
Section Line
Options
45 m
58 m
0
4179 m
2.0 km
1.0 Nm


1 November 2014
6:00 am
Concentration Data
Hydrosure Biocide
Max Water Conc.
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration in Water Column
Close
Section Line
Options
45 m
58 m
0
7405 m
2.0 km
1.0 Nm


1 November 2014
8:00 am
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration Data
Hydrosure Biocide
Max Water Conc.
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
Concentration in Water Column
Close
Section Line
Options
45 m
58 m
0
9852 m
2.0 km
1.0 Nm


1 November 2014
10:00 am
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration Data
Hydrosure Biocide
Max Water Conc.
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
Concentration in Water Column
Close
Section Line
Options
45 m
58 m
0
10168 m
2.0 km
1.0 Nm

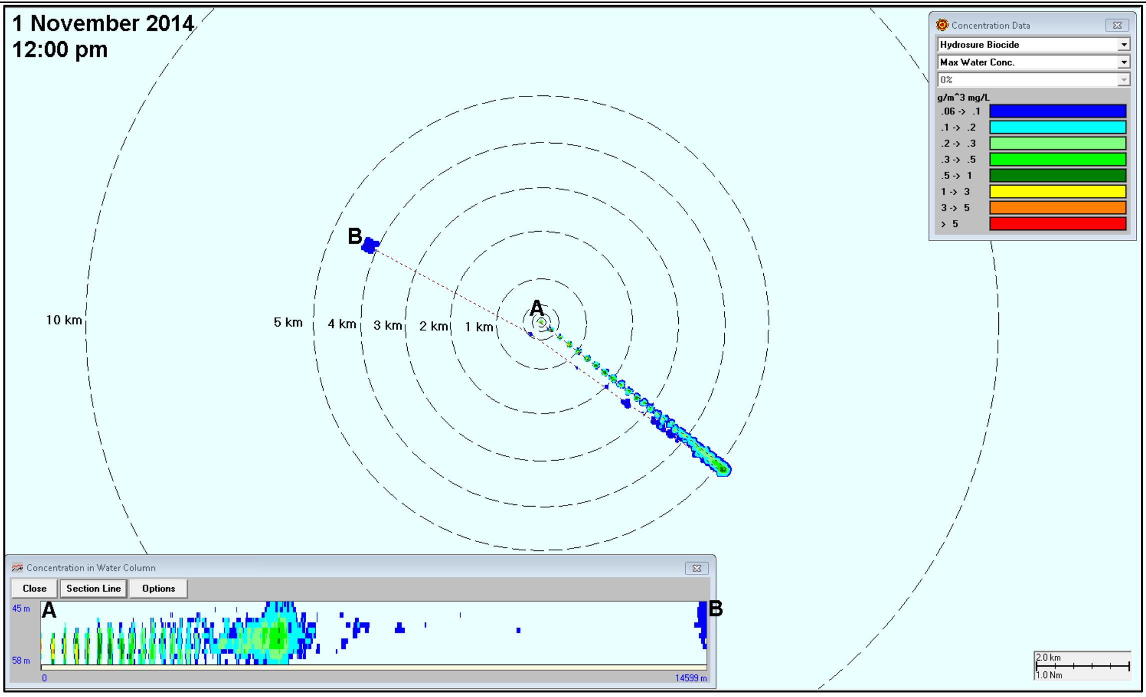
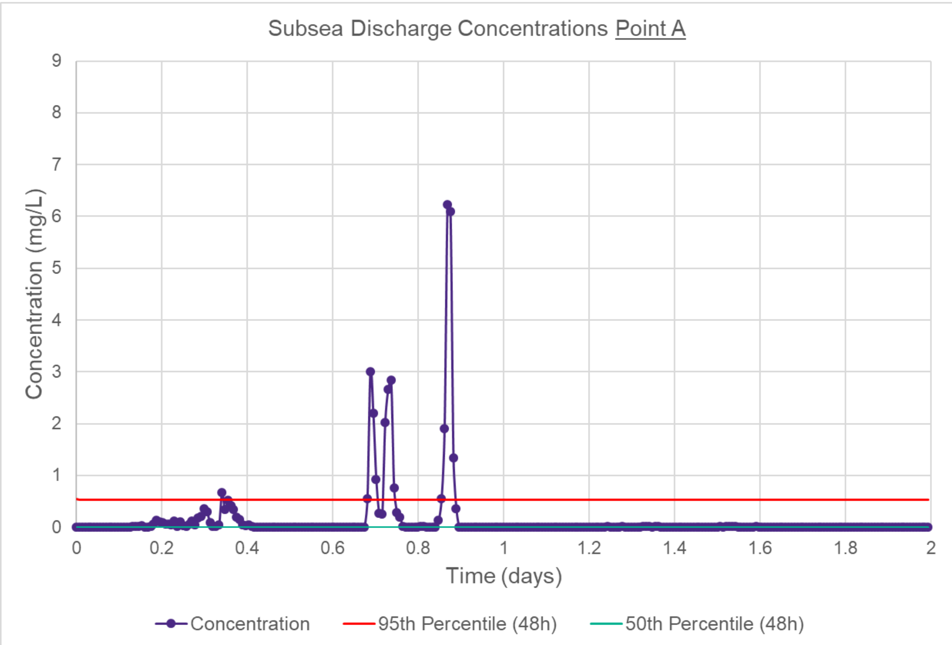



*Figure 5-22: Downstream tie-in pipeline end terminal seabed discharge: predicted dispersion of the hydrotest chemical*



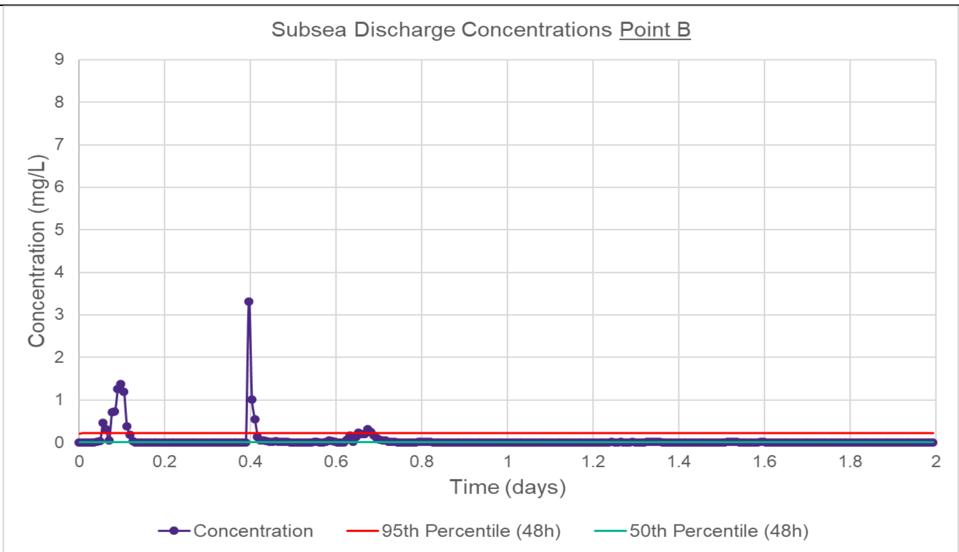



*Figure 5-23: Downstream tie-in pipeline end terminal seabed discharge: time series of the hydrotest chemical concentration at 200 m from the discharge*

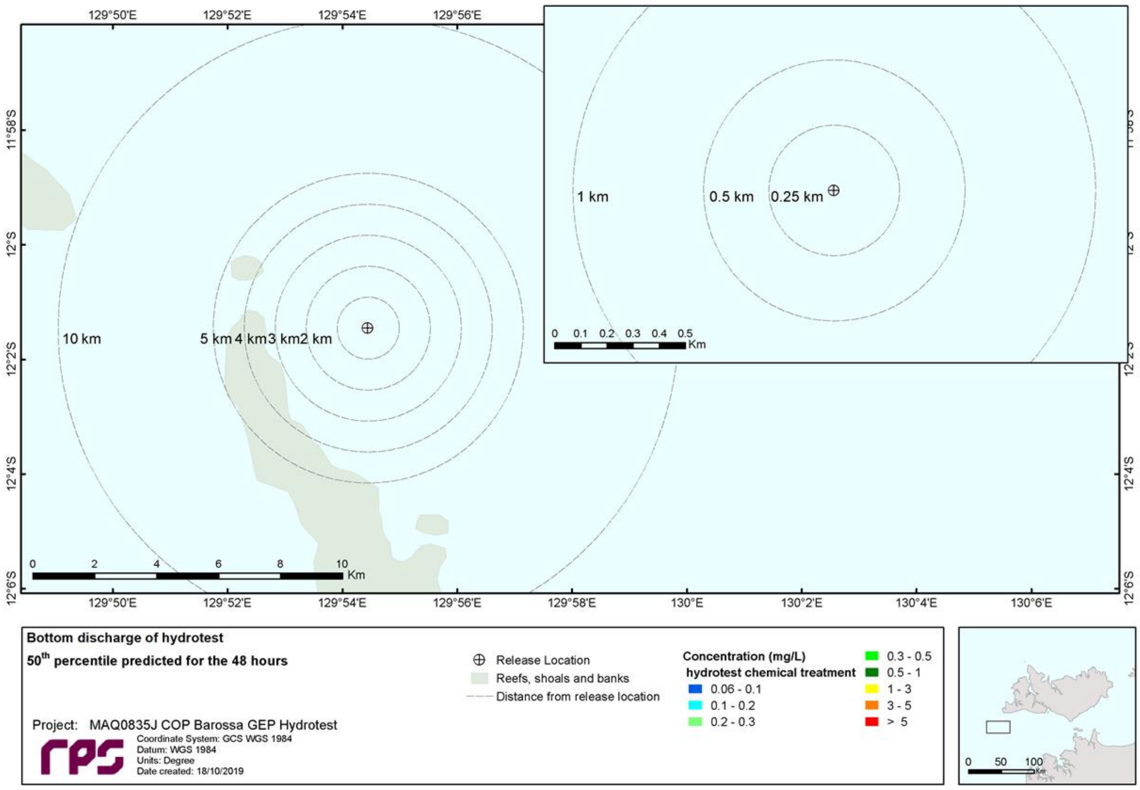



*Figure 5-24: Downstream tie-in pipeline end terminal seabed discharge: median hydrotest chemical concentration*

**Seabed Discharge at the FPSO PLET**

**Table 5-28** presents the modelling parameters applied for the FPSO PLET subsea discharge. 85,000 m³ was discharged over seven days from a four-inch orifice orientated vertically upwards 3.5 m above the seabed.

*Table 5-28: Summary of model parameters used in the modelling for the floating production, storage and offloading vessel pipeline end terminal seabed discharge*

| Parameter | Value/design |
|---|---|
| Maximum discharge volume | 85,000 $m^3$ |
| Discharge duration | 7 days |
| Model run duration | 8 days |
| Discharge depth (m) | Seabed discharge: 3.5 m above the seafloor orientated vertically upwards |
| Outlet pipe internal diameter | 4-inch |
| Hydrotest water temperature | As per ambient seawater |
| Hydrotest water salinity | As per ambient seawater |
| Initial chemical treatment concentrations | 550 mg/L |

**Figure 5-25** and **Figure 5-26** present spatial results for the subsurface discharge. Tidal currents at the FPSO PLET are weak; regional currents dominate and the plume is seen to travel towards the southwest near the seabed. Concentrations peak at more than 5 mg/L; however, as can be seen in **Figure 5-27**, such increases are confined to the near vicinity of the discharge and are sporadic (**Figure 5-28**). At the furthest point from the discharge, the concentration peak is up to 0.1 mg/L. Median (50th percentile) concentrations reduce to below 0.06 mg/L within 100 m (**Figure 5-29**), thereby meeting the environmental criterion.

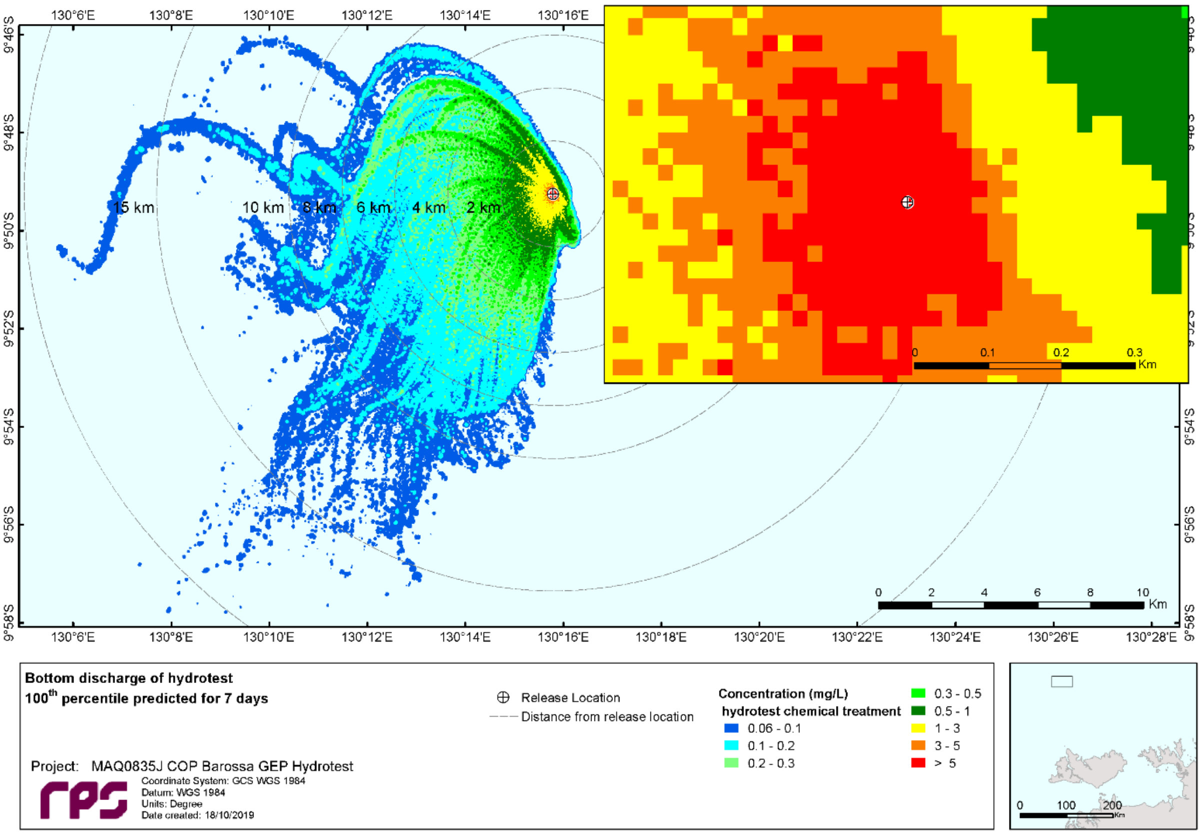
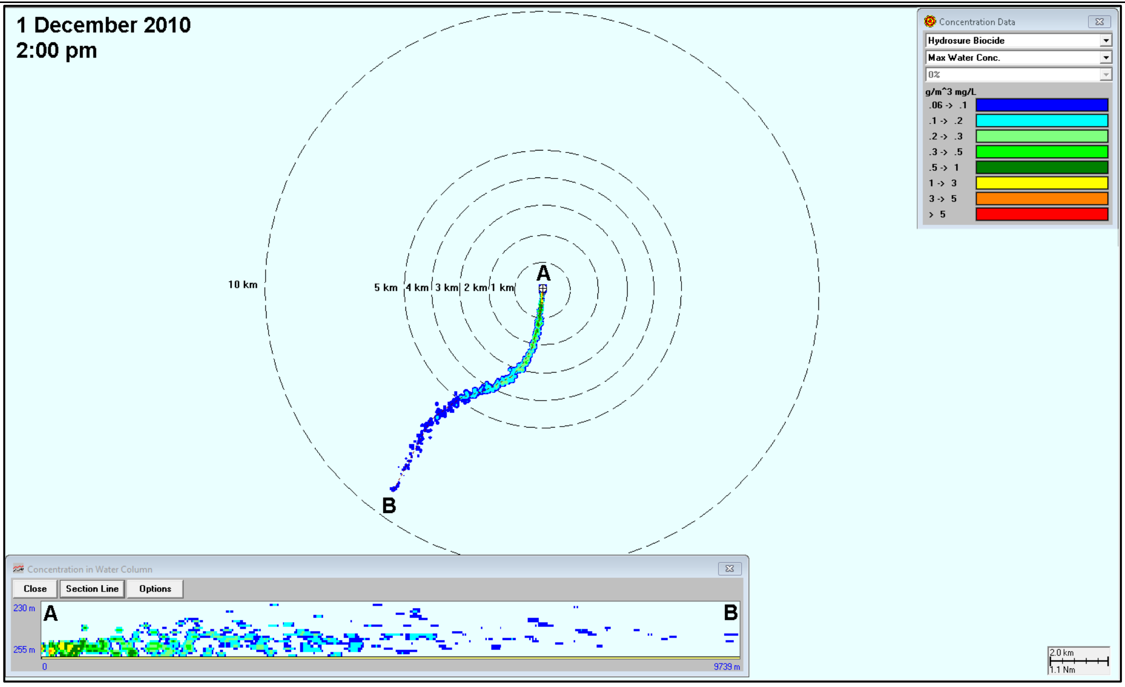
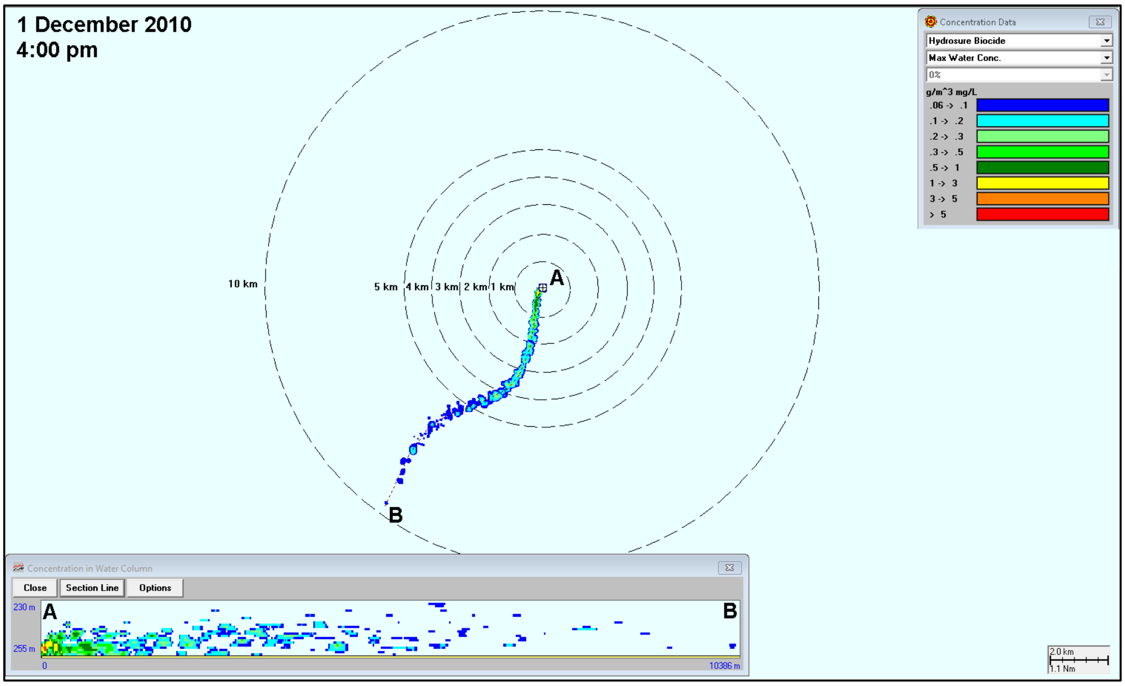
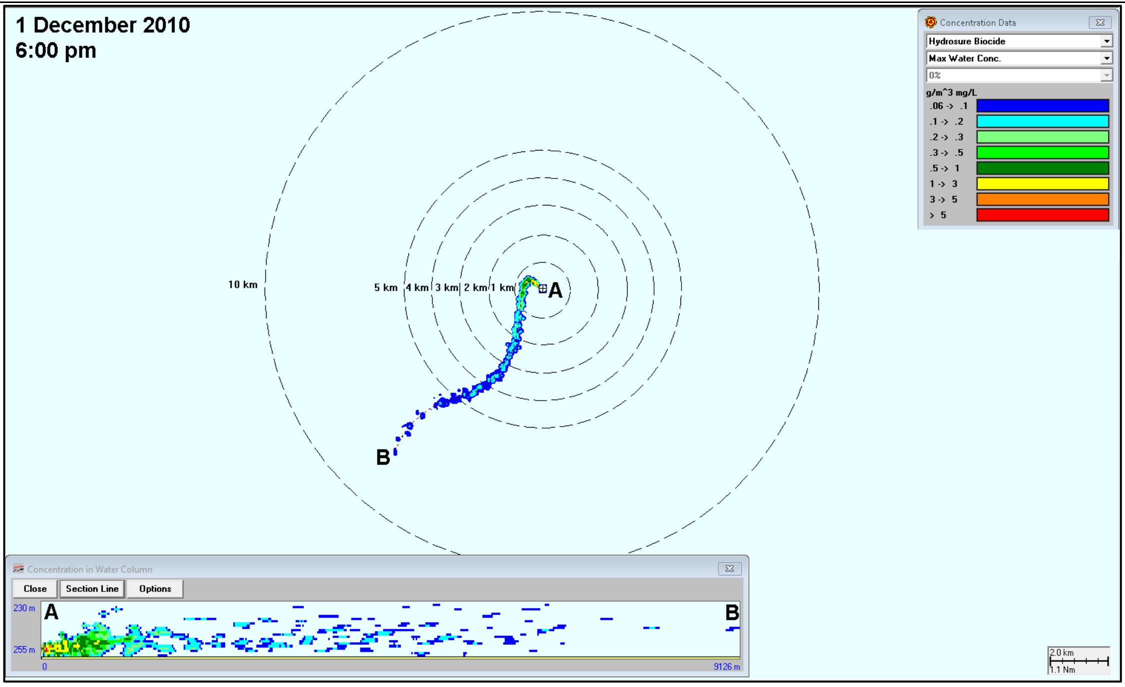
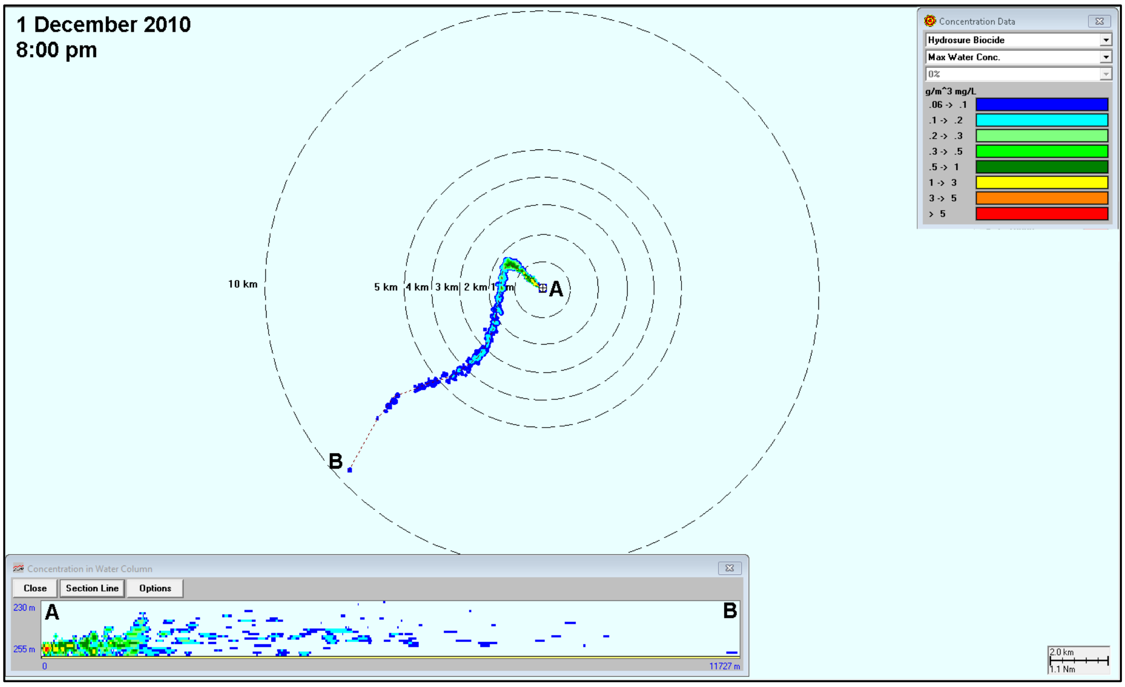



*Figure 5-25: Floating production, storage and offloading vessel pipeline end terminal bottom discharge: Predicted maximum concertation of the hydrotest chemical over the course of the simulation*


1 December 2010
2:00 pm
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
Concentration in Water Column
Close
Section Line
Options
230 m
255 m
0
9739 m
2.0 km
1.1 Nm


1 December 2010
4:00 pm
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
Concentration in Water Column
Close
Section Line
Options
230 m
255 m
0
10386 m
2.0 km
1.1 Nm


1 December 2010
6:00 pm
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration in Water Column
Close
Section Line
Options
230 m
255 m
A
B
0
9126 m
2.0 km
1.1 Nm


1 December 2010
8:00 pm
Concentration Data
Hydrosure Biocide
Max Water Conc.
0%
g/m^3 mg/L
.06 -> .1
.1 -> .2
.2 -> .3
.3 -> .5
.5 -> 1
1 -> 3
3 -> 5
> 5
10 km
5 km
4 km
3 km
2 km
1 km
A
B
Concentration in Water Column
Close
Section Line
Options
230 m
255 m
A
B
0
11727 m
2.0 km
1.1 Nm

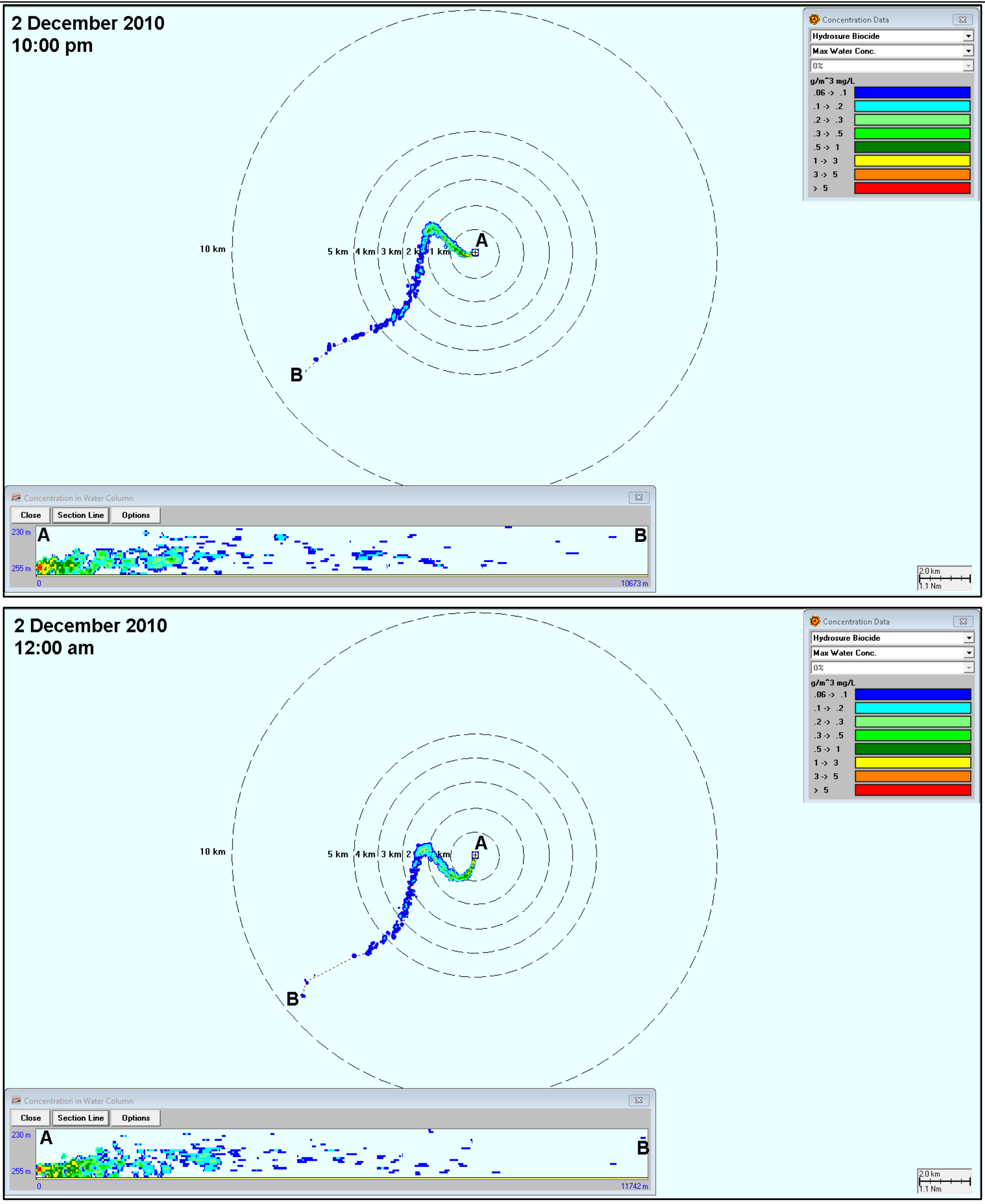



***Figure 5-26: Floating production, storage and offloading vessel pipeline end terminal seabed discharge: predicted dispersion of the hydrotest chemical***

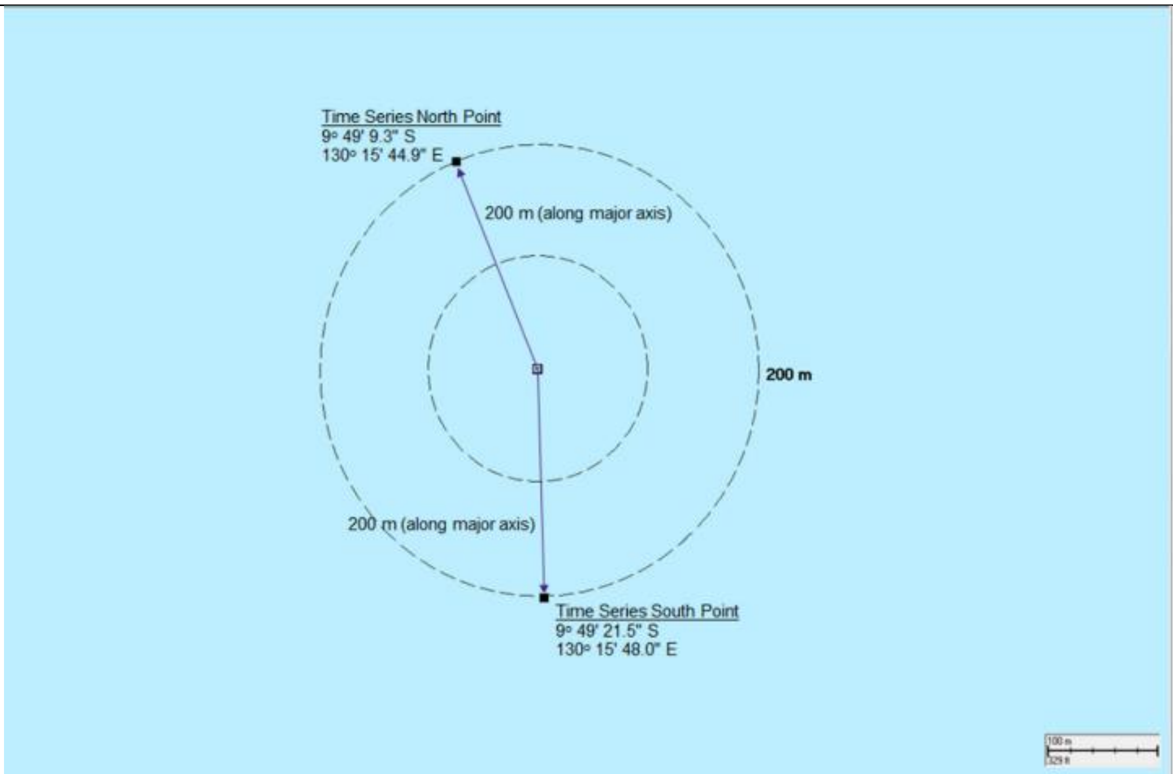
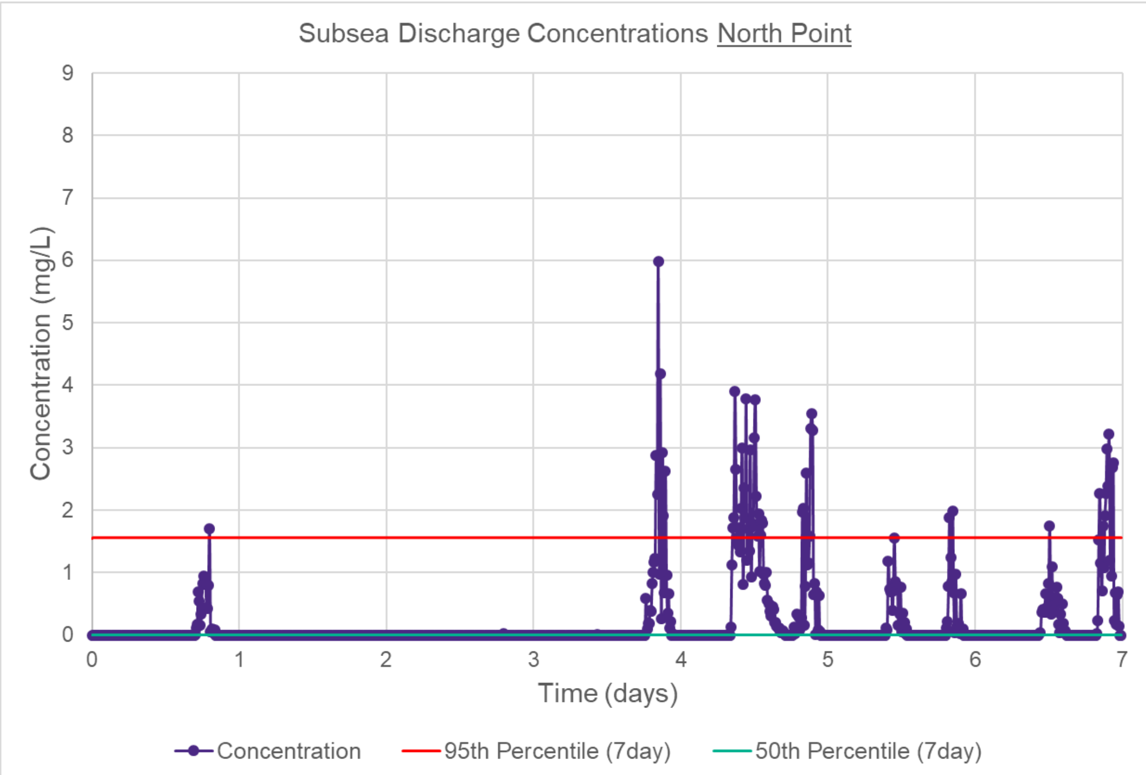



*Figure 5-27: Floating production, storage and offloading vessel pipeline end terminal seabed discharge: time series locations at 200 m from the discharge*



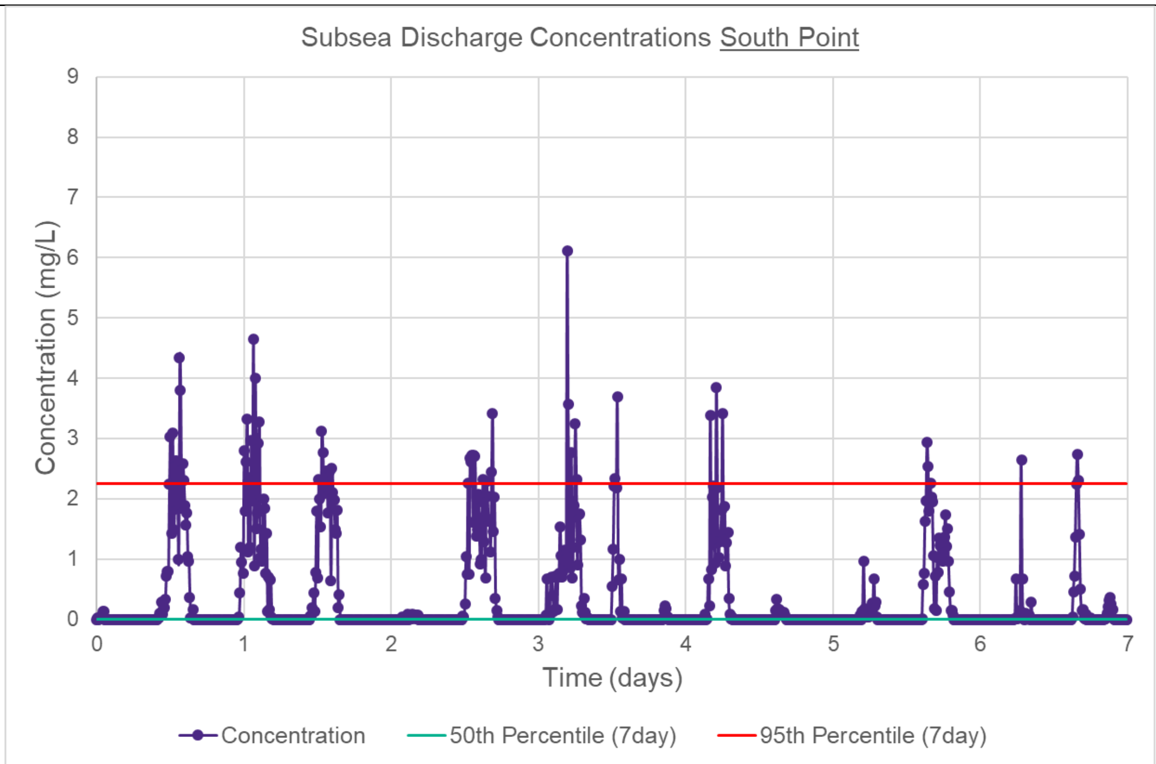



***Figure 5-28: Floating production, storage and offloading vessel pipeline end terminal seabed discharge: time series of the hydrotest chemical concentration at 200 m from the discharge***

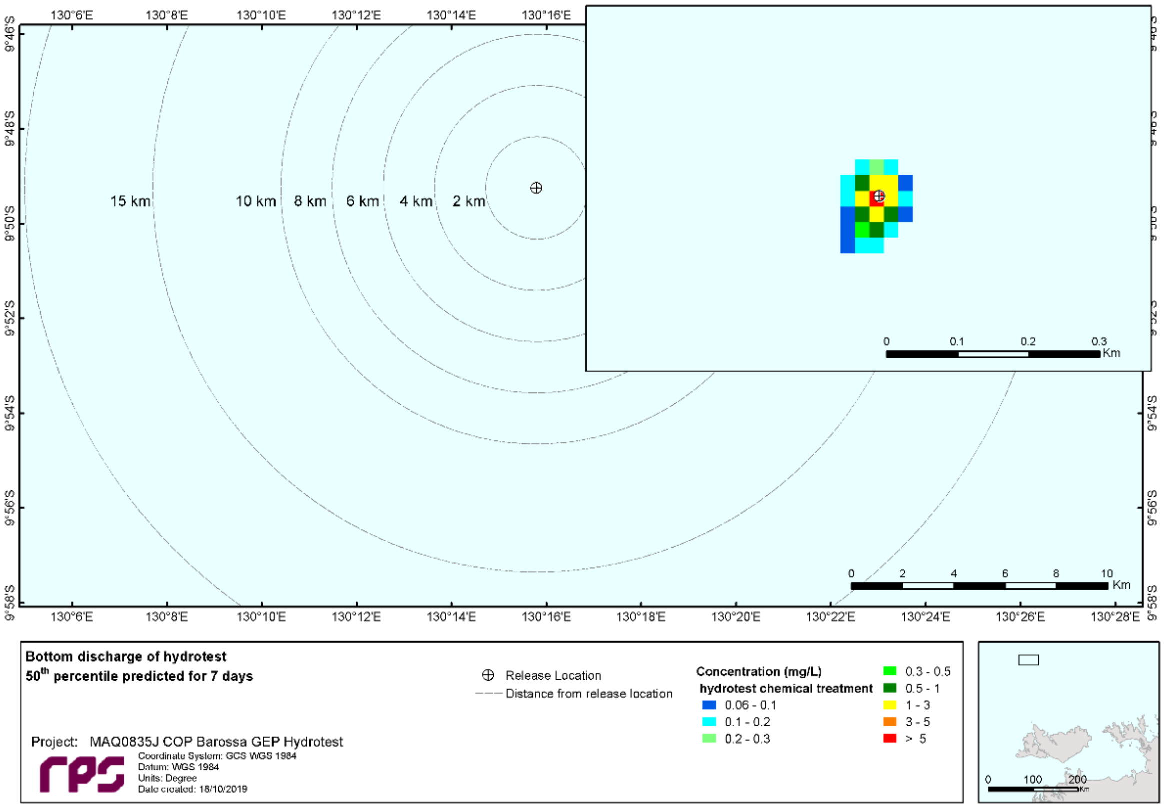



***Figure 5-29: Floating production, storage and offloading vessel pipeline end terminal seabed discharge: median hydrotest chemical concentration***

**Water Quality**

Predictive modelling demonstrates that dilution in the receiving environment is high and the area well flushed. Chemical concentrations reduce rapidly with the median concentrations at any one point predicted to reduce below the 99% species protection concentration within close proximity to the point of discharge.

The release of treated seawater will result in localised and temporary reduction in water quality around the discharge location. Chemicals that will be used are inherently biodegradable with low potential for bioaccumulation. For the above reasons, no substantial change in water quality is expected from dewatering and the impact is therefore deemed acceptable.

**Plankton**

Plankton drifting passed the outlet at the time of discharge may be exposed to concentrations above that which could elicit an effect. However, dilution of the plume is rapid and the exposure concentration travelling with the organism will continually reduce. There may be effects to some individuals, however, plankton are widely distributed in the ocean and regenerate rapidly.

**Sediment Quality**

Sediments are unlikely to be impacted as the release will be through a vertical diffuser, three to four metres above the seabed and orientated vertically upwards.

**Other Communities – Benthic Communities**

No protected or sensitive benthic habitats have been identified with the potential to be exposed to the dewatering plume. The seabed is bare sediment at the northern PLET location (**Figure 5-30**) and consists of sparse filter feeders with small outcrops of hard coral at the southern end (**Figure 5-31**). Sensitive banks and shoals are too far away to be impacted (**Section 4.5.6.3**).

**Marine Mammals, Pelagic and Demersal Fish, Marine Reptiles, Sharks and Rays**

If present, motile animals could pass through the plume, however, exposure will be at low concentration and short duration. The biocide in the dewatering chemical is toxic to marine life, however, effects are greater on simpler life forms. This is illustrated in the ecotoxicological data in which the NOEC for a fish species is 12.5 mg/L compared to 1.3 mg/L for algae (**Table 5-25**). Modelling demonstrated that concentrations within the plume vary both temporally and spatially, rarely exceeding instantaneous concentrations of 10 mg/L.

There are no BIAs, breeding grounds or sensitive habitats (including habitat critical to the survival of species) for EPBC-listed species in proximity to the FPSO PLET location. Moreover, no marine mammal, pelagic fish, demersal fish, shark or ray aggregations areas have been identified within the near vicinity of either the FPSO or downstream PLET discharge locations.

The flatback internesting BIA and habitat critical to the survival of flatback turtles overlap the downstream PLET location. Internesting flatbacks rarely frequent water depths greater than 30 m (**Section 5.2.2**) so, at the depth of the PLET (54 m), it is unlikely they will be present. Even if they were, it is unlikely they would be exposed to concentrations that would illicit an effect.

**Impact Acceptability Summary for Threatened and Migratory Species**

There are no BIAs, breeding grounds or sensitive habitats (including habitat critical to the survival of species) for EPBC-listed species in proximity to the FPSO PLET location. Moreover, no marine mammal, pelagic fish, demersal fish, shark or ray aggregations areas have been identified within the near vicinity of either the FPSO or downstream PLET discharge locations.

The internesting BIA and habitat critical to the survival of flatback turtles overlap the downstream PLET location. Internesting flatbacks rarely frequent water depths greater than 30 m (**Section 5.2.2**) so, at the depth of the PLET (54 m), it is unlikely they will be present. Even if they were it is also unlikely that they would be exposed to concentrations that would illicit an effect.

With controls in place, impacts to the threatened and migratory species are predicted to be negligible and impacts and risks therefore deemed acceptable.

**Key Ecological Features**

Bulk dewatering discharge will occur within the Shelf Break and Slope of the Arafura Shelf KEF but the discharge location is devoid of any of its values. The southern PLET is located about 10 km to the south of the Carbonate Bank and Terrace System of the Van Diemen Rise. Tidal currents are strong and directed along northwest – southwest axis so the plume is not expected to directly impinge on this KEF.

There will be no substantial change that may modify, destroy, fragment, isolate or disturb the values of the KEFs. The impact is therefore deemed acceptable.

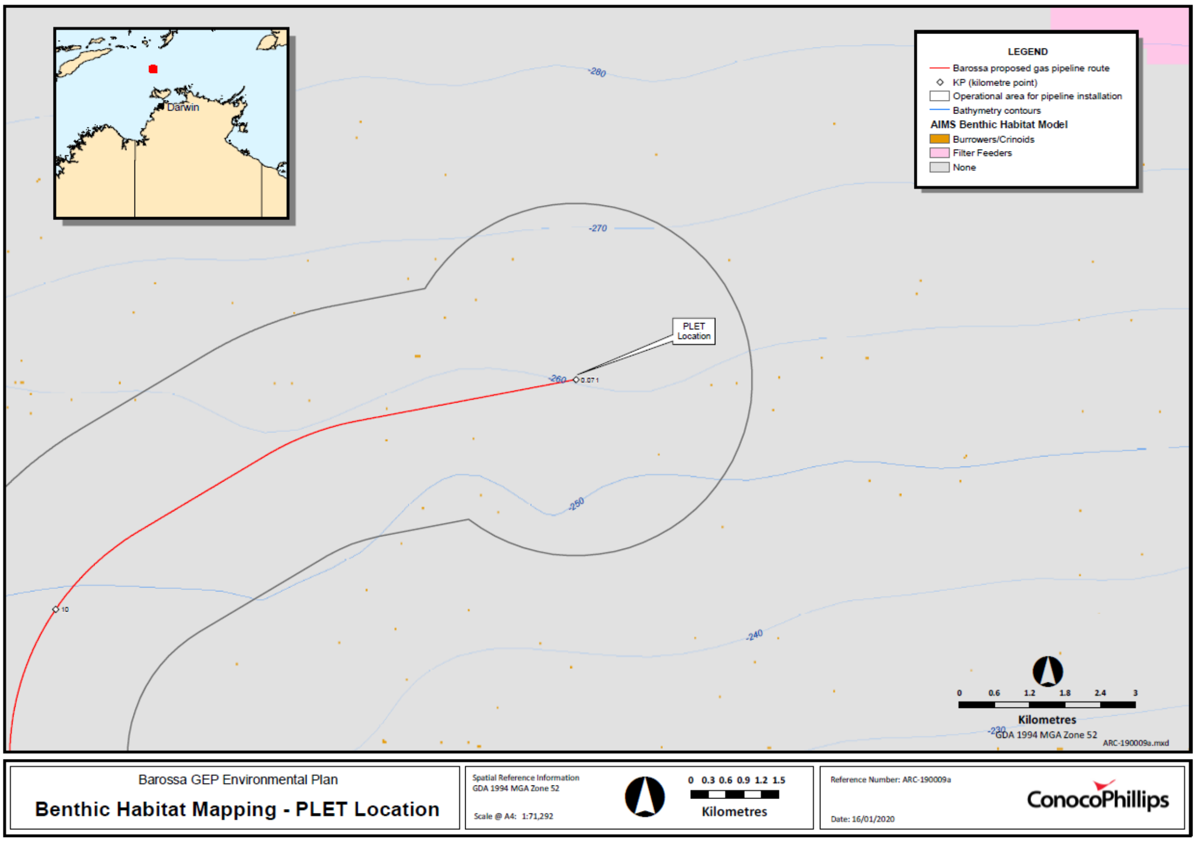



***Figure 5-30: Benthic habitats at the floating production, storage and offloading vessel pipeline end terminal location***

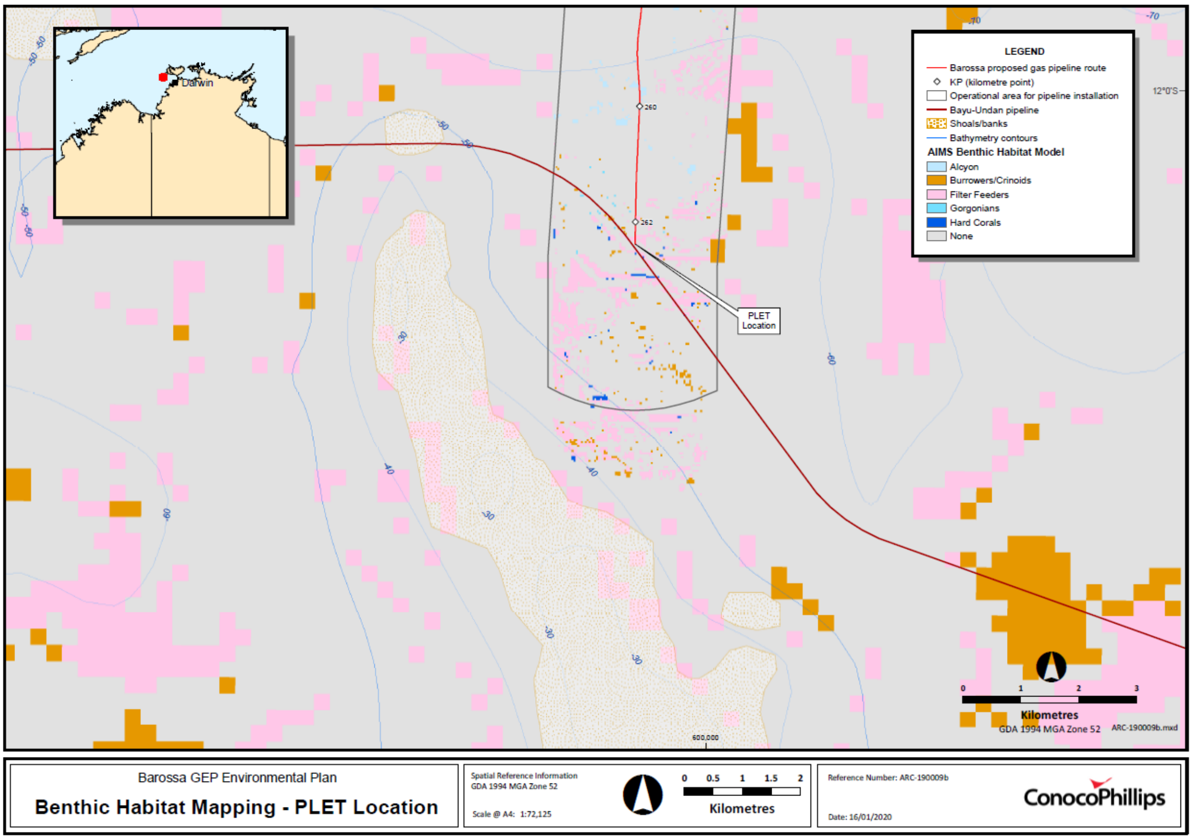



***Figure 5-31: Benthic habitats at the Bayu-Undan pipeline end terminal location***

| **Risk Assessment** | |
|---|---|
| ***Consequence*** | II – Minor |
| **Controls and Demonstration of ALARP** | |
| ***Existing Controls*** | |

| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
|---|---|---|---|
| Chemical selection procedure for all chemicals planned to be released to the marine environment. | A variety of chemicals could be used for pipeline preservation. Should alternative chemicals to those assessed above be required then these will be assessed in accordance with the chemical selection procedure. If the risk posed by the new chemical(s) is greater than that assessed then this will trigger a resubmission of the EP in accordance with Regulation 17 of the OPGGS(E) Regulations (**Section 7.7.5.2**). | **C 7.1** | **EPS 7.1.1**<br>All chemicals planned to be release to the marine environment will be assessed through the chemical selection procedure. |

| | | | |
|---|---|---|---|
| Bulk dewatering will occur at the FPSO PLET location. | This control is effective in reducing the consequence of the impacts to marine environment. | **C 7.2** | **EPS 7.2.1**<br>The bulk dewater will occur at the FPSO PLET location. |
| Contractor FCGT procedures. | This control is effective in reducing the consequence of the impacts to marine environment. | **C 7.3** | **EPS 7.3.1**<br>All FCGT will be conducted in line with the Contractor FCGT procedures. These will include:<br>+ metering of chemical injection volumes during flooding and hydrotest operations<br>+ dosing rates/optimised treatment rates for chemicals. |

| ***Additional Controls*** | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| Omission of flood, clean, gauge and testing operations. | Yes | No | See Justification below. | N/A |
| <u>Justification</u><br>Omission of flood, clean, gauge and testing operations has been assessed and is not considered acceptable from a technical and risk perspective. The gas export pipeline carries dry gas and as such will need to be preconditioned to remove moisture and clean the pipeline internals prior to the introduction of hydrocarbons to avoid the risk of hydrate formation. Performing these preconditioning operations on an air filled pipeline from subsea to subsea (i.e. neither of the pipeline ends is onshore or connected to an above water facility) is high risk from a pig train control perspective and could result in accidental introduction of raw seawater into pipeline or incorrect preconditioning resulting in compromising the pipeline integrity. Furthermore, omitting the hydrotest alleviates the opportunity to discover pipeline leaks, which although highly unlikely would compromise the pipeline integrity if left undiscovered. | | | | |
| Use of raw seawater without any chemical treatment for flood, clean, gauge and testing operations. | No | No | See Justification below. | N/A |
| <u>Justification</u><br>The option of using raw seawater is not considered acceptable to prevent internal corrosion and ensure pipeline integrity. Corrosion by oxidation and microbial action will occur without the use of seawater treatment resulting in wall thickness loss. | | | | |
| Use of deoxygenated fresh water for flood, clean, gauge and testing operations. | Yes | No | See Justification below. | N/A |
| <u>Justification</u><br>The use of deoxygenated freshwater in place of seawater, while technically acceptable, is not considered practical due to the large volume of freshwater that would need to be continuously supplied offshore for the flood, clean, gauge and hydrotesting activities. | | | | |

| | | | | |
|---|---|---|---|---|
| Seawater treated with oxygen scavenger and exposed to Ultraviolet (UV) light for flood, clean, gauge and testing operations. | Yes | No | See Justification below. | N/A |
| Justification<br>The option of seawater treated with oxygen scavenger and exposed to UV light for bacterial sterilisation is not considered acceptable to prevent internal corrosion and ensure pipeline integrity. The effectiveness of UV sterilisation to kill bacteria species is affected by particulate shadowing, therefore it cannot provide an absolute sterilisation solution. Furthermore, UV sterilisation provides no 'residual' treatment and as a result corrosion causing bacteria colonies can grow during the preservation period and in the dewatered state prior to the introduction of hydrocarbons. | | | | |
| ***Substitution*** | | | | |
| Use alternative biocide. | No | No | See Justification below. | N/A |
| Justification<br>Gluteraldehyde and THPS are the only viable alternatives to the proposed package (**Table 5-24**). Previous analysis has shown (see OPP) that these chemicals have about the same toxicity, however, greater concentrations of both glutaraldehyde and THPS would be required to achieve the optimum microbial influence corrosion protection.<br>In addition, glutaraldehyde has health and safety issues associated with handling, requires use of an increased equipment spread and can be incompatibility with oxygen scavenger, eliminated glutaraldehyde as a biocide chemical treatment option.<br>Gluteraldehyde and THPS both react directly with oxygen scavenger and as such the oxygen scavenger must be injected considerably in advance of the biocide to ensure that the oxygen scavenger performs correctly and, in the case of Gluteraldehyde, so the biocide is not neutralised. The oxygen scavenger needs to have totally reacted before the biocide can be injected. A time range of between 15 seconds to 48 hours is noted in literature as being required for the oxygen scavenger to react before the biocide is added. This separation is impractical to implement offshore where there is limited deck space to include enough pipework or water storage to enable the oxygen scavenger to sufficiently react. | | | | |
| Use alternative oxygen scavenger. | No | No | See Justification below. | N/A |
| Justification<br>No alternative oxygen scavenger has been identified. Neither Ammonium Bisulphite nor its by-products are classified as hazardous. It is listed on the Oslo and Paris Commission (OSPAR) list of substances which are considered to pose little or no risk (PLONOR) to the environment. It is therefore considered safe to discharge to the marine environment. | | | | |
| ***Engineering*** | | | | |
| Vertical diffuser for all subsea discharges of treated seawater. | Yes | Yes<br>**C 7.4** | This control is effective in enhancing initial dilution and protecting the seabed by elevating the discharge. | **EPS 7.4.1**<br>All subsea discharges of treated seawater will be through a vertical diffuser. |

| | | | | |
|---|---|---|---|---|
| With reference to the discharge of waters from the flooding operation, restrict the location of the discharge to the FPSO PLET location. | No | No | Restricting the discharge of treated seawater to the FPSO PLET location has technical risks that could result in requirements to reflood the pipeline and therefore increase discharge volumes. As the impacts are expected to be negligible the costs are disproportionate to any benefits. | N/A |
| With reference to the discharge of waters from the flooding operation at the Downstream tie-in PLET, restrict the depth of discharge to either the surface waters or bottom waters. | No | No | Analysis has demonstrated that impacts from either a surface or bottom waters discharge will be localised and temporary and have negligible impact on the marine environment.<br>Restricting the location of the discharge has technical risks that could result in the need to utilise multiple vessels or specialist equipment that could extend the duration of the activities thus increasing the environmental impact. | N/A |
| With reference to the discharge of waters from the dewatering operation at the FPSO PLET, restrict the depth of discharge to either the surface waters or bottom waters. | No | No | Analysis has demonstrated that impacts from either a surface or bottom waters discharge will be localised and temporary and have negligible impact on the marine environment.<br>Restricting the location of the discharge has technical risks that could result in the need to utilise multiple vessels or specialist equipment that could extend the duration of the activities thus increasing the environmental impact. | N/A |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |

| ALARP Statement |
|---|
| Relevant legislative requirements and standard industry practices have been applied to control the impacts. The controls selected for implementation are effective in reducing the impacts of planned discharges from the FCGT, hydrotesting and bulk dewatering. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts.<br>Based on the outcomes of the risk assessment, the implementation of controls throughout the activity. Santos considers that the impacts to the marine environment from the discharge of treated seawater and chemicals from the pipeline are reduced to ALARP. |

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
|---|---|---|---|
| Marine mammals – blue whale | Blue Whale Conservation Management Plan (October 2015) (DoE, 2015a) | Demonstrably minimise anthropogenic threats, including habitat modification through acute/chronic chemical discharge. | + Predictive modelling demonstrates that dilution in the receiving environment is high and the area well flushed. Chemical concentrations reduce rapidly with the median concentrations at any one point predicted to reduce below the PC99% within the very near vicinity of the discharge. location<br>+ There are no significant feeding, breeding or aggregation areas for blue whales in proximity to the discharge location |
| Marine reptiles – loggerhead, green, leatherback, hawksbill, Olive Ridley and flatback turtles | Recovery Plan for Marine Turtles in Australia 2017-2027 (June 2017) (DoEE, 2017a) | Minimise chemical discharge.<br><br>Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival of the species.<br><br>Manage anthropogenic activities in biologically important areas to ensure that biologically important behaviour can continue. | + Predictive modelling demonstrates that dilution in the receiving environment is high and the area well flushed. Chemical concentrations reduce rapidly with the median concentrations at any one point predicted to reduce below the PC99% within the very near vicinity of the discharge location.<br>+ Treated seawater discharge will be of a short duration and toxic effects for turtles are not expected.<br>+ The discharges will not displace marine turtles from important habitat.<br>+ Controls in place demonstrate that activities will be managed in BIAs for marine turtles. |

| Levels of Acceptable Impact |
|---|
| Impacts from dewatering will be acceptable if there is:<br>+ no substantial change in water quality which may adversely impact biodiversity, ecological integrity, social amenity or human health<br>+ no substantial change that may 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.<br>+ no substantial change to threatened and migratory species, that may lead to a reduction in the area of occupancy of the species or in the size of a population<br>+ no substantial change that may modify, destroy, fragment, isolate or disturb the following values of the Oceanic Shoals Marine Park:<br>– KEFs of the marine park<br>– threatened and migratory marine species<br>– BIAs for foraging and internesting marine turtles.<br>+ no substantial change that may modify, destroy, fragment, isolate or disturb the following values of the Carbonate bank and terrace system of the Van Diemen Rise KEF:<br>– sponges, soft corals and other sessile filter feeders associated with hard substrate sediments of the deep channels<br>– epifauna and infauna including polychaetes and ascidians<br>– Olive Ridley turtles, sea snakes and sharks.<br>+ no substantial change that may modify, destroy, fragment, isolate or disturb the following values of the Shelf break and slope of the Arafura Self KEF:<br>– continental slope, patch reefs and hard substrate pinnacles. |
| **EPOs (Table 6-1)** |
| **EPO 7**<br>No substantial change in water quality during the pipeline installation campaign that may adversely impact biodiversity, ecological integrity, social amenity or human health. |

## 5.3 Unplanned activities

### 5.3.1 Physical presence: dropped objects

| | |
|---|---|
| **Risk** | Accidental dropping of objects from vessels resulting from:<br>+ loss of control of suspended loads<br>+ loss of equipment off vessel deck. |
| **Aspect-receptor reference (Table 5-5)** | 8F – Benthic primary producers<br>8G – Other benthic communities<br>8O – Australian marine parks<br>8N – Key ecological features |

**Description of the Source of Risk**

There is potential for objects, such as PPE, small tools and unsecured deck equipment, to be accidentally lost overboard to the marine environment during pipeline installation activities. Suspended loads (e.g. concrete mattresses for pipeline stabilisation) may also be accidentally dropped through operator error or mechanical failure. Larger objects, such as A-frames and sea containers, are secured to the vessel deck and cannot credibly be lost overboard.

**Potential Impacts**

If an object is dropped overboard, potential impacts would be limited to minor and localised disturbance of the seabed and benthic habitats near the dropped object.

Benthic habitats along the gas export pipeline route consist predominantly of bare sediments, with other benthic habitat types constituting relatively small portions of the gas export pipeline route. Areas of benthic habitats, as a percentage of the gas export pipeline route surrounded by a 250 m buffer, derived from benthic habitat modelling are summarised in **Table 5-8**. Based on mapped and modelled benthic habitat classifications, the benthic habitats along the gas export pipeline route are largely bare sediments (82.1%), with relatively small areas of burrowers / crinoids (12.6%) and filter feeders (5.3%). All of these habitat types are well represented throughout the region; these habitats along the gas export pipeline route are not unique or regionally significant (**Section 4.5.3**). Given the activities are restricted to the operational area, which is primarily low sensitivity habitat (bare sediments), the potential consequence to benthic habitats from dropped objects is minor.

**KEFs**

The gas export pipeline route partially overlaps the Carbonate Bank and Terrace System of the Van Diemen Rise KEF and the Shelf Break and Slope of the Arafura Shelf KEF. Studies and habitat mapping indicate that the benthic habitat within the KEFs is largely bare sediment with small areas of burrower/crinoid habitat. Therefore, potential impacts to the values of the KEFs (**Table 4-10**) is low.

**Australian Marine Parks**

The gas export pipeline route overlaps two sections of the Oceanic Shoals Marine Park (**Figure 4-33**), being the:

1. Multiple Use Zone (IUCN Category VI) to the south of the Barossa offshore development area
2. Habitat Protection Zone (IUCN Category IV) to the north-west of Bathurst Island.

Any impacts to benthic habitats from a dropped object will be minor and localised and not expected to impact on the values of the Oceanic Shoals Marine Park. See **Table 5-10** for a demonstration of alignment with the North Marine Parks Network Management Plan objectives for seabed disturbance. Any impacts from a dropped object would be of a magnitude smaller than the installation of the gas export pipeline and therefore there is no change to the alignment with the management plan as described in **Section 5.2.2**.

**Risk Assessment**

| | *Consequence* | *Likelihood* | *Risk rating* |
|---|---|---|---|
| ***Residual risk*** | II – Minor | D – Occasional | Low |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Implement standards and procedures for lifting equipment. | This control is effective in reducing the likelihood of a suspended load being dropped. Engineering standards for load-bearing lifting equipment are widely used in the offshore industry and well understood. Suitable lifting procedures consider a range of technical and environmental factors to reduce the risk of loss of control of a suspended load. | **C 8.1** | **EPS 8.1.1**<br>Santos will confirm the vessel procedures for lifting include:<br>+ lifting operations to be undertaken by competent personnel<br>+ use of appropriate and certified lifting equipment and accessories<br>+ preventative maintenance will be undertaken on the key lifting equipment as per manufacturer's specifications<br>+ consideration of weather conditions (e.g. no heavy lifts undertaken in severe weather conditions). |
| Dropped objects recovered where safe and practicable to do so. | This control may reduce the potential for ongoing disturbance to benthic habitats from a dropped object. The effectiveness of this mitigation control will depend on the nature of the dropped object and the receiving environment. | **C 8.2** | **EPS 8.2.1**<br>All dropped object incidents to assess the environmental risk and the potential to recover the object, and objects will be recovered where safe and practicable to do so. |

| *Additional Controls* | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |

**ALARP Statement**

Based on the outcomes of the impact assessment and the implementation of controls throughout the activity, Santos considers that the impacts from dropped objects are reduced to ALARP.

Relevant standard industry practices have been applied to control the risk. The controls selected for implementation are effective in reducing impacts to a range of environmental receptors. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts.

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
|---|---|---|---|
| Marine parks | As per **Table 5-10**. | | |
| Marine mammals – blue whale | Conservation Management Plan for the Blue Whale (DoEE, 2015) | Identified marine debris as a threat, however there are no relevant management actions to address this issue. | Controls measures will be implemented to minimise marine debris (refer to EPS 6.1.3). |
| Marine vertebrates | Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018) | Identified an objective to contribute to long-term prevention of the incidence of marine debris. | |
| Seabirds | Wildlife Conservation Plan for Seabirds (CoA, 2020b) | Identified marine debris as a threat, particularly relating to injury and fatality caused by ingestion and entanglement of marine life in marine debris. | |

| Levels of Acceptable Impact | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with dropped objects are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate.<br>+ Taking into account the identified management measures, potential dropped objects are not considered to pose a threat of serious or irreversible environmental damage, nor are they considered to change the overall health, diversity or productivity of the environment. |
| **Legislative requirements** | None identified. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans, have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to ensure alignment<br>+ taken into account the North Marine Parks Network Management Plan as detailed above and considers that the activity is in alignment with the objectives of the Plan. |
| **EPOs (Table 6-1)** | |
| **EPO 8**<br>No loss of equipment/cargo overboard from vessels resulting in a Consequence greater than Minor. | |

## 5.3.2 Physical presence: introduction of invasive marine species

| | |
|---|---|
| **Risk** | Unplanned introduction of IMS from vessel ballast water discharge and biofouling on submersible infrastructure/equipment and vessels |
| **Aspect-receptor reference (Table 5-5)** | 9F – Benthic primary producers<br>9G – Other benthic communities<br>9N – Key ecological features<br>9O – Australian marine parks<br>9W – Ports and shipping |
| **Description of the Source of Risk** | |
| Vessels are the most common vector for the translocation of IMS in the marine environment. IMS can be introduced or spread when vessels are mobilised to the operational area, particularly if the vessels originate from international waters with similar water temperatures (e.g. south-east Asia). IMS may be present as biofouling (e.g. adult sessile organisms) on vessel hulls and submersible equipment, and in the ballast water (e.g. as larvae). IMS require suitable habitat to become established in an area; many potential IMS are sessile benthic organisms (e.g. mussels). | |

| Potential Impacts | | | |
|---|---|---|---|

The establishment of IMS in the marine environment because of the gas export pipeline installation campaign requires IMS to:

+ be present on a vector (biofouling on activity vessels and ballast water are considered credible vectors)
+ be released from the vector
+ establish in the receiving environment.

**Benthic Communities (Including Primary Producers)**

The introduction of IMS may result in considerable modification of the environment through out-competing native species and modifying existing habitats. Such modifications may result in significant environmental impact, including decrease in biodiversity (from the reduction or loss of native marine species) and loss of commercial fishing resources. Once established, IMS may be very difficult or impossible to eradicate from an area.

The northern end of the gas export pipeline route is predominantly located in the mid-shelf region where water depths range between approximately 50 m and 240 m. The southern end of the gas export pipeline route is in shallower waters (<50 m, with a minimum depth of approximately 33 m in some sections). Much of the habitat along the operational area is bare sediment, approximately 87% (**Table 5-8**). Introduction of IMS (and therefore IMS-related impacts) in deep waters or in areas of bare sediment is considered improbable.

The closest shoals and banks are Goodrich Bank, Marie Shoal and Shepparton Shoal. Goodrich Bank is 250 m from the operational area (approximately 2 km from the proposed pipeline route), where the water depth is 60 m. The shallowest point of Goodrich Bank, 13 m, is approximately 3 km from the operational area (approximately 5 km from the gas export pipeline route). The other banks/shoals are all located between 1 and 3 km from the operational area, with their shallowest points ranging in depth from 9 to 13 m. Therefore, there may be an increased risk of IMS colonising areas within the shallow water area of the southern section of the gas export pipeline route, where there is suitable light and habitat available (particularly in the vicinity of the shoals/banks).

**KEFs**

The gas export pipeline route partially overlaps the Carbonate Bank and Terrace System of the Van Diemen Rise KEF and the Shelf Break and Slope of the Arafura Shelf KEF (**Figure 4-33**). The values of these KEFs include areas of hard substrate (including patch reefs and pinnacles) that can support ecosystems with high levels of biodiversity. Water depths are >100 m and therefore the values of the KEFs are unlikely to be affected by IMS.

**Australian Marine Parks**

The gas export pipeline traverses part of the Multiple Use Zone and Habitat Protection Zone of the Oceanic Shoals Marine Park. Benthic habitat modelling and mapping along the proposed pipeline route within these areas indicated that 82% of the benthic habitat is bare sediment, 12% burrowers/crinoids and 5% is filter feeders. Given the majority of the proposed pipeline route within the Oceanic Shoals Marine Park occurs in areas where seabed depths range between 50 m and 120 m and most of the areas are bare sediment, the likelihood of impacts from IMS are considered improbable.

| Risk Assessment | | | |
|---|---|---|---|
| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
| ***Residual risk*** | IV– Major | B – Unlikely | Low |

| **Controls and Demonstration of ALARP** | | | |
|---|---|---|---|
| ***Existing Controls*** | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Vessels undertake ballast water management or treatment to achieve low-risk ballast water (see **Section 7.3.4**). | This control is effective in reducing the likelihood of ballast water hosting potential IMS. | **C 9.2** | **EPS 9.2.1**<br>Ballast water discharges will comply with the requirements of the Australian Ballast Water Management Requirements, which implements the requirements of the *Biosecurity Act 2015* (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for vessel class), including:<br>+ no discharge of high-risk ballast water within 12 nautical miles of coastlines, including any ports<br>+ maintenance of a ballast water record system to record the management of all ballast water taken up and discharged<br>+ implementation of approved methods of ballast water management<br>+ vessel equipped with Ballast Water Management Plan<br>+ |
| Vessels equipped with suitable anti-fouling coatings. | This control is effective in the prevention of adverse impacts from the use of anti-fouling systems and the biocidal properties they may contain. | **C 9.1** | **EPS 9.1.1**<br>Vessels will have a suitable anti-fouling coating in accordance with the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) (as applicable for vessel size, type and class), including:<br>+ Marine Order 98 (Marine pollution – Anti fouling Systems) including (as required by vessel class):<br>– a valid International Anti-fouling System Certificate. |
| | This control is effective in reducing the potential for fouling organisms to become established on vessels. | | **EPS 9.3.1**<br>International vessels will comply with the Australian Biofouling Management Requirements (2022) (as appropriate to class), including:<br>+ vessels equipped with a Biofouling Management Plan; and<br>+ vessels maintain a Biofouling Record Book<br>+ |

| | | | |
|---|---|---|---|
| Apply risk-based IMS management for vessels (see **Section 7.3.5**). | The translocation of IMS is best managed through the implementation of risk-based assessments which takes into account the operational history of a vessel. The risk-based approach is effective in reducing the likelihood of IMS introduction by identifying relatively high-risk vessels and applying appropriate management. Risk-based IMS management is the current approach applied in Australian biosecurity legislation. | **C 9.3** | **EPS 9.3.2**<br>Vessels mobilised to the operational area from international or domestic waters will comply with the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Department of Agriculture, Fisheries and Forestry, 2009):<br>+ Completion of IMS Risk Assessment (using either the Vessel Check system or as described in Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Department of Agriculture, Fisheries and Forestry 2009).<br>+ Implement mitigation measures commensurate with the level of risk.<br>+ Only vessels classified as a low-level risk shall be used on the project. |

| ***Additional Controls*** | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |

Santos

| *Engineering* | | | | |
|---|---|---|---|---|
| Marine Growth Prevention System or appropriate manual treatment system in use on relevant vessels. | Yes | Yes<br>**C 9.5** | Some internal niches on vessels are difficult to inspect and/or clean. A marine growth prevention or manual treatment system (e.g. hot water or chlorine dioxide) can be effective preventing biofouling and the presence of IMS in these vessel components. | **EPS 9.5.1**<br>Vessels will have a marine growth prevention system or appropriate manual treatment systems. |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |
| **ALARP Statement** | | | | |
| Relevant legislative requirements and standard industry practices have been applied to control the risk. Additional controls have been evaluated; all additional controls considered were adopted. The controls selected for implementation are effective in reducing the risk of impact of introduction of invasive marine species.<br>Based on the outcomes of the risk assessment and the implementation of controls throughout the activity, Santos considers that the risks and impacts associated with the introduction or spread of IMS are reduced to ALARP. | | | | |

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
|---|---|---|---|
| Marine park | North Marine Parks Network Management Plan 2018 | Invasive species were identified as a pressure in the North Network. | A Quarantine Management Plan will be implemented to minimise risk of invasive species being introduced to marine parks. |

| Levels of Acceptable Impact | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with introduction of invasive marine species are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate.<br>+ Taking into account the identified management measures, significant impacts on the health, diversity, productivity and ecological integrity of the environment are not expected to occur.<br>+ Serious or irreversible damage to environmental values or sensitivities (including socioeconomic receptors) is not expected to occur with the management measures in place. |
| **Legislative requirements** | *Biosecurity Act 2015* (Cth), The Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia, 2008), International Convention for the Control and Management of Ships' Ballast Water and Sediments, *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) and relevant Marine Orders. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | + Santos has consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign.<br>+ Stakeholders queried the biosecurity measures that will be used for overseas vessels therefore controls and EPOs to address this query were assessed and incorporated into this EP. |

| EPOs (Table 6-1) |
|---|
| **EPO 9**<br>Prevent the displacement of native marine species as a result of the introduction, establishment and spread of IMS via activity vessels. |

## 5.3.3 Physical presence: collision with marine fauna

| | |
|---|---|
| **Risk** | Accidental collision between marine fauna (e.g. turtles and cetaceans) and vessels |
| **Aspect-receptor reference (Table 5-5)** | 10J – Marine mammals<br>10K – Marine reptiles<br>10L – Sharks and rays |
| **Description of the Source of Risk** | |
| There will be increased vessel traffic in the operational area during the gas export pipeline installation campaign. Vessels undertaking pipeline installation activities may present a hazard to marine fauna that occur at or near the water surface. Vessel speeds are generally slow during pipelay vessel activities as the pipelay vessel will typically lay ~3 km of pipe a day. Therefore, the pipelay vessel is moving at less than one knot. The other activity vessels will move at higher speeds within the operational area, although speeds will be low while vessels are working.<br>Vessel movements may result in collisions with marine fauna that swim near or at the ocean surface such as cetaceans, turtles and whale sharks. Such collisions may result in injury to, or the death of, the fauna involved. | |
| **Potential Impacts** | |

The risk of vessel strike to marine fauna is inherent to movements of all vessel types. A review of records of vessel collisions with marine megafauna reported a higher number of collisions with whale- watching boats, naval ships and container ships (DoEE, 2017). The recovery plans and conservation advices for whales (blue, humpback, sei and fin whales) and marine turtles (flatback, Olive Ridley, green, loggerhead, hawksbill, leatherback) recognise vessel strikes/disturbance as a key threat to these EPBC listed species (**Table 4-6**).

Vessels associated with the gas export pipeline installation campaign may present a potential risk to marine fauna. Due to the slow speed of the pipelay vessel (<1 knot) it is considered to be effectively immobile and therefore does not present a vessel collision risk to marine fauna. The impact from vessel interactions with marine fauna can be as minimal as temporary behavioural changes, ranging to severe impacts, such as injury or mortality resulting from vessel strikes. The potential risk of a collision with marine fauna is directly related to the abundance of marine fauna and number of vessels in the operational area, and the actual likelihood of a collision occurring is also influenced by vessel speed. As presented in DoEE's (formally DoAWE, now DCCEEW) National Strategy for Reducing Vessel Strike on Cetaceans and Other Marine Megafauna (Commonwealth of Australia, 2017b), the majority of the reported vessel collisions have occurred along eastern or south-eastern Australia, with no reported incidences in NT waters.

Vessel speed has been demonstrated to be a key factor in relation to collision with marine fauna, particularly cetaceans and turtles, with faster moving vessels posing a greater collision risk than slower vessels (Hazel et al., 2009; Jensen and Silber, 2004; Laist et al., 2001; Commonwealth of Australia, 2017b). Laist et al. (2001) suggest the most severe and lethal injuries to cetaceans are caused by vessels travelling at 14 knots or faster. Turtles will typically avoid vessels by rapidly diving, however, their ability to respond varies greatly depending on the speed of the vessel. Hazel (2009) reported that the number of turtles that fled vessels decreased significantly as vessel speed increases. Turtles are also adapted to detect sound in water (Popper et al. 2014) and will generally move from anthropogenic noise generating sources, including vessels, within their detection range (pers. comm. M. Guinea, CDU, 2015).

The behaviour of the individual may also influence the potential for a collision with a vessel. For example, it has been suggested that individual whales engaged in feeding, mating or nursing behaviours may be more vulnerable to vessel collision as they are distracted by these activities and consequently less aware of their surroundings (Laist et al., 2001). A study on the behavioural responses of blue whales to vessels showed limited behavioural response when being approached by ships (McKenna et al., 2015, cited in DoEE, 2016).

**Marine Mammals**

Bryde's whales were observed to be present in the Barossa offshore development area (northern section of the gas export pipeline and the FPSO PLET location) from January to early October, with pygmy blue whales detected between late May and August (JASCO Applied Sciences, 2016a). While some species may be present in the operational area in greater numbers at certain times of the year, the numbers overall are low. Considering this, and the wide distribution of whale species, vessel movements are not anticipated to cause any effects at a population or migration level.

It is well understood that the primary migratory route for humpback whales is near the Kimberley coastline and up to Camden Sound (**Section 4.5.5.5**). Relatively few humpback whales have been known to travel north of Camden Sound (Jenner et al., 2001), which is located more than 580 km south-west of the operational area. Noise monitoring in the Barossa offshore development area (**Table 4-2**) also did not record any humpback whales. Therefore, it is highly unlikely that activity-related vessels in the operational area will interact with this species.

Both sei and fin whales have a wide distribution throughout offshore waters and therefore may pass through the operational area in low numbers (**Section 4.5.5.5**). However, considering the relatively slow vessel speeds within the operational area, and the mobility of these species, it is highly unlikely that activity vessels will adversely interact with any individuals.

Collisions with smaller cetaceans, such as dolphins, are very infrequent due to the mobility of these smaller cetaceans, which allows them to avoid vessels. Dolphins may pass through the operational area, particularly along the southern end however collisions between activity vessels and dolphin species are considered possible.

While dugongs may occur in the operational area, dugongs spend most of their time in shallow tidal and subtidal seagrass meadows. Therefore a few individuals may travel through the operational area; however, if any vessel strikes do occur, they are unlikely to threaten the overall viability of the population as the plausible number of vessels strikes is very small.

**Marine Reptiles**

Turtles are at risk of a vessel strike while they are resting or returning to the sea surface to breathe. However, it has been noted that turtles spend relatively limited (3 to 6%) time at the surface, with dive times generally lasting 15 to 60 minutes (Milton and Lutz, 2003; cited in Woodside Energy Limited, 2014). In the northern section of the gas export pipeline, at least 100 km from the Tiwi Islands, few individuals are expected and therefore risk of injury from vessel strikes to turtles which may be passing through the area is considered low.

The southern end of the gas export pipeline corridor traverses internesting habitat critical to the survival of flatback and Olive Ridley turtles, overlaps a portion of the internesting BIA for flatback turtles and is adjacent to the internesting BIA for Olive Ridley turtles. Therefore, there may be an increase in number of individuals in this area (between June to September for flatback turtles and April to August for Olive Ridley turtles) that are at risk from a vessel strike. The pipelay vessel will be travelling at very low speeds as it expected to lay in the order of approximately 3 km of the gas export pipeline per day. Therefore, the risk of coming into contact with turtles is low as it is expected turtles will dive or move away from the vessels. The installation of the gas export pipeline is also expected to take five months, with installation within the internesting habitat critical to the survival of Olive Ridley turtles expected to take approximately one to two months. Consequently, the likelihood of a vessel strike and the possibility of injury/mortality to individual turtles within the operational area is considered possible.

However, if any vessel strikes do occur, they are unlikely to threaten the overall viability of the population as the plausible number of vessel strikes is small when compared to the overall population sizes for turtles. The Recovery Plan for Marine Turtles in Australia notes that while a vessel strike can be fatal for an individual turtle, vessels strikes (as a standalone threat) have not been shown to cause declines at a population or stock level and have considered vessel disturbance to be of minor consequence to turtle populations in the NT (DoEE, 2017).

Individual sea snakes may transit through the operational area however if any vessel strikes do occur, they are unlikely to threaten the overall viability of the population as the plausible number of vessels strikes is very small.

**Sharks and Rays**

Most ray species identified as potentially occurring within the operational area are not considered at risk of vessel strike as they largely occur on or near the seabed, and are not expected to come to the surface, with the exception of the giant manta ray. The giant manta ray is oceanic and known to feed on plankton, so it may occasionally be close to the sea surface. However, ~73% of its diet is from deep water sources (Burgess et al., 2016). The giant manta ray is not expected to come to the surface within the operational area frequently and is highly mobile (therefore able to avoid vessels), therefore vessel collisions with giant manta rays are considered improbable.

Whale sharks are at risk from vessel strikes when feeding at the surface, or in shallow waters (where there is limited option to dive). Whale sharks are not known to aggregate in the vicinity of the gas export pipeline operational area, nor are there BIAs in the vicinity of the gas export pipeline corridor. Tagging studies have indicated that whale sharks may transit in waters west of the gas export pipeline (Meekan and Radford, 2010). As such, collisions between vessels and whale sharks are considered improbable.

| Risk Assessment | | | |
|---|---|---|---|
| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
| ***Residual risk*** | II – Minor | C – Possible | Low |

**Controls and Demonstration of ALARP**

*Existing Controls*

| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
|---|---|---|---|
| Avoid activities near cetaceans and turtles. | This control is based on the requirements of the EPBC Regulations and is effective in reducing the potential for collisions and behavioural disturbance to cetaceans. Santos also applies this control to marine turtles, while acknowledging that marine turtles are typically harder to detect at sea than cetaceans. | **C 10.1** | **EPS 10.1.1**<br>Vessels[4], excluding those which are unable to alter path while performing operations, will comply with EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles), specifically:<br>+ Apply the following Caution Zones, as per the meaning of Division 8.1 of the EPBC Regulations:<br>– 300 m for whales<br>– 150 m for dolphins<br>– 150 m for turtles.<br>+ When operating a vessel or equipment within a Caution Zone:<br>– operate the vessel or equipment at a constant speed of less than six knots and minimise noise<br>– ensure the vessel or equipment does not drift or approach closer than:<br>- 100 m for whales<br>- 50 m for dolphins, turtles or whale sharks.<br>– If the cetacean, turtle or whale shark shows signs of being disturbed, immediately withdraw (where safe to do so) from the Caution Zone at a constant speed of less than six knots.<br>+ Post a lookout for cetaceans, turtles and whale sharks while within a Caution Zone:<br>– Not approach, pursue or restrict the movement of cetaceans, turtles or whale sharks. |

[4] For the purposes of implementing the requirements of Division 8.1, Santos does not consider any vessels and equipment (including ROVs) to be Prohibited Vessels.

| | | | |
|---|---|---|---|
| HSE inductions which will include environmental requirements. | Personnel associated with vessel activities will be subject to gas export pipeline installation campaign inductions which will address the requirements for vessel operators in relation to interactions with marine fauna. | **C 10.2** | **EPS 10.2.1**<br>All crew will attend HSE inductions which will include environmental requirements as required by this Plan. |

| ***Additional Controls*** | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |
| ***Administrative*** | | | | |
| Vessel Speed restrictions within the operational area. | Yes | Yes<br>**C 10.3** | Vessel speed restrictions will be implemented within the operational area except where necessary to preserve the safety of human life at seas. | **EPS 10.3.1**<br>Vessel speeds with the operational area will limited to 8 knots or less. |
| No pipeline installation activities will occur in the Olive Ridley turtles internesting BIA at any time. | Yes | Yes<br>**C 2.8** | This control is effective in avoiding the internesting BIA for Olive Ridley turtles, which may host turtles undertaking biologically significant behaviour. Given the behaviour of Olive Ridley turtles, they are unlikely to be encountered within the water depths of the gas export pipeline route when internesting. | **EPS 2.8.1**<br>See **Section 5.2.2**. |
| Divide the pipeline installation scope into multiple campaigns to minimise work performed during the peak internesting periods within important habitat for listed marine turtles. | No | No | See Justification below. | N/A |

Justification

Unlike other turtle populations (e.g. on the North West Shelf of WA), the Olive Ridley and flatback turtles nesting seasons on Bathurst Island do not exhibit discrete nesting seasons. Rather, there is low level nesting year-round, with a peak in nesting and internesting during winter months. A seasonal exclusion would not avoid all turtle nesting and internesting activity but may avoid the known peaks.

Should timing of pipeline installation and associated activities be scheduled to avoid peak interesting season this will impose impractically tight restrictions on the window for starting operations in order to ensure the activities can be completed outside of the peak internesting season, without the risk of the activities having to be split over multiple seasons. The start date for the pipelay operations is driven by the limited availability of pipelay vessels in region, prior commitments of pipelay vessels and the availability of associated equipment such as linepipe materials and PLET structures to support the activities. Due to the uncertainty on these elements it is standard practice to negotiate a large window for commencement of pipelay operations with a mechanism to reduce the window as the project progresses and the factors detailed above become more certain. The call down window is initially under the control of Santos before passing to the pipelay vessel operator in order that they can manage their prior vessel commitments. As a result of the call down mechanism for the pipelay vessel and the uncertainty on the pipelay start date it is impractical to guarantee that pipelay activities can be fully completed in a given season.

If seasonal exclusions are imposed and activities cannot be completed in a single season then this will require the activities to be split over multiple seasons. This will result in an overall extension in the duration of the activity, additional vessel mobilisations and demobilisations and will considerably increase the cost of pipelay.

If the campaign extends over two seasons there is a risk that spans are left unrectified in the intervening period which may markedly increase the number of span corrections required or could result in unacceptable fatigue damage to the pipeline resulting in the need to replace a section of pipeline. It may also be counterproductive as multiple vessel mobilisations could increase the overall environmental impact.

It may also raise the risk of simultaneous operations (SIMOPS), where the pipelay vessel ends up interacting with other Barossa construction activities (spool installations, drilling or FPSO mooring installation). SIMOPS is highly undesirable mode of operation as it means vessels either being stood down for a period of time or operating in close proximity to one another. Apart from the additional cost, this could increase collision risk and result in enhanced cumulative environmental impact for aspects such as light and noise.

Santos has assessed if certain activities associated with the pipelay operations, such as pre-lay and post-lay span correction, can be performed outside of peak internesting periods. However, the construction vessels used to support pipelay operations are also required throughout the full pipelay campaign and as such the sequence of pre-lay activities, pipelay and post-lay activities is more effectively performed in a single campaign in order to avoid the requirement to perform multiple mobilisations/demobilisations of the construction vessel(s). As highlighted above it is also necessary to ensure spans are corrected as soon as practicable and as such post-lay work cannot practically be separated from the pipelay activity. Performing the work in a single continuous campaign also enables pre-lay and post-lay activities to be performed in parallel with pipelay where practicable to further reduce the schedule, optimise the offshore campaign and minimise the extent of span correction required thus reducing the seabed footprint and environmental impact.

Given the likely low impact to turtles, implementing seasonal control for elements of the activity and the whole activity was discounted.

**ALARP Statement**

Relevant legislative requirements and standard industry practices have been applied to control the risk. The controls selected for implementation are effective in reducing the risk of impact to marine fauna from the physical presence of the gas export pipeline installation campaign. The risk to marine fauna from vessel strike is considered low given the controls outlined above including speed limits within the operational area.

Based on the outcomes of the risk assessment and the implementation of controls throughout the activity, Santos considers that the risks and impacts of collision with marine fauna are reduced to ALARP.

| Summary of Alignment with EPBC Management Plans (where applicable) | | | |
|---|---|---|---|
| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| Marine mammals | Blue Whale Conservation Management Plan (October 2015) (DoE, 2015a) | Minimising vessel collisions.<br>Consider the risk of vessel strikes on blue/humpback whales when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, implement appropriate mitigation measures. | Controls (mitigation measures) have been identified, and will be implemented, that will minimise the likelihood of vessel collisions. |
| | Humpback Whale Conservation advice (October 2015) (DoE. 2015b) | | |
| | Sei Whale Conservation Advice (October 2015) (DoE, 2015c) | Minimise vessel collisions. | |
| | Fin Whale Conservation advice (October 2015) (DoE, 2015d) | | |
| Marine reptiles | Recovery Plan for Marine Turtles in Australia 2017-2027 (June 2017) (DoEE, 2017a) | Manage infrastructure and coastal development to ensure ongoing biologically important behaviours for marine turtle stocks to continue. | There is no evidence to suggest that the proposed activity will result in marine turtles being displaced from habitat critical to their survival nor important |
| | | Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival of the species. | |

| | | | |
|---|---|---|---|
| | | Manage anthropogenic activities in biologically important areas to ensure that biologically important behaviour can continue. | biological behaviour interrupted.<br>Pipelay is short duration taking approximately three months to complete. Time within the habitat critical areas adjacent to Bathurst Island is expected to be approximately 23 days (for the Olive Ridley Turtle habitat critical area), representing approximately 25% of the peak nesting/internesting period.<br>Pipelay is a slow and highly managed process so physical impact to marine turtles is highly unlikely.<br>The footprint of the pipeline on the seabed is a fraction of the available habitat<br>The pipeline itself will form suitable habitat for colonisation by native biota.<br>This EP summarises the most up-to-date information on turtle nesting, internesting and foraging habitat. |
| Marine mammals, marine reptiles and whale sharks | National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (Commonwealth of Australia, 2017b) | Identify and adopt best-practice mitigation measures and emerging technologies and encourage the development of new mitigation measures.<br>Adaptive management principles, including the use of regular reviews are used during the implementation of mitigation measures. | Controls (mitigation measures) have been identified, and will be implemented, that will manage vessel activity within the operational area. |

| Levels of Acceptable Impact | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with marine fauna collisions are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate.<br>+ Taking into account the identified management measures, the interactions with marine fauna is not considered to pose threats of serious or irreversible damage to socioeconomic receptors.<br>+ Marine fauna collisions are not expected to reduce overall long-term, broad-scale health, diversity and productivity of the environment.<br>+ Biological diversity and ecological integrity are not expected to be significantly impacted by marine fauna collisions. |
| **Legislative requirements** | EPBC Regulations – Part 8 Division 8.1. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to verify alignment<br>+ considered relevant fauna recovery plans, management plans and conservation advices. |
| **EPOs (Table 6-1)** | |
| **EPO 10**<br>Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with activity vessels operating within the operational area. | |

### 5.3.4 Unplanned discharges: subsea release from an unplanned pipeline event

| Risk | Contingency dewatering (e.g. a wet buckle event) to the marine environment from planned treated seawater |
|---|---|
| **Aspect-receptor reference (Table 5-5)** | 11B – Water quality<br>11C – Sediment quality<br>11F – Benthic primary producers<br>11G – Other communities<br>11H – Plankton<br>11I – Pelagic and demersal fish communities<br>11J – Marine mammals<br>11L – Sharks and rays<br>11K – Marine reptiles<br>11N – Key ecological features<br>11O – Australian marine parks |
| **Description of the Source of Risk** | |
| During installation, in the event of a wet buckle or stuck pig, contingency dewatering may be required. Treated seawater will be needed to displace raw seawater that has entered a buckled pipeline in order to preserve the pipeline if pipelay operations cannot safely recommence for more than nominally 30 days. If pipelay operations can recommence in a timely manner then the raw seawater will be displaced with compressed air. Similarly treated seawater will be required to push stuck pigs out of the pipeline during flood/gauge/cleaning operations. Treated seawater used for wet buckles or stuck pigs would then need to be dewatered to facilitate continued installation of the pipeline. The seawater will be treated with the same chemicals as the planned discharges (**Section 5.2.7**). For the removal of stuck pigs, the same chemical concentrations as detailed in **Section 5.2.7** shall be used. However, for the wet buckle scenario the chemical concentration may be able to be lowered from that detailed in **Section 5.2.7** subject to the required preservation period before pipelay operations can recommence. The assessment of the required preservation period will be impacted by what caused the wet buckle and when any control measures and actions from the wet buckle incident investigation will be satisfactorily implemented.<br>The volume of treated seawater required to dewater will vary depending on the amount of pipeline installed prior to the wet buckle, the location of the wet buckle or location of the stuck pig. Dewatering due to wet buckles or stuck pigs may occur anywhere along the pipeline route at the surface or seabed. As a worst-case example, if installation of the pipeline was close to finishing, complete dewatering of the gas export pipeline and discharge of up to approximately 85,000 $m^3$ of chemically-treated seawater may be required to safely recover the pipeline and continue installation. However, the volume is likely to be less than the planned discharge volume discussed in **Section 5.2.7**. Dewatering discharges will not occur within the Habitat Protection Zone of the Oceanic Shoals Marine Park. | |

| Potential Impacts |
|---|
| Impacts from an unplanned release of hydrotest water would be similar to the planned discharge presented in **Section 5.2.7**, that is, a localised and temporary reduction in water quality. Tidal currents along the pipeline route increase towards the south and dilution rates for the discharge are high. Environmental criteria are therefore met within the near vicinity of the release.<br>The only sensitive habitat along the pipeline route requiring further analysis is Goodrich Bank (**Figure 4-15**), which is located 300 m to the east of KP105. Goodrich Bank supports low density filter feeders, dominated by sponges, with limited partial hard corals at 25 m depth (**Figure 4-16**). Should dewatering be necessary at this location, direct impact from the hydrotest discharge plume is not expected due to the strong tidal currents and high dilution rates. In addition, should the water be discharged at the surface, the extent of the plume remains in the surface 15 m, which is above the minimum depth of the bank. If it is discharged at the seabed (approximately 90 m depth), the extent of the plume remains in the bottom waters. There may be direct impact at the base, however concentrations will be low and away from any sensitivities on the top of the bank.<br>**KEFs**<br>The gas export pipeline route overlaps two KEFs (**Table 4-10**; **Figure 4-33**). The dewatering discharge is not expected to diminish the value of the KEFS in an appreciable way due to the following:<br>+ Shelf break and slope of the Arafura shelf KEF is not expected to be impacted as the unique seafloor features of the KEF were not observed in the Barossa offshore development area (northern section of the gas export pipeline route) during surveys and studies undertaken across this area (**Section 4.2**).<br>+ Carbonate Bank and Terrace System of the Van Diemen Rise KEF values are the geomorphic feature that provide habitat for sponges, soft corals and other sessile filter feeders; epifauna and infauna such as polychaetes and ascidians; and Olive Ridley turtles, sea snakes and sharks. However, habitat mapping and modelling indicated that the benthic habitats in the gas export pipeline corridor within the KEF are largely bare sediment, with small areas of burrower/crinoid habitat.<br>**Australian Marine Parks**<br>The gas export pipeline route overlaps two sections of the Oceanic Shoals Marine Park (**Figure 4-35**), being:<br>1. the Multiple Use Zone (IUCN Category VI) to the south of the Barossa offshore development area<br>2. the Habitat Protection Zone (IUCN Category IV) to the north-west of Bathurst Island.<br>There will be no unplanned dewatering in the Habitat Protection Zone (see ALARP demonstration and **C 11.3** (**EPS 11.3.1**)). Within the Multiple Use Zone, dewatering may occur; however, any impacts are expected to be temporary, as habitat is largely comprised of unconsolidated sediments and sparse filter feeder, and therefore the values of the marine park are not expected to be impacted. |

**Risk Assessment**

| | *Consequence* | *Likelihood* | *Risk rating* |
|---|---|---|---|
| ***Residual risk*** | II – Minor | C – Possible | Low |

**Controls and Demonstration of ALARP**

*Existing Controls*

| *Control* | *Effectiveness* | *Reference (Table 6-1)* | *Environmental Performance Standard* |
|---|---|---|---|
| Chemical selection procedure for all chemicals planned to be release to the marine environment. | This control is effective in reducing the consequence of the impacts to marine environment. | **C7.1** | **EPS 7.1.1**<br>Refer **Section 5.2.7**. |
| Contractor FCGT Procedures. | This control is effective in reducing the consequence of the impacts to marine environment. | **C7.3** | **EPS 7.3.1**<br>Refer **Section 5.2.7**. |

| | | | |
|---|---|---|---|
| Pipeline designed with buckle arrests in deep water. | This control is effective in reducing the likelihood of a wet buckle occurring and therefore preventing chemically treated seawater being released to the marine environment. | **C11.1** | **EPS 11.1.1**<br>Buckle arresters installed as per design specifications. |

| *Additional Controls* | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No discharge of chemically treated seawater in the Habitat Protection Zone of the Oceanic Shoals Marine Park. | Yes | Yes<br>**C 11.2** | This control will protect the habitats with the Habitat Protection Zone of the Oceanic Shoals Marine Park thereby maintaining the parks values. | **EPS 11.2.1**<br>No discharge of chemically treated seawater in the Habitat Protection Zone of the Oceanic Shoals Marine Park. |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| DGPS for pipelay vessel to maintain accurate vessel position during installation. | Yes | Yes<br>**C 2.4** | This control is effective in reducing the likelihood of a wet buckle occurring and therefore preventing chemically treated seawater being released to the marine environment. | **EPS 2.4.1**<br>Refer **Section 5.2.2**. |
| Pipeline Installation Procedures. | Yes | Yes<br>**C 11.3** | This control is effective in reducing the likelihood of a wet buckle occurring and therefore preventing chemically treated seawater being released to the marine environment. | **EPS 11.3.1**<br>The contractor will have an installation procedure which will include:<br>+ alarm systems for dynamic positioning to indicate loss of vessel position<br>+ minimum tensioner alarms to ensure pipeline catenary is maintained<br>+ visual monitoring of pipeline relative to stinger<br>+ ROV touchdown monitoring<br>+ pipelay rollerbox load monitoring |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |

| ALARP Statement |
|---|
| Relevant legislative requirements and standard industry practices have been applied to control the risk. The controls selected for implementation are effective in reducing the risks of unplanned discharges from contingency dewatering. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts.<br>Based on the outcomes of the risk assessment, the implementation of controls throughout the activity. Santos considers that the impacts to the marine environment from the discharge of treated seawater are reduced to ALARP. |

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
|---|---|---|---|
| Marine reptiles – loggerhead, green, leatherback, hawksbill, Olive Ridley and flatback turtles | Recovery Plan for Marine Turtles in Australia 2017–2027 (June 2017) (DoEE, 2017a). | Minimise chemical discharge. | The discharge extent is localised and rapid dilution is predicted to occur, reaching levels below those that may cause harm to marine species within 1 to 3 km of the discharge location.<br>Treated seawater discharge will be of short duration and toxic effects for turtles are not expected. |
| | | Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival of the species. | |
| | | Marine anthropogenic activities in BIAs to ensure that biologically important behaviour can continue. | |
| Marine park | North Marine Parks Management Plan | Conditions from the Class Approval – Mining Operations and Green House Gas Activities for the North Marine Parks Network Management Plan 2018. | See Table 2-1. |
| | | Conditions from the Commercial Activity Licence for the installation of the gas export pipeline within the Habitat Protection Zone. | See Table 2-1. |
| | | The objective of the Habitat Protection Zone is to provide for the conservation of ecosystems, habitats and native species in as natural a state as possible while allowing activities that do no harm or cause destruction of seafloor habitats. | Any impacts from the contingency dewatering are expected to be localised and brief with recovery expected thereby conserving the ecosystems, habitats and native species within the marine park. |
| | | The objective of the Multiple Use Zone is to provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species. | |

| Levels of Acceptable Impact | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with the discharge of contingency treated seawater are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate.<br>+ Discharge of treated seawater is not considered to pose threats of serious or irreversible environmental damage.<br>+ It is considered that discharge of treated seawater will not change the overall health, diversity and productivity of the environment. Chemicals used to treat the seawater are biodegradable and do not bioaccumulate; affected populations are expected to recover through natural recruitment.<br>+ The conservation of biological diversity and ecological integrity is incorporated into chemical selection process. |
| **Legislative requirements** | No legislative requirements are applicable. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to ensure alignment<br>+ considered relevant fauna recovery plans, management plans and conservation advices. |
| **EPOs (Table 6-1)** | |
| **EPO 11**<br>Zero unplanned discharge of chemicals to the marine environment as a result of contingency dewatering. | |

### 5.3.5 Unplanned discharges: minor spills

| | |
|---|---|
| **Risk** | Chemical or hydrocarbon release from incidental spill (e.g. minor deck spill) |
| **Aspect-receptor reference (Table 5-5)** | 12B – Water quality |

**Description of the Source of Risk**

Vessels undertaking activities will routinely have a range of chemicals and hydrocarbons onboard, including:

+ fuel for portable/deck equipment
+ hydraulic fluid
+ paints and lubricants
+ miscellaneous chemicals (e.g. cleaning fluids).

Small spills of these may occur when the chemicals/hydrocarbons are in use or from leaks in storage areas. If spilled these liquids may be lost to the marine environment.

Chemicals and hydrocarbons (other than vessel fuel) are generally stored in relatively small isolated containers (typically <200 L), with bunding in place to retain substances in the event of a leak. Operational experience indicates typical incidental spill volumes are <10 L.

Hydraulic fluid is used in a range of equipment, such as A-frames, cranes, ROVs and winches. Failure of hydraulic lines may result in the loss of hydraulic fluid to the environment. Operational experience indicates typical volumes released due to hydraulic line failure are <20 L.

In the event of a fire emergency, firefighting foam will be used, which would then be discharged directly overboard or through deck drainage systems.

**Potential Impacts**

Accidental spills of hydrocarbons or chemicals from vessels undertaking gas export pipeline installation activities will decrease the water quality in the immediate area of the spill. Given the nature and small volumes of chemicals and hydrocarbons that may be released, along with the open water environment, impacts to water quality will be temporary and highly localised. Spilled hydrocarbons or chemicals will be rapidly mixed and diluted in the water column.

The water foaming agents in AFFF may be harmful to marine organisms. Most of these foams have high oxygen demand and the toxicity of the detergents, solvents and other components in the foams may result in adverse effects to marine organisms. However, these effects are greatly diminished in the offshore marine environment due to the natural dilution from wind, wave and currents. The release of these foams is restricted to an emergency event.

Potential impacts to biological receptors will be limited to planktonic biota in the immediate vicinity of the spill; no impacts to fauna such as fishes, turtles, cetaceans or birds are expected to occur. No impacts to socio-economic receptors (e.g. fishers) will occur.

**Risk Assessment**

| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
|---|---|---|---|
| ***Residual risk*** | I – Negligible | D – Occasional | Low |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Chemical and hydrocarbon storage areas designed to contain leaks and spills. | This control is effective in reducing the likelihood of a leak or spill reaching the marine environment by containing spilled material. Spills can then be recovered and disposed of accordingly. | **C 12.1** | **EPS 12.1.1**<br>Selection of vessel contractor is subject to Santos marine vessel vetting processes, specifically:<br>+ appropriate procedures for storage (e.g. bunding), labelling (including Safety Data Sheet (SDS) available) and handling of chemicals and hydrocarbons<br>+ completion of vessel OVID inspection and report<br>+ implementation of a Permit to Work (PTW) or equivalent authorisation process (e.g. JSA) for transfers of hydrocarbon/chemicals (refer to bunkering for bunkering-specific controls). |
| Chemicals and hydrocarbons will be managed in accordance with standard maritime practices. | This control is consistent with standard maritime practices which have been developed through international consensus. The control is consistent with relevant requirements, including the MARPOL convention and Australian Marine Orders. | **C 12.2** | **EPS 6.1.1**<br>Refer **Section 5.2.6**. |
| | | | **EPS 12.2.1**<br>Marine Order 93 (Marine pollution prevention - Noxious liquid substances), including (as required by vessel class):<br>+ International Pollution Prevention (IPP) Certificate. |
| Spill clean-up kits available in high risk areas. | This control is effective in reducing the likelihood of spilled hydrocarbons or chemicals reaching the environment. Spill kits are required as part of vessel SOPEPs. Contaminated material from used spill kits is disposed of accordingly. | **C 12.3** | **EPS 12.3.1**<br>Selection of vessel contractor is subject to Santos marine vessel vetting processes, specifically:<br>+ spill kits stocked and ready for use by trained personnel. |

| | | | |
|---|---|---|---|
| Inspection and maintenance for all equipment using hydrocarbons and/or chemicals. | This control is effective in reducing the likelihood of leaks from equipment if equipment is maintained in good working order. | **C 12.4** | **EPS 12.4.1**<br>Selection of vessel contractor is subject to Santos marine vessel vetting processes, specifically:<br>+ planned maintenance system in place on vessels |
| ROV operations undertaken in accordance with good industry practice. | Using good industry practice to maintain and operate ROVs reduces the likelihood of leaks of hydraulic fluids to the marine environment. | **C 12.5** | **EPS 12.5.1**<br>Procedures for ROV operations, including:<br>+ ROV inspections and maintenance<br>+ pre-mobilisation audit for all ROV systems. |
| Chemical selection procedure for chemicals planned to be released to the marine environment. | This control is effective in reducing impacts to marine receptors if chemicals are spilled the marine environment by selecting chemicals that considering environmental impacts. | **C 7.1** | **EPS 7.1.1**<br>See **Section 5.2.7**. |

| ***Additional Controls*** | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No perfluorinated chemicals (PFAS)/perfluorooctane sulfonate (PFOS) will be used in fire-fighting foam. | Yes | Yes<br>**C 12.6** | PFAS and PFOS have been shown to be toxic to fish and invertebrates, do not readily break down and are known to bioaccumulate in biota. Therefore, this control is effective in reducing impacts to the marine environment. | **EPS 12.6.1**<br>Fire-fighting foams shall be free of PFAS and PFOS. |
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |

| ALARP Statement |
| --- |
| Based on the outcomes of the risk assessment and through the implementation of controls throughout the gas export pipeline installation campaign, Santos considers the risks from incidental spills of fluids, chemicals and lubricants to the environment are reduced to ALARP.<br>Relevant legislative requirements and standard industry practices have been applied to control the risk. The controls selected for implementation are effective in reducing the risk of incidental spills of fluids, chemicals and lubricants to the environment. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts. No credible additional controls were identified. |

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| --- | --- | --- | --- |
| Marine turtles | Recovery Plan for Marine Turtles in Australia (June 2017) | Minimise chemical discharges. | As described above a number of controls will be implemented to reduce the likelihood (minimise) of an unplanned discharge and any release is not expected to impact on turtles. |
| Marine parks | North Marine Parks Network Management Plan 2018 | Marine pollution was identified as a pressure in the North Network.<br>The Director of National Parks must be notified in the event of an oil pollution incident that occurs within or may impact upon, an Australian Marine Park. | A comprehensive suite of well-defined engineering controls will be implemented to minimise risks of a spill occurring.<br>Notifications are included in **Table 7-4**. |

| Levels of Acceptable Impact | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with incidental spills are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate.<br>+ Taking into account the identified management measures and the small volume of chemicals or hydrocarbons that may enter the ocean, incidental spills are not considered to pose threats of serious or irreversible damage to socioeconomic receptors or the environment.<br>+ Incidental spills are not expected to reduce overall long-term, broad-scale health, diversity and productivity of the environment.<br>+ Biological diversity and ecological integrity are not expected to be significantly impacted by incidental spills. |
| **Legislative requirements** | *Navigation Act 2012* (Cth), the *Protection of the Sea (Prevention of Pollution from Ships) Act* 1983 (Cth), Marine Order 91, Marine Order 93. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to ensure alignment.<br>Pollution, such as could occur from a hydrocarbon spill, is identified as a threat in conservation advice for several marine species that may occur in the operational area and as a threat in the North Marine Parks Network Management Plan 2018. Santos considers the selected controls are effective in managing the risk to these species and the Oceanic Shoals Marine Park to a level that is acceptable. |
| **EPOs (Table 6-1)** | |
| **EPO 12**<br>Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of gas export pipeline installation activities. | |

### 5.3.6 Unplanned discharges: loss of hazardous and non-hazardous waste

| **Risk** | Inappropriate management of non-hazardous or hazardous waste |
|---|---|
| **Aspect-receptor reference (Table 5-5)** | 13B – Water quality<br>13C – Sediment quality<br>13J – Marine mammals<br>13K – Marine reptiles<br>13L – Sharks and rays<br>13M – Birds |

**Description of the Source of Risk**

Vessels undertaking gas export pipeline installation activities will generate a range of wastes, some of which are routinely disposed of overboard in accordance with relevant requirements (such as sewage). Wastes that are not discharged overboard are retained and disposed of onshore. These wastes can include domestic wastes, packaging, batteries, etc.

Wastes are required to be securely stored onboard such that they cannot easily be accidentally released into the environment. This may be achieved by having lids on bins, which are secured to the deck, or by storing wastes in sealed containers.

Solid wastes are typically offloaded from vessels in port and handled by a waste management service (and hence this activity is beyond the scope of this EP), however operational circumstances may require the back loading of wastes from vessels undertaking gas export pipeline installation activities.

**Potential Impacts**

The potential impacts of solid wastes accidentally discharged to the marine environment will depend on the nature and amount of waste, and the sensitivity of the receiving environment. Potential impacts may include:

+ decreases to water quality
+ decreases in sediment quality
+ impacts to fauna from entanglement and/or ingestion.

Given the nature and scale of the source of risk, the potential impacts to water and sediment quality are expected to be localised and temporary given the types of wastes that may credibly be lost overboard.

Impacts to fauna may result in injury or mortality through entanglement and/or ingestion, however while this would reasonably be expected to impact upon individual animals; no population-scale impacts would credibly occur.

**Risk Assessment**

| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
|---|---|---|---|
| ***Residual risk*** | I – Negligible | D – Occasional | Low |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| All wastes managed in accordance with vessel waste management plan. | This control is effective in reducing the likelihood of wastes being lost to the environment. It is consistent with MARPOL requirements and standard maritime practices. | **C 13.1** | **EPS 13.1.1**<br>Vessels will be suitably equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 95 (Marine pollution prevention – Garbage), including:<br>– garbage management plan in place<br>– types of wastes that will be generated onboard and will require containment, transport and disposal at a licensed facility onshore<br>– procedures for handling, storage segregation and disposal of wastes<br>– maintenance of Garbage Record Book, recording the types and volumes of waste incinerated or disposed onshore<br>– garbage record book maintained onboard. |
| | | | **EPS 13.1.2**<br>Vessels will be suitably equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 94 (Marine Pollution Prevention - Packaged Harmful Substances) including (as required by vessel class):<br>– no disposal of harmful substances (identified as marine pollutants in the IMDG Code) overboard<br>– packaged harmful substances to be properly packed, marked, labelled, stowed and secured<br>– any loss or discharge to sea of harmful materials will be reported to the AMSA RCC via a marine pollution report (POLREP). |
| HSE inductions – cover requirements e.g. label and cover waste skips and bins. | This control is effective in reducing the likelihood of wastes being lost to the environment as all crew are aware of the waste management plan requirements. | **C 13.2** | **EPS 13.2.1**<br>All crew will attend HSE inductions which will include requirements of the vessel waste management plan. |

| *Additional Controls* | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| No end caps on pipes. | Yes | Yes<br>**C 13.3** | This control is effective in reducing the waste from thousands of plastic end caps. | **EPS 13.3.1**<br>No end caps on pipe lengths that arrive in the operational area. |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |
| **ALARP Statement** | | | | |
| Based on the outcomes of the risk assessment and through the implementation of the control throughout the activity, Santos considers the risks from loss of wastes overboard are reduced to ALARP.<br>Relevant legislative requirements and standard industry practices have been applied to control the risk. The control selected for implementation is effective in reducing the impacts and risks from loss of wastes overboard. Santos considers the control adopted is commensurate to the nature and scale of the risk. No credible additional controls were identified. | | | | |

| **Summary of Alignment with EPBC Management Plans (where applicable)** | | | |
|---|---|---|---|
| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| Dwarf sawfish, green sawfish, freshwater sawfish, narrow sawfish, northern river shark, speartooth shark | Sawfish and River Sharks Multispecies Recovery Plan (November 2015)<br>Conservation Advice: for dwarf sawfish (October 2009), green sawfish (2008), Pristis pristis (freshwater sawfish) (April 2014), speartooth shark (April 2014), and northern river shark (April 2014)<br>Threat Abatement Plan: for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (2018) | Reduce and, where possible, eliminate any adverse impacts of marine debris. | As described above – controls will be implemented including good housekeeping practices to minimise the risk of waste being released to the marine environment. |

| | | | |
|---|---|---|---|
| Marine reptiles | Recovery Plan for Marine Turtles in Australia 2017-2027 (June 2017) (DoEE, 2017) | Reduce the impacts from marine debris.<br>Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival.<br>Manage anthropogenic activities in BIAs to ensure that biologically important behaviour can continue. | |

| **Levels of Acceptable Impact** | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with solid waste lost overboard are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate.<br>+ Taking into account the identified management measures and the small amount of solid waste that may enter the ocean, solid waste not considered to pose threats of serious or irreversible damage to the environment.<br>+ Incidental spills are not expected to reduce overall long-term, broad-scale health, diversity and productivity of the environment.<br>+ Biological diversity and ecological integrity are not expected to be significantly impacted by solid waste. |
| **Legislative requirements** | *Navigation Act 2012* (Cth), the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), Marine Order 94, Marine Order 95. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to ensure alignment.<br>Pollution, such as could occur from loss of wastes overboard, is identified as a threat in conservation advice for several marine species that may occur in the operational area. Santos considers the selected controls are effective in managing the risk to these species to a level that is acceptable. |

| **EPOs (Table 6-1)** |
|---|
| **EPO 13**<br>Zero unplanned discharge of hazardous and non-hazardous solid wastes into the marine environment as a result of gas export pipeline installation activities. |

### 5.3.7 Unplanned hydrocarbon discharges: marine diesel release from vessel collision

| Risk | Loss of marine diesel fuel containment resulting from vessel collision |
|---|---|
| Aspect-receptor reference (Table 5-5) | 14B – Water quality<br>14E – Intertidal primary producers<br>14H – Plankton<br>14I – Pelagic and demersal fish communities<br>14J – Marine mammals<br>14K – Marine reptiles<br>14L – Sharks and rays<br>13M – Seabirds and migratory shorebirds<br>14O – Australian marine parks<br>14P – Reef protection areas<br>14T – Commercial fishing<br>14U – Traditional fishing |

**Description of the Source of Risk**

**Description of Vessel Activities**

A vessel collision resulting in a hydrocarbon spill can credibly occur from KP0 to KP262 (**Figure 3-1**).

All vessels used to undertake activities within the scope of this EP will be fuelled using marine diesel oil (MDO) or lighter (e.g. marine gas oil (MGO), automotive diesel). Heavier fuel types, such as intermediate fuel oil (IFO) or heavy fuel oil (HFO) will not be used.

**MDO Releases from Vessel Collisions**

A number of prerequisite conditions must exist for a vessel collision to result in the loss of fuel to the environment:

- The vessel must be involved in a collision: Collisions involving offshore support vessels, comparable to those that will undertake gas export pipeline installation activities, are very uncommon. Statistics compiled by the ATSB indicated that offshore support vessels were involved in only one collision-related incident between 2011 and 2012, and no pollution-related incidents from offshore support vessels were recorded in the same time period.
- The collision must occur with sufficient force to rupture a fuel tank: fuel tanks are typically located at various positions around a vessel within the hull.
- The rupture must be of such a nature that the fuel can be released into the environment: A tank rupture must be above or near the fuel level within the tank to result in a loss of containment from the tank. Once lost from the tank, fuel may leak to the environment or drain into the vessel hull. Fuel from ruptured tanks may be transferred to other tanks onboard, reducing the volume in the ruptured tank. Fuel transfer measures are typically detailed in vessel SOPEPs.

A range of controls, based on Australian maritime requirements, are selected for implementation in this EP to reduce the potential for interactions with other marine users. These controls reduce the likelihood of a collision occurring (refer to **Section 5.2.1**). Additional controls that reduce the potential consequence of a vessel collision resulting in a release of MDO are detailed in the OPEP (BAA-100 0330).

**Credible Spill Scenario**

**Table 5-29** presents the worst-case credible spill scenario for a vessel collision.

*Table 5-29: Summary of characteristics of worst-case credible spill scenario from a vessel collision*

| Release Parameter | Parameter Characteristic | Justification |
|---|---|---|
| Hydrocarbon Type | MDO | MDO is the most persistent fuel, being considered for this activity, that may be used by vessels. All other fuels (e.g. automotive diesel, MGO) are less persistent in the environment (and hence, may have reduced potential for impacts if released). |
| Release Location | See **Figure 5-32** | Modelling was undertaken at three locations (**Figure 5-32**). These locations were chosen to represent different hydrodynamic conditions along the pipeline route and for their proximity to sensitive receptors. |
| Release Volume | 700 $m^3$ | Guidance from AMSA on spill contingency planning for vessel-based activities (Australian Maritime Safety Authority, 2013a) suggests 50% of the volume of the single largest tank on a vessel is appropriate to inform the risk assessment of an MDO release from a vessel collision. This is based on the scenario of a non-major collision of an oil tanker to take credit for the fact that the pipelay vessel has all fuel tanks internally located and protected by water ballast compartments. Santos has considered vessel specifications for all vessels that could be contracted; No fuel tank onboard the vessels considered exceeded 1,400 $m^3$ hence, the 700 $m^3$ volume is considered suitable to inform the risk assessment. |
| Release Duration | 6 hrs | This is considered a conservative timeframe over which the release may occur. |
| Release Timing | All seasons | Activities may credibly occur at any time of the year. |

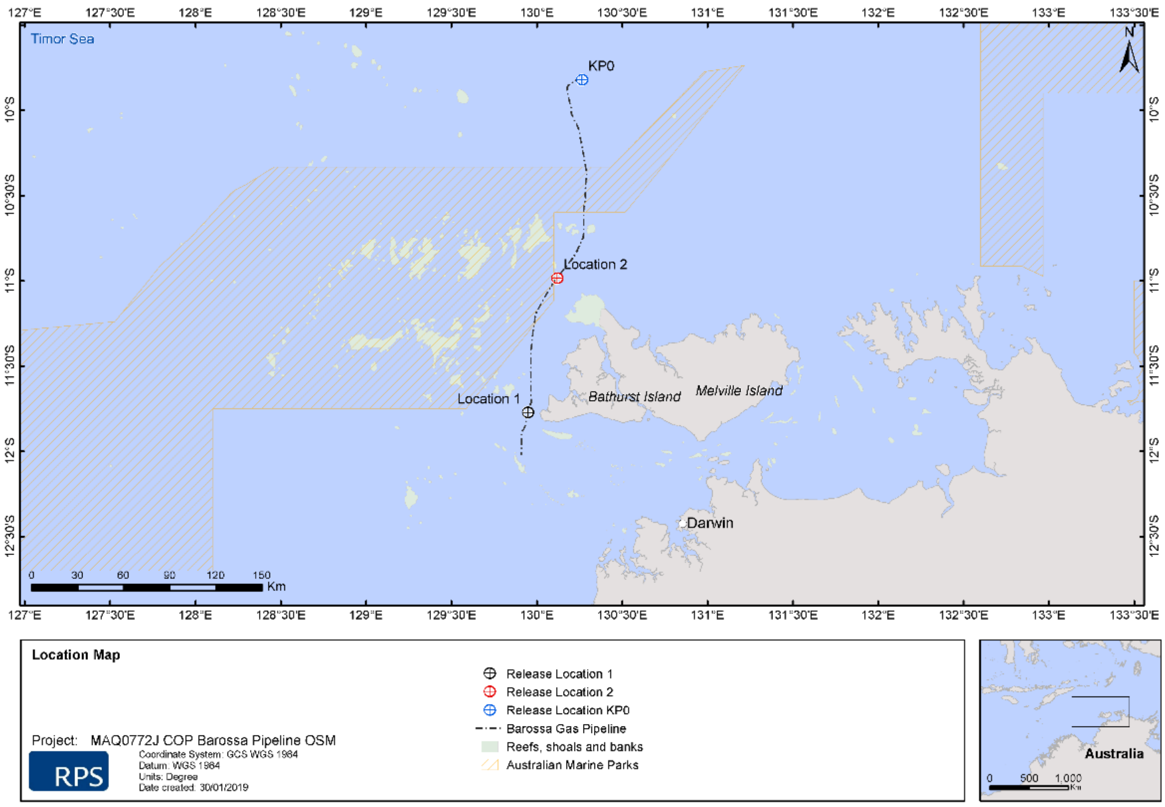



*Figure 5-32: Marine diesel oil release locations for spill modelling in case of vessel collision*

**Hydrocarbon Spill Modelling**

MDO spill modelling has been completed to assess the impact and fate to the environment. The below sections summarise the findings of the modelling.

Modelled Hydrocarbon Types

MDO is a medium grade non-persistent fuel used in the maritime industry. It has a low viscosity (4 cP), which indicates that this hydrocarbon will spread quickly when spilt at sea. MDO will have a thin to low thickness level on the sea surface thereby increasing the rate of evaporation. Characteristics of MDO used in the modelling studies are provided in **Table 5-30**.

***Table 5-30: Characteristics of marine diesel oil***

| Density at 25 °C (kg/m³) | Viscosity at 25 °C (cP) | Component Boiling Point (°C) % of Total | | | |
|---|---|---|---|---|---|
| | | Volative (%) <180 | Semi-volatile (%) 180 to 265 | Low Volatility (%) 265 to 380 | Residual (%) >380 |
| 829 | 4.0 | 6 | 35 | 54 | 5 |

Hydrocarbon Fate and Weathering

MDO is a mixture of volatile, semi-volatile and low volatility hydrocarbons (**Table 5-30**) approximately 60% to 80% of the MDO is predicted to evaporate within 24 to 48 hours, depending upon the prevailing conditions (**Figure 5-33**).

The heavier components of MDO tend to become entrained into the upper water column as oil droplets in the presence of waves but can re-float to the surface if wave energies abate. Entrained MDO is largely concentrated in surface waters (0 to 10 m).

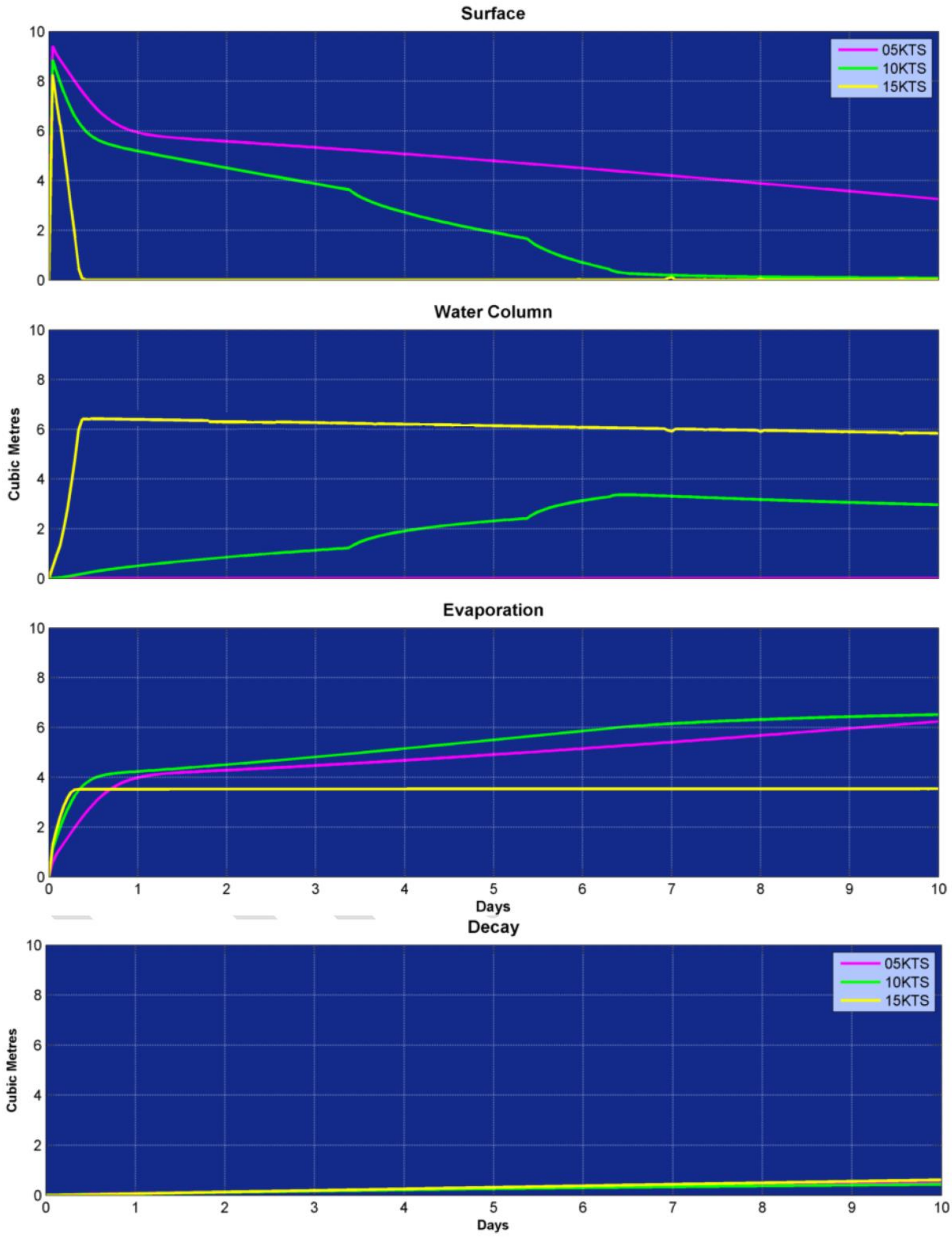



***Figure 5-33: Weathering and fates graph, as a function of volume, for an instantaneous 10 m³ surface release of marine diesel oil tracked over ten days, under 5-, 10- and 15-knot constant wind speeds***

<u>Modelling Methods</u>

The modelling study was carried out in several stages. Firstly, the tidal currents for the region were generated using RPS' ocean/coastal model, HYDROMAP. Secondly, large scale ocean currents were obtained from a large-scale ocean model for the same region and combined with tidal currents. The hybrid ocean/coastal model was used to describe the total water movement within the region. Finally, the currents and local winds were used as inputs in the oil spill model (SIMAP) to simulate the drift, spread, weathering and fate of the spilled hydrocarbon. The model considered the fates described above in Hydrocarbon Fate and Weathering.

Exposure probabilities were determined using a stochastic modelling approach, which aggregates the behaviour of multiple random spill simulations undertaken for three representative seasons (summer, winter and a transitional period). Each of the simulated spills are started at a different time of day to ensure that the predicted transport and weathering of each spill trajectory was subjected to varying wind and current conditions. A total of 100 model runs were conducted for each season, with the total stochastic data set comprising 300 model runs for each release location.

The model results were combined to provide a summary of each season. This output does not represent the potential behaviour of a single spill (which would have a much smaller area of effect) but provides an indication of the probability of any given area of the sea surface being contacted by hydrocarbons at a particular concentration (See Hydrocarbon Exposure Thresholds below). **Table 5-31** summarised the model settings and assumptions.

***Table 5-31: Summary of model settings and assumptions used for spill modelling of vessel collision scenario***

| Parameter | Scenario |
|---|---|
| Scenario description | Vessel collision at three locations |
| Number of randomly selected spill start times per season | 100 |
| Oil type | MDO |
| Spill volume | 700 $m^3$ |
| Release duration | 6 hours |
| Simulation length | 50 days |

Hydrocarbon Exposure Thresholds

Sea-surface, sub-surface (entrained and dissolved hydrocarbon) and shoreline accumulation thresholds were defined based on available scientific literature and applied to the hydrocarbon spill modelling to show the EMBA in the event of a spill, both in terms of contact and impact. The thresholds for the surface and subsurface hydrocarbons are presented in **Table 5-32**.

***Table 5-32: Sea surface and subsurface thresholds***

| Exposure Zone | Threshold | Justification |
|---|---|---|
| *Sea Surface Film Threshold* | | |
| Moderate exposure<br>(10 $g/m^2$ to 25 $g/m^2$) | 10 $g/m^2$ | Ecological impact has been estimated to occur at 10 $g/m^2$ (a film thickness of approximately 10 µm or 0.01 mm) as this level of oiling has been observed to mortally impact birds and other wildlife associated with the water surface (French et al., 1996; French-McCay, 2009).<br>Contact within this exposure zone may result in impacts to the marine environment and has therefore been used to define the EMBA. |
| *Entrained Hydrocarbon Threshold* | | |
| Moderate exposure<br>(100 ppb to 500 ppb) | 100 ppb/over 96 hours | The 100 ppb threshold is considered conservative in terms of potential for toxic effects leading to mortality for sensitive mature individuals and early life stages of species. This threshold has been defined to indicate a potential zone of acute exposure, which is more meaningful over shorter exposure durations (RPS, 2018).<br>The 100 ppb threshold contact within this exposure zone may result in impacts to the marine environment. The moderate exposure for entrained hydrocarbons has been used to define the EMBA. |

| Dissolved Aromatic Hydrocarbon Threshold | | |
|---|---|---|
| Moderate exposure<br>(50 ppb to 100 ppb) | 50 ppb/over 96 hours | A conservative threshold of 50 ppb was chosen as it is more likely to be indicative of potentially harmful exposure to fixed habitats over short exposure durations (French, 2002). French-McCay (2002) indicates an average 96-hour LC50 of 50 ppb could serve as an acute lethal threshold to 5% of biota.<br>Contact within this exposure zone may result in impacts to the marine environment. |
| **Shoreline Accumulation Threshold** | | |
| Moderate accumulation<br>(100 to 1,000 g/m²) | 100 g/m² | Accumulated hydrocarbons above 100 g/m² may coat an animal in the intertidal range and likely impact its survival and reproductive ability (including invertebrates, furbearing aquatic mammals, marine reptiles and shorebirds).<br>This threshold is the minimum thickness that can be cleaned up, which does not inhibit the potential for recovery.<br>The 100 g/m² threshold has been selected to define the moderate accumulation zone and threshold for adverse shoreline accumulation. Accumulation on shorelines above this threshold may result in impacts to the marine environment. |

Modelling Results

The currents in the Joseph Bonaparte Gulf are dominated by tidal and wind driven currents which are dependent on the season. These will influence the direction that the hydrocarbons (entrained and floating) travel in a particular season.

*Location 1 (closest to Bathurst Island)*

Modelling results indicate that floating hydrocarbons, above threshold 10 g/m², may extend up to 41.3 km west during winter and up to 32.5 km south-south west during summer. Modelling predicted shoreline accumulation above 100 g/m² along the western shoreline of Bathurst Island, with the maximum accumulation predicted to be ~7396 g/m². The maximum length of shoreline contact, above the thresholds, is ~19 km.

Modelling results indicate that entrained hydrocarbons will travel north/south from the release location traveling around the southern end of Bathurst Island. During the winter months the entrained hydrocarbons travel further in a western direction. Entrained hydrocarbons above the moderate threshold (<100 ppb) extend up to ~45 km from the release location.

No dissolved aromatics above impact thresholds were predicted to occur in this scenario.

*Location 2 (closest to Melville Island)*

Modelling results indicate that floating hydrocarbons may extend up to 35.8 km south west during winter and up to 77.7 km south west during the transitional seasons. Modelling predicted shoreline accumulation above 100 g/m² at the tip Cape Van Diemen of Melville Island, with the maximum accumulation predicted to be 133 g/m².

Modelling results indicate that entrained hydrocarbons will travel north and south during winter and east during the transition and summer months. Entrained hydrocarbons above the moderate threshold (<100 ppb) extend up to ~65 km from the release location.

No dissolved aromatics above impact thresholds were predicted to occur in this scenario.

*Location 3 (KP0 – offshore development area)*

Modelling results indicate that floating hydrocarbons may extend up to 92.2 km west-northwest during the transitional season and up to 62.0 km west northwest during the winter seasons. No shoreline accumulation was predicted for this location.

Modelling results indicate that entrained hydrocarbons will move in all directions however during winter months the hydrocarbons travel in an east west direction. Entrained hydrocarbons above the moderate threshold (<100 ppb) extend up to ~60 km from the release location.

No dissolved aromatics above impact thresholds were predicted to occur in this scenario.

*EMBA*

The outputs from the modelling at the three identified locations were used to develop the EMBA for a vessel spill resulting in the release of MDO (**Figure 5-34**) based on the extent of floating and entrained (at threshold levels) hydrocarbons travelled in all seasons.

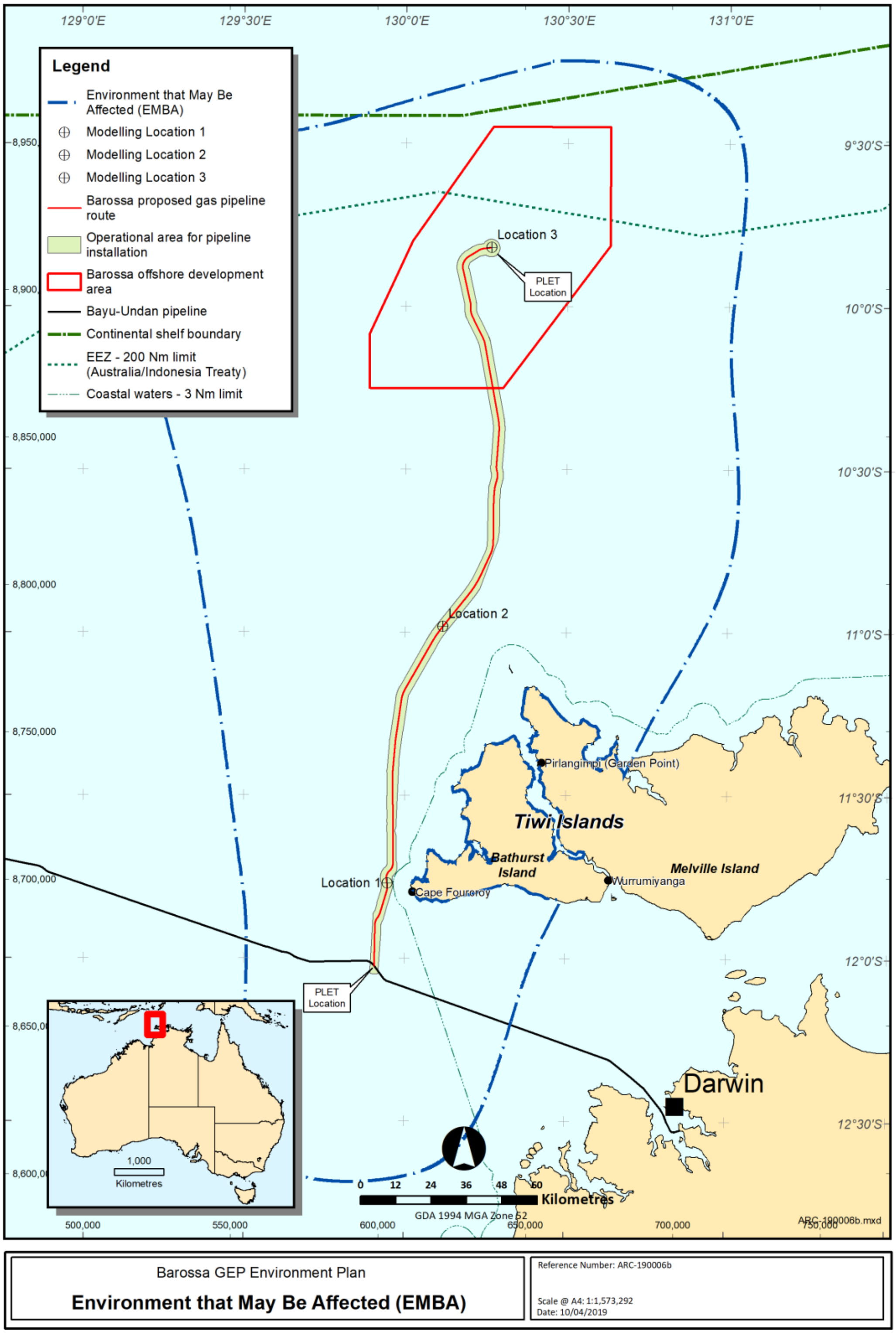



***Figure 5-34: The environment that may be affected for a vessel spill resulting in the release of marine diesel oil***

| Potential Impacts |
| --- |
| **Water Quality**<br>It is likely that water quality will be reduced at the location of the spill due to hydrocarbon contamination, however, such impacts would be temporary and highly localised in nature due to the small spill volume and rapid weathering of the released MDO (**Figure 5-33**). Stochastic modelling results indicated entrained oil concentrations exceeding 100 ppb may occur up to approximately 65 km from the release location.<br>**Benthic Communities and Habitats**<br>Benthic communities, such as macrofauna and infauna (e.g. filter feeders, brittle starts, crustaceans, polychaetes and molluscs) and benthic primary producers (e.g. macroalgae, seagrass and corals) are vulnerable to hydrocarbons (surface and entrained) however as entrained hydrocarbons above threshold levels are only predicted to remain in the top 10 m of the water column a few shallow shoals/banks may be impacted.<br><u>Shoals and Banks</u><br>Shallow shoals (e.g. the top of the shoal is within the top 10 m of the water column) within the EMBA that may be impacted include Marie Shoal, Moss Shoal and Mesquite Shoal. It is expected that these shoals would be characterised by sparse to medium density filter feeders based on surveys of similar inshore banks and shoals (**Section 4.5.6.3**). Lethal and/or sub-lethal effects to filter feeders from hydrocarbons include mortality and changes in population recruitment, growth and reproduction leading to changes in community composition and structure (Wei et al., 2012). Filter feeders are particularly susceptible as they are likely to directly ingest hydrocarbons while feeding. This may cause mortality or sub-lethal impacts such as alteration in respiration rates, decreases in filter feeding activity and reduced growth rates, biochemical effects (Keesing and Edgar, 2016). However, as the hydrocarbon concentration decreases and weathers, the communities are expected to recover.<br><u>Intertidal Primary Producers</u><br>There is the potential for intertidal primary producers such as mangroves, seagrasses and corals to be impacted by spilled hydrocarbons. These are present along much of the coastline. Worst-case deterministic modelling indicated location 1 (close to Bathurst Island) had the greatest potential for shoreline contact. The greatest length of shoreline contacted above the moderate shoreline accumulation threshold was approximately 19 km; the total shoreline length of Bathurst and Melville islands are approximately 308 km and 613 km respectively. Hence a worst-case spill may only credibly impact upon a relatively small portion of the coastline, including any associated primary producer habitats.<br><u>Mangroves</u><br>Mangrove habitat and associated mud flats are widely represented along the Tiwi Islands coastline. Hydrocarbons coating prop roots of mangroves can occur from surface hydrocarbons when they are deposited on the aerial roots. Hydrocarbons deposited on the aerial roots can block the pores used by the plants to breathe or interfere with the trees' salt balance resulting in sub-lethal and potential lethal effects. Mangroves can also be impacted by entrained aromatic hydrocarbons that may adhere to sediment particles. In low energy environments such mangroves, deposited sediment-bound hydrocarbons are unlikely to be removed naturally by wave action and may be deposited in layers by successive tides (National Oceanic and Atmospheric Administration, 2014). Given the low portion of persistent hydrocarbon in MDO, hydrocarbons in mangrove environments are not expected to persist long-term.<br><u>Tidal Mudflats</u><br>Tidal mudflats, like mangroves, are a low energy environment and are, therefore, susceptible to potential impacts from persistent surface or stranded hydrocarbons. Hydrocarbons in contaminated sediments can persist for years and result in significant impacts, particularly on benthic infauna, and their dependent migratory shorebird populations (Duke and Burns, 2003). Saenger (1994) noted that mudflats were the most severely affected habitat two years after the Gulf War spill, with no sign of living epibiota. However, the hydrocarbon type in the Gulf was a crude oil which has a larger fraction, compared to MDO, of persistent components. Given the low persistent hydrocarbons in MDO, persistence of hydrocarbons is not expected to be long-term.<br>**Seagrass**<br>Seagrass in the subtidal and intertidal zones have different degrees of exposure to hydrocarbon spills. Subtidal seagrass is generally considered much less vulnerable to surface hydrocarbon spills than intertidal seagrass, primarily because freshly spilled hydrocarbons float under most circumstances. Dean et al. (1998) found that hydrocarbons mainly affect flowering, therefore, species that are able to spread through apical meristem growth (growth at the roots tips) are not as affected (such as *Zostera*, *Halodule* and *Halophila* species). |

Potential impacts may include smothering or coating (more commonly associated with IFO-180/HFO which is not being used for gas export pipeline installation activities), reduced photosynthesis (due to direct contact or through absorption of the water soluble fraction, which is most commonly associated with MDO and condensate spills as they entrain within the water column) and a reduction in tolerance to other stress factors (Runcie et al., 2010; Taylor and Rasheed, 2011). Seagrass in the intertidal zone, such as that of the Tiwi Islands, is particularly vulnerable as it may come into direct contact with surface hydrocarbons, as well as entrained components, which can smother and kill seagrasses if it coats their leaves and stems (Taylor and Rasheed, 2011). This conclusion is supported by Howard et al. (1989) who noted that surface hydrocarbon spills which become stranded on the seagrass and smother it during the rise and fall of the tide can result in reduced growth rates, blackened leaves and mortality. Wilson and Ralph (2011) concluded that long-term impacts to seagrass are unlikely unless hydrocarbon is retained within the seagrass meadow for a sustained duration.

Only a portion of the shoreline (19 km based on the worst-case deterministic model run) is expected to be affected and therefore impacts at regional benthic community distribution or population level are considered unlikely. As the hydrocarbon disperses over time the shoreline habitats are expected to recover.

Corals

Water soluble hydrocarbon fractions associated with surface slicks are also known to cause high coral mortality (Shigenaka, 2001) via direct physical contact of hydrocarbon droplets to sensitive coral species (such as the branching coral species). Hydrocarbons in the water column resulting from a surface release (e.g. from a vessel collision or bunkering incident) will be concentrated in surface waters. Entrained hydrocarbons are expected to be found in the top 0-10 m of water. On this basis, benthic primary producer habitats, such as corals, are unlikely to be affected as they typically do not occur near surface waters.

Inter-tidal and shallow water corals may be impacted by floating and entrained hydrocarbons. Impacts may include increased mortality and sub-lethal effects such changes in feeding, bleaching (loss of zooxanthellae), increased mucous production resulting in reduced growth rates and impaired reproduction (Negri and Heyward, 2000). Habitat around the Tiwi Islands is restricted to areas of coastal reef and inter-tidal platforms. Given the patchy distribution of inter-tidal and shallow water corals, along with the non-persistent nature of the hydrocarbon, impacts to corals in the event of an MDO release are expected to be restricted to sub-lethal impacts.

**Marine Fauna**

Plankton

Plankton communities may be impacted in the event of a hydrocarbon spill, particularly entrained fractions. Toxic effects from exposure to entrained hydrocarbons may cause impacts such as blocked filter feeding organs and impacts resulting from ingestion of hydrocarbons. Modelling of the credible release scenarios indicates that entrained hydrocarbons above impact thresholds are expected to be highly localised around the release location. Given the high productivity of planktonic communities and the nature and scale of the credible spill, these impacts are expected to be highly localised to the release location and temporary in nature.

Pelagic and Demersal Fish Communities (including Sharks and Rays)

Fish mortalities are rarely observed to occur as a result of hydrocarbon spills (International Tanker Owners Pollution Federation, 2011). 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, which were significantly bigger than the worst-case credible spill scenario considered in this EP) have occurred in sheltered bays which limited the ability of fish to access clean water and eliminate toxicants. Given the nature and scale of the credible spill scenario and the open ocean environment of the credible release locations, impacts to pelagic and demersal fishes are expected to be highly localised and temporary.

Marine Mammals

Cetaceans are highly mobile and are known to transit through the region, though no known migration routes are known within the EMBA. Studies and field observations suggest that cetaceans may be able to detect and avoid hydrocarbon slicks (Geraci and St Aubin, 1988). Cetaceans are vulnerable to the effects of surface hydrocarbons due to the need to surface and breathe. Direct contact with surface slicks and inhalation of vapours may irritate eyes, airways and lungs. Lethal or sub-lethal effects will depend on the concentration of the hydrocarbons and the duration of exposure. Potential impacts to dugongs are expected to be similar to cetaceans given their sensitivity to hydrocarbon exposure is likely to be similar.

Santos

Given spilled MDO is expected to disperse and weather rapidly, the potential for impacts to cetaceans will be concentrated around the release location and limited to individuals. No impacts at the population level are expected.

Marine Reptiles

Marine turtles are susceptible to the effects of hydrocarbon spills during all life stages (National Oceanic and Atmospheric Administration, 2010). They are in frequent contact with the sea surface and show little avoidance behaviour in response to the presence of surface hydrocarbons, which makes them vulnerable to coating and inhalation of toxic vapours.

A number of BIAs and habitats critical to the survival of a species have been identified for marine turtles within the EMBA (**Section 4.5.5.3**). A hydrocarbon spill above impact thresholds in these areas may result in impacts to biologically important behaviours.

Turtle nesting in the region occurs year-round, with a peak during winter months. A spill during winter months may result in impacts to a portion of the population, however the protracted nature of the breeding season means that a spill will not credibly impact upon a large portion of the population. Approximately 260 km of sandy beaches surround the Tiwi Islands, many of which are documented to host turtle nesting. Deterministic modelling indicated the worst-case maximum length of shoreline impacted above the moderate shoreline accumulation threshold is approximately 19 km. Hence, a worst-case spill will not affect a significant portion of the nesting turtle population at any given time.

Internesting BIAs and nesting habitat critical to the survival of flatback and Olive Ridley turtles overlap the EMBA. An MDO release from a vessel collision in these areas may result in exposure of flatback and Olive Ridley turtles to hydrocarbons above impact thresholds. Turtle nests are typically made above the high water mark, which is typically the highest point along the shoreline that stranded oil will reach. As such, direct contact between turtle eggs and the stranded hydrocarbons are very unlikely. Nesting females and hatchlings emerging from nests may be exposed to stranded hydrocarbons when moving on nesting beaches, potentially resulting in contamination. Exposure may result in light oiling of nesting females and hatchling that may subsequently lead to sub-lethal effects such as skin irritation; no mortality is expected to occur. Given the non-persistent nature of MDO and low levels of hydrocarbons potentially stranding on shorelines, the potential for impacts to nesting turtles, egg clutches and hatchlings on beaches is considered to be low.

Adult sea turtles exhibit no avoidance behaviour when they encounter hydrocarbon spills (National Oceanic and Atmospheric Administration, 2010). Contact with surface slicks or entrained hydrocarbon can therefore result in hydrocarbon adherence to body surfaces (Gagnon and Rawson, 2010) causing irritation of mucous membranes in the nose, throat and eyes leading to inflammation and infection (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). Given the non-persistent nature of the hydrocarbon, along with the expected rapid weathering of surface hydrocarbons in the tropical environment, the timeframe during which turtles may be exposed to hydrocarbons above impact thresholds is low. The spatial extent of the EMBA, along with the wide distribution of turtle species in the region, indicates population-scale impacts are unlikely.

Sea snakes may be vulnerable to hydrocarbon spills due to their need to surface to breathe and may spend time at the sea surface to bask in the sun however little information is available to describe the effects of hydrocarbon spills on sea snakes. Sea snakes are expected to be distributed around shallow banks and shoals which are limited within the EMBA and therefore only low numbers are expected to be impacted.

Seabirds and Migratory Shorebirds

Seabirds and migratory shorebirds 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). Seabirds generally do not exhibit avoidance behaviour to floating hydrocarbons. Physical contact of seabirds with surface slicks is by several exposure pathways, primarily immersion, ingestion and inhalation. Contact with hydrocarbons may result in plumage fouling and hypothermia (loss of thermoregulation), decreased buoyancy and potential to drown, inability to fly or feed, anaemia, pneumonia and irritation of eyes, skin, nasal cavities and mouths (Australian Maritime Safety Authority, 2013b; International Petroleum Industry Environmental Conservation Association, 2004) and result in mortality due to oiling of feathers or the ingestion of hydrocarbons. Longer term exposure effects that may potentially impact seabird populations include a loss of reproductive success (loss of breeding adults) and malformation of eggs or chicks (Australian Maritime Safety Authority, 2013b).

A hydrocarbon spill may result in surface slicks above impact thresholds in foraging habitat for seabirds. Seabird distributions are typically concentrated around islands and hydrocarbons in proximity to nesting/roosting areas may result in increased numbers of seabirds being impacted. Nesting/roosting areas in the vicinity of the EMBA include Bathurst and Melville Islands. Given the nature and scale of the credible hydrocarbon spill, the potential for impacts to birds is expected to be temporary (hours to days) and restricted to the area covered by sea surface hydrocarbons above impact thresholds. Stranded hydrocarbons may come into contact with wading shorebirds, potentially resulting in oiling. Given the relatively low likelihood of shoreline accumulation above the moderate impact threshold, contact of this nature is considered very unlikely to occur. As seabirds nest above the high water mark, direct contact to nests, eggs or hatchlings by stranded hydrocarbons is not expected to occur.

**Australian Marine Parks**

As outlined above, a hydrocarbon spill has the potential to impact upon water quality and a range of biological receptors. These environmental values are contained with the Oceanic Shoals Marine Park in Commonwealth waters. Impacts to environmental values within these protected areas may diminish the value of these protected areas, however given the nature and scale of the credible spill scenario such impacts are improbable.

**Fishing (Traditional, Commercial and Recreational)**

A hydrocarbon spill may impact upon fish species targeted by fishers (refer to the discussion on pelagic and demersal fish communities above), potentially reducing fish numbers available for capture within the EMBA. A hydrocarbon spill may also temporarily displace traditional, commercial and recreational fishers from the EMBA. This displacement would be localised and short-term (days). A hydrocarbon spill may result in tainting of commercially fished species resulting in fishers being unable to sell their catch, which may result in a loss of income for commercial fishers. Additionally, spilled hydrocarbons may contaminate fishing gear, which may require cleaning.

**KEFs**

The open waters above the seabed KEFs of the shelf break and slope of the Arafura Shelf and carbonate bank and terrace system of the Van Diemen Rise may be contacted by hydrocarbons above thresholds. Impacts to these seabed KEFs are considered to be minimal given their location on the seabed and the surface nature of the majority of the spills (e.g. vessel collisions in which the concentration of the entrained hydrocarbons is highest in the upper water column (RPS, 2017).

**Risk Assessment**

| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
|---|---|---|---|
| ***Residual risk*** | III – Moderate | B – Unlikely | Low |

**Controls and Demonstration of ALARP**

***Existing Controls***

| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
|---|---|---|---|
| Activity vessels equipped and crewed in accordance with Australian maritime requirements. | This control is effective in avoiding unplanned interactions with other marine users. Crew qualifications and experience, along with communication and navigation equipment, allows activity vessels to detect, communicate with, and avoid interaction with other marine users. | **C 1.1**<br>Refer to **Section 4.3.1**. | **EPS 1.1.1**<br>Refer to **Section 5.3.1**. |
| Undertake consultation with relevant persons (including applicable notifications) to support gas export pipeline installation campaign. | This control is effective in avoiding unplanned interactions with other vessels. Consultation with relevant persons allows all parties to be aware of activities associated with the gas export pipeline and its location. This allows Santos and other users to undertake activities in such | **C 1.2**<br>Refer to **Section 5.3.1**. | **EPS 1.2.1**<br>Refer to **Section 5.3.1**.<br>**EPS 1.2.2**<br>Refer to **Section 5.3.1**. |

| | | | |
|---|---|---|---|
| | a way to minimise the potential for adverse interactions. | | **EPS 1.2.3**<br>Refer to **Section 5.3.1**. |
| Implement the vessel SOPEP. | This control is effective in reducing the potential impacts of an MDO release from a vessel collision. Each vessel has a SOPEP that details the immediate response to a spill. | **C14.1** | **EPS 14.1.1**<br>Implement the vessel SOPEP in the event of an MDO spill. |
| Implement tiered spill response in the event of an MDO spill. | This control is effective in reducing the potential impacts of an MDO release from a vessel collision. Santos had developed a tiered response strategy (described in the OPEP (BAA-100 0330; **Appendix G**) that scales to the needs of the spill. | **C 14.2** | **EPS 14.2.1**<br>Implement tiered spill response in the event of an MDO spill. |

***Additional Controls***

| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
|---|---|---|---|---|
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No IFO or HFO will be used in activity vessels. | Yes | Yes<br>**C 14.3** | This control is effective in reducing the potential impacts from a vessel collision as IFO and HFO are heavier fuels which will persistent longer which may result in a greater environment impact. | **EPS 14.3.1**<br>No IFO or HFO in any activity vessel tanks. |
| ***Engineering*** | | | | |
| One vessel will act as a surveillance vessel within the operational area during gas export pipeline installation. | Yes | Yes<br>**C 1.4** | A vessel will be in the immediate vicinity of the pipelay vessel at all times to act as a surveillance and intervention vessel. The vessel will mitigate potential interactions between the pipelay vessel and other marine users. | **EPS 1.4.1**<br>Refer to **Section 5.3.1**. |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |

| ALARP Statement |
|---|
| Based on the outcomes of the risk assessment and the implementation of controls throughout the activity, Santos considers that the impacts and risks from an MDO release from vessel collisions are reduced to ALARP. EPOs, EPSs and MC applicable to undertaking the spill response are detailed in **Section 5.3.10**.<br>Relevant legislative requirements and standard industry practices/guidelines have been applied to control the risk. Additional controls have been evaluated; all additional controls considered were rejected as the reduction in risks was considered to be grossly disproportionate to the cost of implementation. The controls selected for implementation are effective in reducing the risk of an MDO release from a vessel collision. Santos considers the controls adopted are commensurate to the nature and scale of the risks. |

**Summary of Alignment with EPBC Management Plans (where applicable)**

| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
|---|---|---|---|
| Marine parks | North Marine Parks Network Management Plan 2018 | Marine pollution was identified as a pressure in the North Network.<br>The Director of National Parks must be notified in the event of an oil pollution incident that occurs within or may impact upon, an Australian Marine Park. | A comprehensive suite of well-defined engineering controls will be implemented to minimise risks of a spill occurring.<br>Notifications are included in the OPEP (BAA-100 0330; **Appendix G**). |
| Marine turtles | Recovery Plan for Marine Turtles in Australia (June 2017) | 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.<br>Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival.<br>Manage anthropogenic activities in BIAs to ensure biologically important behaviour can continue. | A comprehensive suite of well-defined engineering controls will be implemented to minimise risks of a spill occurring.<br>Individuals may be affected in the area of influence, considering the large area utilised by internesting turtles (including internesting habitat critical to the survival and BIAs), the potential for impacts at a population level are unlikely.<br>An OPEP will be implemented which details the response strategies (BAA-100 0330; **Appendix G**). |

| | | | |
|---|---|---|---|
| Seabirds and shorebirds | See **Table 4-6** | Oil pollution was identified as a threat to a number of birds. | A comprehensive suite of well-defined engineering controls will be implemented to minimise risks of a spill occurring.<br>In the event of a spill, impacts to birds is expected to be temporary (hours to days) and restricted to the area covered by sea surface hydrocarbons above impact thresholds.<br>An OPEP will be implemented which details the response strategies (BAA-100 0330; **Appendix G**). |
| Seabirds | Wildlife Conservation Plan for Seabirds (Commonwealth of Australia, 2020b) | The relevant objective is to protect and manage seabirds and their habitats with an action to enhance contingency plans to prevent and/or respond to environmental emergencies that impact seabirds and their habitats. | A comprehensive suite of well-defined engineering controls will be implemented to minimise risks of a spill occurring.<br>In the event of a spill, impacts to birds is expected to be temporary (hours to days) and restricted to the area covered by sea surface hydrocarbons above impact thresholds.<br>An OPEP will be implemented which details the response strategies (BAA-100 0330; **Appendix G**). |

| Levels of Acceptable Impact | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with vessel collision resulting in the release of MDO are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate. |
| **Legislative requirements** | The controls implemented are consistent with the requirements of relevant legislation including COLREGS, SOLAS, STCW Convention and related Marine Orders. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ Oil spill preparedness and response strategies are considered applicable to the nature and scale of the risk and associated impacts of the response are reduced to ALARP.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign. Consultation in support of the EP has identified other users that may potentially be affected and provided sufficient opportunity to provide feedback. A number of stakeholders sought information on the OPEP process in general, but no claims or objections were raised in relation to an MDO release from a vessel collision. Information regarding the OPEP process is included in **Section 7.11**<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to ensure alignment.<br>Pollution, such as could occur from a hydrocarbon spill, is identified as a threat in conservation advice for several marine species that may occur in the operational area and as a threat in the North Marine Parks Network Management Plan 2018. Santos considers the selected controls are effective in managing the risk to these species and the Oceanic Shoals Marine Park to a level that is acceptable. |
| **EPOs (Table 6-1)** | |
| **EPO 14**<br>No marine diesel releases to the marine environment as a result of a vessel collision. | |

## 5.3.8 Unplanned hydrocarbon discharges: hydrocarbon release from refuelling

| Risk | Hydrocarbon release from a refuelling |
|---|---|
| **Aspect-receptor reference (Table 5-5)** | 15B – Water quality<br>15H – Plankton<br>15I – Pelagic and demersal fish communities<br>15J – Marine mammals<br>15K – Marine reptiles<br>15L – Sharks and rays<br>15M – Seabirds and migratory shorebirds<br>15O – Australian marine parks<br>15T – Commercial fishing |

**Description of the Source of Risk**

Bunkering of MDO at sea between the support vessels and the pipelay vessel will occur within the operational area. Additionally, refuelling of helicopters with aviation fuel may take place on the pipelay vessel.

**Credible Spill Scenario**

A release of MDO as a result of hose break or coupling failure during vessel refuelling was considered the worst-case scenario for refuelling incidents. Failure of the transfer hose during helicopter refuelling could result in a maximum credible spill volume of <1 m³ which is less than 10 m³ considered for vessel bunkering. The physical and chemical properties of MDO and aviation fuel are similar therefore the MDO scenario is considered more conservative and therefore representative of an aviation fuel scenario.

Spill volumes were determined from transfer hose inventory and spill prevention measures including 'dry break' or 'break away' couplings, rapid shutdown of fuel pumps and spill response preparedness, with 10 m³ considered to be the maximum volume that could escape from the hose prior to shut down. This scenario was modelled by APASA using the methodology outlined below. The scenario parameters used in the modelling study are presented in **Table 5-33**.

***Table 5-33: Summary of model settings and assumptions used for spill modelling of bunkering incident scenario***

| Parameter | Scenario |
|---|---|
| Scenario description | Bunkering incident |
| Number of randomly selected spill start times per site per scenario | 100 per season |
| Oil type | MDO |
| Spill volume | 10 m³ |
| Release duration | Instantaneous |
| Simulation length | 10 days |
| Release location | Barossa Offshore Development Area, as per OPP; this is ~1 km from the operational area |

**Hydrocarbon Spill Modelling**

As with the MDO release from a vessel collision scenario, hydrocarbon spill modelling has been completed to determine the risk of exposure to environmental receptors from an MDO release from a bunkering incident. The bunkering release modelling was undertaken for the OPP and close to the operational area and therefore is considered relevant for this activity. The below sections summarise the findings of the modelling.

<u>Modelled Hydrocarbon Types</u>

A description of MDO, including physical characteristics, is provided in **Section 5.3.7**.

Hydrocarbon Fate and Weathering

A description of MDO, including weathering, is provided in **Section 5.3.7**.

Modelling Methods

A description of modelling methods is provided in **Section 5.3.7**. **Table 5-33** provides a summary of the model settings and assumptions.

Hydrocarbon Thresholds

The same sea surface hydrocarbon thresholds were applied to the bunkering incident scenario as the MDO release form a vessel collision scenario. Refer to **Section 5.3.7** for information on the impact thresholds. No shoreline contact was predicted during any season for the bunkering incident scenario.

**Modelling Results**

The modelling results show:

- no probability of shoreline contact for any season
- when the 10 g/m² spill was tracked, the maximum distance travelled was during winter with the surface hydrocarbons extending up to 3 km from the release location
- there were no entrained or dissolved hydrocarbons predicted in the model.

**Potential Impacts**

The potential impacts for an MDO release during a bunkering incident are similar to those described in **Section 5.3.7** although the significantly smaller credible release volume constrains the receptors that may be impacted. Potential receptors include water quality, marine fauna (particularly those associated with the surface such as cetaceans and marine turtles) and plankton within the upper water column only.

Water quality in the area affected by the bunkering incident will decline due to the presence of floating hydrocarbons. The decrease in water quality is expected to be short-lasting (hours) as MDO has a high portion of volatile hydrocarbons that will evaporate quickly. The low viscosity of MDO indicates a surface slick will spread rapidly, which will facilitate evaporation and entrainment within the water column.

The decrease in water quality may result in acute toxic effects to plankton around the release location. However, given the rapid turnover of plankton communities these impacts will be temporary (e.g. days).

Marine fauna may be exposed to hydrocarbons, particularly fauna associated with the sea surface such as birds and air-breathing animals such as cetaceans and turtles. Given the relatively small area that would be affected, and the low persistence of MDO in the environment, the potential for marine fauna to be impacted is considered to be very low.

If bunkering within the Oceanic Shoals marine park, a hydrocarbon spill has the potential to impact upon water quality and marine fauna (as detailed above). Impacts to environmental values within these protected areas may diminish the value of these protected areas; however, given the nature and scale of the credible spill scenario such impacts are improbable.

**Risk Assessment**

| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
|---|---|---|---|
| ***Residual risk*** | I – Negligible | D – Occasional | Low |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Vessel equipped and crewed in accordance with Australian maritime requirements. | This control is effective in avoiding MDO releases from bunkering incidents. Crew qualifications and experience reduce the likelihood of an incident occurring. | **C 15.1** | **EPS 6.1.1**<br>Refer to **Section 5.2.6**. |
| Spill clean-up kits available in high risk areas. | This control is effective in reducing the likelihood of spilled hydrocarbons or chemicals reaching the environment. Spill kits are required as part of vessel SOPEPs. Contaminated material from used spill kits is disposed of accordingly. | **C 12.3** | **EPS 12.3.1**<br>Refer to **Section 5.3.5**. |
| Vessel-specific bunkering procedures and equipment consistent with Santos marine vessel vetting requirements. | This control effective in avoiding MDO releases from bunkering incidents. Suitable vessel-specific procedures and communications, reduces the likelihood of an incident occurring. | **C 15.2** | **EPS 15.2.1**<br>Santos will confirm vessel bunkering procedures include:<br>+ defined roles and responsibilities – bunkering to be undertaken by trained staff<br>+ use of bunkering hoses that have quick connection couplings<br>+ visual inspection of hose prior to bunkering to confirm they are in good condition and correct valve line up<br>+ assessment of weather and sea state<br>+ testing emergency shutdown mechanism on the transfer pumps<br>+ established communication protocols between vessel master and personnel responsible for monitoring tank levels, leaks and overflows during bunkering operations<br>+ continual visual monitoring during diesel transfers of hoses, connections and tank levels to detect leaks and prevent overflows during bunkering operations. |
| Implement tiered spill response in the event of an MDO spill. | This control is effective in reducing the potential impacts of an MDO release from a bunkering incident. Santos has developed a tiered response strategy (described in the OPEP - BAA-100 0330) that scales to the needs of the spill. | **C 14.2** | **EPS 14.2.1**<br>Refer to **Section 5.3.5**. |

| | | | |
|---|---|---|---|
| No bunkering within 20 km of the Tiwi Islands (including Seagull Island) | This control is effective in reducing the potential impacts of an MDO release from a bunkering incident. | **C 15.3** | **EPS 15.3.1**<br>All bunkering undertaken more than 20 km from the Tiwi Islands (including Seagull Island. |
| Procedures for helicopter refuelling. | Suitable procedures and communications, reduces the likelihood of an incident occurring. | **C 15.4** | **EPS 15.4.1**<br>Refuelling procedures to include:<br>+ a completed PTW and/or JSA for the activity<br>+ continual visual monitoring of gauges, hoses, fittings and the sea surface during the activity<br>+ hose and fittings checks prior to commencement of the activity<br>+ weather conditions to be assessed prior to the activity. |

| ***Additional Controls*** | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No bunkering of fuel during the pipeline installation activity. | No | No | Vessels will routinely bunker when in port, as this is the safest and most cost-effective means to refuel vessels. However due to the gas export pipeline installation method, the pipelay vessel cannot bunker in port and requires bunkering within the operational area to undertake the activity.<br>Following implementation of the selected existing controls, the risk reduction associated with eliminating bunkering at sea is considered to be negligible. The potential impacts to schedule and associated cost of implementing the control is considered to be grossly disproportionate to the reduction in risk. The control has not been adopted. | N/A |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |

| | | | | |
|---|---|---|---|---|
| ***Administrative*** | | | | |
| No bunkering during night hours during the petroleum activity. | No | No | Bunkering only during daylight hours increases the likelihood of detecting a leak, as surface hydrocarbon sheens are typically more visible under sunlight. Bunkering operations are typically completed during daylight hours; however, circumstances may occur where bunkering is required during darkness (e.g. large volume transfers at slow rates or when bunkering is safer to perform at night due to prevailing metocean conditions).<br>Following implementation of the selected existing controls, the risk reduction associated with prohibiting bunkering during darkness is considered to be negligible. The cost of implementing the control is considered to be grossly disproportionate to the reduction in risk. The control has not been adopted. | N/A |

**ALARP Statement**

Based on the outcomes of the risk assessment and through the implementation of controls throughout the activity, Santos considers that the risks to the marine environment from a refuelling incident are reduced to ALARP. EPOs, EPSs and MC applicable to undertaking the spill response are detailed in **Section 5.3.10**.

Relevant legislative requirements and standard industry practices have been applied to control the risk. Additional controls have been evaluated; all additional controls considered were rejected as the reduction in risks was considered to be grossly disproportionate to the cost of implementation. The controls selected for implementation are effective in reducing the risk of a hydrocarbon release from a refuelling incident. Santos considers the controls adopted are commensurate to the nature and scale of the risks.

**Summary of Alignment with EPBC Management Plans (where applicable)**

| *Relevant Receptor* | *Relevant Plan/ Conservation Advice* | *Specific Requirements Relevant to Pipeline Installation* | *Demonstration of Alignment* |
|---|---|---|---|
| Pollution, such as could occur from a hydrocarbon spill, is identified as a threat in conservation advice for several marine species that may occur in the operational area and as a threat in the North Marine Parks Network Management Plan 2018 as detailed in **Section 5.3.7**. Refer to **Section 5.3.7** for discussion on alignment with the relevant plans. | | | |

| | |
|---|---|
| **Levels of Acceptable Impact** | |
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with bunkering are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate.<br>+ Small spills are not expected to reduce overall long-term, broad-scale health, diversity and productivity of the environment. |
| **Legislative requirements** | The controls implemented are consistent with the requirements of relevant legislation, including *Navigation Act 2012* (Cth), the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth), Marine Order 94, Marine Order 95. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ Oil spill preparedness and response strategies are considered applicable to the nature and scale of the risk and associated impacts of the response are reduced to ALARP.<br>+ Aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to ensure alignment.<br>Pollution, such as could occur from unplanned release of hydrocarbon from bunkering, is identified as a threat in conservation advice for several marine species that may occur in the operational area. Santos considers the selected controls are effective in managing the risk to these species to a level that is acceptable. |
| **EPOs (Table 6-1)** | |
| **EPO 15**<br>No marine diesel releases to the marine environment as a result of refuelling. | |

### 5.3.9 Atmospheric emissions: dry natural gas release from Bayu-Undan pipeline loss of containment

| **Risk** | Loss of Bayu-Undan pipeline containment resulting in dry gas release |
|---|---|
| **Aspect-receptor reference (Table 5-5)** | 17D – Air quality<br>17J – Marine mammals<br>17K – Marine reptiles<br>17M – Seabirds and migratory shorebirds<br>17T – Commercial fishing<br>17U – Traditional fishing<br>17V – Tourism and recreational activities<br>17W – Port and commercial shipping |

**Description of the Source of Risk**

The proposed gas export pipeline will terminate near the Bayu-Undan pipeline; therefore, activity vessels will be operating in the vicinity of the Bayu-Undan pipeline. Activities will include lifting, the PLET foundation and the PLET, and pipeline initiation structure (if pipeline installation commences at the downstream PLET). Santos has identified a rupture of the Bayu-Undan pipeline may be caused by damage to the pipeline for initiation structure impact/drag or dropped object. A pipeline rupture will result in a release of dry gas to the environment.

The scale of the Bayu-Undan pipeline leak is dependent on the nature of the rupture. Small 'pinhole' leaks will result in a stream of bubbles which may dissolve before reaching the surface. A major rupture (e.g. catastrophic failure) would result in the discharge of a volume 151,000 $m^3$ of dry gas forming a large plume in the water column and dispersing into the atmosphere. A catastrophic failure is considered to be the worst-case credible release from the Bayu-Undan Pipeline.

The Bayu-Undan Pipeline transports dry gas (i.e. no liquid phase hydrocarbons) from the Bayu-Undan field to the DLNG Plant. Given the contents of the Bayu-Undan Pipeline consists entirely of dehydrated gas, no liquid phase hydrocarbons will be released to the environment as a result of a Pipeline loss of containment. Given the pressure and temperature differential between the contents of the Bayu-Undan Pipeline and the receiving environment, condensation of gas phase components of the dry gas will not occur upon release.

**Potential Impacts**

A gas plume would be released from the Bayu-Undan Pipeline in the event of a rupture. The plume would move towards the surface, with some of the gas becoming dissolved in seawater as the plume rises. A worst-case rupture would lead to the formation of a large gas cloud, which would rapidly disperse in the atmosphere. Methane (the main component of the dry gas) is lighter than air and would rise into the atmosphere, away from the release location.

The gas cloud may result in impacts to air-breathing fauna, such as marine mammals, marine reptiles and birds. Animals breathing in the immediate vicinity of the release may be asphyxiated, potentially resulting in mortality. Given the dispersion of gas into the atmosphere, this potential effect would be highly localised to the release location.

The gas cloud poses a risk to the health and safety of other users, such as fishers (traditional and commercial), tourism and recreational users. A gas cloud could potentially form an explosive mix which, if ignited, result in injury/death and damage to property. However, all other marine users will be excluded from the exclusion zone and therefore will not be within 500 m of an event, if it occurs.

**Risk Assessment**

| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
|---|---|---|---|
| ***Residual risk*** | II – Minor | B – Unlikely | Very Low |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Implement standards and procedures for lifting equipment. | This control is effective in reducing the likelihood of a suspended load being dropped. Engineering standards for load-bearing lifting equipment are widely used in the offshore industry and well understood. Suitable lifting procedures consider a range of technical and environmental factors to reduce the risk of loss of control of a suspended load. | **C 8.1** | **EPS 8.1.1**<br>Santos will confirm the vessel procedures for lifting include:<br>+ lifting operations to be undertaken by competent personnel<br>+ use of appropriate and certified lifting equipment and accessories<br>+ preventative maintenance will be undertaken on the key lifting equipment as per manufacturer's specifications<br>+ consideration of weather conditions (e.g. no heavy lifts undertaken in severe weather conditions). |
| Implement procedures for lifting over live infrastructure. | This control is effective in reducing the likelihood of a suspended load being dropped. Engineering standards for load-bearing lifting equipment are widely used in the offshore industry and well understood. Suitable lifting procedures consider a range of technical and environmental factors to reduce the risk of loss of control of a suspended load. | **C 16.1** | **EPS 16.1**<br>Santos will confirm the vessel procedures for lifting over live infrastructure include:<br>+ the vessel is offset from the Bayu-Undan pipeline<br>+ then objects are slowly 'walked' to the target location at a reduced height above the seabed. |
| Emergency response implemented to mitigate impacts in the event of a loss of containment from the Bayu-Undan Pipeline. | This control is effective in mitigating the impact of a leak from the from the Bayu-Undan Pipeline. The emergency response has been developed based on the safety case for the Bayu-Undan Pipeline. | **C 16.2** | **EPS 16.2.1**<br>The Bayu-Undan Emergency Response Plan (ALL/HSE/ER/003) and the Pipeline Emergency Repair Management Plan (H8-10000005136) to be followed in the event of an impact to the Bayu-Undan Pipeline. |

| *Additional Controls* | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |

| Administrative | | | |
|---|---|---|---|
| No additional controls identified. | | | |
| **ALARP Statement** | | | |
| Based on the outcomes of the risk assessment and the implementation of controls throughout the activity, Santos considers that the impacts and risks to the environment and other users from a dry gas release from a Pipeline loss of containment are reduced to ALARP.<br>Relevant legislative requirements and standard industry practices have been applied to control the risk. The controls selected for implementation are effective in reducing the risk of a dry gas release from a Pipeline loss of containment. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts. No credible additional controls were identified. | | | |
| **Summary of Alignment with EPBC Management Plans (where applicable)** | | | |
| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| No relevant management plans identified. | | | |

| Levels of Acceptable Impact | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with a dropped object/initiation structure drag resulting in the release of dry natural gas are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate. |
| **Legislative requirements** | No legislative requirements are applicable. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ Emergency response plans are considered applicable to the nature and scale of the risk and associated impacts of the response are reduced to ALARP.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign; consultation in support of the EP has identified other users that may potentially be affected and provided sufficient opportunity to provide feedback<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to ensure alignment.<br>Pollution, such as could occur from a hydrocarbon spill, is identified as a threat in conservation advice for several marine species that may occur in the operational area and as a threat in the North Marine Parks Network Management Plan 2018. Santos considers the selected controls are effective in managing the risk to these species and the Oceanic Shoals Marine Park to a level that is acceptable. |
| **EPOs (Table 6-1)** | |
| **EPO 16**<br>No releases of gas from the Bayu-Undan pipeline to the environment as a result of impact/drag or dropped object from the pipeline installation activities. | |

## 5.3.10 Response strategy implementation

| Risk | Implementation of inappropriate response strategies in response to a significant hydrocarbon spill |
|---|---|
| **Aspect-receptor reference (Table 5-5)** | 16B – Water quality<br>16J – Marine mammals<br>16K – Marine reptiles<br>16L – Sharks and rays<br>16M – Seabirds and migratory shorebirds |

**Description of the Source of Risk**

Accidents or emergencies during the gas export pipeline installation campaign may warrant implementation of emergency response activities. Santos has identified one risk event that may warrant implementation of an emergency response, being:

+ hydrocarbon spill warranting the implementation of spill response tactics.

Further description of the hydrocarbon spill response is provided below. Refer to the OPEP (**Appendix G**) for additional information on response tactics.

**Hydrocarbon Spill Response Tactics**

In the event of a hydrocarbon spill during the gas export pipeline installation campaign, Santos may implement a spill response to maintain situational awareness or reduce the potential impacts. Two credible worst-case spill scenarios were identified for the installation of the pipeline, being:

1. an MDO release from vessel collision, resulting in up to 700 $m^3$ released to the marine environment (**Section 5.3.7**)
2. an MDO release from a bunkering incident, resulting in up to 10 $m^3$ released to the marine environment (**Section 5.3.8**.

Santos has undertaken a Net Environmental Benefit Analysis (NEBA) assessment of response options (**Appendix C**), which resulted in a suite of primary and secondary response options being selected for use in the OPEP. Primary response options are implemented for all scenarios triggering Tier 1 or greater incident response. Secondary response options may be implemented if determined to result in a net environmental benefit during the spill response. The suite of response options considered in the OPEP are:

+ primary response options:
  - monitor and evaluate.
+ secondary response options:
  - wildlife response – hazing
  - pre-emptive capture/post-contact wildlife response.

All response options were assessed using a pre-operational NEBA. Given some response options have the potential to result in environmental damage, all secondary response options will be subject to an operational NEBA prior to implementation. Refer to the OPEP (**Appendix G**) for additional information and **Section 7.11** for relevant EPOs, EPSs and MC.

| Potential Impacts |
|---|
| **Monitor and Evaluate**<br>The monitor and evaluate option for the credible spill scenarios during the gas export pipeline installation campaign will typically be conducted from deployment of oil spill tracking buoys and vessels. Aerial platforms may supplement observations from vessels. The environmental risks and impacts from vessel operations have been considered elsewhere in this EP. Vessels implementing the monitor and evaluate response option will comply with the requirements for vessels in this EP.<br>**Wildlife Response – Hazing**<br>Implementation of the wildlife hazing secondary response option relies on behavioural disturbance to encourage animals to avoid areas where hydrocarbons above impact thresholds may be present. Methods used will depend on the fauna at risk (e.g. acoustic deterrents for birds). The behavioural disturbance may interfere with normal animal behaviours, such as foraging. MDO from the credible spill scenarios is expected to disperse rapidly in the marine environment, as such the window of opportunity for this response option is in the order of hours to days. As such, the potential behavioural impacts of this response option are temporary.<br>**Pre-Emptive Capture/Post-Contact Wildlife Response**<br>The capture of wildlife (either pre-emptive or post-contact) may result in considerable stress on animals, particularly when oiled animals are cleaned. MDO from the credible spill scenarios is expected to disperse rapidly in the marine environment, as such the window of opportunity for this response option is in the order of hours to days. Given the non-persistent nature of the hydrocarbon, the potential for oiled wildlife requiring cleaning is considered to be very low.<br>Cleaning of oiled wildlife will result in the generation of wastes which may be contaminated with hydrocarbons. Oily wastes may result in secondary contamination if not handled and disposed of effectively. |

| Risk Assessment | | | |
|---|---|---|---|
| | ***Consequence*** | ***Likelihood*** | ***Risk rating*** |
| ***Residual risk*** | II – Minor | B – Unlikely | Low |

| Controls and Demonstration of ALARP | | | |
|---|---|---|---|
| *Existing Controls* | | | |
| ***Control*** | ***Effectiveness*** | ***Reference (Table 6-1)*** | ***Environmental Performance Standard*** |
| Undertake operational NEBA during implementation of OPEP. | This control is effective in reducing the potential of implementation of response options with no net environmental benefit. Several of the secondary response options may result in environmental impacts, which warrant consideration prior to implementation. The operational NEBA framework provides the Incident Management Team (IMT) implementing the OPEP with the means to undertake as assessment of the environmental benefit of the secondary response options. | **C 17.1** | **EPS 17.1.1**<br>IMT to undertake spill response (operational) NEBA to determine applicable response strategies, initiation and termination of response options. |

| *Additional Controls* | | | | |
|---|---|---|---|---|
| ***Additional control*** | ***Practicable?*** | ***Will it be applied?*** | ***Justification*** | ***Environmental Performance Standard*** |
| ***Elimination*** | | | | |
| No additional controls identified. | | | | |
| ***Substitution*** | | | | |
| No additional controls identified. | | | | |
| ***Engineering*** | | | | |
| No additional controls identified. | | | | |
| ***Administrative*** | | | | |
| No additional controls identified. | | | | |

| **ALARP Statement** |
|---|
| Based on the outcomes of the risk assessment and through the implementation of controls throughout the activity, Santos considers that the impacts and risks to the marine environment from emergency response to be ALARP, with EPOs, EPSs and MC applicable to undertaking the oil spill response detailed in **Section 5.3.10**. Standard industry practices have been applied to control the risk. The control selected for implementation is effective in reducing the risks to the marine environment from emergency response. Santos considers the control adopted is commensurate to the nature and scale of the risk. No credible additional controls were identified. |

| **Summary of Alignment with EPBC Management Plans (where applicable)** | | | |
|---|---|---|---|
| ***Relevant Receptor*** | ***Relevant Plan/ Conservation Advice*** | ***Specific Requirements Relevant to Pipeline Installation*** | ***Demonstration of Alignment*** |
| Marine parks | North Network Management Plan 2018 | The Director of National Parks should be notified in the event of an oil pollution incident that occurs within, or may impact upon, an Australian Marine Park. | The OPEP (**Appendix G**) details how Santos will respond in the event of a spill and includes notification to the Director of National Parks. |

Santos

| Levels of Acceptable Impact | |
|---|---|
| **Risk is ALARP** | Yes – see ALARP statement. |
| **Principles of ESD** | The impacts associated with a dropped object/initiation structure drag resulting in the release of dry natural gas are considered to align with the principles of ESD based on the following:<br>+ Long-term and short-term social, economic and environmental factors have been considered and management measures identified where appropriate.<br>+ Biological diversity and ecological integrity are not expected to be significantly impacted by the implementation of the identified response strategies. |
| **Legislative requirements** | The controls implemented are consistent with the requirements of relevant legislation, including OPGGS Act. |
| **Internal requirements** | + Relevant corporate requirements to the gas export pipeline installation campaign, including the Communication and Stakeholder Engagement plans have been applied.<br>+ All controls and EPOs have been assessed against internal requirements to verify alignment.<br>+ Emergency response plans are considered applicable to the nature and scale of the risk and associated impacts of the response are reduced to ALARP.<br>+ The installation campaign aligns with Santos Management System and Santos Environment Health and Safety Policy. |
| **External requirements** | Santos has:<br>+ consulted with relevant stakeholders and considered all statements and claims made during this process when assessing impacts and risks of the gas export pipeline installation campaign<br>+ assessed all controls and EPOs against outcomes from stakeholder consultation to ensure alignment.<br>Consultation in support of the EP has identified relevant and interested persons, such as wildlife management agencies and non-government organisation, that may have functions, interests and activities that relate to marine fauna. No claims or objections were raised in relation to the risk of response strategies options to marine fauna. |
| **EPOs (Table 6-1)** | |
| **EPO 17**<br>In the event of a hydrocarbon spill, Santos will manage the risks of implementing appropriate response strategies to reduce the potential impacts to the environment. | |

# 6. Environmental performance outcomes, standards and measurement criteria

For each environmental aspect (risk) and the associated impacts, as identified and assessed in **Section 5**, specific EPO(s), EPSs and MC have been developed. The EPSs are related to the control measures that will be implemented to achieve the relevant EPO(s). The MC provide the evidence base to demonstrate that the EPOs and EPSs are being achieved.

This section details the EPOs, EPSs, and MC that have been developed as part of a systematic approach to the management of the environmental risks (**Section 5**) to ALARP and acceptable levels. The EPOs, EPSs and MC detailed in this EP are consistent with relevant legislation and other requirements (e.g. international conventions, guidelines, etc) and Santos internal standards and procedures.

The 'Aspect-receptor reference' and EPO numbering have been included to provide a clear link to the environmental risk assessment (**Section 5**) and demonstrate that all risks have relevant EPOs and standards. The tables also identify key responsible and accountable personnel who will confirm that the records/documents required by the MC are captured and reflected in the appropriate internal and external environmental performance reports.

Any new, or proposed amendment to a control measure, EPS or EPO will be managed in accordance with the Environment Management of Change Procedure (EA-91-IQ-10001) (**Section 7.7.5**).

EPOs, EPSs and MC applicable to oil pollution response are detailed separately within the activity OPEP.

*Table 6-1: Compiled list of environmental performance outcomes, standards and measurement criteria*

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| ***Physical Presence*** | | | | | |
| Interactions between activity vessels, the gas export pipeline and other marine users | **EPO 1**<br>No adverse interactions[5] between other marine users and activity vessels or the gas export pipeline. | **C 1.1**<br>Activity vessels equipped and crewed in accordance with Australian maritime requirements. | **EPS 1.1.1**<br>Vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 21 (Safety and emergency procedures), including:<br>– safety measures such as manning and watchkeeping.<br>+ Marine Order 27 (Safety of navigation and radio equipment), including:<br>– radio equipment and communications<br>– navigation safety measures and equipment<br>– danger, urgency and distress signals and messages.<br>+ Marine Order 30 (Prevention of Collisions), including:<br>– lights and signals as applicable to vessel class per COLREGS requirements.<br>+ Marine Order 71 (Masters and Deck Officers), including:<br>– all master, mate and watchkeeper officer duties undertaken by crew certified as applicable to vessel class per STCW requirements. | **MC 1.1.1.1**<br>Records of Santos marine vessel vetting process demonstrate compliance with SOLAS, AMSA, COLREGS, STCW Convention and applicable Marine Orders.<br>**MC 1.1.1.2**<br>Non-compliance with relevant Marine Orders 21, 27, 30 and 71 during the gas export pipeline installation campaign and corrective action undertaken documented. | Santos Marine Director |

[5] Examples of adverse interactions may include substantiated complaints by other marine users to Santos or NOPSEMA, vessel collisions, or damage to unsupervised fishing equipment (e.g. traps).

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 1.2**<br>Undertake consultation with relevant persons (including applicable notifications) to support gas export pipeline installation campaign. | **EPS 1.2.1**<br>Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan. | **MC 1.2.1.1**<br>Consultation records demonstrate implementation of a stakeholder consultation plan. | Santos External Relations Advisor |
| | | | **EPS 1.2.2**<br>AHS Notice to Mariners and AMSA MSI will be notified prior to relevant gas export pipeline installation activities. | **MC 1.2.2.1**<br>Consultation records demonstrate AHS and AMSA MSI provided sufficient information to generate Notice to Mariners prior to relevant gas export pipeline installation activities. | Vessel Master |
| | | | **EPS 1.2.3**<br>Subsea infrastructure and gas export pipeline will be clearly marked on Australian nautical charts published by the AHO. | **MC 1.2.3.1**<br>Inspection of nautical charts confirms subsea infrastructure and gas export pipeline is marked appropriately. | Santos HSE Manager |
| | | **C 1.3**<br>PLET at the downstream tie-in location has been designed with anti-snag protection. | **EPS 1.3.1**<br>PLET at the downstream tie-in Location is designed with anti-snag protection. | **MC 1.3.1.1**<br>Design drawings and as built surveys demonstrate PLET at the downstream tie-in location designed and installed with anti-snag protection. | Santos Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 1.6**<br>Anti-snag protection for mechanical support structures. | **EPS 1.6.1**<br>Anti-snag protection for any mechanical support structures installed shall be considered in detailed engineering and potential snagging mitigated accordingly. | **MC 1.6.1.1**<br>Design drawings and as built surveys demonstrate snagging risk considered and mitigated accordingly. | Santos Gas Export Pipeline Package Lead |
| | | **C 1.4**<br>One vessel will act as a surveillance vessel within the immediate vicinity of the pipelay vessel during pipelay. | **EPS 1.4.1**<br>An activity vessel will remain in proximity to the pipelay vessel to act as a surveillance vessel during pipelay. | **MC 1.4.1.1**<br>Vessel daily reports record activities. | Santos Gas Export Pipeline Package Lead |
| | | **C 1.5**<br>Communications plan will be implemented for engagement with marine users. | **EPS 1.5.1**<br>Communications plan will be implemented for engagement with marine users. | **MC 1.5.1.1**<br>Consultation records demonstrate implementation of a communication plan. | Santos External Relations Advisor |
| | | **C.1.7**<br>Pipeline installation activities undertaken in accordance with Santos HSE management and marine vessel vetting processes. | **EPS 1.7.1**<br>Pipeline installed in accordance with Santos HSE management and marine vessel vetting process, including the establishment of a 500 m exclusion zone. | **MC 1.7.1.1**<br>Daily operational reports demonstrate the implementation of the 500 m exclusion zone around the pipelay and construction vessels. | Santos Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| Seabed disturbance | **EPO 2**<br>Direct impacts to benthic habitats will be restricted to the footprint of the pipeline and supporting structures.<br>Beyond the footprint of the pipeline and supporting structures impact will be limited to localised, short term disturbance associated with suspension and deposition of surface sediment. | **C 2.2**<br>Confirmation of gas export pipeline route prior to and during installation | **EPS 2.2.1**<br>Gas export pipeline route to be surveyed and confirmed prior to installation. | **MC 2.2.1.1**<br>Records confirm pre-lay gas export pipeline route surveys completed. | Santos Gas Export Pipeline Package Lead |
| | | | **EPS 2.2.2**<br>Gas export pipeline position to be continuously verified during installation. | **MC 2.2.2.1**<br>Records confirm gas export pipeline route surveys completed during installation. | |
| | | | **EPS 2.2.3**<br>Adherence to the Unexpected Finds Protocol when positioning the pipeline. | **MC 2.2.3.1**<br>Records confirm gas export pipeline avoids any discovered cultural heritage site or has managed site disturbance in accordance with the protocol. | |
| | | **C 2.3**<br>DP pipelay vessel will be used for installation of the pipeline. | **EPS 2.3.1**<br>Pipelay vessel will use DP at all times during pipelaying operations. | **MC 2.3.1.1**<br>Records confirm DP pipelay vessel is contracted for gas export pipeline installation campaign. | |
| | | **C 2.4**<br>DGPS for pipelay vessel to maintain accurate vessel position during installation. | **EPS 2.4.1**<br>Pipelay vessel will use DGPS at all times during pipelaying operations. | **MC 2.4.1.1**<br>Contract specifies that pipelay installation vessel required to have DGPS. | Santos Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 2.5**<br>Survey technology used to ensure all structures are installed within designed tolerances. | **EPS 2.5.1**<br>Checks prior to PLET installation to confirm:<br>+ DGPS used to confirm initiation structure position during installation<br>+ underwater positioning system (USBL/LBL) and ROV to confirm PLET installation location and positioning (within required location accuracy to reduce disturbance to the seabed. | **MC 2.5.1.1**<br>Procedures require location of PLETs checked prior to installation. As installed records confirm pipeline location. | Santos Gas Export Pipeline Package Lead |
| | | **C 2.6**<br>Placement of initiation structure for pipelay initiation to avoid sensitive benthic habitats and mitigate initiation structure dragging. | **EPS 2.6.1**<br>Initiation structure plan developed based on pre-lay survey information and include:<br>+ requirement for trained and experienced vessel crews<br>+ continuous monitoring of initiation wire tensions to prevent drag on seabed during pipelay<br>+ review of initiation structure plan to verify initiation structure location avoids sensitive habitat. | **MC 2.6.1.1**<br>Records confirm initiation structure plan is implemented and includes relevant requirements. | Santos Gas Export Pipeline Package Lead |
| | | **C 2.7**<br>No planned anchoring in the Habitat Protection Zone (IUCN IV) – Zone 2 of the Oceanic Shoals Marine Park or on named Shoals and Banks, unless it is required in an emergency. | **EPS 2.7.1**<br>All anchoring restricted to the areas beyond named banks and shoals. | **MC 2.7.1.1**<br>Project documentation states no anchoring areas around banks and shoals. | Santos Gas Export Pipeline Package Lead |
| | | | **EPS 2.7.2**<br>Activity vessels shall not anchor in the Habitat Protection Zone (IUCN IV) – Zone 2 of the Oceanic Shoals Marine Park, unless it is required in an emergency. | **MC 2.7.2.1**<br>Project documentation states no anchoring within the Habitat Protection Zone of the Oceanic Shoals Marine Park. | |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 2.8**<br>No pipeline installation activities within Olive Ridley turtles internesting BIA. | **EPS 2.8.1**<br>All gas export pipeline installation activities restricted to areas beyond the Olive Ridley turtle internesting BIA. | **MC 2.8.1.1**<br>Pipeline alignment sheets demonstrate that pipeline route avoids Olive Ridley BIA. | Santos Gas Export Pipeline Package Lead |
| | | **C2.10**<br>Sequence activities to minimise the time pipelay, and associated activities, are performed within peak internesting periods in important habitat for listed marine turtles. | **EPS 2.10.1**<br>Planning for pipelay installation (including span rectification) shall consider turtle internesting season and activities shall be sequenced to avoid with peak periods where the pipeline integrity is not compromised as a result. | **MC 2.10.1.1**<br>Pipelay installation schedule considers turtle peak internesting season and the direction of pipelay is selected to minimise the time pipelay, and associated activities, are performed within peak internesting periods in important habitat for listed marine turtles. | Santos Gas Export Pipeline Package Lead |
| | | **C 2.11**<br>Pre-lay and post-lay surveys at pipeline initiation structure location. | **EPS 2.11.1**<br>The pipeline initiation structure shall be placed on a bare area of seabed.<br>**EPS 2.11.2**<br>Pre- and post-lay surveys of pipeline initiation location will be undertaken. | **MC 2.11.1.1**<br>Records confirm pre-lay surveys of initiation structure location completed, and pipeline initiation structure placed on a bare area of seabed. | Santos Senior Client Site Representative |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C2.12**<br>Span-specific rectification plans developed that include:<br>+ pre-span method selection<br>+ real-time monitoring of span rectification<br>+ post-rectification inspections. | **EPS 2.12.1**<br>Span-specific procedures developed for all span rectifications that include:<br>+ provision for real-time monitoring of span rectification activities<br>+ post-rectification inspection of spans. | **MC 2.12.1.1**<br>Records confirm span rectification procedures developed. | Santos Gas Export Pipeline Package Lead |
| | | **C2.13**<br>Limiting duration for continuous mass flow excavation at any one location. | **EPS 2.13.1**<br>Mass flow excavation procedures, shall include the requirement to limit mass flow excavation at any one location to no greater than 12 hours within a 24-hour period. | **MC 2.13.1.1**<br>Mass Flow Excavation procedures contain the requirement for limiting the duration of mass flow exaction to 12 hours within a 24-hour period. | Santos Gas Export Pipeline Package Lead |
| | **EPO 18**<br>No significant impacts to cultural features from the Activity. | **C2.14**<br>Cultural heritage | **EPS 2.14.1**<br>+ Cultural Heritage monitors to accompany the construction crew to conduct cultural training, ensure a culturally appropriate figure is present and introduce the Activity to the seas and the spiritual beings (unless recorded by Santos that relevant senior and authoritative Tiwi Islanders do not want the attendance of cultural heritage monitors for any or all of these purposes).<br>+ Community benefits package. | **MC 2.14.1.1**<br>Progress reporting as part of the EP Annual Environmental Report. | Santos Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| Dropped objects | **EPO 8**<br>No loss of equipment/cargo overboard from vessels resulting in a Consequence Severity greater than Minor. | **C 8.1**<br>Implement standards and procedures for lifting equipment. | **EPS 8.1.1**<br>Santos will confirm the vessel procedures for lifting include:<br>+ lifting operations to be undertaken by competent personnel<br>+ use of appropriate and certified lifting equipment and accessories<br>+ preventative maintenance will be undertaken on the key lifting equipment as per manufacturer's specifications<br>+ consideration of weather conditions (e.g. no heavy lifts undertaken in severe weather conditions). | **MC 8.1.1.1**<br>Records demonstrate lifting procedures in place. | Contractor Project Manager |
| | | **C 8.2**<br>Dropped objects recovered where safe and practicable to do so. | **EPS 8.2.1**<br>All dropped object incidents to assess the environmental risk and the potential to recover the object, and objects will be recovered where safe and practicable to do so. | **MC 8.2.1.1**<br>Incident documentation details considerations and outcomes of recovery of dropped objects. | Contractor Project Manager |
| Introduction of invasive marine species | **EPO 9**<br>Prevent the displacement of native marine species as a result of the introduction and establishment of IMS via activity vessels. | **C 9.1**<br>Vessels equipped with effective anti-fouling coatings. | **EPS 9.1.1**<br>Vessels will have a suitable anti-fouling coating in accordance with the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) (as applicable for vessel size, type and class), including:<br>+ Marine Order 98 (Marine Pollution – Anti-fouling Systems) including (as required by vessel class):<br>  – a valid International Anti-fouling System Certificate. | **MC 9.1.1.1**<br>Non-compliances with Marine Order 98 during gas export pipeline installation activities and corrective action undertaken documented.<br><br>**MC 9.1.1.2**<br>Records of valid vessel's International Anti-fouling Systems Certificates documented and saved on file. | Vessel Master |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 9.2**<br>Vessels undertake ballast water management or treatment to achieve low-risk ballast water. | **EPS 9.2.1**<br>Ballast water discharges will comply with the requirements of the Australian Ballast Water Management Requirements, which implements the requirements of the *Biosecurity Act 2015* (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for vessel class), including:<br>+ no discharge of high-risk ballast water within 12 nautical miles of coastlines, including any ports<br>+ maintain a ballast water record system to record the management of all ballast water taken up and discharged<br>+ implementation of approved methods of ballast water management<br>+ vessel equipped with Ballast Water Management Plan<br>+ | **MC 9.1.2.1**<br>Records of ballast water discharge logs to confirming no discharge within 12 nautical miles of coastlines including any ports and Ballast Water Management Plan documented and saved on file.<br>**MC 9.1.2.2**<br>Internal inspections/audits confirm implementation of ballast water recording system and approved methods of ballast water management. | Vessel Master |
| | | **C 9.3**<br>Apply risk-based IMS management for vessels | **EPS 9.3.1**<br>Vessels will comply with the Australian Biofouling Management Requirements (2022) (as appropriate to class), including:<br>+ vessels equipped with a Biofouling Management Plan; and<br>+ vessels maintain a Biofouling Record Book. | **MC 9.3.1.1**<br>Records demonstrate vessels comply with the Australian Biofouling Management Requirements, including:<br>+ vessels equipped with a Biofouling Management Plan; and<br>+ vessels maintain a Biofouling Record Book. | Contractor Project Manager |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | | **EPS 9.3.2**<br>Vessels mobilised to the operational area from international or domestic waters will comply with the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Department of Agriculture, Fisheries and Forestry 2009):<br>+ Completion of IMS Risk Assessment (using either the Vessel Check system or as described in Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Department of Agriculture, Fisheries and Forestry 2009)<br>+ implementation of mitigation measures commensurate with the level of risk<br>+ only vessels classified as a low-level risk used on the project. | **MC 12.3.2.1**<br>Records demonstrate compliance with the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia, 2008), including:<br>+ IMS Risk Assessment (using either the Vessel Check system or as described in Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Department of Agriculture, Fisheries and Forestry 2009)<br>+ implementation of mitigation measures commensurate with level of risk. | Contractor Project Manager |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 9.5**<br>Marine Growth Prevention System | **EPS 9.5.1**<br>Vessels will have a marine growth prevention system or appropriate manual treatment systems. | **MC 9.5.1.1**<br>Records of quarantine management system process demonstrate vessels have a marine growth prevention system or appropriate manual treatment systems. | Contractor Project Manager |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| Collision with marine fauna | **EPO 10**<br>Zero incidents of injury or mortality of cetaceans and marine reptiles from collision with activity vessels operating within the operational area. | **C 10.1**<br>Avoid activities near cetaceans and turtles. | **EPS 10.1.1**<br>Vessels, excluding vessels which are unable to alter path while performing operations, will comply with EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles), specifically:<br>+ Apply the following Caution Zones, as per the meaning of Division 8.1 of the EPBC Regulations:<br>– 300 m for whales;<br>– 150 m for dolphins;<br>– 150 for turtles.<br>+ When operating a vessel or equipment within a Caution Zone:<br>– Operate the vessel or equipment at a constant speed of <6 knots and minimise noise.<br>– Make sure the vessel or equipment does not drift or approach closer than:<br>- 100 m for whales<br>- 50 m for dolphins, turtles or whale sharks.<br>– If the cetacean, turtle or whale shark shows signs of being disturbed, immediately withdraw (where safe to do so) from the Caution Zone at a constant speed of <6 knots.<br>+ Post a lookout for cetaceans, turtles and whale sharks while within a Caution Zone.<br>+ Not approach, pursue or restrict the movement of cetaceans, turtles or whale sharks. | **MC 10.1.1.1**<br>Non-compliances with EPBC Regulations– Part 8 Division 8.1 during gas export pipeline installation activities and corrective action undertaken documented | Vessel Master |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 10.2**<br>HSE inductions which will include environmental requirements | **EPS 10.2.1**<br>All crew will attend HSE inductions which will include environmental requirements as required by this Environment Plan | **MC 10.2.1.1**<br>Personnel training records documented and saved on file. | Contractor Project Manager |
| | | **C10.3**<br>Vessel speed restrictions within the operational area | **EPS 10.3.1**<br>Vessel speeds with the operational area will limited to 8 knots or less. | **MC10.3.1.1**<br>Speed limit requirements contained within project documentation. | Vessel Master |
| | | **C 2.8**<br>No pipeline installation activities will occur in the Olive Ridley turtles internesting BIA at any time | Refer to **EPS 2.8.1**. | | |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| ***Discharges*** | | | | | |
| Activity vessels | **EPO 6**<br>Reduce impacts to water quality from activity vessel discharges by maintaining discharge streams in accordance with standard maritime practices. | **C 6.1**<br>Routine discharges of treated sewage, grey water, putrescible waste, deck drainage, and bilge water in accordance with standard maritime practice. | **EPS 6.1.1**<br>Vessels shall be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 91 (Marine Pollution Prevention – Oil), including (as required by vessel class):<br>– Machinery space bilge/oily water shall have 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.<br>– A deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination.<br>– Waste oil storage is available.<br>– Have a valid International Oil Pollution Prevention (IOPP) Certificate.<br>– Have a vessel-specific SOPEP.<br>– Maintain an oil record book. | **MC 6.1.1.1**<br>Records of demonstrate compliance MARPOL73/78 Annex I, Annex IV and Annex V, and applicable Marine Orders. | Vessel Master |
| | | | | **MC 6.1.1.2**<br>Non-compliances with Marine Orders 91, 95 & 96 recorded during gas export pipeline activities and corrective action undertaken documented. | Vessel Master |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | | **EPS 6.1.2**<br>Vessels shall be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 96 (Marine Pollution Prevention – Sewage) including (as required by vessel class):<br>– a valid International Sewage Pollution Prevention (ISPP) Certificate<br>– a MARPOL approved sewage treatment plant;<br>– a sewage comminuting and disinfecting system;<br>– a sewage holding tank sized appropriately to contain all generated waste (black and grey water);<br>– discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land;<br>– 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. | | Vessel Master |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | | **EPS 6.1.3**<br>Vessels shall be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 95 (Marine Pollution Prevention – Garbage), including:<br>– Putrescible waste and food scraps are passed through a macerator prior to discharge so that it can pass through a screen with no opening wider than 25 mm.<br>– Garbage management plan is in place.<br>– Garbage record book is maintained onboard. | | Vessel Master |
| Pipeline dewatering and pre-commissioning fluids | **EPO 7**<br>No impacts to the marine environment from pipeline discharges resulting in a Consequence Severity greater than Minor. | **C 7.1**<br>Chemical selection procedure for all chemicals planned to be released to the marine environment. | **EPS 7.1.1**<br>All chemicals planned to be released to the marine environment will be assessed through the chemical selection procedure. | **MC 7.1.1.1**<br>Records demonstrate the chemical selection procedure has been implemented for all relevant chemicals. | Santos Environmental Advisor |
| | | **C 7.2**<br>Bulk dewatering will occur at the FPSO PLET location. | **EPS 7.2.1**<br>The bulk dewater will occur at the FPSO PLET location. | **MC 7.2.1.1**<br>Records demonstrate bulk dewatering was at the FPSO PLET location. | Santos Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 7.3**<br>Contractor FCGT procedures. | **EPS 7.3.1**<br>All FCGT will be conducted in line with the Contractor FCGT procedures. These will include:<br>+ metering of chemical injection volumes during flooding and hydrotest operations<br>+ dosing rates/optimised treatment rates for chemicals. | **MC 7.3.1.1**<br>Records demonstrate a FCGT procedure implemented which included metering of volumes. | Santos Senior Client Site Representative |
| | | **C7.4**<br>Vertical diffuser for all subsea discharges of treated seawater. | **EPS 7.4.1**<br>All subsea discharges of treated seawater will be through a vertical diffuser. | **MC 7.4.1.1**<br>Records demonstrate a vertical diffuser used for discharge of treated seawater. | Santos Gas Export Pipeline Package Lead |
| Subsea release from an unplanned pipeline wet buckle event/ stuck pig | **EPO 11**<br>Zero unplanned discharge of chemicals to the marine environment as a result of contingency dewatering. | **C 7.1**<br>Chemical selection procedure for all chemicals planned to be release to the marine environment. | **EPS 7.1.1**<br>Refer to **EPO 7**. | | |
| | | **C 7.3**<br>Contractor FCGT procedures. | **EPS 7.3.1**<br>Refer to **EPO 7**. | | |
| | | **C 11.1**<br>Pipeline designed with buckle arrests in deep water. | **EPS 11.1.1**<br>Buckle arresters installed as per design specifications. | **MC 11.1.1.1**<br>Alignment sheets show buckle arresters locations. | Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 11.2**<br>No discharge of chemically treated seawater in the Habitat Protection Zone of the Oceanic Shoals Marine Park. | **EPS 11.2.1**<br>No discharge of chemically treated seawater in the Habitat Protection Zone of the Oceanic Shoals Marine Park. | **MC 11.2.1.1**<br>Procedures contain requirement for no discharge of treated seawater within the Habitat Protection Zone of the Oceanic Shoals Marine Park. | Gas Export Pipeline Package Lead |
| | | **C 2.4**<br>DGPS for pipelay vessel to maintain accurate vessel position during installation. | EPS 2.4.1<br>Refer to **EPO 2**. | | |
| | | **C 11.3**<br>Pipeline Installation Procedures. | **EPS 11.3.1**<br>The contractor will have an installation procedure which will include:<br>+ alarm systems for dynamic positioning to indicate loss of vessel position<br>+ minimum tensioner alarms to ensure pipeline catenary is maintained<br>+ visual monitoring of pipeline relative to stinger<br>+ ROV Touchdown monitoring<br>+ rollerbox load monitoring. | **MC 11.3.1.1**<br>Installation procedures shall detail requirements implemented. | Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| Deck and minor subsea spills | **EPO 12**<br>Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of gas export pipeline installation activities. | **C 12.1**<br>Chemical and hydrocarbon storage areas designed to contain leaks and spills. | **EPS 12.1.1**<br>Selection of vessel contractor is subject to Santos marine vessel vetting processes, specifically:<br>+ appropriate procedures for storage (e.g. bunding), labelling (including Safety Data Sheet (SDS) available) and handling of chemicals and hydrocarbons<br>+ completion of vessel OVID inspection and report<br>+ implementation of a Permit to Work (PTW) or equivalent authorisation process (e.g. JSA) for transfers of hydrocarbon/chemicals (refer to bunkering for bunkering-specific controls). | **MC 12.1.1.1**<br>Records of contractor vessel audits demonstrate compliance with chemical and hydrocarbon storage and handling requirements and Marine Order 91 and 93. | Contractor Project Manager |
| | | **C 12.2**<br>Chemicals and hydrocarbons will be managed in accordance with standard maritime practices. | **EPS 6.1.1**<br>Refer to **EPO 6**. | | |
| | | | **EPS 12.2.1**<br>Marine Order 93 (Marine Pollution Prevention – Noxious Liquid Substances) including (as required by vessel class):<br>+ International Pollution Prevention (IPP) Certificate. | | |
| | | **C 12.3**<br>Spill clean-up kits available in high risk areas. | **EPS 12.3.1**<br>Selection of vessel contractor is subject to Santos marine vessel vetting processes, specifically:<br>+ spill kits stocked and ready for use by trained personnel. | **MC 12.3.1.1**<br>Contractor vessel audit process confirm spill kits stocked and ready for use. | |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 12.4**<br>Inspection and maintenance for all equipment using hydrocarbons and/or chemicals. | EPS 12.4.1<br>Selection of vessel contractor is subject to Santos vetting processes, specifically:<br>+ planned maintenance system in place on vessels. | **MC 12.4.1.1**<br>Records from Santos vessel vetting process confirm PMS schedule adhered to. | |
| | | **C 12.5**<br>ROV operations undertaken in accordance with good industry practice. | **EPS 12.5.1**<br>Procedures for ROV operations, including:<br>+ ROV inspections and maintenance<br>+ pre-mobilisation audit for all ROV systems. | **MC 12.5.1.1**<br>Procedures and audit records available for ROV operations. | |
| | | **C 7.1**<br>Chemical selection procedure for chemicals planned to be released to the marine environment. | **EPS 7.1.1**<br>Refer to **EPO 7**. | | |
| | | **C 12.6**<br>No Perfluorinated Chemicals (PFAS)/ Perfluorooctane sulfonate (PFOS) will be used in firefighting foam. | **EPS 12.6.1**<br>Fire-fighting foams shall be free of PFAS and PFOS. | **MC 12.6.1.1**<br>MSDS for firefighting foam will confirm no PFAS or PFOS. | Santos Environmental Specialist |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| Loss of hazardous and non-hazardous wastes | **EPO 13**<br>Zero unplanned discharge of hazardous and non-hazardous solid wastes into the marine environment as a result of gas export pipeline installation activities. | **C 13.1**<br>All wastes managed in accordance with vessel waste management plan. | **EPS 13.1.1**<br>Vessels will be suitably equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 95 (Marine Pollution Prevention – Garbage), including:<br>– garbage management plan in place<br>– types of wastes that will be generated onboard and will require containment, transport and disposal at a licensed facility onshore<br>– procedures for handling, storage segregation and disposal of wastes<br>– maintenance of Garbage Record Book, recording the types and volumes of waste incinerated or disposed onshore<br>– garbage record book maintained onboard. | See **MC 1.1.1.1**. | Vessel Master |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | | **EPS 13.1.2**<br>Vessels will be suitably equipped and crewed in accordance with the *Navigation Act 2012* (Cth) and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth) (as applicable for vessel size, type and class), including implementing:<br>+ Marine Order 94 (Marine Pollution Prevention – Packaged Harmful Substances), including (as required by vessel class):<br>– no disposal of harmful substances (identified as marine pollutants in the IMDG Code) overboard<br>– packaged harmful substances to be properly packed, marked, labelled, stowed and secured<br>– any loss or discharge to sea of harmful materials will be reported to the AMSA RCC via a marine pollution report (POLREP). | | Vessel Master |
| | | **C 13.2**<br>HSE inductions – cover requirements; e.g. label and cover waste skips and bins. | **EPS 13.2.1**<br>All crew will attend HSE inductions which will include requirements of the vessel waste management plan. | **MC 10.2.1.1**<br>Personnel training records documented and saved on file. | Contractor Project Manager |
| | | **C 13.3**<br>No end caps on pipes. | **EPS 13.3.1**<br>No end caps on pipe lengths that arrive in the operational area. | **MC 13.3.1.1**<br>Specifications require no end caps. | Gas Export Pipeline Package Lead |
| Marine diesel release from vessel collision | **EPO 14**<br>No marine diesel releases to the marine environment as a | **C1.1**<br>Activity vessels equipped and crewed in accordance with Australian maritime requirements. | **EPS 1.1.1**<br>Refer to **EPO 1**. | | |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | result of a vessel collision. | **C 1.2**<br>Undertake consultation with relevant persons (including applicable notifications) to support gas export pipeline installation campaign. | **EPS 1.2.1, 1.2.2** and **1.2.3**<br>Refer to **EPO 1**. | | |
| | | **C 1.4**<br>One vessel will act as a surveillance vessel within the operational area during gas export pipeline installation. | **EPS 1.4.1**<br>Refer to **EPO 1**. | | |
| | | **C 14.1**<br>Implement the vessel SOPEP. | **EPS 14.1.1**<br>Implement the vessel SOPEP in the event of an MDO spill. | **MC 14.1.1**<br>Records demonstrate that the SOPEP was implemented. | Vessel Master |
| | | **C 14.2**<br>Implement tiered spill response in the event of an MDO spill. | **EPS 14.2.1**<br>Implement tiered spill response in the event of an MDO spill. | **MC 14.2.1**<br>Records demonstrate that spill response options are delivered in accordance with OPEP (BAA-100 0330). | Santos HSE Manager |
| | | **C 14.3**<br>No IFO or HFO will be used in activity vessels. | **EPS 14.3.1**<br>No IFO or HFO in any activity vessel tanks. | **MC14.3.1.1**<br>Contract specifies no IFO on board any activity vessels in the operational area. | Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| Hydrocarbon release from refuelling incident | **EPO 15**<br>No hydrocarbon releases to the marine environment as a result of refuelling. | **C 15.1**<br>Vessel equipped and crewed in accordance with Australian maritime requirements. | **EPS 6.1.1**<br>Refer to **EPO 6**. | | |
| | | **C 12.3**<br>Spill clean-up kits available in high-risk areas. | **EPS 12.3.1**<br>Refer to **EPO 12**. | | |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 15.2**<br>Vessel-specific bunkering procedures and equipment consistent with Santos marine vessel vetting requirements. | **EPS 15.2.1**<br>Santos will confirm vessel bunkering procedures include:<br>+ defined roles and responsibilities – bunkering to be undertaken by trained staff<br>+ use of bunkering hoses that have quick connection couplings<br>+ Visual inspection of hose prior to bunkering to confirm they are in good condition and correct valve line up<br>+ assessment of weather and sea state<br>+ testing of emergency shutdown mechanism on the transfer pumps<br>+ established communication protocols between vessel master and personnel responsible for monitoring tank levels, leaks and overflows during bunkering operations<br>+ continual visual monitoring during diesel transfers of hoses, connections and tank levels to detect leaks and prevent overflows during bunkering operations. | **MC 15.2.1.1**<br>Vessel bunkering procedures in place. | Gas Export Pipeline Package Lead |
| | | **C14.2**<br>Implement tiered spill response in the event of an MDO spill. | **EPS 14.2.1**<br>Refer to **EPO 14**. | | |
| | | **C 15.3**<br>No bunkering within 20 km of the Tiwi Islands (including Seagull Island) | **EPS 15.3.1**<br>All bunkering undertaken more than 20 km from the Tiwi Islands (including Seagull Island). | **MC 15.3.1**<br>Bunkering procedures contain no bunkering within 20 km from Tiwi Islands (including Seagull Island). | Gas Export Pipeline Package Lead |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 15.4**<br>Helicopter refuelling. | Helicopter refuelling procedures to include:<br>+ a completed PTW and/or JSA for the activity<br>+ continual visual monitoring of gauges, hoses, fittings and the sea surface during the activity<br>+ hose and fittings checks prior to commencement of the activity<br>+ weather conditions to be assessed prior to the activity. | **MC15.2.1.1**<br>Helicopter refuelling procedures in place. | Gas Export Pipeline Package Lead |
| ***Atmospheric, Sound and Light Emissions*** | | | | | |
| Atmospheric emissions from vessels combustion engines and incinerators impacting on air quality | **EPO 5**<br>Reduce impacts to air quality from combustion engines and incinerators by maintaining atmospheric emissions in accordance with standard maritime practices. | **C 5.1**<br>Atmospheric emissions from combustion, incinerators and ODS managed in accordance with standard maritime practice. | **EPS 5.1.1**<br>Vessels will be suitably equipped and crewed in accordance with the *Navigation Act 2012* (Cth), including implementing:<br>+ Marine Order 97 (Marine Pollution Prevention – Air Pollution) including (as required by vessel class):<br>– a valid International Air Pollution Prevention (IAPP) Certificate and/or Engine International Air Pollution Prevention (EIAPP) Certificate and/or International Energy Efficiency (IEE) Certificate<br>– a Ship Energy Efficiency Management Plan (SEEMP)<br>– use of incinerators in accordance with Annex VI of the MARPOL Convention<br>– ODS record book<br>– use of low sulphur fuel. | **MC 5.1.1.1**<br>Records of Santos marine vessel vetting process demonstrate compliance with MARPOL73/78 Annex VI and applicable Marine Orders. | Santos GEP Delivery Manager |
| | | | | **MC 5.1.1.2**<br>Non-compliances with Marine Order 97 during gas export pipeline installation activities and corrective action undertaken documented. | Vessel Master |
| | | | | **MC 5.1.1.3**<br>Record of the activity vessel OVIDs obtained prior to mobilisation. | Santos GEP Delivery Manager |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| Atmospheric emissions from the release of dry gas impacting on air quality | **EPO 16**<br>No releases of gas from the Bayu-Undan Pipeline to the environment. | **C 8.1**<br>Implement standards and procedures for lifting equipment. | **EPS 8.1.1**<br>Refer to **EPO 8**. | | |
| | | **C16.1**<br>Implement procedures for lifting over live infrastructure. | **EPS 16.1.1**<br>Santos will confirm the vessel procedures for lifting over live infrastructure include<br>+ the vessel is offset from the Bayu-Undan pipeline<br>+ then objects are slowly 'walked' to the target location at a reduced height above the seabed. | **MC 16.1.1.1**<br>Procedures in place for lifting over live infrastructure. | Gas Export Pipeline Package Lead |
| | | **C 16.2**<br>Emergency response implemented to minimise potential for impacts in the event of a loss of containment from the Bayu-Undan Pipeline. | **EPS 16.2.1**<br>The Santos Bayu-Undan Emergency Response Plan (ALL/HSE/ER/003) and the Pipeline Emergency Repair Management Plan (H8-10000005136) to be followed in the event of an impact to the Bayu-Undan Pipeline. | **MC 16.2.1.1**<br>Records show the Santos Bayu-Undan Emergency Response Plan (ALL/HSE/ER/003) and the Pipeline Emergency Repair Management Plan (H8-10000005136) are in place and followed in the event of an impact to the Bayu-Undan Pipeline. | Santos GEP Delivery Manager |
| Light emissions from vessels and ROV altering | **EPO 4**<br>No significant impacts to turtle populations from installation of the | **C 2.8**<br>No pipeline installation activities within Olive Ridley turtles internesting BIA. | **EPS 2.8.1**<br>Refer to **EPO 2**. | | |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| marine fauna behaviour | gas export pipeline. | **C 5.9**<br>The pipelay vessel will have an enclosed pipe welding deck. | **EPS 5.9.1**<br>The pipelay vessel shall have an enclosed pipe welding deck to shield light emissions. | **MC 5.9.1.1**<br>Pipelay vessel specification demonstrate that the pipelay vessel has an enclosed pipe welding deck. | Gas Export Pipeline Package Lead |
| | | **C 5.10**<br>Crew transfers or loading of supplies (not including linepipe deliveries) which require direction of floodlights outside vessel will not occur during hours of darkness within 10 km of turtle nesting beaches during peak hatchling season. | **EPS 5.10.1**<br>From KP224 to KP240 between 01 April to 31 October, activities within the operational area that require direction of floodlights outside the vessels (crew transfers or loading of supplies but excluding linepipe deliveries) shall not be undertaken during hours of darkness. | **MC 5.10.1.1**<br>Vessel daily operational reports confirm that prohibited night-time activities did not occur. | Gas Export Pipeline Package Lead |
| | | **C2.10**<br>Sequence activities to minimise the time pipelay, and associated activities, are performed within peak internesting periods in important habitat for listed marine turtles. | Refer to **EPS 2.10.1**. | | |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 5.11**<br>Vessel searchlights will only be operated in an emergency situation. | **EPS 5.11.1**<br>Vessel searchlights shall only be operated in an emergency situation. | **MC 5.11.1.1**<br>Audit confirms that the vessel master is aware that search lights are to be operated only in an emergency situation. Visual observations confirm that search light not illuminated during routine pipelay activities. | Vessel Master |
| | | **C 5.12**<br>Minimise direct light spill on the ocean surface by adjusting orientation of lights and installing shielding when operating vessels within 10 km of marine turtle nesting habitat during peak hatchling emergence season. | **EPS 5.12.1**<br>Vessels operating (excluding transiting vessels) between KP224 and KP240 within the operation area between 01 April to 31 October require a qualitative assessment of vessel lighting to be undertaken to identify any lights causing light spill overboard from the vessel . | **MC 5.12.1.1**<br>Qualitative light assessment report identifies lights requiring reorientation or shielding. | Contractor Project Manager |
| | | | **EPS 5.12.2**<br>Prior to entering (excluding transiting vessels) between KP224 and KP240 within the operation area between 01 April to 31 October, direct light spill on the ocean surface shall be minimised by adjusting orientation of lights and installing shielding where it does not impact safety. | **MC 5.12.1.2**<br>Pipelay contractor confirms lights have been adjusted and shields installed within limitations. | |

| Risk/Impact | Environmental Performance Outcome | Control | Environmental Performance Standards | Measurement Criteria | Responsible Person |
|---|---|---|---|---|---|
| | | **C 5.13**<br>Communicate the requirement and implement light management measures when operating vessels within 10 km of marine turtle nesting habitat during peak nesting and hatchling emergence season. | **EPS 5.13.1**<br>Light management measures shall be implemented when operating vessels (excluding transiting vessels) between KP224 and KP240 within the operation area between 01 April to 31 October. Lighting management measures includes crew awareness through inductions and daily HSE meetings, the switching off of lights not operationally critical and the closing of curtains in sleeping accommodation. | **MC 5.13.1.1**<br>Induction records and records of daily HSE meetings confirm that crew are aware of light management requirements. | Contractor Project Manager |
| Underwater noise emissions | **EPO 3**<br>No significant impacts to marine fauna from noise generated during the gas export pipeline installation campaign. | **C 3.1**<br>Maintaining helicopter separation from cetaceans as per EPBC Regulations. | **EP 3 1.1**<br>Helicopters will comply with EPBC Regulations– Part 8 Division 8.3 Interacting with cetaceans, specifically:<br>+ Helicopters shall not operate lower than 1650 feet or within a horizontal radius of 500 m of a cetacean known to be present in the area, except for take-off and landing. | **MC 3.1.1.1**<br>Records demonstrate no breaches of EPBC Regulations– Part 8 Division 8.1 Interacting with cetaceans. | Helicopter Pilot |

# 7. Implementation strategy

This section details the implementation strategy for the activity, as required under Regulation 14 of the OPGGS(E) Regulations. The implementation strategy describes the arrangements for monitoring, review and reporting of environmental performance and the strategy to confirm the controls are implemented, maintained and effective for the in-force period of the EP. This will allow environmental impacts and risks to be continually managed to a level that is ALARP and acceptable, and EPOs and environmental performance standards to be met.

The implementation strategy includes roles/responsibilities and training/competency requirements for all personnel (Santos and contractors) in relation to:

+ implementing controls
+ managing non-conformance
+ emergency response
+ meeting monitoring, auditing, and reporting requirements.

## 7.1 Environmental Management System

Santos's Management System exists to support its moral, professional and legal obligations to undertake work in a manner that does not cause harm to people or the environment. The framework of policies, standards, processes, procedures, tools and control measures that, when used together by a properly resourced and competent organisation, result in:

+ A common HSE approach is followed across the organisation.
+ HSE is proactively managed and maintained.
+ The mandatory requirements of HSE management are implemented and are auditable.
+ HSE management performance is measured and corrective actions are taken.
+ Opportunities for improvement are recognised and implemented.
+ Workforce commitments are understood and demonstrated.

The structure of this implementation strategy aligns with the Management System structure and is designed to require that:

+ environmental impacts and risks continue to be identified for the duration of the activity and reduced to ALARP
+ controls are effective in reducing environmental impacts and risks to ALARP and acceptable levels
+ environmental performance outcomes and standards set out in this EP are met
+ stakeholder consultation is maintained throughout the activity as appropriate.

## 7.2 Environment, Health and Safety Policy

Santos' Environment, Health and Safety Policy (**Figure 7-1**) clearly sets out its strategic environmental objectives and the commitment of the management team to continuous environmental performance improvement. This EP has been prepared in accordance with the fundamentals of this policy. By accepting employment with Santos, each employee and contractor is made aware during the recruitment process that he or she is responsible for the application of this policy.

# Environment, Health & Safety

Policy

## Our Commitment

Santos is committed to being the safest oil and gas operator in Australia and preventing harm to people and the environment

## Our Actions

We will:

1. Integrate environment, health and safety management requirements into the way we work and ensure that we comply with all relevant environmental, health and safety laws
2. Include environmental, health and safety considerations in business planning, decision making and asset management processes
3. Identify, effectively control, monitor and ensure awareness of risks that have the potential for serious harm to people and the environment
4. Lead a strong and consistent environment, health and safety culture across all aspects of business
5. Work proactively and collaboratively with our stakeholders and the communities in which we operate
6. Set, measure, review and monitor objectives and targets to demonstrate proactive processes in place to continuously reduce the risk of harm to people and the environment
7. Report publicly on our environmental health and safety performance

## Governance

The Environment Health Safety and Sustainability Committee is responsible for reviewing the effectiveness of this policy.

This policy will be reviewed at appropriate intervals and revised when necessary to keep it current.

Kevin Gallagher

**Managing Director & CEO**

**Status: APPROVED**

| | | | |
|---|---|---|---|
| Document Owner: | Jodie Hatherly, General Counsel & Vice President, Legal, Risk and Governance | | |
| Approved by: | The Board | Version: | 2 |

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***Figure 7-1: Santos Environment Health and Safety Policy***

## 7.3 Supporting Management Processes and Procedures

### 7.3.1 Contractor Health, Safety and Environment requirements

The Santos HSE Supplier Management Operating Standard (SMS-HSS-OS08) supports the minimum requirements and expectations for HSE management of Contractors and subcontractors. In addition, Barossa has a contractual HSE Exhibit for the subsea and pipeline scopes of work. The HSE Exhibit has a detailed environmental requirements section for:

+ contractor to determine environmental risks and proposed controls
+ understanding and compliance with applicable environmental legislation
+ Contractor Group to have involvement in meeting environmental requirements
+ EMS used to manage environmental risks
+ key activities to support continuous environmental improvement
+ definition of the operational area of the work
+ chemical selection and approvals
+ prohibition of materials and chemicals
+ vessel requirements
+ additional environmental requirements for transferring line pipe in sheltered waters.

The HSE requirements for contracts/contractor management during pre-contract planning, contracting, contract execution and contract completion and evaluation are outlined in the HSE Contractor Management Operating Standard and the Contracting and Procurement Operating Standard. It includes the following minimum requirements:

+ Contractors to comply with all applicable HSE laws and regulations and any additional guidelines, operating standards and policies provided to the Contractor.
+ A review of the Contractor HSE Management System is completed before being contracted.
+ Provisions for Santos to conduct audits/inspections of the Contractor's operations, equipment and emergency procedures at any time.

### 7.3.2 Santos marine vessel vetting process

Santos manages marine vessel vetting and assurance using a hierarchy of procedures, outlined below. These requirements for vessel acceptance criteria include technical, personnel (e.g. crew competencies) and operational requirements for marine vessels engaged by Santos.

#### 7.3.2.1 Marine Vetting and Audit Process Manual for Offshore Vessels

The  Marine Assurance Procedure (SO 91 ZH 10001) is a standard that requires all vessels (including MODUs) used by Santos to be vetted. The vetting process is based on industry standards and best practices along with considerations of guidelines and recommendations form recognised industry organisations such as Oil Companies International Marine Forum (OCIMF) and International Maritime Contractors Association (IMCA), and international regulatory agencies like the IMO and vessel Classification Societies.

The Marine Assurance Procedure (SO 91 ZH 10001) requires a valid Offshore Vessel Inspection Database (OVID) report or Common Marine Inspection Document (CMID) report as required for vessel operation types.

For vessels where the OVID and/or CMID are not valid or available, a Santos Approved Inspection Report is required.

#### 7.3.2.2 Marine Operations Manual

The Marine Operations Manual (IOSC/OPS/HBK/0003) details:

+ standard operating procedures for all vessels under contract with Santos
+ compliance requirements for relevant maritime legislation and relevant guidelines, standards and codes
+ compliance requirements for international conventions and agreements, including:
  - International Convention for the Safety of Life at Sea (SOLAS), 1974 and its Protocol of 1988
  - International Convention for the Prevention of Pollution from Ships 1973/1978 (MARPOL 73/78)
  - the Convention on the International Regulations for Preventing Collisions at Sea 1972 (COLREGS)
  - International Convention on Standards of Training, Certification and Watchkeeping (STCW) for Seafarers, 1978.
+ compliance requirements for industry standards as set up by:
  - Oil Companies International Marine Forum (OCIMF)
  - International Marine Contractors Association (IMCA)
  - Guidelines for Offshore Marine Operations (GOMO)
  - Nautical Institute.
+ Santos and contractor standards, procedures and best practice management, including:
  - vessels' safety of navigation; vessels' using DP systems
  - vessels' bunkering procedures
  - crew competency and training records
  - biosecurity management
  - chemical storage and handling procedures
  - discharge management procedures
  - waste management procedures
  - anchoring procedures
  - vessel and equipment maintenance procedures as per the vessel specific safety management system.

Santos performs a risk assessment or HSE Qualification Evaluation process for each vessel to identify any HSE issues or specific management requirements prior to commencing activities.

### 7.3.3 Santos waste management process

The Waste Management Plan establishes a requirement to evaluate the suitability of industrial waste facilities used by Santos and to only use those that are company approved. It applies to captive waste management units (owned or operated by Santos or one of its subsidiaries) or commercial waste management facilities (not owned or operated by Santos) where industrial wastes and residuals, generated by Santos or its contractors, are subsequently managed.

Santos is responsible for evaluating the suitability of the waste facilities and a Waste Management Plan outlines the requirements for the management of wastes produced by Santos operated facilities, including compliance assurance processes.

### 7.3.4 Ballast water management

#### 7.3.4.1 Summary of requirements

The Australian ballast water requirements set out the obligation on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas. All internationally operating vessels entering Australia will require:

+ an approved Ballast Water Management Plan
+ maintenance of a complete and accurate record of all ballast water movements including those conducted in Australian waters
+ an international Ballast Water Management Certificate.

Ballast water exchange should be conducted in areas at least 12 nautical miles from the nearest land and in water at least 50 metres deep. Volumetric exchange must be at least 95% of the relevant tank.

Records on ballast water exchange shall include the start and finish times and geographic co-ordinates of the operation.

All ballast water management equipment such as pumps will be maintained as per the vessel preventive maintenance system and regularly tested to ascertain accurate calculations for ballast water exchange operations.

#### 7.3.4.2 Australian Pre-Arrival Report

All international vessels must submit a Ballast Water Report and a Pre-Arrival Report (PAR), 96 to 12 hours prior to arriving in an Australian port through the Maritime Arrival Reporting System (MARS), for the Australian Department of Agriculture to review and process.

MARS is the online portal for commercial Vessel Masters and Shipping Agents to submit reports required of all international vessels seeking Australian biosecurity clearance; and request services such as coastal strip, waste removal, ship sanitation certification and crew change.

Department of Agriculture will request evidence from vessels with a ballast water management system of:

+ valid ballast water management plan specific to the vessel (consistent with the Convention)
+ valid ballast water management certificate, or certificate of compliance, that is approved by a port state administration, or a recognised survey authority (consistent with the Convention)
+ ballast water management records that clearly demonstrate the BWMS has been operated consistent with the ballast water management plan.

A Department of Agriculture biosecurity officer will board the vessel to verify the Pre-Arrival Report and Vessel Master must ensure the vessel and personnel are available and able to demonstrate proficiency in the operation and maintenance of the ballast water management system.

### 7.3.5 Biofouling management

IMS may be present as biofouling on the vessel hull, or within piping, sea chests, etc. The biofouling which may be found on and in a vessel reflects the vessel's design, construction, maintenance and operations. Each of these aspects introduces particular biofouling vulnerabilities but also offers opportunities to limit the extent and development of biofouling, with commensurate reduction in biosecurity risks.

#### 7.3.5.1 Vessel risk assessment

Vessels mobilised to the operational area from international or domestic waters will comply with the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Department of Agriculture, Fisheries and Forestry 2009). This includes:

+ completion of a biofouling risk assessment
+ implementation of mitigation measures commensurate with the level of risk.

**Figure 7-2** presents the risk assessment process. Factors that will inform risk are:

+ timing of marine pest risk assessment relative to vessels selection and movement to the title area to ensure there is sufficient time to implement control measures in cases where management is warranted
+ history of the vessels including time spent in ports of call since last dry dock and clean to inform whether the facility or vessel may have been exposed to high risk ports/locations
+ level of biofouling and the presence of species of concern (in particular the presence of marine pests) within biofouling communities on the vessels associated with the activity (often informed by biofouling record books and/or maintenance/cleaning or inspection programs)
+ operational profile relevant to biosecurity risk such as operating speed, time alongside a facility and the need for ballast exchanges within the title area
+ receiving environment including the presence of shallow water sensitivities within proximity to the activity and the presence and area of non-biocidal surfaces on facilities that could harbour marine pests
+ presence and effectiveness of external and internal marine growth prevention systems including effectiveness and integrity of antifouling coatings and functionality of internal treatment systems
+ qualifications and competency of personnel conducting and reviewing the risk assessment and making management decisions.

#### 7.3.5.2 Vessel risk status

There are three outcomes from the risk assessment which categorise the vessels risk status as outlined below. Vessels are required to have a 'low' risk status to demonstrate to the government that Santos has taken all reasonable measures to minimise the risk of IMS.

+ low – low risk of introducing IMS; no additional management measures required
+ uncertain – risk of introducing IMS is not apparent; precautionary approach adopted, additional management measures required to achieve low status
+ high – high risk of introducing IMS; additional management measures will be required.

#### 7.3.5.3 Potential management measures to achieve low risk status

The outcome of the risk assessment will determine management measures required. If the vessel is deemed as 'low' risk status, no other measures are required (providing the vessel does not exceed the seven-day threshold at stationary or slow speed, in waters outside Australia (similar region)).

For vessels that present an 'uncertain' or 'high' risk, Contractors will engage a qualified IMS inspector to conduct inspections and/or provide advice on obtaining low status. **Table 7-1** lists mitigation measures that can be applied to achieve 'low' risk status.

*Table 7-1: Biofouling mitigation measures*

| No. | Mitigation Measure | Overview |
|---|---|---|
| 1 | IMS inspection | Visual inspection of submerged surfaces and niche areas by a qualified biosecurity inspector to better understand the actual biosecurity risk. IMS Inspectors will have the qualifications and align inspections and reports with DPIRD guidance in:<br>+ Criteria for Suitably Qualified Invasive Marine Pest Experts (DPIRD, 2017a)<br>+ Best Practice Guidelines for Invasive Marine Species Inspections (DPIRD, 2017b)<br>+ Invasive Marine Species Inspection Report Requirements (DPIRD, 2017b). |
| 2 | In-water cleaning | The appropriateness of in-water cleaning operations must be a decision made closely with IMS inspector on a case-by-case basis. Many factors will be considered, including:<br>+ Degree and type of biofouling;<br>+ Location of biofouling on the vessel.<br>Prior to undertaking in-water cleaning within Australia, approval from the relevant state/territory authority must be granted and conditions may be imposed. Application for administering authority (Harbour Master, local government or state environmental protection agency) at least five working days prior to the proposed commencement of the work. |
| 3 | Dry docking cleaning | Dry docking and the removal/cleaning of biofouling will include hull surfaces, niche areas such as sea chests, all retractable equipment such as thrusters, intakes and outlets, anodes and voids. |
| 4 | Temporal or spatial controls | Temporal or spatial controls to limit vessel exposure to sources of risk. |
| 5 | Application of anti-fouling coating | Depending on the age the vessel may require application of new anti-fouling coating. The anti-fouling coating type will be based on technical advice and carried out by professional operators. All vessels greater than 400 gt will retain Antifouling System Certificate. |
| 6 | Treatment of internal seawater systems | In the absence of a marine growth prevention system, cleaning of internal seawater systems may be required, which may include:<br>+ dehydration<br>+ heat<br>+ physical removal<br>+ chemical treatment.<br>Treatment of Internal Seawater systems will ideally be undertaken prior to mobilisation to Australia. Where chemical treatments are to be undertaken within Australian waters, advice will be sought from the Australian Pesticides and Veterinary Medical Authority (www.apvma.gov.au) in relation to permit and reporting requirements as it is prohibited to clean internal systems without a permit. |

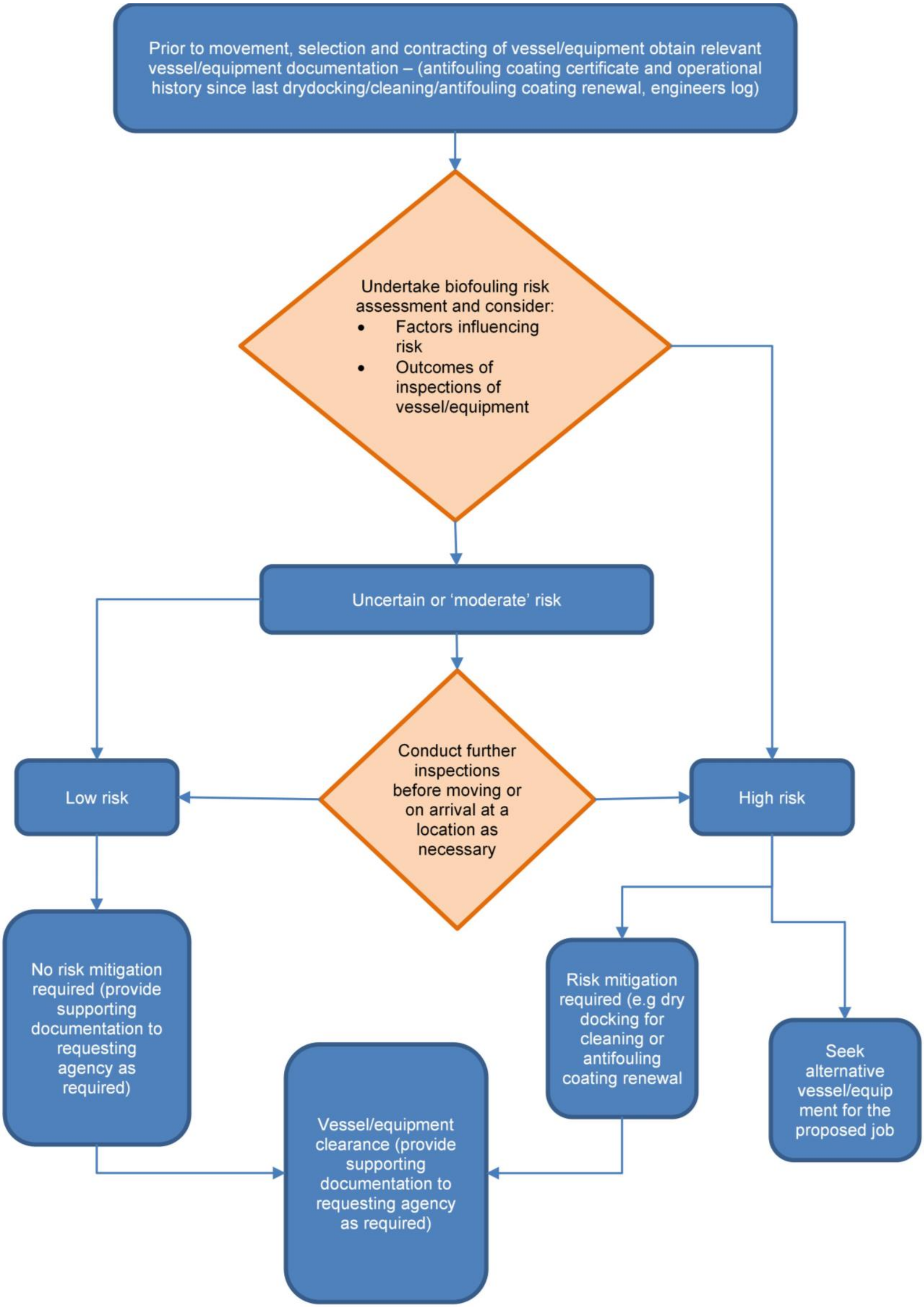


***Figure 7-2: Generic biofouling risk assessment process (from Department of Agriculture, Fisheries and Forestry, 2009)***

## 7.3.6 Unexpected Finds Protocol

Santos has completed the assessment required by the General Direction to identify any underwater cultural heritage places along the Barossa pipeline route to which people, in accordance with Indigenous tradition, may have spiritual and cultural connections that may be affected by the future activities covered by the EP. The assessment found no specific underwater cultural heritage places along the pipeline route that may be affected by the proposed activities.

Notwithstanding the finding of the assessment, Santos is adopting the assessment recommendation by Wessex that a Protocol for Archaeological Discoveries is established in order that any underwater cultural heritage discovered during works is recorded by appropriate specialists, and to allow appropriate additional mitigation measures to be defined and put in place as required. Santos is implementing this recommendation from Wessex through its Santos (Barossa) Offshore Unexpected Finds Protocol (BAS-210 0051 - Rev 1) (the Unexpected Finds Protocol), which has been developed in consultation with appropriate specialists in the fields of maritime and First Nations archaeology, who, under the Protocol, are on-call for the duration of the activity to assist with the identification and management of any unexpected finds.

This Unexpected Finds Protocol will be used to confirm the route of the pipeline during pre-lay surveys, which may require localised re-routing of the pipeline or the recovery/relocation of potential or actual heritage objects in the highly unlikely scenario of a discovery.

The Unexpected Finds Protocol includes separate protocols specific to discovery of maritime archaeology and first nations cultural heritage. Implementation of each of these protocols is further described below.

### 7.3.6.1 Maritime Archaeology Unexpected Finds Protocol

The Maritime Archaeology Unexpected Finds Protocol is part of the Santos (Barossa) Offshore Unexpected Finds Protocol (BAS-210 0051 - Rev 1) and is summarised as follows:

+ upon discovery of a potential archaeological object, the Santos Client Representative is to be notified;
+ the Santos Client Representative will then determine whether it is a possible object or significant archaeological deposit using the Object Recognition Sheet;
+ if the object is assessed as a possible heritage object, work is to cease in the vicinity of the discovery of the object's find location and the project maritime archaeologist is to be immediately contacted, following the steps in Recording Methods and Procedures.
+ cultural objects encountered on the seafloor, for example, during ROV survey, should be left and recorded in situ, unless they are under imminent threat of destruction. The guidelines for whether an object is to be retained for conservation or put back in the water near where it was found is presented in Artefact Collection and Curation Policies.

Stop work triggers and notification protocols are further described in **Figure 7-3**.

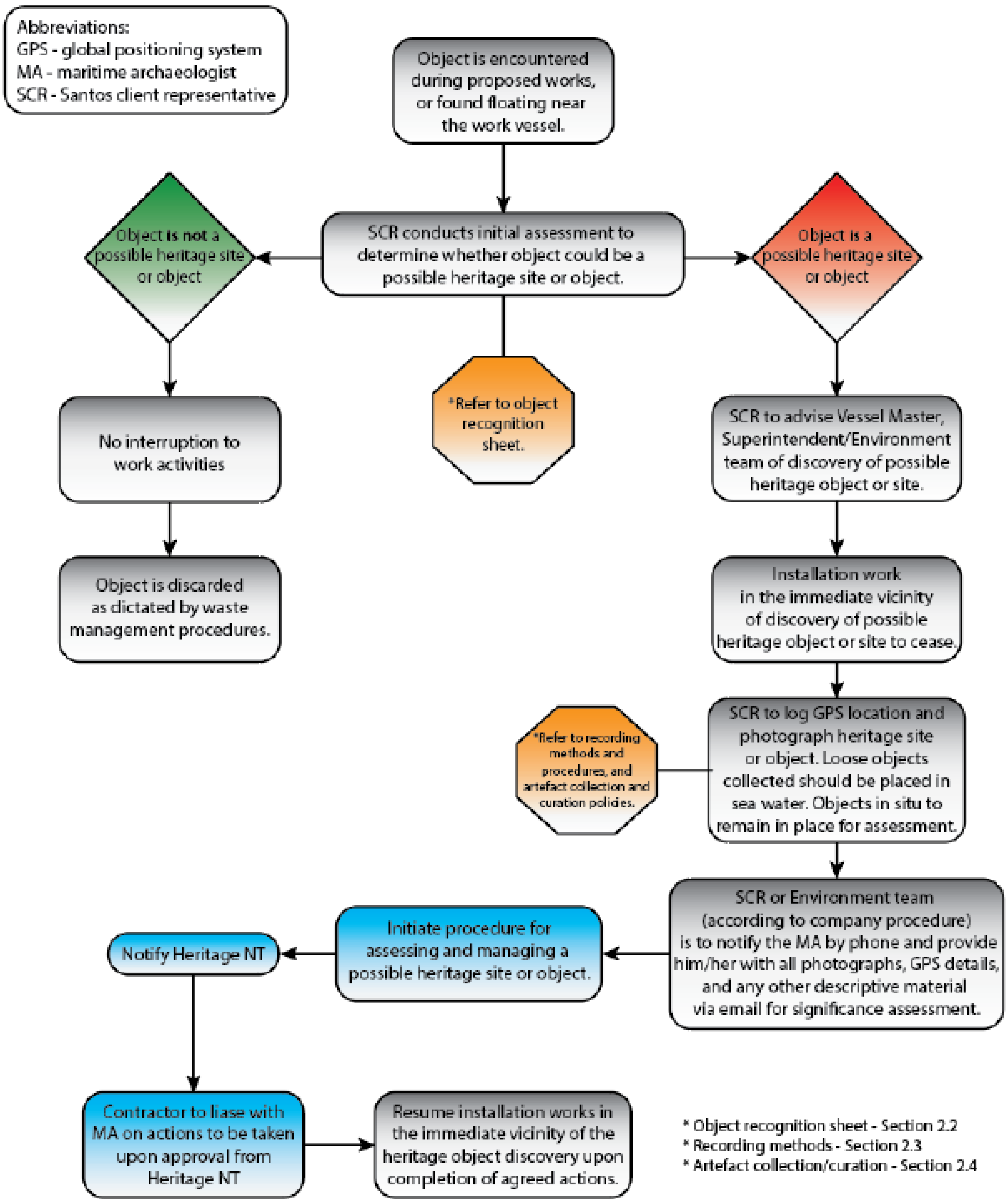


***Figure 7-3: Maritime Archaeology Unexpected Finds Protocol Stop Work Triggers and Notification Protocols***

All Santos and contractor staff identified as relevant to implementation of this protocol , will be nominated to complete an induction on the maritime archaeology unexpected finds protocol, and shall confirm by signature their understanding of the requirements.

#### 7.3.6.2 First Nations Cultural Heritage Unexpected Finds Protocol

A First Nations unexpected finds protocol(has been developed as part of the Santos (Barossa) Offshore Unexpected Finds Protocol (BAS-210 0051 - Rev 1) to assist Santos in identifying and managing unexpected First Nations cultural heritage that may be encountered during the installation of the Gas Export Pipeline (GEP).

The protocol covers First Nations and Macassan archaeological sites. The protocol has been separated into two elements for pre-lay corridor route survey activities (Phase 1) and pipelay construction activities (Phase 2).

##### 7.3.6.2.1 Pre-lay pipeline survey (Phase 1)

+ Upon observing an object that the operatives, including the Santos Client Representative Team (SCRT), believe could be a potential archaeological object ("an article that appears to be underwater cultural heritage"), the SCRT and contact archaeologist (A) are to be notified. This could occur during the initial flyover of the ROV or because of review of the pre-lay survey video footage undertaken later.
+ The SCRT and A will then use imagery available to determine whether the object is a possible First Nations object or significant archaeological deposit using the Object Recognition Sheet and their collective experience.
+ If the object is assessed as a likely cultural heritage object and it is likely to be impacted by the pipelay activities, a possible route deviation or sidestep within the pre-lay corridor will be assessed and the new route/lateral deviation shall be surveyed, if not yet covered. Steps in the Recording Methods and Procedures section of the First Nations Cultural Heritage Unexpected Finds Protocol should be followed. If rerouting the pipeline is not practical/possible then options to recover the likely cultural heritage object should be discussed and agreed as per the Artefact Collection and Curation Policies section of the First Nations Cultural Heritage Unexpected Finds Protocol.
+ If the object cannot be positively identified from the imagery available, further investigation of the object may be required if requested by the by the SCRT and A. This may take the form of additional ROV deployment to obtain better quality imagery, to enable a positive identification. Steps in the Recording Methods and Procedures section should be followed.

The process to be followed if unexpected potential heritage finds are encountered during the pre-lay pipeline survey is further described in Figure 7-4.

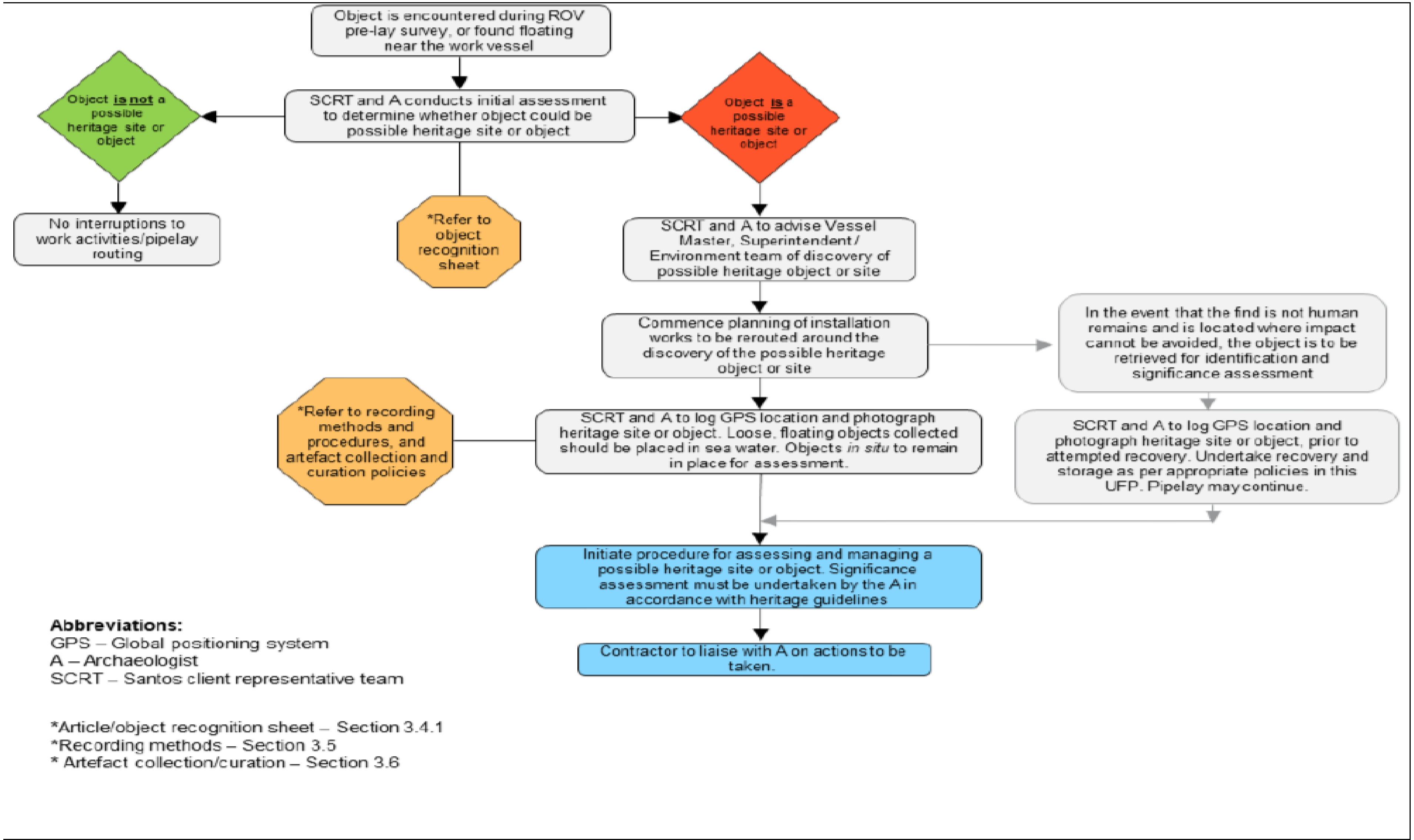


***Figure 7-4: Flow chart detailing the Phase 1 heritage response process upon encountering unexpected potential heritage finds during the pre-lay pipeline survey.***

#### 7.3.6.2.2 Pipelay construction (Phase 2)

+ Upon observing an object that the operatives, including the SCRT, believe could be a potential archaeological object ("an article that appears to be underwater cultural heritage"), the SCRT and A are to be notified.
+ The SCRT and A will then use imagery available to determine whether the object is a possible First Nations object or significant archaeological deposit using the Object Recognition Sheet and their collective experience.
+ If the object is assessed as:
  - likely to be human remains, and these remains are located directly in the path of the pipeline, then works in the immediate area (within 10 m) must be halted pending the results of appropriate further investigation
  - likely to be a cultural heritage object that is directly in the path of the pipeline, then the following steps should be undertaken:
    - log the GPS location and photograph the heritage site or object while insitu as per steps in Recording Methods and Procedures
    - if the pipeline cannot be locally rerouted around the object in a timely manner then attempt to recover the object via ROV, and manage as per Artefact collection and curation policies
    - once recovered, SCRT and A to assess, confirm or not the identification of the object as cultural heritage and undertake a significance assessment for identified heritage
  - likely to be a cultural heritage object that is not directly in the path of the pipeline, then the following steps should be undertaken:
    - log the GPS location and photograph the heritage site or object while in situ as per steps in Recording Methods and Procedures
    - leave object in situ.
+ Construction work may continue, although further actions may be requested by the SCRT and A subsequent to the positive identification of the object as First Nations cultural heritage and the significance assessment results.
+ Construction work cannot be performed within 10 m of the potential cultural heritage object until approved by the SCRT and A, if the potential cultural heritage object is detected prior to work encroaching within this distance.

The process to be followed if unexpected potential heritage finds are encountered during pipeline construction is further described in Figure 7-5.

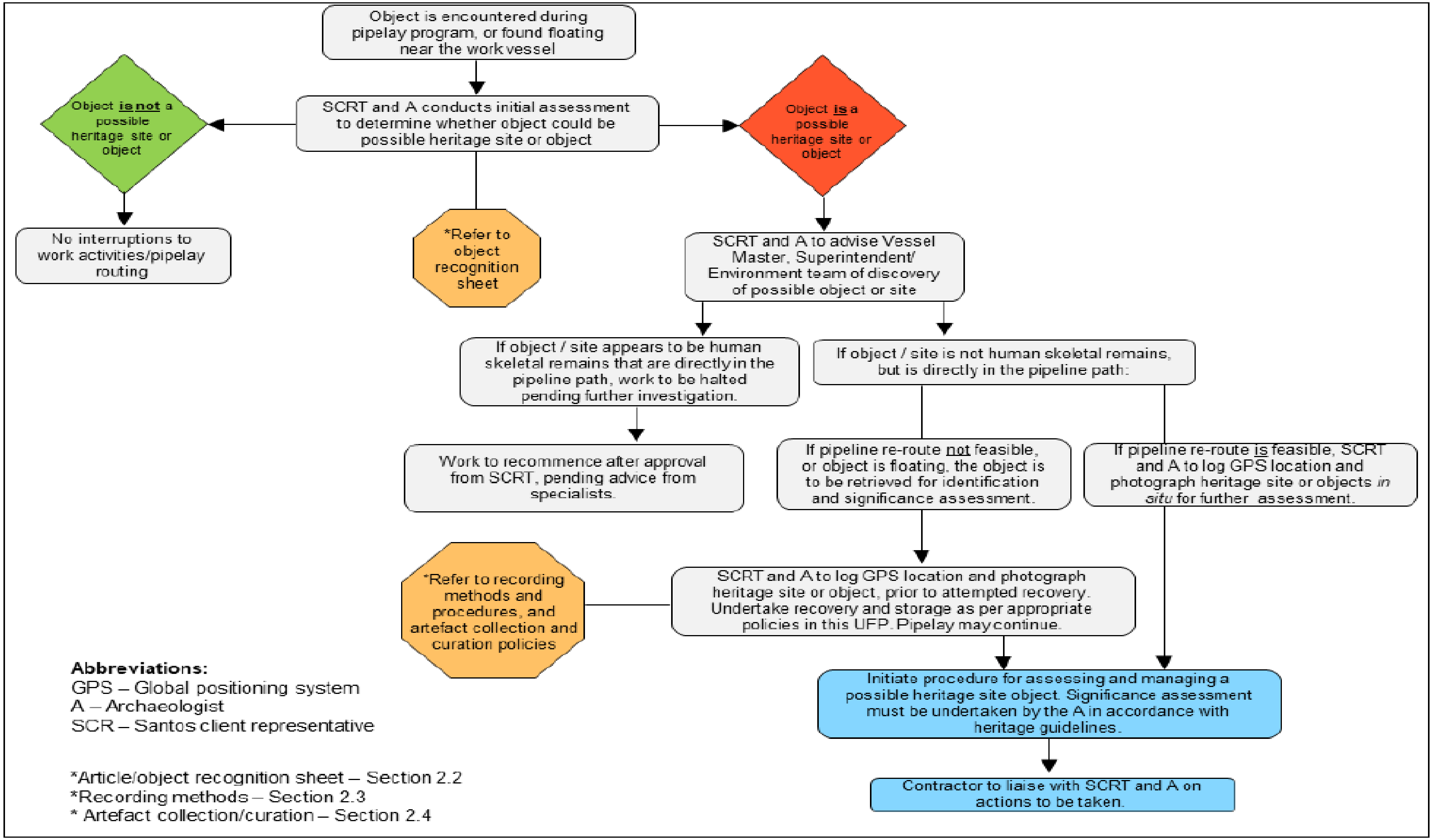


*Figure 7-5: Flow chart detailing the Phase 2 heritage response process upon encountering unexpected heritage finds during the pipeline laying program.*

All new workers who have the potential to interact with First Nations cultural heritage finds, such as ROV operators and applicable vessel captains, will be required to complete a cultural heritage induction prior to commencing work, and shall confirm by signature their understanding of the requirements.

## 7.4 Systems, practices and procedures

All activities associated with the pipeline installation campaign are identified, planned and implemented in accordance with relevant legislation, EP commitments and Santos environment standards and procedures. Processes are in place to verify that the controls and performance standards contained in this EP are being implemented to manage environmental impacts and risks associated with the maintenance activities to ALARP.

### 7.4.1 Health, Safety and Environmental Management System interfaces

The Contractor pipelay and construction vessels will operate under their own Safety Case. The Contractor's 'vessel' Safety Case will cover pipeline installation and associated construction operations. The Safety Case addresses generic aspects and the Safety Case Revision documentation addresses project and location specific aspects. This includes the HSEMS interfaces between Contractor and Santos and any additional hazards/risks associated with specific operations of the installation campaign.

It is the intention of Santos and the Contractor to have a clear demarcation of management system interfaces to ensure there will be no confusion between the roles and responsibilities of personnel, organisations, management of environment, operating procedures and/or reporting structure.

## 7.5 Roles and responsibilities of personnel

### 7.5.1 Pipeline installation campaign

In general, it is the responsibility of all personnel to act in an environmentally responsible manner and to follow the environmental procedures detailed within this EP. The Contractor's HSEMS will ensure responsibilities for environmental performance are clearly delegated, all personnel are aware of their roles and responsibilities and personnel achieve adequate training on environmental issues. The suitability of the Contractor to undertake the proposed work, including their HSEMS and past HSE performance, has been evaluated during the contractor evaluation phase of the project planning. Roles and responsibilities for the pipeline installation campaign are outlined in **Table 7-2**.

***Table 7-2: Roles and responsibilities relevant to this Environment Plan***

| Title (role) | Environmental responsibilities |
|---|---|
| *Office-based personnel* | |
| Santos Barossa Subsea and Pipelines Manager | + Confirm that the campaign is undertaken in accordance with this EP.<br>+ Provide sufficient resources to implement the management controls in this EP.<br>+ Confirm Contractor personnel attend an environmental induction (**Section 7.6**) upon commencing work on the campaign.<br>+ Action the management controls, as detailed in the EPSs in this EP (**Section 5.3.10**), as required, prior to the commencement of the activity.<br>+ Confirm the Contractor meets the requirements of the Santos management system and relevant standards/procedures. |

| Title (role) | Environmental responsibilities |
|---|---|
| Santos Barossa HSE Manager | + Provide assurance that adequate resources are provided to support all environmental activities associated with this EP.<br>+ Develop and Implement a program to implement and monitor EP commitments.<br>+ Liaise with NOPSEMA and Parks Australia.<br>+ Ensure incident notification process is in place and investigations completed to identify root causes.<br>+ Review and submit monthly and end of activity reports. |
| Santos Barossa Gas Export Pipeline Package Lead | + Confirm the campaign is undertaken in accordance with this EP.<br>+ Communicate any changes to the activity that may affect the risk and impacts assessment, EPOs, EPSs and MC detailed in this EP to the Santos HSE team.<br>+ Provide the resources required to enable the commitments in this EP to be maintained.<br>+ Ensure that lighting inspection is carried out on vessels prior to operating within 10 km of marine turtle nesting habitat during peak hatchling emergence season.<br>+ Confirm the reporting of environmental incidents meets both external and Santos incident reporting requirements.<br>+ Liaise with Santos Environmental Advisor on environmental incidents and what constitutes a reportable incident.<br>+ Track and close out of any corrective actions raised from environmental audits as required by this EP. |
| Santos Barossa Gas Export Pipeline Engineer | + Communicate any changes to the activity to the Santos Environmental Advisor.<br>+ Confirm all subsea chemical components and other fluids that may be discharged to the marine environment are approved for use. |
| Santos Barossa Marine Director | + Confirm vessel vetting as per the Santos Offshore Marine Assurance Procedure (SO 91 ZH 10001).<br>+ Conduct relevant inspections to confirm vessels comply with relevant Marine Orders and Santos marine standards/procedures and on boarding requirements to meet safety, navigation and emergency response requirements.<br>+ Communicate activity-specific EP requirements to the support vessel crew. |
| Santos Barossa Crisis and Emergency Management Specialist | + Ensure emergency response drills are undertaken as per the schedule outlined in this EP.<br>+ Develop Santos Crisis Management and Emergency Response Plans and procedures.<br>+ Provide input into NEBA for response strategies. |
| Santos Barossa Emergency Response Coordinator | + Undertake IMT drills in accordance with this EP and OPEP (**Appendix G**).<br>+ Assure that stocks of spill response equipment are maintained and adequately stocked.<br>+ Review Santos Emergency Response Plans and procedures.<br>+ Provide input into NEBA for response strategies. |

| Title (role) | Environmental responsibilities |
|---|---|
| Santos Barossa Environmental Advisor | + Confirm environmental audits are undertaken as outlined in this EP.<br>+ Develop offshore environmental approval documents, including EPs and OPEPs, for submission and acceptance by NOPSEMA.<br>+ Provide environmental induction to contractor personnel.<br>+ Review and approve chemical products that will be discharged to the marine environment and require assessment.<br>+ Review biofouling risk assessments undertaken by Contractors.<br>+ Prepare monthly and end of activity environmental reports.<br>+ Advise on incident reporting requirements, particularly what constitutes a reportable incident. |
| Santos Barossa External Relations Advisor | + Prepare and implement the stakeholder consultation program for the activity.<br>+ Manage and report on any stakeholder consultation received in relation to the activity.<br>+ Undertake ongoing engagement with relevant stakeholders for the duration of the activity, as required. |
| Contractor Project Manager | + Undertake the pipelay installation in accordance with this EP.<br>+ Provide the resources required to enable the commitments in this EP to be maintained.<br>+ Undertake biofouling risk assessment on all vessels mobilised to the operational area (**Section 7.3.5**).<br>+ Ensure that all crew attend HSE inductions and that attendance records saved.<br>+ Ensure incidents are reported and investigated, as required. |
| ***Offshore based personnel*** | |
| Santos Senior Client Site Representative | + Confirm contractors undertake the activity in a manner consistent with the EPOs and environmental management procedures detailed in this EP.<br>+ Confirm the management measures detailed in this EP are implemented.<br>+ Confirm that the Vessel Master and all crew adhere to the requirements of this EP.<br>+ Advise the Santos Gas Export Pipeline Package Lead of any changes in activities that may lead to non-conformance with the EPOs in this EP.<br>+ Report environmental incidents to Santos Gas Export Pipeline Package Lead. |
| Vessel Master (contractor personnel) | + Confirm vessel management system and procedures are implemented and comply with the requirements detailed in this EP.<br>+ Confirm personnel receive an environmental induction that meets the requirements outlined in this EP on commencing work on the vessel.<br>+ Confirm crew personnel are competent to undertake the assigned work tasks.<br>+ Confirm SOPEP drills are undertaken in accordance with the vessel's schedule.<br>+ Comply with vessel entry and movement requirements within the 500 m exclusion zone.<br>+ Maintain ballast water management plan, valid ballast water management certificate, ballast water management records, and Antifouling System Certificate specific to the vessel.<br>+ Confirm vessel crew are provided with sufficient training to implement the SOPEP/SMPEP (as appropriate to vessel class).<br>+ Supervise all bunkering/transfer operations to the vessel.<br>+ Report any environmental incidents or non-conformance with the EPOs, EPSs or MC in this EP, immediately to the Santos Senior Client Site Representative. |

| Title (role) | Environmental responsibilities |
|---|---|
| Offshore Construction Superintendent (Contractor Personnel) | + Responsible for ensuring that pipeline installation activities are performed in accordance with this EP. |
| Offshore HSE Advisors (Santos and/or Contractor) | + Support the Santos Senior Client Site Representative to ensure that the controls detailed in this EP relevant to offshore activities are implemented, and assist in collection and recording of evidence of implementation (other controls are implemented and evidence collected onshore).<br>+ Support the Santos Senior Client Site Representative 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.<br>+ Ensure periodic environmental inspections/reviews are completed and corrective actions from inspections are developed, tracked and closed out in a timely manner.<br>+ Review Contractors procedures, input into Toolbox talks and JSAs.<br>+ Provide day to day environmental support for activities in consultation with the Santos Environmental Advisor. |
| All offshore staff | + Act in an environmentally responsible manner.<br>+ Undertake work in accordance with accepted vessel HSE systems and procedures.<br>+ Comply with this EP and all regulatory requirements as applicable to assigned role.<br>+ Report any unsafe conditions, near misses or environmental incidents immediately to supervisors.<br>+ Attend environmental inductions and HSE meetings, and complete training as required. |

## 7.6 Training and competencies

### 7.6.1 Pre-mobilisation campaign vessel engagement

All contractors are managed through Santos HSE Supplier Management Operating Standard (SMS-HSS-OS08). As part of this process all contractors undergo a prequalification screening of HSE Management systems. This includes a review of training and competency processes.

### 7.6.2 Pre-installation campaign

All personnel, including third party contractors, involved with the activity will undergo environmental awareness training prior to commencing work on the project as part of their induction. This will include being made aware of their responsibility to implement the commitments in this EP. The environmental training will inform the work crews of their obligations and specific environmental management procedures, including responsibilities and lines of communication.

Inductions will also cover the relevant components of this EP, Santos Environmental Management System, Contractor HSEMS, and Gas Export Pipeline Installation Safety Case revision documents developed to link procedures, roles and responsibilities.

The induction will cover aspects such as:

+ environmental regulatory requirements described in this EP
+ marine user interaction:
  – requirement to record and report sightings of whales
  – complaint/issue handling from other users.

- waste segregation, containment and disposal:
  - no waste disposal overboard
  - requirements for waste, segregation, labelling, handling and storage
  - requirements for recording waste movements and transfers in Garbage Record Book.
- housekeeping and spill prevention:
  - requirements to store chemicals, oils and wastes in designated area
  - requirements to adhere to bunkering procedure for fuel transfers
  - availability of spill transfer equipment.
- spill preparedness and response:
  - alerting procedure and immediate spill response actions.
- environmental incident reporting:
  - requirements for reporting reportable and recordable incidents.

### 7.6.3 During installation campaign

HSE management system audits of third-party contractors are completed in a manner consistent with Santos' Barossa HSEQ Audit Procedure (BAA-100 0248), which includes an evaluation of training matrix, checks of training and competency and site-specific environmental training requirements. The frequency of contractor audits is reviewed and updated annually in the Barossa Project Audit Schedule. Environmental risks will be discussed through job safety analyses, pre-tour and safety meetings conducted on board the vessels.

Additional communications, including the findings of any incident investigations, will continue through daily meetings on board the maintenance vessels and via daily progress reporting.

## 7.7 Monitoring, auditing, management of non-conformance and review

### 7.7.1 Environmental monitoring

Santos has a process of measuring and monitoring HSE performance, evaluating the achievement of HSE goals and objectives, identifying opportunities for improvement and providing assurance of compliance. Leading and lagging performance measures are developed, identified and tracked to provide timely information to manage trends and impacts and to establish future goals and direction. Processes are also in place to measure and monitor project operations and activities.

Santos and its contractors will monitor and review HSE performance for the duration of the installation campaign. Specific monitoring activities related to the management of environmental risks identified within **Section 5.2** and **Section 5.3** will collect, as a minimum, the information referred to in the MC listed in **Section 6**. This information will be collected through set internal reporting processes, as detailed in this section.

### 7.7.2 Environmental audits and review

Environmental performance auditing and review programs will be completed to:

- confirm impacts and risks are being effectively managed
- confirm relevant standards and procedures are being followed
- demonstrate compliance with regulatory requirements, approval commitments and conditions within this EP
- monitor, review and evaluate the effectiveness of the Santos Environmental Management System
- confirm a senior management review of performance via consideration of the audit reports.

An environmental auditing program will be implemented for the pipeline installation campaign and will include the key elements and frequencies outlined in **Table 7-3**.

***Table 7-3: Barossa Gas Export Pipeline Installation Environment Plan auditing and review program summary***

| Description | Scope | Frequency |
|---|---|---|
| Weekly performance checklist for the vessel | Site inspection of chemical and hydrocarbon storage areas, deck and bilge drainage and waste segregation | Weekly |
| Internal environmental compliance audit | Audit of Contractor HSEMS, which will include an audit of implementation of the requirements of the EP, specifically performance against the EPOs, EPSs and MC | As per Barossa Project Audit Schedule (i.e. minimum of monthly) |
| NOPSEMA audits | Regulatory compliance | Unscheduled (i.e. on notification by NOPSEMA) |
| Management review: Barossa Leadership Team | Management team mid-year and annual review of HSE performance | Mid-year/ annually |
| Incident investigation review: Review in accordance with vessel contractors procedures | The objective of the incident investigation is to establish the root cause(s) of an incident and to raise and close-out corrective actions to prevent recurrence | Following an incident or training exercise |

HSE audits and follow-up actions are performed in a manner consistent with Santos' Barossa HSEQ Audit Procedure (BAA-100 0248). The audits will be documented and corrective actions tracked to completion in accordance with this standard.

### 7.7.3 Vessel contractor management

HSE assurance of all contracted vessels will be performed in accordance with Santos HSE Supplier Management Operating Standard (SMS-HSS-OS08). The Santos marine vessel vetting process (**Section 7.3.2**) outlines the minimum requirements that must be met and confirms that the vessels meet or exceed the standards and criteria set by industry practice, international regulations, and relevant authorities such as AMSA. The marine assurance process includes assessment of vessel suitability, equipment and design, and personnel training, including officer experience, followed by on vessel inspection and verification.

### 7.7.4 Management of non-conformance investigation and corrective action

HSE hazards and incidents will be reported in accordance with the vessel operator procedures. A corrective action plan will be developed in consultation with senior management and other relevant action owners to address non-conformances. Audit findings and agreed audit follow-up actions will be entered into a dedicated incident and assessment action tracking system and tracked through to closure.

### 7.7.5 Management of change

#### 7.7.5.1 Pipeline installation campaign management of change

Any modification to the pipeline installation campaign must comply with the Barossa Management of Change (MOC) Procedure to ensure:

+ changes conform to appropriate standards, utilise safe and approved methods, and ensure risk remains within an acceptable level from their concept to implementation
+ all relevant documentation e.g. procedures, instructions, guidelines, drawings, databases, etc, affected by the change process are updated accordingly and provided for reference
+ changes are promptly communicated to all sections of the workforce who are affected by the change.

The MOC process includes the stages of:

+ preliminary risk rating (included on Change Request Form)
+ screening review covering process safety management, safety and OHS issues
+ HSE checklist covering major hazards, occupational health and safety (OHS) and loss prevention (aimed at determining whether the proposed changed would have an impact on the Gas Export Pipeline Installation Safety Case)
+ hazard identification (HAZID) and hazard and operability (HAZOP) studies, where required
+ risk assessment
+ construction HAZID (if required).

#### 7.7.5.2 Environment Plan maintenance and revision

Santos has a Management of Change (MOC) procedure (EA-91-IQ-10001) which is specific to managing (potential) changes associated with operations/activities within an accepted EP. It covers all content of the EP, including any legislative, procedural, engineering or physical change that is permanent, temporary, prospective or retrospective that may affect the potential impacts and risks from an activity and/or the environmental performance of an activity. The procedure defines a framework that enables changes to be considered in the merit of a number of aspects including regulatory requirements and a screening for significance. The procedure allows for (potential) changes to be appropriately assessed and managed under internal decision points or to identify when resubmission to the regulator is required.

A risk assessment may also be completed to determine if there is an increased risk to the marine environment. In all cases, where a potential release to the marine environment has been identified, assessment of implementing additional risk control measures to lower the potential risk to ALARP will be undertaken. Any significant changes to the operations may necessitate amendment to the EP and OPEP, as appropriate to the level of change.

A revised EP will be submitted to NOPSEMA under Regulation 17 of the OPGGS(E) Regulations if any changes occur to this EP due to:

+ a new activity
+ a significant modification or new stage of activity that is not provided for in the approved EP
+ significant new or increased environmental impact or risk
+ changes in titleholder that results in a change in the way the environmental impacts and risks of the activity are managed.

NOPSEMA will assess the revised EP and all relevant documents under Regulation 21 of the OPGGS(E) Regulations. While the revision is being assessed any activities adequately addressed under the existing accepted EP can still occur.

The EP may be revised in line with Santos' management of change process but may not be resubmitted to NOPSEMA if it does not trigger Regulation 17 of the OPGGS (E) Regulations.

Santos will undertake an annual review of this EP to identify any changes that may have arisen since acceptance, such as:

+ any additions to the threatened species list within the EMBA (e.g. PMST report)
+ publication of new conservation advice, recovery plans and/or scientific literature
+ changes to the risk profile of the activities.

## 7.8 Routine reporting

### 7.8.1 Internal routine reporting

**Table 7-4** contains a summary of internal reporting that will be completed for the duration of installation activities.

***Table 7-4: Summary of internal reporting***

| Report | Frequency | Contents |
|---|---|---|
| OVID inspection reports | Prior to commencement of the activity | Provides a summary of the findings of the support vessel inspection which assesses compliance with relevant international (e.g. MARPOL 73/78), Australian and Santos requirements. |
| Pre-start contractor audit | Prior to commencement of the activity | Confirmation of compliance for various matters outlined in **Section 7** of this EP relating to operational procedures and processes that Santos require to be in place prior to the commencement of the activity. |
| Vessel Reports | Daily | Update on day's activities, including any identified non-conformance against this EP, and any issues that may need addressing. |
| Meetings (agenda includes HSE) | Weekly | Weekly meetings are held with the offshore and Perth-based management (including contractor management) and advisors and will include an agenda item to address targeted health, safety and environment incidents and initiatives. Minutes of these meetings are produced and distributed as appropriate. |
| Incident Report | Incident specific | Provides framework for Internal notification of incidents including spills. The first report contains tools for assessing the severity of the incident and escalating as per the incident notification procedure. |
| Gas Export Pipeline Installation Environmental Report | At completion of the activity. | Provides a summary of compliance performance, specifically in relation to the environmental performance objectives, standards and measurement criteria within this EP. |
| Incident Action Plan | Incident specific | Provides an action plan in the event of an incident which summarises the appropriate policy, aims, objectives, response strategies and methods that will be employed as appropriate to the incident. |
| Incident Investigation Report | Incident specific | Contains a summary of the audit and review process undertaken to investigate an incident. The report also details close-out corrective actions to prevent recurrence. |

| | | |
|---|---|---|
| Post Exercise Report | Incident/drill specific | These reports are completed following an exercise or drill. They generally report on what worked well, opportunities for improvement and corrective actions to address opportunities for improvement. |
| Spill Debrief Report | Incident specific | Spill debrief reports provide key information pertaining to the spill that has occurred. This includes details of the drill (date, time), list of attendees, key response actions, lessons learnt, outcomes/actions from the spill debrief meeting. |

### 7.8.2 External routine reporting

#### 7.8.2.1 Director of National Parks notifications

As per Condition 4 of the Commercial Activity Licence (**Table 2-2**), Santos shall:

+ notify the director of the grant of the GEP Licence (if granted) within 24 hours of its grant
+ notify the Director of the acceptance or refusal of an environment plan by NOPSEMA within 24 hours of its acceptance or refusal
+ following acceptance of an environment plan by NOPSEMA, provide the Director with a copy of that environment plan within ten business days of acceptance
+ following the completion of construction of the GEP, promptly provide the Director with as built co-ordinates for the location of the GEP in degrees, minutes and seconds using geographic coordinate system GDA94.

Santos will also notify the Director, at least 10 days prior to the start date, of the commencement of pipeline installation activities, including details of the vessels to be used for pipeline installation activities in the Oceanic Shoals Marine Park. Santos will then notify the Director upon completion of the pipeline installation activities, within ten days of completion.

#### 7.8.2.2 Annual Environmental Report

Santos will submit an environmental report to NOPSEMA in accordance with Regulations 14(2) and 26C of the OPGGS(E) Regulations. The report shall be submitted:

+ as soon as practicable after the end of the activity, and in any case not later than three months after the end of the activity; or
+ annually, if activities extend for more than one year.

It will include all information necessary to enable NOPSEMA to determine whether the environmental performance objectives and standards for the petroleum activities, as detailed within this EP, have been met.

#### 7.8.2.3 End of the Environment Plan

As per Regulation 25A of the OPGGS(E) Regulations, this EP will end when:

+ Santos notifies NOPSEMA that:
  - the activity has ended
  - all obligations under the EP have been completed.
+ NOPSEMA accepts the notification.

## 7.9 Incident reporting

**Table 7-4** provides a summary of incident reporting requirements.

### 7.9.1 Reportable incidents

A reportable incident is defined as 'an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage, including moderate to significant environmental damage to an Australian Marine Park or its values, as categorised by the risk assessment process undertaken as part of the preparation of this EP.

The environmental risk assessment (**Section 5**) conducted for the activity identified the following risks that have the potential to cause moderate or significant environmental/social damage:

+ adverse interaction with other marine users (as defined in **Section 5.2.1**)
+ introduction of IMS (**Section 5.3.2**)
+ marine diesel spill from a vessel collision (**Section 5.3.7**).

The notification and reporting requirements for incidents in Commonwealth Waters are outlined in **Table 7-5**. NOPSEMA reporting forms are provided in **Appendix D**. The Santos Environmental Advisor shall decide on what volume constitutes a reportable incident. For an oil spill and as a guide, a volume of 80 Litres or greater is considered reportable.

Reporting of any injury or death of any marine fauna species listed as threatened or migratory under the EPBC Act will be also undertaken and reported to DCCEEW within seven days.

### 7.9.2 Recordable incidents

A recordable incident as defined as an incident arising from the activity that breaches an EPO or EPS in the EP that applies to the activity and is not a reportable incident.

With respect to recordable incidents, the environmental management strategies described in **Section 6** contain EPOs and EPSs. MC are also described to outline how the desired EPSs are maintained for the duration of the activity. Any incident that breaches these EPSs will be considered as a recordable incident and reported to NOPSEMA.

NOPSEMA will be notified of all recordable incidents as soon as practicable after the end of the calendar month but not later than 15 days after the end of the calendar month. The written report must contain:

+ a record of all recordable incidents that occurred during the calendar month
+ all material facts and circumstances concerning the recordable incidents that the titleholder knows or is able, by reasonable search or enquiry, to find out
+ any action taken to avoid or mitigate any adverse environmental impacts of the recordable incidents
+ the corrective action that has been taken, or is proposed to be taken, to stop, control or remedy the recordable incident
+ the action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

If no recordable incidents have occurred a 'nil incident' report will be submitted to NOSPEMA.

### 7.9.3 Other incident reporting requirements

#### 7.9.3.1 Reporting under MARPOL

In addition to the notification and reporting of environmental incidents defined in this EP and Santos requirements, incident reporting requirements also apply for:

+ damage, failure or breakdown of a ship of 15 metres in length or more which affects the safety of the ship or results in impairment of the safety of navigation (including collision, grounding, fire, structural or engine failure)

- any discharge or probable discharge of oil or noxious liquids substances carried in bulk, resulting from damage to the ship or its equipment, or for the purpose of securing the safety of a ship or saving life at sea
- any discharge during the operation of the ship of oil or noxious liquid substances in excess of MARPOL discharge limits or rates
- any discharge or probable discharge of harmful substances in packaged form (including freight containers, shipborne barges, road and rail vehicles, and portable tanks).

Reports are to be made without delay to AMSA via the national 24-hour emergency notification contacts:

- Phone: 02 6230 6811 or 1800 641 792
- Facsimile: 02 6230 6868
- Email: rccaus@amsa.gov.au

Additionally, the following pollution activity should also be reported to AMSA via RCC Australia by the Vessel Master:

- any loss of plastic material
- garbage disposed of in the sea within 12 nm of land
- 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 Santos' OPEP for this activity.

*Table 7-5: Summary of external incident reporting*

| Report | Designated Authority | Timing | Contents |
|---|---|---|---|
| *Reportable Incident Notification* | | | |
| **Commonwealth Waters** | | | |
| Reportable Incident Notification | NOPSEMA | Verbally, as soon as practicable, but within two hours | Santos must notify the Regulator of any unplanned event identified as having the potential to cause moderate to significant environmental damage.<br>In most circumstances reportable incident parameters will be detailed specifically within an EP for an activity; however, should an unforeseen event occur that has caused or has the potential to cause moderate to significant environmental damage this must also be reported to NOPSEMA.<br>**Section 7.9.1** details what constitutes a reportable incident. |
| Written report of reportable incident | NOPSEMA<br>NOPTA | As soon as practicable but no later than three days after the incident | A written report of a reportable environmental incident must be provided unless otherwise agreed with NOPSEMA. The report will contain all material facts and circumstances concerning the reportable incident, actions taken to avoid or mitigate any adverse impacts, and corrective action taken.<br>If NOPSEMA is not satisfied that the initial written report satisfies the requirements of the Regulations further information may be requested from the operator, which may include:<br>+ immediate cause analysis<br>+ root cause analysis and a full report<br>+ actions taken to prevent recurrence of the incident with the responsible party, and<br>+ completion date.<br>+ Santos will provide NOPTA with a copy of the written report within seven days after giving NOPSEMA the written report. |
| Monthly Recordable Incident Reports (refer **Section 7.9.2**) | NOPSEMA | Monthly, on or prior to the 15th day of each month | Either a ‘nil incident’ report or details of recordable incidents that have occurred for previous month. |

| Report | Designated Authority | Timing | Contents |
|---|---|---|---|
| *Other Reporting Requirements* | | | |
| Any discharge or probable discharge in excess of MARPOL 73/78 discharge rates – Marine Pollution Report (POLREP) | AMSA Response Centre (ARC) | Within 24 hours of the incident occurring (by vessel master) | Contents of the reports will slightly differ depending on the type of discharge but generally will contain technical name, MSDS information, manufacturer, quantity spilled, etc. |
| Any injury or death of any marine fauna species listed as threatened or migratory under the EPBC Ac | DAWE | Within seven days | The report will contain:<br>+ titleholder details<br>+ time, location and description of the incident<br>+ a summary of the response being undertaken by Santos<br>+ details of the relevant contact person. |
| Any incidents that have caused or have potential to cause moderate to significant environmental damage to an Australian Marine Park or its values | Director of National Parks | Within 24hrs of the incident occurring | The report will contain:<br>+ titleholder details<br>+ time, location and description of the incident<br>+ the Australian Marine Park at risk<br>+ a summary of the response being undertaken by Santos<br>+ details of the relevant contact person in the IMT. |
| Suspected contravention of the OPGGS Act within the Habitat Protection Zone | Director of National Parks | Within 24hrs of incident being identified | Santos must notify the Director of any activities in contravention of the OPGGS Act. |
| Any discharge during the operation of the ship of oil or noxious liquid substances in excess of MARPOL discharge limits or rates; or any discharge or probable discharge of harmful substances in packaged form | AMSA Response Centre (ARC) | Within 1 hour of the incident occurring | Verbal reporting will consist of transfer of information to conduct a coordinated emergency response. All reporting will be carried out by the vessel master as per the vessel specific SOPEP. |

| Report | Designated Authority | Timing | Contents |
|---|---|---|---|
| Any spills likely to enter NT Waters | NT DPIR | As soon as practicable.<br>Written report as soon as practicable after request by DPIR | Verbal reporting will consist of transfer of information to conduct a coordinated emergency response. All reporting will be carried out by the vessel master as per the vessel specific SOPEP.<br>Written reports will contain all material facts and circumstances concerning the reportable incident, actions taken to avoid or mitigate any adverse impacts, and corrective action taken. |

## 7.10 Record keeping

Records management is the systematic control of information from creation to disposal. Santos has procedures in place detailing the types of records and duration records need to be retained.

The following records will be maintained for the activity:

+ environmental training and induction records
+ details of non-conformance inducing environmental incidents, complaints and follow up actions
+ internal and external environmental audit reports
+ reports of any regulatory authority inspection and actions undertaken and actions taken to rectify any issues raised through the audit or inspection
+ contractor daily reports
+ equipment and activity inspection records.

Documents and records related to the integrity of the pipeline will be stored in the Santos document management system. The documentation will be stored for at least the lifetime of the Pipeline or five years from the issuing of the document or record, whichever is the greater.

## 7.11 Emergency preparedness and response

### 7.11.1 Overview

Under Regulations 14(8) the Implementation Strategy must contain an OPEP and provide for the updating of the OPEP. Regulation 14(8AA) outlines the requirements for the OPEP which must include adequate arrangements for responding to and monitoring of oil pollution.

A summary of the key documents that may be used to guide an emergency response are described in the following sections. It should be noted that in the event of an incident occurring, the Emergency Response Plan and OPEP will be used to guide personnel in the initial stages of an incident. Following this, if an IMT is established then IMT personnel will continue to use the OPEP and the detailed guidance and checklists in the Santos Crisis and Incident Management Plan to direct the response.

### 7.11.2 Contractor Emergency Response Plan

The installation contractor will develop a comprehensive Emergency Response Plan (ERP) that addresses emergency response actions associated with all credible incidents for the activity, including. It will describe the interface arrangements between the Santos IMT and covers all aspects of emergency response including technical, logistical and medical support.

The ERP also outlines roles and responsibilities of contractor personnel for emergency events. The ERP is accepted by Santos and reviewed on an annual basis by the contractor or if a significant change has occurred to the incident management or emergency response arrangements.

Scenario-based drills are performed to test the emergency response arrangements and updates are made to improve the ERP, if required.

### 7.11.3 Oil Pollution Emergency Plan

The OPEP (BAA-100 0330) outlines the emergency management arrangements and oil spill response for the activity. The OPEP provides activity-specific information required for an effective response in the unlikely event of an unplanned release of petroleum products. The OPEP details the actions to be taken by the Incident Management Team (IMT) in response to the incident (consistent with the Santos Crisis and Incident Management Plan); describes arrangements and reporting relationships for command, control and communication; provides interfaces to oil spill response organisations and third party support entities; and provides procedures for notifying jurisdictional authorities and other external bodies.

For this EP, a 'fit-for-purpose' approach to spill response has been adopted, with consideration of:

- the low environmental risk profile of the installation campaign utilising marine diesel oil with little risk of significant liquid hydrocarbon release
- NOPSEMA's acceptance criteria, including the requirement for updating of the OPEP (Regulation 14(8) of the OPGGS(E) Regulations).

The only credible source of an oil spill in relation to the installation campaign within Commonwealth waters is from project vessels. As described in **Sections 5.3.7** and **5.3.8**, modelling was undertaken for two credible spill scenarios. It has been demonstrated that there is a low inherent risk of either of these scenarios occurring with the existing Santos controls in place.

### 7.11.4 Roles and responsibilities

The following tables provide an overview of the responsibilities of the Santos CMT (**Table 7-6**), IMT (**Table 7-7**), and field-based response team members in responding to an incident (**Table 7-7**).

***Table 7-6: Roles and responsibilities in the Santos Crisis Management Team***

| Santos CMT Role | Main Responsibilities |
|---|---|
| **CMT Leader** | + Maintain contact with IMT or Issue Notification stakeholder until the CMT is fully functional.<br>+ Articulate the overall response priorities and required actions using the PEARL approach<br>+ Consider response options to achieve priorities, including mitigating the potential worst-case scenario.<br>+ Determine Key Messages and Stakeholders, assigning Santos points of contact for each stakeholder.<br>+ Ensure CEO or delegate is engaged for all internal (staff) and external communications.<br>+ Confirm frequency of CMT reports and meetings and coordination with CEO, IMT and other stakeholders.<br>+ Consider how a change in the situation over time may alter the most likely and worst-case scenarios originally identified, and how this impacts response options and priorities.<br>+ Consider CMT requirements for the next phase of activity, allocating actions as appropriate. |
| **Administrator – Environmental, Health, Safety and Governance** | + Provide location, time and meeting medium details (e.g., telecon) to CMT members.<br>+ Work with the CMT Log Keeper to maintain an accurate CM Log with key situation details, meeting decisions/actions and next meeting time/location details.<br>+ Disseminate approved briefing material to personnel following CMT Leader’s direction.<br>+ Liaise with Public Affairs/Safety & Security/Facilities on any reception, premises security or media/adviser briefing requirements.<br>+ Ensure role discipline of CMT representatives, monitoring action progress and any coordination.<br>+ At each CMT meeting, summarise and record:<br>– any change/handover in CMT representatives<br>– the situation reviews and actions since last CMT meeting<br>– any issues raised between meetings requiring escalation to, or coordination with, the CMT. |

| Santos CMT Role | Main Responsibilities |
|---|---|
| **Duty Manager** | + With CEO agreement and appointment of a CMT Leader, assist with/oversee activation of the CMT.<br>+ Ensure the core CMT and specialist members are given details for the initial CMT meeting including location, time and meeting medium (e.g., telecon).<br>+ Where applicable contact IMT Leader or Issue Notification stakeholder and gain latest update for team.<br>+ Articulate the overall response priorities and required actions using the PEARL approach. Ensure ongoing monitoring for hidden or emerging risks.<br>+ Determine Key Messages and Stakeholders, assigning Santos points of contact for each stakeholder.<br>+ Ensure appropriate Legal Protocols are established on advice from CMT Legal.<br>+ Ensure CEO or delegate is engaged for all internal (staff) and external communications.<br>+ Consider how a change in the situation over time may alter the most likely and worst-case scenarios originally identified, and how this impacts response options and priorities. |
| **Government and Public Affairs** | + Without delaying CMT attendance, gain advice from Government and Public Affairs teams on main and social media situation, government stakeholder requests and requirements, and immediate strategy.<br>+ Gain requirements from the CEO or delegate on strategy, timings, and media representation.<br>+ Follow the Crisis Management Process using the nominated support tools.<br>+ An initial CMT meeting, take the lead role setting out and updating the stakeholder communications plan.<br>+ Identify current and immediate messaging needs (i.e., Holding Statements, internal communications, industry advices, government notifications, media releases) and ongoing issues management.<br>+ Advise on Government and Public Affairs recommendations and other considerations to support company sustainability and resilience.<br>+ Advise on and coordinate the stakeholder management approach across all levels of Santos, including media monitoring and media inquiry.<br>+ Engage and oversee any specific asset or sub teams required for stakeholder management. |
| **Risk and Audit** | + Advise on current and potential company risk issues.<br>+ Determine if additional specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated.<br>+ Advise on Santos risk options and recommendations, other mitigation controls to company sustainability, and resilience requirements.<br>+ Monitor and assess cumulative risk consequences and potential exposures to Santos.<br>+ Engage and oversee any specific sub teams or specialists required for Risk and Audit support.<br>+ Between meetings, liaise with sub teams and specialist advisers to ensure an effective response. Ensure confidentiality and authorised comment is continually observed. |

| Santos CMT Role | Main Responsibilities |
|---|---|
| **Safety and Security** | + Identify current and potential safety and security response, support or regulatory issues.<br>+ Determine if additional safety or security specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated.<br>+ Advise on safety and security recommendations and other considerations to support company sustainability and resilience.<br>+ Advise on notifications to any safety or security related stakeholders, including mandatory regulatory advice or reports.<br>+ Monitor and assess safety and security consequences, advise on strategies and potential penalties and financial exposures to Santos.<br>+ Engage and oversee any specific sub teams or specialists required for Safety and Security support.<br>+ Between meetings, liaise with sub teams and specialist advisers to ensure an effective response. Ensure confidentiality and authorised comment is continually observed. |
| **Human Resource Team Leader** | + Identify current and potential Human Resources (HR), People Support (PS) and Industrial Relations (IR) response, support (including incident site deployment) or regulatory issues.<br>+ Determine if additional HR, PS or IR specialists are needed. If so, coordinate and monitor their implementation (via the IMT where active with the respective IMT Leader) and keep the CMT updated.<br>+ Advise on and coordinate the personnel and next of kin communication approach across all levels of Santos with support from the Government and Public Affairs representative.<br>+ Advise on HR, PS and IR recommendations and other considerations to support company sustainability and resilience.<br>+ Monitor and report on any casualty condition, movement and health tracking to support injured parties (staff, contractors, and community as applicable).<br>+ Advise and coordinate management of HR, PS and IR stakeholders (via the IMT Leader where an IMT is active), including emergency services, union representation.<br>+ Monitor any HR or IR consequences, advise on strategies and potential penalties and financial exposures to Santos.<br>+ Engage and oversee any specific asset or sub teams used for HR, PS and IR stakeholder management.<br>+ Between meetings, liaise with asset and sub teams and specialist advisers to ensure an effective response. Ensure confidentiality and authorised comment is continually observed. |
| **Legal and Company Secretariat** | + Identify current and potential legal and company secretary issues.<br>+ Determine if additional legal specialists are needed. If so, coordinate and monitor their implementation (via the IMT Leader where an IMT is active) and keep the CMT updated.<br>+ Advise on Legal Professional Privilege matters for the CMT and coordinate with other groups (including IMT representation) to ensure company information and personnel are appropriately advised.<br>+ Advise the CMT, asset and sub teams about contractual obligations, including Joint Venture and supply agreements, as required.<br>+ Advise on legal and company secretariat recommendations and other considerations to support company sustainability and resilience.<br>+ Advise on notifications to regulatory or legal related stakeholders, including mandatory advice or reports.<br>+ Monitor and assess legal consequences, advise on strategies and potential penalties and financial exposures to Santos. |

| Santos CMT Role | Main Responsibilities |
|---|---|
| **Additional CMT support available as required:**<br>+ Environment and Land Access<br>+ Assets and Operations<br>+ Engineering and Technical<br>+ Exploration<br>+ Finance<br>+ Information Systems<br>+ Insurance<br>+ Marketing and Trading<br>+ Treasury<br>+ Commercial and Procurement | |

***Table 7-7: Roles and responsibilities in the Santos Incident Management Team***

| Santos Management/ IMT Role | Main Responsibilities |
|---|---|
| **Vice President Offshore (VPO) Upstream WA** | + Depending on the level of the incident, the VPO (and/or their delegate) will act as the primary liaison to the CMT Duty Manager.<br>+ On the activation of the IMT, the VPO is advised by the Incident Commander. |
| **Incident Commander** | + Coordinate all onshore support in accordance with the Incident Response Plan (IRP) and/or activity specific Oil Spill Contingency Plan or OPEP.<br>+ Set the response objectives and strategic direction.<br>+ Oversee the development and implementation of IAPs.<br>+ Oversee implementation of MoUs and contracted support for 'mutual aid'.<br>+ Ensure coordination with external organisations/police, etc.<br>+ Prepare and review strategic and tactical objectives with the VPO.<br>+ Liaise with the VPO and provide factual information.<br>+ Set response termination criteria in consultation with regulatory authorities.<br>+ Coordinate authorities for search and rescue. |
| **Planning Team Leader** | + Collect and document situational awareness information of the incident.<br>+ Develop, document, communicate and implement IAPs to achieve incident objectives.<br>+ Determine the status of action/s or planned activities under the IAPs and assess and document performance against the objectives.<br>+ Assess long term consequences of incident and plan for long term recovery.<br>+ Manage the Geographic Information System (GIS) Team in a response. |
| **Operations Team Leader**<br>**or**<br>**Drilling Team Leader** | + Coordinate operational aspects of Incident Response.<br>+ Provide the key contact for On-Scene Commanders (OSCs).<br>+ Liaise with contractors or third parties.<br>+ Mobilise additional Santos staff and external experts to form Technical Support Team.<br>+ Assist Planning Team Leader with overall general plan preparation and preparation of IAPs.<br>+ Implement IAPs.<br>+ Manage field response teams and activities. |

| | |
|---|---|
| **Public Information/ Government and Public Affairs** | + Manage all communications with media.<br>+ Liaise with government.<br>+ Prepare media releases for nominated spokesperson (CM or VPO).<br>+ Brief all Santos personnel appearing before the media.<br>+ Manage the Telephone Support Team.<br>+ Ensure timely approve by CMT and release of communications briefs to the Telephone Support Team. |
| **Logistics Team Leader** | + Mobilise response equipment, helicopters, vessels, supplies and personnel.<br>+ Provide transport and accommodation for evacuated personnel.<br>+ Oversee the implementation of the Waste Management Plan throughout a Level 2 or Level 3 oil spill response.<br>+ Liaise with the Supply Team to activate supply contracts and arrange procurements.<br>+ Coordinate authorities for search and rescue. |
| **Supply Team Leader** | + Arrange fast track procurement.<br>+ Activate supply contracts as required.<br>+ Implement and maintain Cost Tracking System to enable the tracking of all costs associated to the response of the incident. |
| **Environmental Team Leader** | + Manage notification to designated Environmental Authorities and liaise as required.<br>+ Assist in the development of IAPs.<br>+ Advise of the Net Environmental Benefit Analysis of oil spill response strategies and tactics.<br>+ Oversee the implementation of scientific monitoring programs in an oil spill response.<br>+ Provide liaison for implementation of the NT Oiled Wildlife Response Plan (NTOWRP) in an oil spill response. |
| **HR/Welfare Team Leader** | + Obtain personnel status involved in the incident.<br>+ Review Persons on Board (POB) lists and clarify accuracy through Safety Team Leader.<br>+ Obtain list of Contactor Companies involved in the incident and obtain Third-Party Contractor contact to advise of situation and safety of personnel when appropriate.<br>+ Obtain employee’s emergency contact list (next of kin (NOK)) to advise of situation and safety of personnel when appropriate.<br>+ Liaise with the CMT HR Team Leader.<br>+ Work with Logistics Team Leader to arrange transport for affected families to hospitals, etc.<br>+ Assist with arrangements through EAP to support families/employees.<br>+ Arrange NOK notifications for affected personnel (excluding Police managed fatalities).<br>+ Determine NOK assistance required; i.e., family travel to hospital, child support, etc.<br>+ Arrange for dedicated management support for families and next-of-kin, if appropriate.<br>+ Arrange EAP counselling at airports and homes where required – HR personnel to attend where possible. |
| **Safety Team Leader** | + Manage notification to Designated Safety Authorities and liaise as required.<br>+ Assist in the development of IAPs.<br>+ Oversee the development and implementation of incident Safety Management Plans as required.<br>+ Work with the Welfare Team Leader to support personnel safety. |

| | |
|---|---|
| **IMT Data Manager** | + Ensure IMT resources are in place and functional in the ICC.<br>+ Oversee the setting up of communications systems by the Computing and Communications Leader.<br>+ Establish the incident/exercise specific electronic folder system for records/information management.<br>+ Distribute manuals, contact lists and supporting information to IMT personnel.<br>+ Record and collect all information associated with the response to the incident.<br>+ Maintain filing system for Incident Response. |
| **GIS** | + Manage and keep up-to-date facility and asset drawings, data sets, and photos in the 'GIS in IMT Database'.<br>+ Manage and keep up-to-date environmental features and sensitivity data sets in the 'GIS in IMT Database'.<br>+ Manage and keep up-to-date marine maps in the 'GIS in IMT Database'.<br>+ Provide IMT with quick access to up-to-date drawings and data sets in the ICC.<br>+ Provide software system to IMT that allows tactical response mapping overlays on facility drawings and area maps. |
| **Finance** | + Handle accounting services and financial record-keeping, track and report on incident costs.<br>+ Facilitate all procurement requirements and ensure that expenditures are properly audited.<br>+ May be tasked with handling the receipt and processing of IMT third party claims. |
| **Spill Response** | + Provide specific advice and support to the IMT on spill response matters, excluding source control.<br>+ Activate and supervise spill response elements in accordance with the IAP and direct its execution.<br>+ Direct dedicated spill response equipment, request or release resources, approve group operational plans, and approve spill response changes to the IAP as necessary. |
| **Air Operations** | + Provide specific advice and support to the IMT on air operation matters.<br>+ Activate and supervise air operation elements in accordance with the IAP and directs its execution.<br>+ Direct dedicated air operations equipment, request or release resources, approve group operational plans, and approve air operations changes to the IAP as necessary. |
| **Situation /Log Keeper** | + Maintain the IMT main event log.<br>+ Collate inputs from other IMT members into the main event log.<br>+ Assist with updating status boards, and other visual displays.<br>+ Collate IMT information on stand down. |
| **Information Systems** | + Provide specific advice and support to the IMT on Information Systems matters.<br>+ Activate and lead Information Systems support resources as required. |
| **Subject Matter Expert** | + Provide specific advice to the IMT on your area of expertise.<br>+ Develop assessments and strategies to address the incident.<br>+ Activate and lead a Subject Matter Expert support team as required. |

*Table 7-8: Roles and responsibilities in the field-based response team*

| Field-Based Position | Main Responsibilities |
|---|---|
| On-Scene Commander | + Assess facility-based situations / incidents and respond accordingly.<br>+ Single point of communications between facility/site and IMT.<br>+ Communicate the incident response actions and delegates actions to the Incident Coordinator.<br>+ Manage the incident in accordance with Facility Incident Response Plan, Third Party Incident Response Plan, and/or activity specific Oil Spill Contingency Plan or Oil Pollution Emergency Plan.<br>+ Coordinate medical evacuations as required.<br>+ Refer to the Facility Incident Response Plan for detailed descriptions of roles and responsibilities. |
| Company Site Representative | + Notify the Perth based Incident Commander of oil spills.<br>+ Coordinate onsite monitoring of oil spill and ongoing communication with Incident Commander. |
| Facility Incident Response Team (IRT) | + Manage the incident in accordance with Facility Incident Response Plan, Third Party Incident Response Plan, and/or activity specific Oil Spill Contingency Plan or OPEP<br>+ Coordinate forward operations response teams and activities for on-asset incidents<br>+ Refer to the facility Incident Response Plan for detailed descriptions of roles and responsibilities within the IRT. |
| Medical Evacuation Team | + Manage all medical and transportation requirements related to injured personnel to an appropriate medical facility<br>+ Refer to the Medical Evacuation Procedure (QE-91-IF-00020) for detailed descriptions of roles and responsibilities within the Medical Evacuation Team |
| Off-Asset Oil Spill Response Teams | + Respond to oil spills at sea to minimise the impacts to as low as reasonably practicable.<br>+ Refer to activity specific Oil Spill Contingency Plans (OSCP) and OPEP for detailed descriptions of roles and responsibilities within the Off-Asset Oil Spill Response Team |
| Source Control Team | + Respond to incidents involving well loss of containment to stop the flow of oil to sea.<br>+ Refer to the Santos Source Control Planning and Response Guideline (DR-00-OZ-20001) for detailed descriptions of roles and responsibilities within the Source Control Team. |
| Oiled Wildlife Response Team | + Respond to oiled wildlife incidents to minimise the impacts to wildlife.<br>+ Refer to the Northern Territory Oiled Wildlife Response Plan (NTOWRP) for detailed descriptions of roles and responsibilities within the Oiled Wildlife Response Team. |
| Scientific Monitoring Teams | + Monitor the impacts and recovery to sensitive receptors from an oil spill and associated response actions.<br>+ Refer to the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) for detail on Scientific Monitoring Team roles and responsibilities. |

## 7.11.5 Training and exercises

In order to refresh IMT roles and responsibilities and provide familiarisation with OPEP processes and arrangements, IMT workshops are conducted as per the Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).

To familiarise the IMT with functions and processes, an OPEP Desktop and Activation Exercise is undertaken as per the Incident and Crisis Management Training and Exercise Plan (SO-92-HG-10001).

All workshops and exercises undertaken are recorded in the Santos EHS Toolbox, with the key recommendations recorded and tracked.

### 7.11.5.1 Incident management team training and exercises

Santos provides training to its personnel to fill all required positions within the IMT.

Competency is maintained through participation in regular response exercises and workshops. Exercise and training requirements for Santos' IMT members are summarised in **Table 7-9**.

***Table 7-9: Training and exercise requirements for incident management team positions***

| IMT Role | Exercise | Training |
|---|---|---|
| Incident Commander<br>Operations/IMT Drilling Team Leader | One Level 3 exercise annually <u>or</u> two Level 2 desktop exercises annually[6] | + PMAOMIR320<br>+ PMAOMIR418<br>+ AMOSC – IMO3 Oil Spill Command & Control |
| Planning Team Leader<br>Logistics Team Leader<br>Environmental Team Leader | | + PMAOMIR320<br>+ AMOSC – IMO2 Oil Spill Management Course |
| Safety Team Leader<br>Supply Team Leader<br>GIS Team Leader<br>Data Manager<br>HR/Welfare Team Leader | | + PMAOMIR320<br>+ AMOSC – Oil Spill Response Familiarisation Training |

### 7.11.5.2 Oil spill responder training

Santos has an internal capability of trained oil spill responders who can be deployed in the field in a spill response and has access to external, trained spill responder resources (**Table 7-10**).

***Table 7-10: Spill responder personnel resources***

| Responder | Role | Training | Available Number |
|---|---|---|---|
| Santos AMOSC Core Group Responders | Santos personnel trained and competency assessed by AMOSC as the AMOSC Core Group.<br>Deployed by IMT for spill response operations. | AMOSC Core Group Workshop (refresher training undertaken every two years).<br>AMOSC – IMO1 Oil Spill Operators Course | 12 |
| Santos Facility Emergency Response Teams | Present at Facility for first strike response to incidents. | Internal Santos training and exercises as defined in each facility's Emergency Response Plan<br>OSC to have AMOSC – Oil Spill Response Familiarisation Training. | One Incident Response (IR) team per operational facility per shift |

[6] All IMT members are required to participate in at least one Level 3 exercise every two years

| | | | |
|---|---|---|---|
| Santos Aerial Observers | Undertake aerial surveillance of spill.<br>Deployed by IMT in the aerial surveillance aircrafts. | AMOSC – Aerial Surveillance Course (refresher training undertaken tri-annually). | 7 |
| AMOSC Core Group Oil Spill Responders | Industry personnel as the AMOSC Core Group, available to Santos under the AMOSPlan.<br>For providing incident management (IMT) and operations (field response) assistance. | AMOSC Core Group Workshop (refresher training undertaken every two years).<br>AMOSC – IMO1 Oil Spill Operators Course and/or IMO2 Oil Spill Management Course | As defined in Core Group Member Reports[7]<br>Target to maintain at least 84 members (Ref.: AMOSC Core Group Program and Policies) |
| OSRL Oil Spill Response Personnel | Oil Spill Response Ltd professionals, providing technical, incident management and operational advice and assistance available under Santos-OSRL contract. | As per OSRL training and competency matrix. | 18 |
| AMOSC Oil Spill Response Specialists | Professionals, providing technical, incident management and operational advice and assistance available under Santos-AMOSC contract. | As per AMOSC training and competency matrix. | 8 |
| Oiled Wildlife Response Roles | Refer **Section 12** and the OPEP | | |
| Monitoring Service Provider: Monitoring Coordination Team (MCT) and Scientific Monitoring Plan Teams | Monitoring Coordination Team (MCT)<br>Scientific Monitoring Plan Teams:<br>Technical Advisers<br>Field Team Leader<br>Field Team Member | As defined in the Oil Spill Scientific Monitoring Standby and Response Manual (EA-00-RI-10162) | Capability defined in Monthly Capability Reports.<br>MCT – five personnel<br>Scientific Monitoring Plan Teams 12+ per team |
| Level 1 Oiled Wildlife Responders (Workforce Hire) | Provide oiled wildlife support activities under supervision. | No previous training required; on the job training provided. | Nominally over 1,000 |
| Shoreline clean-up personnel (Workforce Hire) | Manual clean-up activities under supervision. | | |

In addition to the resources listed in **Table 7-10**, the following resources are available for spill response and may be activated by the relevant Control Agency:

+ National Plan: National Response Team – Trained oil spill response specialists, including aerial observers, will be deployed under the direction of AMOSC and the IMT in a response. The National Response Team is trained and managed in accordance with the National Response Team Policy, approved by the National Plan Strategic Coordination Committee (AMSA, 2013b).

[7] An average of 41 personnel plus 16 AMOSC staff members available as of 5th May 2021.

+ NT Oil Spill Contingency Plan (NT OSCP): NT Response Team are available to assist under the jurisdiction of the NT IMT. NT Response Team members remain trained and accredited in line with the NT OSCP.

In the event of a spill, the trained spill responders listed in **Table 7-10** would be required to undertake various roles in key spill response operations, including operational monitoring, shoreline protection, shoreline clean-up, oiled wildlife response and scientific monitoring.

In the event of a spill, Team Leader roles for protection and deflection and shoreline clean-up would be filled through Santos' AMOSC Core Group Responders and then industry Core Group Responders.

### 7.11.6 Response testing arrangements and audits

Santos has oil spill response testing arrangements and auditing programmes in place which are detailed within the Santos Offshore Oil Spill Response Readiness Guideline (SO-91-OI-20001). Testing of key response provider arrangements may be done as part of larger exercises or as standalone tests where the capability and availability of resources through the response provider are assessed against the performance requirement.

#### 7.11.6.1 Testing arrangements

Santos employs a range of tests to ensure that the various response arrangements function as required. These tests include;

7. Review
8. Audit
9. Equipment Checks/ Deployments
10. Desktop Exercise
11. Level 2/3 IMT Exercise

The above tests and the testing schedule are detailed in full within the Oil Spill Response Readiness Guideline (SO-91-OI-20001); an excerpt of the testing arrangements plan is provided in. Objectives are set for the various tests identified for each of the response arrangements. The effectiveness of response arrangements against these objectives are assessed using pre-identified Key Performance Indicators (KPIs).

All testing activities are documented, and all reports generated will be saved in Santos's EHS Toolbox system. Once completed, records of testing arrangements are entered into the Santos EHS Toolbox and any actions, recommendations or corrective actions identified are assigned a responsible party for completion and tracked to closure. The status of completion is tracked through the 'Action module' in the EHS Toolbox and communicated widely through monthly EHS KPI reporting.

| # | Response Arrangements & Critical Components | Type of Test | Schedule | Objectives | KPIs |
|---|---|---|---|---|---|
| 1 | Source Control | | | | |
| | Source Control<br>a) Relief Well Drilling - Access to MODU | Review - MODU Register | Once per month for the duration of drilling campaign | Identify suitable MODU that can be utilized in the event of a Source control incident requiring a relief well | Document the identified suitable MODU by:<br>•Name<br>•MODU Type<br>•Location<br>•Contract Status |
| | Source Control<br>b) Well Capping - Access to Capping Stack | Review - Contract/Agreement | Annually (when drilling activity is occurring) | To confirm access to capping stack for well capping | Review to confirm access to Capping Stack through maintenance of service provision contract |
| | Source Control<br>c) Access to Source Control Emergency Response Personnel | Desktop Exercise | Annually (when drilling activity is occurring) | To check arrangements for access to Well Control Specialists from WWC as per Source Control Planning and Response Guideline DR-00-OZ-20001 | Confirmation (email) from WWC that listed Well Control specialists can be made available and will be mobilized within 72 hours of a notification |
| | Source Control<br>d) Vessel Fuel Tank Rupture - SOPEP | Review - Plan | Prior to vessel arrival in field | To confirm that each vessel within the field has an approved SOPEP in place | Review to confirm approved SOPEP in place for vessels |
| 2 | Operational Monitoring | | | | |
| | Operational Monitoring - Vessel Surveillance<br>a) Access to vessels | Review - Contract/Agreement | Annually | To confirm access to vessels for surveillance | Review to confirm Master Service Agreements (MSAs) with vessel providers to gain access to vessels |
| | Operational Monitoring - Aerial Surveillance<br>a) Access to aircrafts | Review - Contract/Agreement | Annually | To confirm access to aircrafts for surveillance | Review to confirm Master Service Agreements (MSAs) with aircraft providers to gain access to aircrafts for surveillance |
| | Operational Monitoring - Aerial Surveillance<br>b) Access to trained aerial observers | Review - Contract/Agreement | Annually | To confirm access to trained aerial observers | Review to confirm access to trained aerial observers through;<br>•Trained Santos personnel or<br>•AMOSC Member Contract or<br>•OSRL Associate Member Contract |

***Figure 7-6: Excerpt of Testing Arrangement Plan, taken from Oil Spill Response Readiness Guideline (SO-91-OI-20001)***

### 7.11.7 Audits

Oil spill response audits will follow the Santos Assurance Management Standard (SMS-MS15.1) and are scheduled as per the Santos Assurance Schedule (E-910HA-20002). Audits will assist in identifying and addressing any deficiencies in systems and procedures. At the conclusion of the audit, any opportunities for improvement and corrective actions required (non-conformances) will be formally noted and discussed, with corrective actions developed and accepted. In some instances, audits may conclude with potential amendments to the OPEP.

The deployment readiness and capability of AMOSC's oil spill response equipment and resources in Geelong and Fremantle are audited every two years under the direction of AMOSC's participating members. The intent of this audit is to provide assurances to Santos and associated members about AMOSC's ability to respond to an oil spill incident as per the methods and responsibilities defined in OPEPs and AMOSC's Service Level Statement.

The deployment readiness and capability of OSRL's oil spill response equipment and personnel are audited every two years by the Emergency & Oil Spill Coordinator. The intent of this audit is to provide assurances to Santos of OSRL's ability to respond to an oil spill incident as per the methods and responsibilities defined in Santos' OPEPs and OSRL's SLA.

### 7.11.8 Cost recovery

As required under Section 571(2) of the OPGGS Act 2006, Santos has financial assurances in place to cover any costs, expenses and liabilities arising from carrying out its Petroleum Activities, including major oil spills.

This includes costs incurred by relevant Control agencies (e.g., NT IMT) and third-party spill response service providers

### 7.11.9 Cyclone and severe weather response

Cyclones and other severe weather events are a potential risk to the safety and health of personnel.

The timing of pipeline installation activities may overlap with the cyclone season (November to April, with most cyclones occurring between January and March). Vessel contractors must have a Cyclone Response Plan in place outlining the processes and procedures that would be implemented during a cyclone event, which will be reviewed and accepted by Santos.

Activity vessels will receive daily forecasts from the BoM. 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 (or severe weather event) to affect pipeline installation activities, the Cyclone Response Plan will be actioned. If required, vessels can transit away from the proposed track of the cyclone (or severe weather event).

# 8. Stakeholder consultation

In accordance with the requirements of Regulations 11A and 14(9) of the OPGGS(E) Regulations, consultation has occurred with interested and relevant stakeholders while preparing this EP.

This section outlines the stakeholder consultation principles, approach and methodology, how these were applied to this specific consultation program, the outcomes achieved and how stakeholders will be consulted on an ongoing basis.

All feedback has been considered and addressed as appropriate. A detailed summary table supported by all relevant correspondence records has been provided.

## 8.1 Approach and objectives

The key sources of guidance for stakeholder engagement used for this EP are summarised in **Table 8-1**.

***Table 8-1: Stakeholder engagement guidance sources***

| | |
|---|---|
| **Internal** | + Corporate Principles for Stakeholder Engagement<br>+ Corporate Stakeholder Engagement Action Plan |
| **External** | + Australian regulatory agencies (legislation and guidelines) – NOPSEMA, NT Department of Primary Industry and Resources, AFMA<br>+ Australian industry organisations (principles and methodology) – APPEA<br>+ International organisations (guidelines) – IPIECA, American Petroleum Institute, International Finance Corporation, International Association for Public Participation |

The Barossa Gas Export Pipeline Installation EP is the first EP prepared since acceptance of the OPP. The consultation program for the EP, which commenced in mid-January 2019, was designed to:

- update stakeholders on the future plans for development and consultation to be conducted over a period of years
- explain the scope of activities to be covered in the EP
- explain how potential risks that may impact stakeholders are identified and mitigated
- obtain information and advice regarding oil spill response resources and capability
- understand any concerns, objections or claims that stakeholders may have in relation to the EP
- address stakeholder concerns arising from the EP and requirements for ongoing consultation
- inform stakeholder/s about how their concerns have been addressed and how they will be represented to NOPSEMA in the EP.

The minimum period that should be afforded stakeholders for consultation on proposed activities prior to an EP's submittal to the regulator is not mandated in the governing regulations. As per NOPSEMA's guidelines, an appropriate timeframe was based on the nature of the proposed activity and an understanding of the likely issues and concerns that may be raised by stakeholders and the need that these be addressed and discussed with them. In the case of this EP, a 20-week consultation period was determined as appropriate considering the nature and scale of the activity.

## 8.2 Identification and classification

Consistent with Regulation 11A of the OPGGS(E) Regulations, stakeholders are defined as either 'relevant' or 'interested'. The Regulations state that 'relevant' stakeholders are:

- persons or organisations whose functions, interests or activities may be affected by the pipeline activities to be carried out under the EP; (in this instance the activity means the pipeline installation

- those that have a regulatory role (Commonwealth or State/Territory).

Prior to development of the EP, a stakeholder database was reviewed to verify all existing stakeholders that would be relevant to this activity and ensure any new stakeholders were captured.

An internal exercise then identified potential stakeholder-specific issues that needed to be addressed and cross-referenced these with the outcomes from the ENVID workshop and risk assessment conducted as part of the EP preparation process. Around 100 stakeholders were identified, with just over 50 of these considered 'relevant' for this EP.

Stakeholder groups identified included Commonwealth Government Departments and Agencies, fishing industry associations, commercial fishing licence-holders and guided fishing companies operating close to the gas export pipeline within Commonwealth Waters. Spill response agencies with a role to play should an incident occur during the proposed activities were also consulted during preparation of the OPEP.

Issues, risks and opportunities associated with the gas export pipeline installation activities were mapped to stakeholders' interests.

Within the broad stakeholder groupings, the following list of stakeholders was identified as being interested or relevant for Commonwealth waters and NT Coastal Waters (for the OPEP).

***Table 8-2: Full list of stakeholders***

| Organisation | Stakeholder Group |
|---|---|
| ***Relevant*** | |
| A. Raptis & Sons Pty Ltd | Industry |
| Amateur Fishermen's Association of the Northern Territory (AFANT) | Other marine users |
| Aquarium Fishery NT Commercial License Holders | Industry |
| Arafura Bluewater Charters | Industry |
| Austfish Pty Ltd | Industry |
| Austral Fisheries Pty Ltd | Industry |
| Australia Bay Seafoods | Industry |
| Australian Communications and Media Authority | Commonwealth Government |
| Australian Fisheries Management Authority (AFMA) | Commonwealth Government |
| Australian Marine Conservation Society | Associations |
| Australian Marine Science Association – NT | Research |
| AMOSC | OPEP |
| AMSA | Commonwealth Government/OPEP |
| Australian Southern Bluefin Tuna Industry Association | Industry associations |
| Bathurst Island Lodge | Other marine users |
| Beach Energy | Industry |
| Clearwater Island Lodge | Other marine users |
| Commonwealth Fisheries Association | Industry Associations |
| Communities of the Tiwi Islands (including Tiwi Clan Groups). | - |
| Darwin Harbour Advisory Committee (DHAC) members | NT Government/OPEP |
| Darwin Port Corporation | NT Government/OPEP |

| Organisation | Stakeholder Group |
|---|---|
| Darwin Sailing / Cruising Yacht Clubs | Other marine users |
| Demersal Fishery NT Commercial License Holders | Industry |
| Department of Agriculture and Water Resources, Commonwealth | Commonwealth Government |
| Department of Defence (including Australian Hydrographic Service and Maritime Border Command) | Commonwealth Government |
| Department of Environment and Natural Resources (Marine Ecosystems), NT | NT Government |
| Department of Foreign Affairs and Trade | Commonwealth Government |
| Department of Industry, Innovation and Science | Commonwealth Government |
| Department of Infrastructure, Planning and Logistics NT | OPEP |
| Department of Primary Industry and Resources (Fisheries) NT | NT Government |
| Department of Primary Industry and Resources (Mines and Energy) NT | NT Government |
| Department of the Environment and Energy (including Parks Australia) | Commonwealth Government |
| Eni Australia | Industry |
| Environment Centre, NT | Associations |
| Fischer, Horst (commercial fishing license holder) | Industry |
| INPEX | Industry |
| Jamaclan Marine Services | Industry |
| Melbana Energy | Industry |
| Member for Arafura, NT | NT Government |
| Monsoon Aquatics | Industry |
| Neptune Energy | Industry |
| Northern Land Council | Associations |
| Northern Prawn Fishery (NPF) | Industry associations |
| Northern Territory Department of Territory Families, Housing and Communities (Heritage Branch) | NT Government |
| Northern Territory Guided Fishing Industry Association (NTGFIA) | Industry associations |
| Northern Territory Seafood Council (NTSC) | Industry associations |
| Northern Trawl Owners Association | Industry associations |
| Northern Wildcatch Seafood Australia | Industry |
| NT Ports and Marine (Melville Island) | Industry |
| Office of the Minister for Primary Industry and Resources, NT | NT Government |
| Office of the Minister for Environment and Natural Resources, NT | NT Government |
| Offshore Net and Line Fishery Commercial License Holders | Industry |
| Oil Spill Response Ltd | OPEP |
| Origin Energy | Industry |
| Paspaley Pearling Company | Industry |
| Pearl Oyster Fishery Commercial License Holders | Industry |

| Organisation | Stakeholder Group |
|---|---|
| Santos | Industry |
| Sea Turtle Foundation | Associations |
| Shell Australia | Industry |
| Spanish Mackerel Fishery (NT) License Holders | Industry |
| Sun Cable | Industry |
| Tellurian Inc | Industry |
| Timor Reef Fishery License Holders | Industry |
| Tiwi Island Adventures | Other marine users |
| Tiwi Land Council | Other marine users |
| Tourism NT | NT Government |
| Tourism Top End | Other marine users |
| Vocus | Industry |
| WA Seafoods | Industry |
| Woodside | Industry |
| ***Interested*** | |
| Aboriginal Areas Protection Authority | Associations |
| Australian Institute of Marine Science | Research |
| Australian Petroleum Production and Exploration Association | Industry associations |
| Centre for Whale Research | Research |
| Chamber of Commerce NT | Associations |
| Charles Darwin University | Research |
| Clearwater Island Lodge | Other marine users |
| Commonwealth Scientific and Industrial Research Organisation (CSIRO) | Research |
| Department of Environment and Natural Resources, NT | NT Government |
| Department of resources, Energy and Northern Australia | Commonwealth Government |
| Department of the Chief Minister NT | NT Government |
| Department of Tourism and Culture, NT | NT Government |
| Department of Trade and Business Innovation NT | NT Government |
| Edith Cowan University | Research |
| Environmental Defenders Office NT | Non-Government Organisation (NGO) |
| Environmental Protection Authority NT | NT Government |
| Federal Member for Solomon NT | Commonwealth Government |
| Fisheries Research Development Council NT | Research |
| Geoscience Australia | Commonwealth Government |
| Monash University | Research |

| Organisation | Stakeholder Group |
|---|---|
| NOPTA | Commonwealth Government |
| Office of Aboriginal Affairs | NT Government |
| Office of the Chief Minister NT | NT Government |
| Office of the Leader of the Opposition NT | NT Government |
| Office of the Minister for Energy and Environment Cwlth | Commonwealth Government |
| Office of the Minister for Environment and Natural Resources NT | NT Government |
| Office of the Minister for Indigenous Affairs Cwlth | Commonwealth Government |
| Office of the Minister for Industry, Innovation and Science Cwlth | Commonwealth Government |
| Office of the Minister for Infrastructure, Planning and Logistics NT | NT Government |
| Office of the Minister for Primary Industry and Resources NT | NT Government |
| Office of the Minister for Resources and Northern Australia Cwlth | Commonwealth Government |
| Office of the Minister for Tourism and Culture, NT | NT Government |
| Office of the Minister for Trade, Business and Innovation, NT | NT Government |
| Office of the Senator for the Northern Territory | Commonwealth Government |
| Pearl Producers Association | Industry Associations |
| Pendoley Environmental | Research |
| RPS Group | OPEP |
| Shadow Minister for Industry, Innovation and Science Cwlth | Commonwealth Government |
| Shadow Minister for Resources and Northern Australia Cwlth | Commonwealth Government |
| Shadow Parliamentary Secretary for Northern Australia Cwlth | Commonwealth Government |
| WA Fishing Industry Council (WAFIC) | Industry Associations |
| Whale and Dolphin Conservation (WDC) | NGO |
| Wilderness Society | NGO |
| World-Wide Fund for Nature (WWF) | NGO |

## 8.3 Methods and tools

NOPSEMA guidance has been applied during consultation, which advises that the time required for consultation varies depending on the individual circumstances of the relevant person, the proposed activity, the extent of potential impact to that relevant person and the level of information that has been provided.

Flexibility was built into the timeframe and processes to incorporate the differing requirements of stakeholders and incorporated the updated requirements around sensitive information contained in Regulation 4 of the OPGGS (E) Regulations. Each stakeholder providing feedback was asked to advise if any information provided during consultation was sensitive information which should not be published.

During the consultation period, all stakeholders were given an appropriate time to assess the information provided and consider responses. Stakeholder engagement occurred over 20 weeks in three stages:

1. Initial feedback period for all interested and relevant stakeholders including an additional week for any late feedback - 15 January 2019 to 19 February 2019 (approximately five weeks).
2. Direct follow-up with all relevant stakeholders – 19 February to 16 April 2019 (approximately eight weeks).

3. Additional time for all relevant stakeholders to provide comment and a final period of direct follow-up (approximately seven weeks to 30 April 2019).

Throughout this entire period feedback from stakeholders was considered at any time up to the final weeks of the EP's preparation for submittal; i.e. four weeks after the 20-week period.

In mid-January 2019 a fact sheet was initially provided under covering email or letter to all 'relevant' and 'interested' stakeholders. The information provided included:

+ a project overview, including the development concept
+ the project's current status
+ the proposed pipeline route, installation, operational area and timing/schedule
+ the regulatory and consultation process
+ detailed links to relevant sections of the accepted OPP.

In addition to this fact sheet, tailored information on issues and concerns of relevance to the commercial fishing industry was provided to all commercial fishing stakeholders, including government departments, at the request of the WA Fishing Industry Council and the NT Fishing Industry Council.

Correspondence was replied to and meetings proactively sought with relevant stakeholders with direct activities in or adjacent to the proposed pipeline installation area. The co-ordinates of the proposed pipeline route were provided to all commercial fishing industry stakeholders.

Direct follow-up via phone and email contact with all 'relevant' stakeholders was undertaken, resulting in a range of meetings. During this period detailed messages were left when unable to contact stakeholders and continued to respond via email to all feedback.

During consultation, most stakeholders did not provide any written feedback. Where stakeholders did provide written feedback, the consultation is summarised in **Table 8-3** at the end of this section and full records provided in **Appendix E**.

If a comment was provided by a stakeholder during a meeting or phone discussion but not followed-up by the stakeholder with an email, a summary of the issues raised and an assessment was provided back to the stakeholder in writing.

All relevant/interested stakeholders who raised either written or verbal issues, concerns or claims during the consultation process were provided with written details, where required, indicating how their concerns had been or would be addressed.

Throughout the consultation process, fully considered and appropriate written responses to issues were provided to stakeholder as soon as possible, dependant on the nature of the required response and the information that was available to be provided.

If responses could not be provided within the original advised response period, stakeholder were kept informed as to when a written response would be provided.

Following the direct follow-up period, a consolidated document on the issues raised and responses provided and published on an external website along with a power point presentation that had been provided at stakeholder meetings.

Further correspondence was sent to all relevant stakeholders providing further opportunity to comment, advising that information was also available on the website and following this conducted direct follow-up with several stakeholders.

At the end of this period all stakeholders were advised that the EP was in its final stage of preparation and were thanked for their input. All stakeholder feedback received over the duration of the stakeholder engagement program has been recorded. A record of all relevant meeting notes, phone calls and email exchanges, along with copies of project letters and fact sheets have been incorporated in **Appendix E**.

## 8.4 Consultation outcomes

The majority of stakeholders did not have specific issues or concerns, as evidenced by the detailed consultation summary and records of correspondence.

Many of the 'relevant' stakeholders engaged via phone call advised they were only likely to provide feedback via email if they had concerns. Others advised that if an email had not been provided it could be assumed there were no concerns.

Of the 100 stakeholders, 19 raised issues or concerns or sought additional information. Meetings were conducted with 17 of these stakeholders and written responses were provided to all.

There were three areas of concern raised, being:

1. impacts and risks to the seabed and nearby habitat due to pipeline installation
2. impacts and risks to other vessels and activities being conducted at the same time in the same area as installation was occurring
3. impacts and risks to the marine environment generally, but specifically due to installation occurring partly within a marine park and occurring during increased periods of turtle activity.

The following is a summary of the consultation outcomes for the key stakeholder groups while further detail for every stakeholder is provided in the stakeholder consultation table at the end of this section.

### 8.4.1 Commonwealth government

A total of ten Commonwealth Government departments were contacted, the AFMA, the AMSA and Parks Australia within the DoEE (now DAWE). Nine offices of Ministerial and other political officeholders were also contacted.

Consultation principally occurred with Parks Australia via the pipeline licence application (**Section 2.1.5**), but the agency was also provided opportunity to provide feedback on the EP.

One agency, the Department of Agriculture and Water Resources, sought further information on biosecurity arrangements while AFMA provided advice on fisheries to be consulted. A timely response was provided and no further action was required for these stakeholders for the preparation of the EP.

### 8.4.2 Northern Territory government

While the scope of activities for this EP is entirely in Commonwealth Waters, 11 NT Government departments were contacted, including the Mines and Energy and Fisheries divisions of the Department of Primary Industry and Resources, the Environment division of the Department of Environment and Natural Resources and the Darwin Ports Corporation. Eight offices of Ministerial and other political officeholders were also contacted.

A meeting was initiated with four departments – Fisheries; Infrastructure, Planning and Logistics, Mines and Energy; and Darwin Port.

The Department of Fisheries provided information on additional fishing licence-holders to be consulted and fishing activity periods and productive areas. In addition to answering the Department's specific queries in writing, the department was provided with the tailored information provided to commercial fishing licence holders on their relevant issues and concerns. No further issues or concerns were raised by the Department.

The other three meetings were primarily information-sharing and did not raise any issues or concerns. The four departments will be involved in future discussions related to the planning of pipeline installation activities.

### 8.4.3 Industry associations

Of the nine industry associations contacted, eight represent commercial fishing licence-holders. Four of the nine associations, Northern Prawn Fishery Industry (NPFI), NTSC, WAFIC and NTGFIA, responded to requests for feedback.

The WAFIC and the NTSC requested that tailored information addressing issues and concerns of relevance to the commercial fishing industry also be prepared and provided to the associations.

Information was provided to both the associations and all commercial fishing stakeholders, including licence-holders, along with co-ordinates for the proposed pipeline route.

The WAFIC advised it was not a relevant stakeholder for the activity covered by this EP while the NTSC did not notify of any issues or concerns.

A meeting was held with the NT Guided Fishing Industry Association at which the following issues and concerns were raised, being:

1. impacts and risks to the seabed and nearby habitat due to pipeline installation.
2. impacts and risks to other vessels and activities being conducted at the same time in the same area as installation was occurring.

The NPFI raised the same issues in writing with specific concerns raised for prawn stocks and habitat and sawfish populations.

A response was made in writing to all concerns. In addition, a commitment to ongoing consultation with the NPFI with regard to the safe interaction of vessels and activities during the pipeline installation once further detail and clarity around timeframe was available.

### 8.4.4 Industry/business

Commercial fishing interests are the key industry stakeholders in their capacity as co-users of the Commonwealth waters within which the gas export pipeline is located. Initial and tailored written information was provided to more than 40 licence-holders across all relevant fisheries and followed-up with phone calls to 12 businesses or individuals and their relevant association representatives.

Meetings were conducted with five businesses: Austral Fisheries, NT Spanish Mackerel Fishery representatives and three guided fishing operators located on the Tiwi Islands, Bathurst Island Lodge, Clearwater Islands Resort and Tiwi Island Adventures.

At all five meetings the following issues and concerns were raised, being:

1. impacts and risks to the seabed and nearby habitat due to pipeline installation
2. impacts and risks to other vessels and activities being conducted at the same time in the same area as installation was occurring.

Each stakeholder also had specific questions related to their operations and areas of activity, further details of which are provided in the stakeholder consultation table at the end of this section.

A response in writing was made to all concerns. Two stakeholders advised they were satisfied with the responses while no further issues or concerns were raised by the other two stakeholders.

A commitment was made to ongoing communication with all the stakeholders regarding the safe interaction of vessels and activities during the pipeline installation once further detail and clarity around timeframe was available.

The other main industry with interests and/or operations in the area is the oil and gas industry and 11 companies were contacted. Again, the limited number that responded advised they had no concerns or would only respond if they had concerns or queries.

### 8.4.5 Other marine users

Recreational fishing and military exercises are the other key activities that are or can be active in the area. The recreational fishing representative organisation, AFANT, raised similar issues and concerns to commercial fishing stakeholders while the Commonwealth Department of Defence did not raise any concerns or queries.

A meeting was held with AFANT at which the organisation also sought information on the rationale for the pipeline route partly traversing a marine park and expressed the importance communicating relevant information and outcomes with stakeholders.

A response was made in writing to all AFANT concerns and the stakeholder did not raise any further issues or concerns.

A commitment was made to ongoing communication on its activities and consultation on the safe interaction of vessels and activities during the pipeline installation once further detail and clarity around timeframe was available.

### 8.4.6 Environmental interest groups

Nine environmental interest groups were provided written information and follow-up was made by phone to five of these, including the three NT-based organisations that had previously made submissions on the Barossa development OPP.

Two organisations, the Australian Marine Conservation Society and the Environment Centre NT, requested a joint meeting to discuss its concerns related to:

+ impacts and risks to the seabed and nearby habitat due to pipeline installation
+ impacts and risks to the marine environment generally, but specifically due to installation occurring partly within a marine park and occurring during increased periods of turtle activity
+ impacts and risks to marine fauna due to increased vessel movements.

The stakeholders were specifically concerned that pipeline installation should not occur in a marine park nor during any turtle internesting periods.

A response was made in writing to all the concerns raised and the stakeholders did not raise any further issues or concerns. Ongoing communication with stakeholders on the activities will continue.

### 8.4.7 Indigenous groups

The Tiwi Islands are the nearest land mass to the pipeline route in Commonwealth Waters. Engagement has been ongoing with the Tiwi Land Council (TLC), the governing indigenous-based organisation for the Islands, since late 2016.

This engagement included two workshops held in 2018 to verify desktop studies and gain a deeper understanding of the environmental, social, cultural and economic sensitivities for the Tiwi Islands through direct engagement. The initial workshop was held on 25 October with Traditional Owners identified by the TLC while the second workshop, held on 13 December, was more targeted and attended by TLC marine and land rangers. The information gained was used in the preparation of the OPEP supporting this EP.

Both the TLC and the Northern Land Council (NLC) were then consulted for the EP during the formal consultation period that commenced in January 2019. The NLC advised it was happy to be considered an 'interested' stakeholder only provided consultation was occurring with the TLC and it (the TLC) was satisfied with the process and the responses.

A meeting with the TLC to discuss the gas export pipeline installation EP discussed the TLC's issues and concerns related to impacts and risks to the seabed and nearby habitat and turtle activity due to pipeline installation.

A response was made in writing  to all the concerns raised and the TLC advised it was satisfied with the responses. Ongoing dialogue with the TLC on the gas export pipeline installation and all activities associated with the Barossa Development will continue.

### 8.4.8 Research/education groups

Six research and/or education organisations with interests in Commonwealth and/or NT Waters were provided written information and follow-up was made by phone to two with no responses received. A meeting was held with a representative of Edith Cowan University at the request of the Australian Marine Conservation Society and no issues or concerns were raised.

### 8.4.9 Summary

All stakeholders have been provided information in a fair and reasonable timeframe for the discussion and assessment of all issues raised during the course of the consultation period, and that this has been accurately represented in the EP, as presented in the detailed summary of consultation.

Of the 19 stakeholders that raised issues and concerns or sought additional information, nine advised they were happy with the responses provided. The other stakeholders were followed-up directly and did not raise any further issues or concerns.

Communication and consultation will continue with those stakeholders who have indicated they will or may be operating in the area and have particular concerns related to vessel interaction, as well as those stakeholders with interest in how impacts and risks will be of its activities to the marine environment.

## 8.5 Ongoing process

Ongoing consultation with all stakeholders relevant to the future installation of the gas export pipeline may occur in three ways:

1. gas export pipeline installation activity notification
2. regular activity updates
3. general enquiry process.

A number of activities relating to the Barossa development will occur that will require stakeholder consultation over coming years. With a high number of common stakeholders across these activities, quarterly stakeholder update covering all current and future activities are proposed. Quarterly updates to complement, not replace, stakeholder consultation requirements in Regulations 11A and 14(9) of the OPGGS(E) Regulations.

### 8.5.1 Pipeline installation activity notification

The steps below detail the approach to consultation closer to the period when the activities will take place.

**Lead-up Period:**

1. Provide a latest version of a Stakeholder Communication and Consultation Plan to stakeholders (via email) three weeks prior to commencement date of activity.
2. Provide notification to AHS and AMSA three weeks prior to commencement date of activity.
3. Provide a weekly activity update to relevant stakeholders (via email) with information to include the status of approvals, details of the vessels undertaking the activities, and the proposed schedule, starting two weeks prior to commencement date of activity.
4. Follow-up via telephone contact with stakeholders who have not responded to email prior to commencement date of activity.
5. Manage stakeholder queries (via email/phone; fortnightly teleconference and, separate meeting if required) as per assessment process stated below.

**Activity Period:**

1. Provide weekly status report, including information regarding activity progress, look-ahead for coming week and vessel interactions to stakeholders via email.
2. Provide opportunity for stakeholders to have direct access to a company representatives to discuss any concerns.
3. Manage stakeholder queries (via email/phone; weekly teleconference and, separate meeting if required) as per assessment process stated below.

**Post Activity Period:**

1. Provide notification (via email) to stakeholders that activity has been completed.
2. Manage stakeholder queries (via email/phone; meeting if required) as per enquiry communication and consultation process below.

## 8.6 Consultation summary table

A detailed summary of the consultation conducted for this EP is provided in **Table 8-3**. The table include dates of meetings, telephone discussions and written communications; the issues, objections and claims raised by stakeholders; how this information has been assessed and how each issue, objection and claim has been responded to.

Every effort has been undertaken to ensure the table, while a summary, represents a true and accurate reflection of the consultation undertaken and views expressed.

Where reference to the Company is made in this table, this relates to the previous Barossa titleholder, ConocoPhillips.

*Table 8-3: Stakeholder consultation summary table*

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
|---|---|---|---|---|
| ***A Raptis and Sons*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to OPP sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 21 Feb 2019 | Telephone discussion and follow-up email provided by Company with pipeline route co-ordinates.<br>Raptis advised if it had not responded by now, it meant it had no concerns. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that information provided to individual stakeholders during the consultation period had been summarised and consolidated on the company website and provided the website address.<br>Stakeholder was advised that the documentation on the company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
|---|---|---|---|---|
| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| ***Amateur Fisherman's Association NT (AFANT)*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | The following information was provided by Company to the stakeholder in response to the issues and concerns raised at a meeting held on 19 March (see entry in left column):<br>**1 Impact in marine park and Habitat Protection Zone**<br>Company identified several preliminary pipeline routes following a review of available information on the bathymetry, seabed topography and underlying geology relevant to each route. This was done during the early design phases of the Barossa Development and included a range of contingencies to account for uncertainty around the requirements of the project.<br>Given several pipeline routes were under consideration, the Barossa OPP that was published for public comment allowed for potential route alignments within a pipeline corridor, both within and outside the Oceanic Shoals marine park. These potential pipeline routes were | The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to environmental impacts and risks (1 and 3) did not result in any specific amendments to the EP.<br>The issues and concerns related to communications (2, 4 and 5) helped inform the commitments Company has made in the ongoing communications process. | Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. The stakeholder will continue to be notified of Barossa |
| 31 Jan 2019 | Company phoned and left message to offer meeting in Darwin the following week. No response received. | | | |
| 21 Feb 2019 | Telephone discussion and follow-up email with pipeline route co-ordinates sent by Company. Meeting to be held. | | | |
| 19 Mar 2019 | Meeting held in Darwin with AFANT representative. | | | |

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| 22 Mar 2019 | Company emailed AFANT with list of issues/questions raised at meeting and advised we would respond in writing as soon as possible:<br>Pipeline installation activities specifically within the Marine Park and Habitat Protection Zone, the impact of these activities on the sea floor and marine environment, particularly fish and fish habitat, and how these impacts will be mitigated and managed by Company in terms of achieving net reduction in environmental harm.<br>It is Company role to properly and clearly communicate its reasons for seeking to route the pipeline through the Marine Park and HPZ and its evidence related to impacts.<br>While the number of recreational fishers that would conduct activities more than 100 km from the mainland is limited, the southern section of the pipeline route enters a pristine and highly valued fishing area and recreational fishing activities do occur there from time to time.<br>AFANT also represents charter fishing businesses, some of whom are active in the area. Their customers are recreational fishers who have paid for a remote fishing/tourism experience and do not expect to have their experience impacted by the sight of industrial activities. Therefore, advance communications by Company of work schedules and vessel presence will be critical.<br>Overall, public communication by Company of its planned activities, both prior to and during the pipeline installation, will be | subject to further survey and engineering studies to determine their technical feasibility.<br>Based on the additional work, the previously considered routes to the alternative western tie-in point on the Bayu-Undan pipeline (the western route alignment within the marine park) were ruled out as not being technically feasible due to the presence of significant seabed features and highly irregular seabed topography along the southern section of that alignment that could not be avoided. Dropping this western route alignment also had the advantage of minimising the length of pipeline route that overlaps the Oceanic Shoals marine park and allowed for a much narrower pipeline corridor to be defined in the Barossa OPP.<br>As a result, three candidate pipeline routes were the subject of a feasibility and practicability assessment.<br>Within the Oceanic Shoals marine park:<br>+ Two central route alignments (excluding the original preliminary pipeline route) within the Oceanic Shoals marine park that intersect the multiple use zone and HPZ of the Oceanic Shoals marine park, tying into the existing Bayu-Undan to Darwin pipeline at the preferred eastern tie-in location.<br>Outside the Oceanic Shoals marine park HPZ:<br>+ An eastern route alignment; i.e. crossing the shallow water area located between the marine park and the Tiwi Islands. This route would require secondary stabilisation of the pipeline due to the relatively shallow and rugose seabed. Secondary stabilisation methods could include rock dumping, pre-lay and post-lay trenching or dredging, resulting in greater environmental impact.<br>Engineering and design activities have focused on the two central route alignments within the Oceanic Shoals marine park HPZ (the proposed route and the | | activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | essential to ensure other marine users understand and have opportunity to comment on the impacts. | discounted central route alignment). Seabed conditions and expected span rectifications were considered to be similar for both of the routes, with the proposed route being selected as it has the benefits that it:<br>+ minimises the area that the pipeline route needs to overlap the Oceanic Shoals marine park HPZ<br>+ minimises the amount of seabed installation required and eliminates secondary stabilisation requirements for pipeline installation (which would be required to install the pipeline along the eastern route alignment located in the shallow water area outside the marine park HPZ)<br>+ minimises, as much as practicable, the installation of the pipeline over areas of seabed that are associated with the seafloor features/values of the shelf break and slope of the Arafura Shelf and carbonate bank and terrace system of the Van Diemen Rise KEFs<br>+ reduces inspection, maintenance and repair (IMR) requirements during operations, compared to all other alternative route alignments considered.<br>The reduced route length and smoother seabed profile (less spans) represents the shortest length of pipeline required and minimises the amount of seabed installation and stabilisation required, requiring the shortest installation campaign, thereby minimising the time installation activities will overlap with internesting habitat critical to the survival for marine turtles.<br>Installation and operation of a pipeline with the HPZ of the marine park is allowable with authorisation from the Director of National Parks, and Company has worked closely with Parks Australia to achieve this authorisation. | | |
| 10 April 2019 | Company provided written responses to the issues and concerns raised during the meeting of 19 March, noting that one of the responses included a change to the indicative schedule.<br>Company had previously advised that the activities associated with the installation of the pipeline are expected to commence as early as Q1 2021 and finish as late as Q2 2023. The finish date is now 'as late as Q1 2024'. All other indicative schedule information is the same, including the duration period of approximately nine months for the activities.<br>Company advised we would contact the stakeholder to check if there were any further issues or concerns. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on the company website included a new potential end date of Q1, | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
|---|---|---|---|---|
| | 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that they did not want to be published by NOPSEMA following EP submittal. | The pipeline activities are considered to be consistent with the management objective of the HPZ within the Oceanic Shoals marine park. Although the presence of the pipeline will result in a small direct loss of benthic habitat, there will be no impact on the habitat representativeness or habitat diversity of the marine park. Where the pipeline traverses the HPZ, it is distant from seafloor features associated with the key ecological features (KEFs) considered values of the marine park. Therefore, no impacts to KEFs and values of the marine park are expected from pipeline activities within the HPZ.<br>**2 Communications**<br>The Barossa Gas Export Pipeline Installation EP submitted to NOPSEMA for assessment will include information updated from that previously published in the draft and accepted versions of the Barossa OPP. The Gas Export Pipeline Installation EP will be published in full by NOPSEMA on its submittal. Company will also provide advice of any decision by Parks Australia and link to the information provided by the agency.<br>**3 Impact on recreational fishing**<br>The pipeline will be constructed from carbon steel and have an external anti-corrosion coating, concrete weight coating and anodes to maintain integrity. It will be laid using a continuous assembly pipe-welding installation method with sections of pipe gradually lowered to the seabed behind the pipelay vessel using an S-lay method. This method is commonly used in offshore pipeline installation in comparable water depths. The use of dynamically positioned pipelay and support vessels will eliminate the need for anchoring during routine installation operations. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
|---|---|---|---|---|
| | | The primary method of maintaining pipeline stability on the seabed, where required, will be through the concrete weight-coating. Several seabed intervention methods could be used to manage spans and stability where concrete weight-coating alone is not sufficient. These methods could include concrete mattresses, sand/grout bags, local modification to the seabed, steel structures, rock bolting and gravity anchors.<br>Activities associated with the installation of the pipeline are expected to commence as early as Q1 2021 and finish as late as Q1 2024. It is anticipated that the pre-lay survey could commence up to nine months earlier than pipeline installation, and pre-lay span rectification may occur up to 30 days prior to pipeline installation. The total infield duration of the offshore installation activities is expected to be approximately nine months. The schedule is indicative only; exact timing and duration of the installation activities is subject to pipelay vessel availability, sea state, weather conditions and operational efficiencies. (i.e. the pipelay vessel will be present for approximately three months).<br>Installation activities will occur within a 2km corridor either side of the gas export pipeline (3km around the pipeline end termination points at both ends of the pipeline). During installation activities, a 500m safety exclusion zone will be established around the pipelay vessel. There will be no ongoing exclusion zones established around the pipeline during operations.<br>It is highly unlikely that the presence of the project will result in significant changes in habitat usage by marine species or to the physical environment. Within the pipeline corridor, potential impacts associated with the installation are expected to be short term and localised | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
|---|---|---|---|---|
| | | (within hundreds of metres) with impacts to the wider marine environment considered highly unlikely. Over the longer term, impacts over the operating life of the pipeline are expected to be minimal.<br>The pipeline route has been refined to avoid areas of significant seabed features as much as practicable, and avoid uneven seabed features wherever possible. The benthic habitat in the vicinity of the pipeline route is widely represented in the region and predominantly supports burrowers/crinoids, filter feeders and macroalgae.<br>The following potential environmental impacts were assessed in the Barossa Offshore Project Proposal (OPP) and are being further examined during the development of the Gas Export Pipeline Installation Environment Plan (EP).<br><u>Fauna</u><br>Impacts to fauna such as marine turtles, cetaceans and fishes are expected to primarily be short-term displacement from the immediate vicinity of the pipeline during installation.<br>Baseline environmental assessment has confirmed that marine mammals (cetaceans) are generally widely distributed and highly mobile in the region. Both sei and fin whales have a wide distribution throughout offshore waters and therefore may pass through the project area in low numbers. No aggregation areas or migration pathways for cetaceans occur within or in the vicinity of the proposed pipeline route.<br>The crested tern is widespread and numerous along the NT coastline, with 20 breeding colonies reported. The colony on Seagull Island, 4 km north-west of Melville | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
|---|---|---|---|---|
| | | Island, supports over 50,000 birds and is considered globally significant. Significant numbers of Olive Ridley and flatback turtles are also known to nest on the beaches of Seagull Island and on the west coast of Melville Island.<br>A 'biologically important area' (BIA) for Olive Ridley turtles has been defined adjacent to this area, and the pipeline installation activities will not encroach this area. A larger area has been defined as a BIA for flatback turtles as well as 'habitat critical to the survival of flatback and Olive Ridley turtles'. While pipeline installation activities will traverse a small part of these areas, installation activities are considered highly unlikely to impact the species use of the area as low numbers of turtles are expected in the vicinity of the pipeline due to the water depths.<br>During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area. Therefore, light emissions from the pipelay installation vessels are not anticipated to impact the breeding population of crested terns or turtles.<br>Underwater sound generated by installation activities may affect individuals passing through the area; however, impacts at a population level are considered unlikely given the area affected is highly localised. The key noise sources associated with installation activities along the pipeline will also be relatively slow moving (approximately 3 km to 5 km of the pipeline will be laid | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
|---|---|---|---|---|
| | | per day), thereby allowing individuals to move away from the area, and reasonably short in duration.<br>The risk of vessel strike to marine fauna is inherent to movements of all vessel types, including recreational vessels, fishing vessels, passenger ships, whale-watching boats, container ships and naval ships. Impacts from the presence of offshore infrastructure and related vessels interacting with marine fauna are not considered to present a significant risk at a population level.<br>Key controls to minimise impacts from the physical presence of offshore infrastructure and project related vessels interacting with marine fauna include:<br>+ placement of pipeline infrastructure in areas where there are no regionally significant feeding, breeding or aggregation areas for marine mammals<br>+ limiting of the physical footprint of the pipeline area such that displacement of individual mammals is unlikely, and the likelihood of a collision is remote<br>+ vessels travelling at relatively low speeds within operational areas<br>+ project vessels proactively responding to potential fauna interactions in line with the requirements of the EPBC Regulation s2000 – Part 8 Division 8.1<br><u>Water Quality</u><br>During the installation campaign project vessels will routinely discharge small volumes of treated sewage, cooling water, putrescible waste, reverse osmosis brine, bilge and deck water. Any potential impacts are expected to be highly localised and temporary and will not impact environmental values/sensitivities.<br>Given the typically small volumes and temporary (i.e. instantaneous) duration of accidental discharge events, | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
| --- | --- | --- | --- | --- |
| | | impacts to water quality would be temporary and highly localised. Subsequently, there would be limited potential for toxicity to marine fauna due to temporary exposure and low toxicity as a result of rapid dilution. Therefore, any potential impacts to marine fauna would be limited to any individuals that may be transiting within the immediate area of the discharge (within tens to several hundred metres).<br>After completion of installation, the pipeline will be FCGT with chemically-treated seawater (typically a mixture of biocides to prevent biofouling on the internal surfaces, an oxygen scavenger to control corrosion of the pipeline and a dye to allow for leaks to be detected during visual inspections). Approximately 16,000 m³ of treated seawater will be discharged over one to two days during cleaning, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>The pipeline will then be left filled with treated seawater before being dewatered and conditioned with mono ethylene glycol (MEG) (to prevent hydrate or moisture formation) and nitrogen purged (to displace moisture and oxygen within the pipeline). Approximately 85,000 m³ of treated seawater will be discharged over three to seven days during dewatering, with approximately 1,000 m³ MEG being discharged over a period of less than one day. Discharge of the dewatering fluid will only occur at the seabed through a vertically orientated diffuser at the northern end of the pipeline located in the Barossa field, which is approximately 150 km from the Tiwi Islands in ~250 m water depth. This area is also distant from known fishing activities.<br>Following cleaning, the pipeline will be pressure tested (hydrotested) to confirm pipeline integrity. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | | Approximately 2,000 m³ of treated seawater will be discharged over a half day period during hydrotesting, with discharges occurring at the seabed or the surface at either end of the pipeline.<br>Impacts from treated seawater arise mainly from the addition of biocides, corrosion inhibitors, scale inhibitors and oxygen scavengers. Given the short duration of discharges and low volumes/toxicities of chemicals used for FCGT and hydrotesting, and that biocides are readily biodegradable and do not bioaccumulate, impacts from these activities are expected to be restricted to localised short-term reductions in water quality with no significant impacts to protected or commercially important marine fauna.<br>Controls to manage this risk include:<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the potential impacts of planned discharges.<br>+ Bulk dewatering will occur at the offshore endpoint of the pipeline to maximise dilution and avoid sensitive habitats and areas of higher densities of marine fauna.<br>+ Chemical injection volumes will be metered during flooding and hydrotest operations to identify leakage and trigger activity to stop, as well as to mitigate the risk of under/over-dosage of chemical.<br>+ Contracted vessel will have dedicated FCGT procedures.<br>+ A vertically orientated diffuser will be used during dewatering to re-oxygenate treated seawater at the northern discharge point in the Barossa Field. | | |

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| | | <u>Introduced Marine Species</u><br>There may be an increased risk of introduced marine species (IMS) colonising areas of the pipeline corridor in the shallower water depths where there is suitable light and habitat available (particularly in the vicinity of the shoals/banks). However, the risk of this occurring is considered low given the key management controls that will be implemented throughout the life of the project including a project Quarantine Management Plan, and compliance with contemporary ballast water and biofouling requirements (see separate issue/response for further detail).<br>Impacts of pipeline installation activities on fishing activities near the proposed route are expected to be localised and short-term. Activities associated with installation of the pipeline will occur within a 2 km buffer around the pipeline route, and 3 km radius around each endpoint of the pipeline. However, support vessels may transit to and from port as required (note: vessel movements to and from the operational area are outside the scope of the EP).<br>Peak vessel activity is expected to occur during installation of the pipeline, when the pipelay vessel and a dedicated support vessel will be present in the operational area, while supply vessels will transit to and from the pipelay vessel regularly (expected to be daily). During the campaign, vessels will operate 24 hours a day, seven days a week.<br>The pipeline will overlap approximately 0.18 km² of the area actively fished in the Northern Prawn Fishery at low intensity. The pipeline corridor does not intersect any areas trawled by the NT Demersal Fishery. Once the pipeline is operational, trawl fisheries such as the | | |

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| | | Northern Prawn Fishery and NT Demersal Fishery may be affected on an ongoing basis due to the long-term presence of the pipeline and infrastructure. Recent effort for both these fisheries is concentrated outside the operational area and therefore impacts are expected to be minimal. Only limited recreational fishing activity occurs in or near the operational area due to the distance from the NT mainland.<br>Considering the relatively short duration of the pipeline installation in which higher numbers of vessels will be present), and minimal number of project related vessel movements within the pipeline corridor during operations (i.e. limited to periodic maintenance and inspection activities), the impact to commercial fishing activities from vessels movements are considered to be minor.<br>Controls to manage this risk include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of Navigation and Emergency Procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan.<br>+ AHS Notice to Mariners and AMSA MSI will be notified prior to relevant pipeline installation activities. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | | + Subsea infrastructure and pipeline will be clearly marked on Australian nautical charts published by the Australian Hydrographic Office (AHO).<br>+ The pipeline end termination (PLET) at the southern end of the Barossa pipeline where it joins the existing Bayu-Undan pipeline has been designed with anti-snag protection.<br>+ A support vessel will always be in the Operational Area while the pipelay vessel is installing the pipeline to minimise the potential adverse interactions with commercial fishing activities.<br>+ An ongoing communications plan will be implemented for engagement with potentially affected fishers.<br>The temporary presence of the pipelay vessels in the operational area will not significantly increase the volume of existing vessel traffic in the area. The area west and south-west of the Tiwi Islands is subject to regular vessel traffic.<br>Data from the Australian Maritime Safety Authority's (AMSA's) craft tracking system indicates vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest point of the pipeline corridor.<br>Darwin will continue to be the main supply and maintenance hub for all Company' Australian regional offshore exploration and production operations, including the Barossa Development. Company will continue to engage with vessel contractors regarding future port and transit plans.<br>**4 and 5 Communications** | | |

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| | | Company will continue to undertake consultation with all relevant fishing stakeholders in more detail during preparation of activity-specific EPs and on an ongoing basis in the lead-up to and during all operational activities. In addition to commercial fishers this will include recreational fishers through AFANT and charter vessel operators both directly and through their association. An ongoing stakeholder engagement and communications plan is included as part of the Gas Export Pipeline Installation EP submitted to NOPSEMA for assessment.<br>Controls to manage the risk of interaction with other vessels during pipeline installation activities include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of Navigation and Emergency Procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan.<br>+ AHS Notice to Mariners and AMSA MSI will be notified prior to relevant gas export pipeline installation activities.<br>+ Subsea infrastructure and gas export pipeline will be clearly marked on Australian nautical charts published by the AHO.<br>+ The PLET at the end of the gas export pipeline where the pipeline joins the existing Bayu-Undan pipeline has been designed with anti-snag protection. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | | + A support vessel will always be in the Operational Area while the pipelay vessel is installing the pipeline to minimise the potential adverse interactions with fishing activities.<br>+ An ongoing communications plan will be implemented for engagement with potentially affected fishers. | | |
| ***Aquarium Fishery, NT Commercial Licence Holders*** | | | | |
| 17 Jan 2019 | Company provided initial fact sheet via covering letter with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by |
| 6 Mar 2019 | Company provided tailored information on commercial fisheries' issues and concerns via letter, as requested by the Northern Territory Seafood Council (NTSC). | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 Apr 2019 | Company provided follow-up letter advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | + Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to As Low As Reasonably Practicable (ALARP). | | NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| ***Arafura Bluewater Charters*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the |
| 21/22 Feb 2019 | Company left phone messages and follow-up email with pipeline route co-ordinates. Advised were meeting with NTGFIA representative in Darwin and would Arafura like to join the meeting or have a separate one. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| ***Austfish*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the |
| 21/22 Feb 2019 | Company left phone message and follow-up email with pipeline route co-ordinates. | | | |
| 1 Mar 2019 | Company emailed information tailored to the commercial fishing industry. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the company website and provided the website address.<br>Stakeholder was advised that the documentation on the company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | + Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| ***Austral Fisheries*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | On request from the licence holders' representative body, the NT Seafood Council, Company proactively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP.<br>The following information was provided by Company to the stakeholder in response to the issues and concerns raised at a meeting held on 5 February (see entry in left column): | The stakeholder raised several issues and concerns that required consideration and written responses.<br>The stakeholder has advised that it should be considered as consulted for this EP and did not raise any further issues and concerns.<br>The issues and concerns related to environmental impacts and risks (1 and 2) did not result in any specific amendments to the EP.<br>The issues and concerns related to potential interaction with commercial fishing activity (2 to 5) helped inform the commitments Company has made in the ongoing communications process.<br>The issues and concerns related to the Development Area (3) will also be further addressed during the consultation | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of |
| 22 Jan 2019 | Austral emailed requesting the following further information to properly assess the proposed activity: co-ordinate listings and/or geo-located shapefiles for:<br>gas export pipeline corridor<br>Barossa proposed pipeline route<br>Bayu-Undan pipeline<br>Barossa offshore development area.<br>Company phoned Austral to arrange meeting and advised via email that the further information requested would be provided before the meeting. | | | |
| 4 Feb 2019 | Company provided further information requested by Austral on 22 Jan via email. | | | |
| 5 Feb 2019 | Company met with Austral in Perth and provided further information via PowerPoint presentation. Company advised it will provide Austral with a written summary of the issues raised during the meeting. | | | |

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| 13 Feb 2019 | Company emailed Austral with summary of issues discussed at 5 Feb 2019 meeting along with PowerPoint presentation and links to Offshore Project Proposal on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.<br>Company advised it would start preparing a detailed written response to the issues and requested Austral advise if anything had been missed in the summary or they wished to add further detail. Company advised it would ensure all items are covered in our responses.<br>Company advised it will also send the tailored fact sheet being prepared for the NTSC to Austral and the Northern Prawn Fishery, will ensure a direct follow-up with a specific Northern Prawn Fishery scampi fisher cited by Austral and organise another meeting with Austral in April.<br>Issues raised:<br>+ Impacts of pipeline installation activities on the sea floor and marine environment, specifically related to fish, fish habitat and fishing activities. How these impacts will be mitigated and managed by Company<br>+ Impacts of pipeline installation activities on fishing activities near the proposed route; i.e. exclusion areas, length of installation period, proposed period of year for installation, bearing in mind Austral's peak fishing period is September | **1 Impact on sea floor and marine environment**<br>The pipeline route has been refined to avoid areas of significant seabed features as much as practicable and uneven seabed features wherever possible. Benthic habitats within the pipeline corridor are expected to consist of predominantly burrowers/crinoids, filter feeders, macroalgae, with a substantial portion of the area also supporting no benthic habitat (approximately 81%).<br>No significant or restricted areas of benthic habitat are known to occur. It is considered highly unlikely that the presence of the project will result in significant changes in habitat usage by marine species or to the physical environment.<br>The pipeline will be constructed from carbon steel and have an external anti-corrosion coating, concrete weight coating and anodes to maintain integrity. It will be laid using a continuous assembly pipe-welding installation method with sections of pipe gradually lowered to the seabed behind the pipelay vessel using an S-lay method. This method is commonly used in offshore pipeline installation in comparable water depths. The use of dynamically positioned pipelay and support vessels will eliminate the need for anchoring during routine installation operations.<br>The primary method of maintaining pipeline stability on the seabed, where required, will be through the concrete weight-coating. Several seabed intervention methods could be used to manage spans and stability where concrete weight-coating alone is not sufficient. These methods could include concrete mattresses, | phase for the Development Drilling EP. | pipeline installation activities as per the ongoing communications process. |

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| | to May. How these impacts will be mitigated and managed by Company.<br>+ Pipeline route is generally not a major concern. Of more concern is the Development Area which is closer to Austral's current and/or planned fishing interests and activities. The main concern is the extent of fishing area that will be unavailable as a result of exclusion zones around Company activities/facilities both during construction/installation and ongoing operations.<br>+ Austral expressed a desire to have regular, close and open consultation and potential sharing of relevant information (fishing effort, hydrographic data) of mutual benefit.<br>+ Suggested Company ensure it speaks to a specific scampi fisher. | sand/grout bags, local modification to the seabed, steel structures, rock bolting and gravity anchors.<br>Pipelay and associated offshore activities (e.g. pre-lay and post-lay surveys) are expected to take up to nine months of offshore operations to complete. Pipeline installation activities (i.e. involving the pipelay vessel) are expected to occur over approximately three months, with installation activities occurring within a 2 km corridor either side of the gas export pipeline (3 km around the pipeline end termination points at both ends of the pipeline). During pipeline installation activities, a 500m safety exclusion zone will be established around the pipelay vessel. There will be no ongoing exclusion zones established around the pipeline during operations.<br>Within this corridor, potential impacts associated with the installation of pipeline infrastructure are expected to be short term and localised (within hundreds of metres) with impacts to the wider marine environment considered highly unlikely. Over the longer term, impacts over the operating life of the pipeline are expected to be minimal. Furthermore, the presence of the pipeline infrastructure has the potential to provide a beneficial impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna.<br>The following potential impacts on the marine environment have been assessed in the Barossa Offshore Project Proposal (OPP) (see OPP for full assessment) and will be further examined during the development of the Gas Export Pipeline Installation EP.<br><u>Discharges</u> | | |
| 1 Mar 2019 | Company emailed tailored issues and concerns information related to commercial fishing and update re provision of specific responses to issues raised by Austral which acknowledged via email. | | | |
| 13 Mar 2019 | Company provided written responses to the questions raised at the 5 February meeting and re-attached the information provided 1 March for ease of reference.<br>Company advised it would contact again to see if the stakeholder required an additional meeting or had further feedback. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal.<br>Company asked whether the stakeholder wanted to have another meeting and flagged the email that would be sent to all stakeholders that day. | During the installation campaign project vessels will routinely discharge small volumes of treated sewage, cooling water, putrescible waste, reverse osmosis brine, bilge and deck water. Any potential impacts are expected to be highly localised and temporary and will not impact environmental values/sensitivities.<br>Accidental spill events associated with vessel activities have also been assessed. Given the typical small volumes and temporary (i.e. instantaneous) duration of accidental discharge events, impacts to water quality would be temporary and highly localised. Subsequently, there would be limited potential for toxicity to marine fauna due to temporary exposure and low toxicity as a result of rapid dilution. Therefore, any potential impacts to marine fauna would be limited to any individuals that may be transiting within the immediate area of the discharge (within tens to several hundred metres).<br>Underwater noise associated with the installation vessels is also expected to be highly localised and temporary and is unlikely to impact fauna in the vicinity of installation activities.<br>Controls to manage this risk include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 91 (Marine pollution prevention – Oil), 95 (Marine pollution prevention – Garbage) and 96 (Marine pollution prevention – Sewage).<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the area influenced by planned discharges and significance of any impacts. | | |

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| | | + OVID inspections will be conducted to ensure all contracted vessels have IMO-approved treatment systems.<br>After completion of installation, the gas export pipeline will be FCGT with chemically-treated seawater (typically a mixture of biocides to prevent biofouling on the internal surfaces, an oxygen scavenger to control corrosion of the pipeline and a dye to allow for leaks to be detected during visual inspections). Approximately 16,000 m³ of treated seawater will be discharged over one to two days during cleaning, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>Following cleaning, the gas export pipeline will be pressure tested (hydrotested) to confirm pipeline integrity. Approximately 2,000 m³ of treated seawater will be discharged over a half day period during hydrotesting, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>Impacts from treated seawater arise mainly from the addition of biocides, corrosion inhibitors, scale inhibitors and oxygen scavengers.<br>Given the short duration of discharges and low volumes/toxicities of chemicals used for FCGT and hydrotesting, and that biocides are readily biodegradable and do not bioaccumulate, impacts from these activities are expected to be restricted to localised short-term reductions in water quality with no significant impacts to protected or commercially important marine fauna.<br>Controls to manage this risk include: | | |

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| | | + A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the potential impacts of planned discharges.<br>+ Bulk dewatering will occur at the offshore endpoint of the gas export pipeline to maximise dilution and avoid sensitive habitats and areas of higher densities of marine fauna.<br>+ Chemical injection volumes will be metered during flooding and hydrotest operations to identify leakage and trigger activity to stop, as well as to mitigate the risk of under/over-dosage of chemical.<br>+ Contracted vessel will have dedicated FCGT procedures.<br>+ A vertically orientated diffuser will be used during dewatering to re-oxygenate treated seawater at the discharge point.<br><u>Introduced Marine Species</u><br>There may be an increased risk of IMS colonising areas of the pipeline corridor in the shallower water depths where there is suitable light and habitat available (particularly in the vicinity of the shoals/banks). However, the risk of this occurring is considered low given the key management controls that will be implemented throughout the life of the project including a project Quarantine Management Plan, and compliance with contemporary ballast water and biofouling requirements.<br><u>Fauna</u><br>Impacts to fauna such as marine turtles, cetaceans and fishes are expected to primarily be short-term displacement from the immediate vicinity of the pipeline | | |

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| | | during installation. The presence of the pipeline infrastructure has the potential to provide a beneficial impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna.<br>The crested tern is widespread and numerous along the NT coastline, with 20 breeding colonies reported. The colony on Seagull Island supports over 50,000 birds and is considered globally significant.<br>Significant numbers of Olive Ridley turtles are known to nest on the beaches of Seagull Island and the north-west coast of Melville Island. As the physical presence of the gas export pipeline within internesting habitat critical to the survival of marine turtles has been minimised; i.e. approximately 0.0001% and 0.0015% of the internesting habitat critical to the survival of flatback and Olive Ridley turtles respectively, the physical presence of the gas export pipeline during is considered highly unlikely to impact the species use of the area.<br>During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area. Therefore, light emissions from the pipelay installation vessels are not anticipated to impact the breeding population of crested terns or Olive Ridley turtles located on the shoreline of Seagull Island.<br>Underwater sound generated by installation activities may affect individuals passing through the area; however, impacts at a population level are considered | | |

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| | | unlikely given the area affected is highly localised. The key noise sources associated with installation activities along the gas export pipeline will also be relatively slow moving (approximately 3 km–5 km of the gas export pipeline will be laid per day), thereby allowing individuals to move away from the area, and reasonably short in duration.<br>The risk of vessel strike to marine fauna is inherent to movements of all vessel types, including recreational vessels, fishing vessels, passenger ships, whale-watching boats, container ships and naval ships. Impacts from the presence of offshore infrastructure and related vessels interacting with marine fauna are not considered to present a significant risk at a population level.<br>Key controls to minimise impacts from the physical presence of offshore infrastructure and project related vessels interacting with marine fauna include:<br>+ placement of pipeline infrastructure in areas where there are no regionally significant feeding, breeding or aggregation areas for marine mammals<br>+ limiting of the physical footprint of the pipeline area such that displacement of individual mammals is unlikely, and the likelihood of a collision is remote<br>+ vessels travelling at relatively low speeds within operational areas<br>+ project vessels proactively responding to potential fauna interactions in line with the requirements of the EPBC Regulation s2000 – Part 8 Division 8.1.<br>**2 Impacts on commercial fishing**<br>Impacts of pipeline installation activities on fishing activities near the proposed route are expected to be localised and short-term. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | | Pipelay and associated offshore activities (e.g. pre-lay and post-lay surveys) are expected to take up to nine months of offshore operations to complete. Pipeline installation activities (i.e. involving the pipelay vessel) are expected to occur over approximately three months, with installation activities occurring within a 2 km corridor either side of the gas export pipeline (3 km around the pipeline end termination points at both ends of the pipeline). During pipeline installation activities, a 500m safety exclusion zone will be established around the pipelay vessel. There will be no ongoing exclusion zones established around the pipeline during operations.<br>Installation of the pipeline is expected to commence as early as Q3 2021 and finish as late as Q2 2023. However, pre-lay survey could commence up to nine months earlier than pipeline installation, and pre-lay span rectification may occur up to 30 days prior to pipeline installation.<br>The total infield duration of the offshore installation activities is expected to be approximately nine months. The schedule is indicative only; exact timing and duration of gas export pipeline installation activities is subject to pipelay vessel availability, sea state, weather conditions and operational efficiencies. (i.e. the pipelay vessel will be present for approximately three months). Company will continue to consult with Austral Fisheries on operational detail, including proposed timeframes and environmental factors.<br>Peak vessel activity is expected to occur during installation of the pipeline, when the pipelay vessel and a dedicated support vessel will be present in the operational area, while supply vessels will transit to and from the pipelay vessel regularly (expected to be daily). | | |

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| | | During the campaign, vessels will operate 24 hours a day, seven days a week.<br>Activities associated with installation of the gas export pipeline will occur within a 2 km buffer around the gas export pipeline route, and 3 km radius around each endpoint of the gas export pipeline (i.e. the Operational Area). However, support vessels may transit to and from port as required (outside the scope of the EP).<br>The pipeline will overlap approximately 0.18 km² of the area actively fished in the Northern Prawn Fishery at low intensity. The pipeline corridor does not intersect any areas trawled by the NT demersal fishery. Once the pipeline is operational, trawl fisheries such as the Northern Prawn Fishery and NT Demersal Fishery may be affected on an ongoing basis due to the long-term presence of the pipeline and infrastructure. Recent effort for both these fisheries is concentrated outside the Operational Area and therefore impacts are expected to be minimal.<br>Considering the relatively short duration of the pipeline installation in which higher numbers of vessels will be present), and minimal number of project related vessel movements within the pipeline corridor during operations (i.e. limited to periodic maintenance and inspection activities), the impact to commercial fishing activities from vessels movements are considered to be minor.<br>Company will continue to undertake consultation with Austral Fisheries and all relevant commercial fishing stakeholders in more detail during preparation of activity-specific EPs and on an ongoing basis in the lead-up to and during all operational activities. | | |

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| | | Controls to manage this risk include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of Navigation and Emergency Procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan.<br>+ AHS Notice to Mariners and AMSA MSI will be notified prior to relevant gas export pipeline installation activities.<br>+ Subsea infrastructure and gas export pipeline will be clearly marked on Australian nautical charts published by the AHO.<br>+ The PLET at the end of the gas export pipeline where the pipeline joins the existing Bayu-Undan pipeline has been designed with anti-snag protection.<br>+ A support vessel will always be in the Operational Area while the pipelay vessel is installing the pipeline to minimise the potential adverse interactions with commercial fishing activities.<br>+ An ongoing communications plan will be implemented for engagement with potentially affected fishers.<br>**3 Development area and exclusion zones**<br>A temporary petroleum safety zone around the drill rig (500 m radius during development drilling) and pipelay vessel (500 m during installation), and exclusion zones | | |

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| | | around the offshore facilities (500 m around each wellhead and the FPSO facility) in the Barossa offshore development area will exclude commercial fishing vessels from a small proportion of their current fishing and available areas.<br>The location of the offshore facilities/infrastructure and equipment in this area does not represent a significant portion of the area commercially fished, with primary fishing effort of the Timor Reef Fishery undertaken to the south-west. The areas actively fished by the Northern Prawn Fishery in nearshore waters are a minimum of approximately 64 km from the Barossa offshore development area.<br>Consultation with commercial fishers of the Timor Reef Fishery previously undertaken identified some concerns regarding the physical presence of vessels during periods of peak fishing activity (October and May) and the potential for disruption of their activities. Through the consultation process it was noted that potential impacts for trap fishers would have been greater if activities were over fishing grounds further to the south-west (>50 km away).<br>During the meeting held on 5 February 2019 Austral Fisheries advised that its activities may extend further north and Company will provide further assessment based on additional detailed information provided by Austral.<br>Company will continue to undertake consultation with Austral Fisheries and all relevant commercial fishing stakeholders in more detail during preparation of activity-specific EPs and on an ongoing basis in the lead-up to and during all operational activities. This includes the Development Drilling EP which is relevant to the | | |

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| | | Development Area and will be prepared later in 2019 for submittal to NOPSEMA in 2020.<br>Controls to manage this risk include:<br>+ The project will comply with the OPGGS Act 2006 – Section 616 (2) Petroleum safety zones, which includes establishment and maintenance of a petroleum safety zone offshore structure or equipment which prohibits vessels entering or being present within the specified area without written consent.<br>+ Accepted procedures will be implemented to meet the requirements of the Marine Operations Manual, which includes details of:<br>– roles, responsibilities and competency requirements<br>– requirements (e.g. storage, transfer) for bulk cargo and bulk liquids (including bunker fuel) operations<br>– general requirements for entering/departure and movement within the designated exclusion or petroleum safety zones<br>– checklist required to be completed for vessels entering the exclusion zones in the development area<br>– safe and sustainable dynamic positioning operations.<br>+ The Stakeholder Engagement Plan will include consultation with commercial fisheries, shipping, AHO and other relevant stakeholders operating in the vicinity of the development area to inform them of the proposed project. Ongoing consultation will | | |

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| | | also be undertaken throughout the life of the project.<br>+ Subsea infrastructure and pipelines will be clearly marked on nautical charts published by the AHO.<br>**4 Consultation and Data Sharing**<br>Company shares the desire for regular, close and open consultation on a regular basis. We will organise a further meeting for April at which we can discuss these arrangements. Company will also be available to answer enquiries from Austral Fisheries at any other time. Company is also happy to discuss potential sharing of relevant information with mutual benefits to both organisations.<br>**5 Consultation with other stakeholder**<br>Company has provided the scampi fisher specifically cited by Austral with the relevant information and has offered him a separate meeting to discuss the pipeline activities and preparation of the Environment Plan. The fisher will also continue to be provided with all relevant information and afforded opportunities to provide feedback. | | |
| ***Australia Bay Seafoods*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>The stakeholder advised that its operations are not relevant for this activity. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further |

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| 21/22 Feb 2019 | Company left phone message and follow-up email with pipeline route co-ordinates. | | | action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and |
| 24 Feb 2019 | Australia Bay Seafoods advised via email that its operations in the Demersal Fishery is not relevant for this activity. Company provided confirmation and advised that Timor Reef Fishery was being consulted. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| *Australian Fisheries Management Authority (AFMA), Commonwealth Government* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. The stakeholder advised satisfaction with the stakeholder consultation process. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and |
| 22 Feb 2019 | Company sent follow-up email reminder re comments and advised consultation was occurring with stakeholders as advised by AFMA on its website. | | | |
| 28 Feb 2019 | AFMA advised it had no further comments to provide as it was satisfied with Company's current engagement with relevant fisheries stakeholders. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

<table>
<tr><th>Date</th><th>Contact made/feedback received/issues raised</th><th>Assessment of issues raised</th><th>Company response (including outcomes proposed/achieved)</th><th>Summary of Company assessment and response</th></tr>
<tr><td colspan="5">Australian Marine Conservation Society</td></tr>
<tr><td>16 Jan 2019</td><td>Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019.</td><td rowspan="4">The following information was provided by Company to this stakeholder and the Environment Centre – NT in response to the issues and concerns raised at a meeting held with both organisations on 8 February (see entry in left column):<br><br>1 and 2: Pipeline installation through marine park and Habitat Protection Zone<br><br>Company identified several preliminary pipeline routes following a preliminary review of available information on the bathymetry, seabed topography and underlying geology relevant to each route. This was done during the early design phases of the Barossa Development and included a range of contingencies to account for uncertainty around the requirements of the Project. Further engineering studies were undertaken to investigate technical feasibility and a preliminary pipeline route, which included passing through the then zoned multiple use zone (now the HPZ) of the Oceanic Shoals marine park to remain in deeper water, was identified and surveyed in November 2015.<br><br>In September 2016, the reports prepared as part of the independent Commonwealth Marine Reserves Review were released and recommended that part of the Oceanic Shoals marine park be re-zoned as a habitat protection zone. In response, Company defined and presented a broad pipeline corridor in the Barossa OPP that allowed public comment on and assessment of the acceptability of installing and operating the pipeline within this corridor. The pipeline corridor in the Barossa OPP that was published for public comment allowed for</td><td rowspan="4">The stakeholder raised several issues and concerns that required consideration and written responses.<br><br>The issues and concerns related to environmental impacts and risks (1 to 5) did not result in any specific amendments to the EP.<br><br>The stakeholder has expressed a general opposition to any oil and gas activity occurring in a marine park or during a turtle internesting period.<br><br>The submitted EP reflects both Parks Australia’s conditions for its authorisation of entry to the marine park and HPZ and Company’ contingency measures for the timeline for activities, dependent on the final EP conditions.</td><td rowspan="4">Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br><br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br><br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br><br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br><br>As a ‘relevant’ stakeholder, they will also be engaged</td></tr>
<tr><td>31 Jan 2019</td><td>AMCS representative phoned Company to request a meeting which may also be attended by Environment Centre, NT. Company organised meeting to be held in Darwin on 8 Feb.</td></tr>
<tr><td>8 Feb 2019</td><td>Company met with representatives of AMCS and Environment Centre, NT in Darwin and provided further information via PowerPoint presentation. Company advised it will provide both organisations with a written summary of the issues raised during the meeting.</td></tr>
<tr><td>13 Feb 2019</td><td>Company emailed AMCS and EC-NT a summary of the issues discussed at 8 Feb 2019 meeting via email along with PowerPoint presentation, current pipeline route co-ordinates, Pendoley report on marine turtles from OPP and links to OPP on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.</td></tr>
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| | Company advised it would start preparing a detailed written response to the issues and requested both organisations advise if anything had been missed in the summary or they wished to add further detail. Company advised it would ensure all items are covered in our responses. Company also advised it would follow-up with a representative of Edith Cowan University as requested by AMCS.<br>Issues/concerns raised:<br>+ Does not support the pipeline being installed through part of the habitat area for reasons of both impact to habitat and the precedent this would set.<br>+ Would like further detail as to reasons for wanting to route the pipeline through a section of the habitat area, including assessment of the risks/impacts and mitigations proposed.<br>+ Reiterated its concerns re the risks/impacts to turtles during internesting periods but also the risks/impacts and proposed mitigations on turtle activity and movements at all times.<br>+ Is concerned by the potential increased risk to marine fauna in particular due to the increased level of vessel traffic to and from Darwin Port and around the installation and development areas and would like further detail as to the nature and extent of this increased activity both | a number of the preliminary pipeline route alignments, both within and outside the Oceanic Shoals marine park which were all subject to further survey and engineering studies to determine their technical feasibility. However, possible routing alignments outside the HPZ are constrained by two critical aspects that cannot be overcome:<br>+ the presence of an internesting BIA for Olive Ridley turtles, which Company has committed to avoiding for the duration of the project, including pipelay installation and operations activities (see Section 6 of the Barossa OPP)<br>+ water depths in the shallow water area to the east of the marine park HPZ areas, are as shallow as 5 m restricting vessel movements, making pipeline installation impractical.<br>To progress pipeline route selection and to meet commitments made in the Barossa OPP, additional bathymetric, geophysical and environmental surveys were undertaken on the alternative route alignments (August 2017). Using the data collected, further engineering and design work was progressed and used to inform the revised pipeline corridor that was assessed and accepted in the Barossa Offshore Project Proposal (OPP).<br>As a result of this, the original preliminary pipeline route (most westerly route within the marine park HPZ) was discounted as the two other central route alignments were considered just as feasible and would reduce the ingress of the pipeline route within the marine park HPZ. The accepted pipeline corridor only allows for further consideration of two central route alignments within the marine park HPZ, or an eastern route alignment outside | | by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| | during installation of the pipeline and drilling of wells, etc, and during ongoing operations.<br>+ Expressed its general concern at the level of emissions caused by the fossil fuel industry and reiterated that companies should be making greater efforts towards renewable energy generation.<br>+ Is interested in the identification of grey nurse shark(s) in the video footage taken by Jacobs and whether there is any additional research on grey nurse sharks proposed given this is considered unusual distribution for this species.<br>+ Suggested Company speaks to a specific representative of ECU in Perth re extent and nature of whale activity in the area. | the marine park HPZ through the shallow water area (if a licence from the Director of National Parks was not granted).<br>Based on the additional work, the previously considered routes to the alternative western tie-in point on the Bayu-Undan pipeline (the western route alignment within the marine park) have been ruled out as not being technically feasible due to the presence of significant seabed features and highly irregular seabed topography along the southern section of that alignment that could not be avoided. Dropping this western route alignment also had the advantage of minimising the length of pipeline route that overlaps the Oceanic Shoals marine park and allowed for a much narrower pipeline corridor to be defined in the Barossa OPP.<br>As a result, three candidate pipeline routes were the subject of a feasibility and practicability assessment.<br>Within the Oceanic Shoals marine park:<br>+ Two central route alignments (excluding the original preliminary pipeline route) within the Oceanic Shoals marine park that intersect the MUZ and HPZ of the Oceanic Shoals marine park, tying into the existing Bayu-Undan to Darwin pipeline at the preferred eastern tie-in location.<br>Outside the Oceanic Shoals marine park HPZ:<br>+ An eastern route alignment; i.e. crossing the shallow water area located between the marine park and the Tiwi Islands. This route would require secondary stabilisation of the pipeline due to the relatively shallow and rugose seabed. Secondary stabilisation methods could include rock dumping, pre-lay and | | |
| 14 Mar 2019 | Company provided written responses to the questions raised at the 8 February meeting and advised it would contact again to see if the stakeholder had further feedback. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on the company website | | | |

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| | included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | post-lay trenching or dredging, resulting in greater environmental impact.<br>Engineering and design activities have focused on the two central route alignments within the Oceanic Shoals marine park HPZ (the proposed route and the discounted central route alignment). Seabed conditions and expected span rectifications were considered to be similar for both of the routes, with the proposed route being selected as it achieves the following benefits:<br>+ minimises the area that the pipeline route needs to overlap the Oceanic Shoals marine park HPZ<br>+ minimises the amount of seabed installation required and eliminates secondary stabilisation requirements for pipeline installation (which would be required to install the pipeline along the eastern route alignment located in the shallow water area outside the marine park HPZ)<br>+ minimises, as much as practicable, the installation of the pipeline over areas of seabed that are associated with the seafloor features/values of the shelf break and slope of the Arafura Shelf and carbonate bank and terrace system of the Van Diemen Rise KEFs<br>+ the proposed pipeline route will reduce inspection, maintenance and repair (IMR) requirements during operations, compared to all other alternative route alignments considered. The reduced route length and smoother seabed profile (less spans) represents the shortest length of pipeline required and minimises the amount of seabed installation and stabilisation required, requiring the shortest installation campaign, thereby minimising the time | | |

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| | | installation activities will overlap with internesting habitat critical to the survival for marine turtles.<br>Based on all available data, information and evaluation from the surveys, engineering studies and environmental impact assessments undertaken to date, it has been concluded that the only practicable route alignment is the proposed route alignment within the HPZ.<br>Although the eastern route alignment outside of the marine park HPZ is considered to be technically feasible, it results in greater environmental impact both to habitats and species within and outside the HPZ, and therefore is not considered a practicable route.<br>Installation and operation of a pipeline with the HPZ of the marine park is allowable with authorisation from the Director pf National Parks.<br>The pipeline activities are considered to be consistent with the management objective of the habitat protection zone (HPZ) within the Oceanic Shoals marine park. Although the presence of the pipeline will result in a small direct loss of benthic habitat, there will be no impact on the habitat representativeness or habitat diversity of the marine park.<br>Where the pipeline traverses the HPZ, it is distant from seafloor features associated with the key ecological features (KEFs) considered values of the marine park. Therefore, no impacts to KEFs are expected from pipeline activities within the HPZ.<br>Where the pipeline route traverses the HPZ, it is outside the water depths (i.e. >30 m) where the majority of flatback turtle internesting activity is known to occur. Therefore, the pipeline activities are not likely to have | | |

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| | | adverse impacts to seafloor habitat considered as internesting habitat critical to the survival of flatback turtles.<br>There are no sensitive or important benthic habitats, or feeding, breeding or aggregation areas for marine fauna in the vicinity of the pipeline route that could be impacted by pipeline activities. Therefore, pipeline activities, including direct and indirect impacts from installation and operations, will not result in the destruction of seafloor habitats or impact the conservation of ecosystems within the HPZ of the Oceanic Shoals marine park.<br>**3 Impact During Turtle Internesting Periods**<br>Independent scientific assessment Appendix Q of the accepted OPP has concluded that the installation of the Barossa gas export pipeline is not expected to form a significant risk to flatback and Olive Ridley turtles at a population level, as per DoEE's Significant Impact Guidelines 1.1 – Matters of National Environmental Significance based on the following points:<br>There is a spatial separation (approximately 10 to 20 km) between the favoured coastal Internesting habitat for flatback and Olive Ridley turtles, and the offshore pipeline corridor.<br>The relatively short time frame of the pipeline installation is insignificant within the context of the long breeding period of marine turtles and so the time frame the breeding females are potentially exposed to the project is low.<br>Pipelay vessels are mobile and will not be on any one location for extended periods of time. Any exposure of | | |

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| | | internesting females or dispersing hatchlings to project related risk will be temporary.<br>The seasonally dispersed nesting behaviour reduces the risk of exposure to the entire breeding population.<br>While migrating offshore, hatchlings will be dispersed by currents across large areas of ocean, under the influence of tides and currents which will reduce the opportunity for individuals to intercept or pool around a vessel.<br>Hatchlings are unable to swim against fast moving tides and currents and a few individuals might be trapped by light spill from a vessel if they are carried directly to the vessel location by tides or currents.<br>Hatchlings will only be able to engage in directional swimming (i.e. to actively swim directly towards a vessel light) during the few hours a day when water speeds are very slow or at slack water and will be swept away as the tide gains strength. The number of individuals potentially impacted are expected to be low.<br>•The current large (60 – 80 km) Biologically Important Area boundary to the north and west of Tiwi Islands can be reassessed based on recent publications that indicate internesting habitat for flatback and Olive Ridley turtles is in shallow water closer to shore and can be comfortably encompassed by the Contiguous Zone Boundary (24 nm, 44.5 km).<br>**4 Impact of vessel movements**<br>The Barossa Development OPP Section 6.4.2 commencing on page 283 provides a thorough risk assessment of vessel movements (from p.284). The in-field subsea infrastructure and gas export pipeline are unlikely to significantly affect marine fauna behaviour and movements given their location on the seabed. | | |

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| | | The risk of vessel strike to marine fauna is inherent to movements of all vessel types, including recreational vessels, fishing vessels, passenger ships, whale-watching boats, container ships and naval ships. Impacts from the presence of offshore infrastructure and related vessels interacting with marine fauna are not considered to present a significant risk at a population level.<br>Key controls to minimise impacts from the physical presence of offshore infrastructure and project related vessels interacting with marine fauna include:<br>+ placement of project infrastructure in areas where there are no regionally significant feeding, breeding or aggregation areas for marine mammals<br>+ limiting of the physical footprint of the pipeline area such that displacement of individual mammals is unlikely and the likelihood of a collision is remote<br>+ vessels travelling at relatively low speeds within operational areas<br>+ project vessels proactively responding to potential fauna interactions in line with the requirements of the OPBC Regulation s2000 – Part 8 Division 8.1.<br>**5 Impact of increased emissions**<br>The project will generate atmospheric emissions; mainly associated with the combustion of fuel in vessel engines (including the MODU/drill ship) and in the FPSO facility for gas/condensate processing, offshore removal of CO2 and non-routine flaring due to process upsets or during emergency shut-in of production.<br>Specifically, for the gas export pipeline installation, given the short-term duration of installation activities, and the frequency and short term duration of inspection, maintenance and repair activities, atmospheric | | |

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| | | emissions will be limited. The actual expected volumes will be dependent on the size of vessel, the duration of the activity and the probability of the vessel having/using a waste incinerator. Although atmospheric emissions from project vessels can result in the localised deterioration of air quality, the impact to the marine environment is considered negligible.<br>Atmospheric emissions associated with the project will meet all regulatory source emissions standards. Engineering design of the FPSO facility will seek to reduce atmospheric and GHG emissions through energy efficient design. Combustion engines and flaring equipment will be maintained according to vendor specifications to achieve optimal performance.<br>**6 Presence of grey nurse sharks**<br>There are no regionally significant feeding, breeding or aggregation areas for grey nurse sharks known to occur in the project area.<br>The physical footprint of the project is limited to a very small proportion of the habitat available for grey nurse sharks and, therefore, displacement of individuals is unlikely. No specific actions or requirements have been identified for assessing the threat of habitat modification/degradation for grey nurse sharks as a result of development, as relevant to the project<br>Four grey nurse sharks were observed during baseline studies at a seamount in around 130 to 160 m water depth approximately 18 km to the west of the Barossa offshore development area. Based on the findings of the Barossa marine studies program and the species habitat preference, it is considered possible that individuals may | | |

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| | | be encountered in low numbers within the project area and area of influence.<br>**7 Additional consultation request**<br>Company met with the representative of Edith Cowan University cited by AMCS who did not provide any specific views on the proposed activity. | | |
| *Australian Marine Oil Spill Centre (AMOSC)* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. |
| 7 Feb 2019 | Follow up phone call. Stakeholder advised that they have no comment on the EP and will be involved in the preparation of Company’s OPEP. | | | |
| 12 Feb 2019 | Follow up email confirming stakeholder's participation in the preparation of Company’ OPEP and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process.<br>As a 'relevant' stakeholder for the OPEP, AMOSC will be provided with the approved plan. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| *Australian Maritime Safety Authority* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 7 Feb 2019 | Follow up phone call. Advised to send follow up email. | | | |
| 12 Feb 2019 | Follow up email attaching fact sheet and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process.<br>As a 'relevant' stakeholder for the OPEP, AMSA will be provided with the approved plan. |
| ***Australian Southern Bluefin Tuna Industry Association*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is |
| 21/22 Feb 2019 | Company left phone message and follow-up email with pipeline route co-ordinates. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| ***Bathurst Island Lodge, Bathurst Island (Tiwi Islands)*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | The following information was provided by Company to this stakeholder in response to the issues and concerns raised at a meeting held on 16 February (see entry in left column):<br>**1 Risks/impacts to marine fauna (whales and mantra rays)**<br>Stakeholder consultation with the local Tiwi people and baseline environment assessment have confirmed that the reef manta ray (*Manta alfredi*) may be found within the southern extent of the gas export pipeline corridor given its proximity to coastal areas. Baseline environmental assessment has also confirmed that marine mammals (cetaceans) are generally widely distributed and highly mobile in the region. Both sei and fin whales have a wide distribution throughout offshore waters and therefore may pass through the project area in low numbers. No aggregation areas or migration pathways for cetaceans occur within or in the vicinity of the proposed pipeline route. | The stakeholder raised issues and concerns that required consideration and written responses.<br>The issue/concern related to environmental impacts and risks (1) did not result in any specific amendments to the EP.<br>The other issue/concern (2) was a general one related to the project and not relevant to this EP. | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. |
| 30 Jan 2019 | TLC invited Lodge operators to attend meeting with Company in Darwin on 7 Feb. Note: Meeting with Lodge rescheduled when they were unable to attend. | | | |
| 8 Feb 2019 | Company met with representatives of Wright Expeditions, operators of Bathurst Island Lodge, in Darwin and provided further information via PowerPoint presentation. Company advised it will provide the Lodge with a written summary of the issues raised during the meeting. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 13 Feb 2019 | Company emailed Wright Expeditions a summary of the issues discussed at 8 Feb 2019 meeting along with PowerPoint presentation, current pipeline route co-ordinates and links to OPP on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.<br>Company advised it would start preparing a detailed written response to the issues and requested both organisations advise if anything had been missed in the summary or they wished to add further detail. Company advised it would ensure all items are covered in our responses.<br>Issues raised:<br>+ Advised that manta ray migration occurs along the south coast of Bathurst Island as well as some whales passing through and the risks/impacts to this marine fauna should be understood and mitigated<br>+ Questioned whether Company may look to an area near the Bathurst Fishing Lodge for lay-down or other activities associated with the installation. If so, they would be amenable to looking at how they could accommodate this. | Key controls to manage risks from the physical presence of offshore infrastructure and project related vessels interacting with marine fauna include:<br>+ placement of pipeline infrastructure in areas where there are no regionally significant feeding, breeding or aggregation areas for marine mammals<br>+ limiting of the physical footprint of the pipeline area such that displacement of individual mammals is unlikely and the likelihood of a collision is remote<br>+ vessels travelling at relatively low speeds within operational areas<br>+ project vessels proactively responding to potential fauna interactions in line with the requirements of the OPBC Regulation s2000 – Part 8 Division 8.1.<br>Barossa is primarily an offshore project and will not require new accommodation to be established onshore. During the installation, hook-up and commissioning phases an accommodation support vessel may be located in the offshore development area supporting several hundred personnel. The FPSO will be towed to the offshore development area and will also have accommodation for approximately 150 personnel offshore.<br>**2 Project accommodation**<br>The project will involve an increased number of personnel needing to transit through Darwin, particularly during the offshore installation phase. At this early planning stage, it is anticipated this increased demand would be for short-term accommodation only and could be met through existing and planned future | | The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 14 Mar 2019 | Company provided written responses to the questions raised at the 13 February meeting and advised it would contact again to see if the stakeholder had further feedback. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | facilities. Estimates of onshore accommodation requirements will be determined during the detailed planning stage and will be planned well in advance in consultation with local facilities.<br>In addition to directly providing Company with details of business capability, Clearwater should formally register for the Barossa Development with the Industry Capability Network in the NT which will provide information and details of how to tender for any future potential accommodation needs related to the project. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| ***Beach Energy*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 6 Feb 2019 | Follow up phone call. Voicemail left. | | | |
| 12 Feb 2019 | Follow up email attaching fact sheet and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| ***Clearwater Island Lodge, Melville Island (Tiwi Islands)*** | | | | |
| 23 Jan 2019 | Company phone discussion with Lodge operator to organise meeting on Melville Island and provided follow-up email with initial fact sheet/email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to OPP sections. | The following information was provided by Company to this stakeholder in response to the issues and concerns raised at a meeting held on 6 February (see entry in left column):<br>**1 Biosecurity measures**<br>Ballast water discharges will comply with the requirements of the Australian Ballast Water Management Requirements, which implements the requirements of the *Biosecurity Act 2015* (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for vessel class)<br>Vessels will have a suitable anti-fouling coating in accordance with the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) (as applicable for | The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to environmental impacts and risks (1, 2, 4 and 6) did not result in any specific amendments to the EP.<br>The issue/concern related to potential interaction with commercial fishing activity (5) helped inform the commitments | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by |
| 6 Feb 2019 | Company met with operators of Lodge on Melville Island and provided further information via PowerPoint presentation. Company advised it will provide the Lodge with a written summary of the issues raised during the meeting. | | | |

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| 13 Feb 2019 | Company provided Lodge operators with summary of issues at 6 Feb 2019 meeting via email along with PowerPoint presentation, current pipeline route co-ordinates and links to OPP on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.<br>Company advised it would start preparing a detailed written response to the issues and requested both organisations advise if anything had been missed in the summary or they wished to add further detail. Company advised it would ensure all items are covered in our responses. Company also advised it would ensure direct follow-up with the Member for Arafura in the NT parliament, as requested.<br>Issues raised:<br>+ Requested information on the arrangements that would be in place for biosecurity protection (IMS) for vessels coming from overseas<br>+ The lodge utilises fishing grounds for black jewfish in Aspley Strait between Melville and Bathurst Islands and would be concerned if there were plans to utilise Port Melville and/or the Apsley Strait and the increased vessel movements that would result during development and/or operations. This would be concerning for the environment generally, for vessel interactions and risk of spills<br>+ If the project requires accommodation for some personnel on Melville Island, the Lodge could be available. Would like to understand any future requirements. | vessel size, type and class), including Marine Order 98. Vessels will comply with the International Convention on the Control of Harmful Anti-fouling Systems on Ships (as appropriate to class) including vessels having a valid IAFS Certificate. Contracted pipelay vessels will have a marine growth prevention system in place.<br>Vessels mobilising from outside Australia or from nearshore waters within Australia will be subject to an IMS risk assessment, the findings of which will determine if additional management measures are required prior to mobilisation, such as a hull inspection and cleaning as required.<br>**2 Vessel movements**<br>Darwin will continue to be the main supply and maintenance hub for all Company' regional offshore exploration and production operations, including the Barossa Development. Company will continue to engage with vessel contractors regarding future port and transit plans.<br>The Tiwi Land Council has indicated a desire for Company to consider future use of facilities at Port Melville for any activities conducted offshore NT, not just those related to the Barossa Development. Company has been provided with a familiarisation of the Port Melville facilities by the Port Operator and will assess any further information that may be provided in the future.<br>It is expected that approximately two to five vessels will enter/exit the Barossa offshore development area per week during operations, with peak numbers occurring during maintenance and shutdown periods. Although several different vessel types will be used in the Barossa offshore development area during operations, not all will be in the field simultaneously.<br>The temporary presence of the pipelay vessels in the operational area will not significantly increase the | Company has made in the ongoing communications process.<br>The request for additional consultation (7) was met by Company.<br>The other issue/concern (3) was a general one related to the project and not relevant to this EP. | NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| | + Impacts of pipeline installation activities on the sea floor and marine environment, specifically related to fish, fish habitat and fishing activities near the Tiwi Islands, bearing in mind they can operate up to 40 km away, including around Goodrich Bank and Seagull Island. How these impacts will be mitigated and managed by Company.<br>+ Impacts of pipeline installation activities on fishing activities near the proposed route, specifically whether this could cause commercial fishers to move closer to the Tiwi Islands. How these impacts will be mitigated and managed by Company.<br>+ Questioned if the pipeline will attract fish from other fishing grounds (specifically the areas currently utilised) or will the new pipeline create additional habitat.<br>+ Requested Company also liaise with the Member for Arafura. | volume of existing vessel traffic in the area. The area west and south west of the Tiwi Islands is subject to regular vessel traffic. Data from AMSA's craft tracking system indicates vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest point of the pipeline corridor.<br>Company has conducted a detailed examination of the potential impacts that may arise in the event of an accidental spill of fuel from a vessel within the operational area. While the potential for such a spill occurring is considered highly unlikely, a number of controls to prevent the event or minimise impacts have been identified, including:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of navigation and emergency procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ A dedicated Oil Pollution Emergency Plan (OPEP) will be prepared and implemented throughout the gas export pipeline installation campaign.<br>+ All vessels will have a dedicated SOPEP.<br>+ A support vessel will always be within the Operational Area while the pipelay vessel is installing the pipeline to minimise the potential for vessel collision. | | |
| 13 Mar 2019 | Company provided written responses to the questions raised at the 13 February meeting and advised it would contact again to see if the stakeholder had further feedback.<br>Company also advised that it would be meeting with the Member for Arafura as requested by the stakeholder. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA. | | | |

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| | Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the company website and provided the website address.<br>Stakeholder was advised that the documentation on the company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | + The pipelay vessel will be double-hulled and with internal fuel tanks protected from a potential vessel collision.<br>**3 Project logistics**<br>Barossa is primarily an offshore project and is unlikely to require accommodation to be established onshore. During the installation, hook-up and commissioning phases an accommodation support vessel may be located in the offshore development area to support personnel. The FPSO will be towed to the offshore development area and will also have accommodation for approximately 150 personnel offshore.<br>The project will involve an increased number of personnel needing to transit through Darwin, particularly during the offshore installation phase. At this early planning stage, it is anticipated this increased demand would be for short-term accommodation only and could be met through existing and planned future facilities. Estimates of onshore accommodation requirements will be determined during the detailed planning stage and will be planned well in advance in consultation with local facilities.<br>In addition to directly providing Company with details of business capability, Clearwater should formally register for the Barossa Development with the Industry Capability Network in the NT which will provide information and details of how to tender for any future potential accommodation needs related to the project.<br>**4 Impact on sea floor and marine environment**<br>The pipeline route has been refined to avoid areas of significant seabed features as much as practicable and uneven seabed features wherever possible. Benthic | | |

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| | | habitats within the pipeline corridor are expected to consist of predominantly burrowers/crinoids, filter feeders, macroalgae, with a substantial portion of the area also supporting no benthic habitat (approximately 81%).<br>No significant or restricted areas of benthic habitat are known to occur. It is considered highly unlikely that the presence of the project will result in significant changes in habitat usage by marine species or to the physical environment.<br>The pipeline will be constructed from carbon steel and have an external anti-corrosion coating, concrete weight coating and anodes to maintain integrity. It will be laid using a continuous assembly pipe-welding installation method with sections of pipe gradually lowered to the seabed behind the pipelay vessel using an S-lay method. This method is commonly used in offshore pipeline installation in comparable water depths. The use of dynamically positioned pipelay and support vessels will eliminate the need for anchoring during routine installation operations.<br>The primary method of maintaining pipeline stability on the seabed, where required, will be through the concrete weight-coating. Several seabed intervention methods could be used to manage spans and stability where concrete weight-coating alone is not sufficient. These methods could include concrete mattresses, sand/grout bags, local modification to the seabed, steel structures, rock bolting and gravity anchors.<br>Pipelay and associated offshore activities (e.g. pre-lay and post-lay surveys) are expected to take up to nine months of offshore operations to complete. Pipeline installation activities (i.e. involving the pipelay vessel) | | |

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| | | are expected to occur over approximately three months, with installation activities occurring within a 2 km corridor either side of the gas export pipeline (3 km around the pipeline end termination points at both ends of the pipeline). During pipeline installation activities, a 500 m safety exclusion zone will be established around the pipelay vessel. There will be no ongoing exclusion zones established around the pipeline during operations.<br>Within this corridor, potential impacts associated with the installation of pipeline infrastructure are expected to be short-term and localised (within hundreds of metres) with impacts to the wider marine environment considered highly unlikely. Over the longer term, impacts over the operating life of the pipeline are expected to be minimal. Furthermore, the presence of the pipeline infrastructure has the potential to provide a beneficial impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna.<br>The following potential impacts on the marine environment have been assessed in the Barossa OPP (see OPP for full assessment), and will be further examined during the development of the Gas Export Pipeline Installation EP:<br><u>Discharges</u><br>During the installation campaign project vessels will routinely discharge small volumes of treated sewage, cooling water, putrescible waste, reverse osmosis brine, bilge and deck water. Any potential impacts are expected to be highly localised and temporary and will not impact environmental values/sensitivities. Accidental spill events associated with vessel activities | | |

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| | | have also been assessed. Given the typical small volumes and temporary (i.e. instantaneous) duration of accidental discharge events, impacts to water quality would be temporary and highly localised. Subsequently, there would be limited potential for toxicity to marine fauna due to temporary exposure and low toxicity as a result of rapid dilution. Therefore, any potential impacts to marine fauna would be limited to any individuals that may be transiting within the immediate area of the discharge (within tens to several hundred metres). Underwater noise associated with the installation vessels is also expected to be highly localised and temporary and is unlikely to impact fauna in the vicinity of installation activities.<br>Controls to manage this risk include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 91 (Marine Pollution Prevention – Oil), 95 (Marine Pollution Prevention – Garbage) and 96 (Marine Pollution Prevention – Sewage).<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the area influenced by planned discharges and significance of any impacts.<br>+ OVID inspections will be conducted to ensure all contracted vessels have IMO-approved treatment systems.<br>After completion of installation, the gas export pipeline will be FCGT with chemically-treated seawater (typically a mixture of biocides to prevent biofouling on the internal surfaces, an oxygen scavenger to control corrosion of the pipeline and a dye to allow for leaks to | | |

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| | | be detected during visual inspections). Approximately 16,000 $m^3$ of treated seawater will be discharged over one to two days period during cleaning, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>Following cleaning, the gas export pipeline will be pressure tested (hydrotested) to confirm pipeline integrity. Approximately 2,000 $m^3$ of treated seawater will be discharged over a half day period during hydrotesting, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>Impacts from treated seawater arise mainly from the addition of biocides, corrosion inhibitors, scale inhibitors and oxygen scavengers.<br>Given the short duration of discharges and low volumes/toxicities of chemicals used for FCGT and hydrotesting, and that biocides are readily biodegradable and do not bioaccumulate, impacts from these activities are expected to be restricted to localised short-term reductions in water quality with no significant impacts to protected or commercially important marine fauna.<br>Controls to manage this risk include:<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the potential impacts of planned discharges.<br>+ Bulk dewatering will occur at the offshore endpoint of the gas export pipeline to maximise dilution and avoid sensitive habitats and areas of higher densities of marine fauna. | | |

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| | | + Chemical injection volumes will be metered during flooding and hydrotest operations to identify leakage and trigger activity to stop, as well as to mitigate the risk of under/over-dosage of chemical.<br>+ Contracted vessel will have dedicated FCGT procedures.<br>+ A vertically orientated diffuser will be used during dewatering to re-oxygenate treated seawater at the discharge point.<br><u>Introduced Marine Species</u><br>There may be an increased risk of IMS colonising areas of the pipeline corridor in the shallower water depths where there is suitable light and habitat available (particularly in the vicinity of the shoals/banks). However, the risk of this occurring is considered low given the key management controls that will be implemented throughout the life of the project including a project Quarantine Management Plan, and compliance with contemporary ballast water and biofouling requirements.<br><u>Fauna</u><br>Impacts to fauna such as marine turtles, cetaceans and fishes are expected to primarily be short-term displacement from the immediate vicinity of the pipeline during installation. The presence of the pipeline infrastructure has the potential to provide a beneficial impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna.<br>The crested tern is widespread and numerous along the NT coastline, with 20 breeding colonies reported. The | | |

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| | | colony on Seagull Island supports over 50,000 birds and is considered globally significant.<br>Significant numbers of Olive Ridley turtles are known to nest on the beaches of Seagull Island and the north-west coast of Melville Island. As the physical presence of the gas export pipeline within internesting habitat critical to the survival of marine turtles has been minimised; i.e. approximately 0.0001% and 0.0015% of the internesting habitat critical to the survival of flatback and Olive Ridley turtles respectively, the physical presence of the gas export pipeline during is considered highly unlikely to impact the species use of the area.<br>During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area. Therefore, light emissions from the pipelay installation vessels are not anticipated to impact the breeding population of crested terns or Olive Ridley turtles located on the shoreline of Seagull Island.<br>Underwater sound generated by installation activities may affect individuals passing through the area; however, impacts at a population level are considered unlikely given the area affected is highly localised. The key noise sources associated with installation activities along the gas export pipeline will also be relatively slow moving (approximately 3 km to 5 km of the gas export pipeline will be laid per day), thereby allowing individuals to move away from the area, and reasonably short in duration. | | |

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| | | The risk of vessel strike to marine fauna is inherent to movements of all vessel types, including recreational vessels, fishing vessels, passenger ships, whale-watching boats, container ships and naval ships. Impacts from the presence of offshore infrastructure and related vessels interacting with marine fauna are not considered to present a significant risk at a population level.<br>Key controls to minimise impacts from the physical presence of offshore infrastructure and project related vessels interacting with marine fauna include:<br>+ placement of pipeline infrastructure in areas where there are no regionally significant feeding, breeding or aggregation areas for marine mammals<br>+ limiting of the physical footprint of the pipeline area such that displacement of individual mammals is unlikely, and the likelihood of a collision is remote<br>+ vessels travelling at relatively low speeds within operational areas<br>+ project vessels proactively responding to potential fauna interactions in line with the requirements of the EPBC Regulation s2000 – Part 8 Division 8.1.<br>Some of the shoals/banks in close proximity to the pipeline corridor, such as Shepparton Shoal, Marie Shoal and Goodrich Bank, may be temporarily affected by increased sediment levels. Considering the expected short duration of increased sedimentation at any one area, and that these areas have naturally highly turbid environments meaning that benthic habitats in these areas are likely to have a natural resilience to higher sediment/turbid conditions, significant impacts are considered unlikely. The outcomes of the pre-lay surveys | | |

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| | | will be used to further inform final route optimisation and reduce environmental impacts.<br>**5 Impact on fishing activities**<br>Impacts from interactions from project infrastructure and vessel movements with other marine users, including commercial fishers, throughout the project are considered remote given the relatively minor physical scale of the offshore infrastructure and presence of project-related vessels, combined with the relatively low level of activity within the open offshore waters of the project area. The impacts of pipeline installation activities on fishing activities near the proposed route are therefore expected to be localised and short-term.<br>Pipelay and associated offshore activities (e.g. pre-lay and post-lay surveys) are expected to take up to nine months of offshore operations to complete. Pipeline installation activities (i.e. involving the pipelay vessel) are expected to occur over approximately three months, with installation activities occurring within a 2 km corridor either side of the gas export pipeline (3 km around the pipeline end termination points at both ends of the pipeline). During pipeline installation activities, a 500 m safety exclusion zone will be established around the pipelay vessel. There will be no ongoing exclusion zones established around the pipeline during operations.<br>Installation of the pipeline is expected to commence as early as Q3 2021 and finish as late as Q2 2023. However, pre-lay survey could commence up to nine months earlier than pipeline installation, and pre-lay span rectification may occur up to 30 days prior to pipeline installation.<br>The total infield duration of the offshore installation activities is expected to be approximately nine months. | | |

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| | | The schedule is indicative only; exact timing and duration of gas export pipeline installation activities is subject to pipelay vessel availability, sea state, weather conditions and operational efficiencies. (i.e. the pipelay vessel will be present for approximately three months.<br>Peak vessel activity is expected to occur during installation of the pipeline, when the pipelay vessel and a dedicated support vessel will be present in the operational area, while supply vessels will transit to and from the pipelay vessel regularly (expected to be daily). During the campaign, vessels will operate 24 hours a day, seven days a week.<br>Activities associated with installation of the gas export pipeline will occur within a 2 km buffer around the gas export pipeline route, and 3 km radius around each endpoint of the gas export pipeline (i.e. the Operational Area). However, support vessels may transit to and from port as required (outside the scope of the EP).<br>Considering the relatively short duration of the pipeline installation in which higher numbers of vessels will be present), and minimal number of project related vessel movements within the pipeline corridor during operations (i.e. limited to periodic maintenance and inspection activities), the impact to commercial fishing activities from vessels movements are considered to be minor.<br>**6 Habitat creation**<br>A number of studies have been conducted to investigate this question, for example a recent publication in the journal Continental Shelf Research "Using industry ROV videos to assess fish associations with subsea pipelines" (McLean et al., 2017). The presence of the pipeline infrastructure has the potential to provide a beneficial | | |

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| | | impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna<br>**7 Additional consultation request**<br>Company has provided the relevant information to the Member for Arafura and will be meeting with him on 18 March to receive any direct feedback he may have. He will be provided with relevant information and opportunities to provide input on an ongoing basis. | | |
| **Commonwealth Fisheries Association (CFA)** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is |
| 21/22 Feb 2019 | Company left phone message and follow-up email with pipeline route co-ordinates. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on Company website and provided the website address.<br>Stakeholder was advised that the documentation on Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| **Darwin Port** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | Company provided the following responses to the issues and concerns raised:<br>**1 Vessel movements and supply base**<br>Company Response: The attached presentation contains the currently available information on vessels. It is too early at this point in time to provide DIPL and Darwin Port with specific vessel details and movements. Company will keep DIPL and Darwin Ports informed as part of ongoing stakeholder consultation.<br>**2 Darwin LNG second train**<br>Company Response: It is Company' priority to ensure that gas is available to backfill the existing capacity at DLNG as the Bayu-Undan field declines. The proposed Barossa development is being progressed as a backfill option to keep DLNG supplied with gas for another 20 years or more.<br>Favourable results from our activities and from others in northern Australia, combined with the right economic conditions and cost structure, may potentially support future expansion of DLNG. We will continue to investigate how cost structure changes could be | The stakeholder's issues and concerns were assessed to have been presented as additional information requests.<br>Both requests helped inform the commitments Company has made in the ongoing communications process. | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. |
| 7 Feb 2019 | Follow up phone call. Voicemail left. | | | |
| 8 Feb 2019 | Phone call with stakeholder. Stakeholder advised that they will review fact sheet and provide any feedback by 19 Feb 2019. | | | |
| 12 Feb 2019 | Follow up email attaching fact sheet and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |
| 2 April 2019 | Meeting held in Darwin with representatives of Darwin Port and NT Department of Planning, Infrastructure and Logistics. | | | |

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| 4 April 2019 | Company provided a summary via email of the issues/concerns raised at the 2 April meeting and Company' responses (refer column right) and the presentation that was talked through at the meeting.<br>The issues/concerns raised were as follows:<br>+ DIPL would like more detail on vessel movements and is keen for Company to use Darwin Port as a supply base.<br>+ DIPL asked if the Barossa development would lead to a second train being built at Darwin LNG.<br>Company also advised stakeholder if they have further questions to please email or phone. | achieved, to allow expansion of DLNG to become a competitive future option. | | The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process.<br>As a 'relevant' stakeholder for the OPEP, they will also be provided with the approved plan. |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |
| ***Demersal Fishery, NT Commercial Licence-holders*** | | | | |
| 17 Jan 2019 | Company provided initial fact sheet via covering letter with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised by any licence holder or their representative body, the NTSC.<br>On request from the licence holders' representative body, the NT Seafood Council, Company proactively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal. |
| 6 Mar 2019 | Letter and commercial fishing issues sent. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| *Department of Agriculture and Water Resources, Commonwealth Government* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | The following information was provided by Company to the stakeholder in response to the issues and concerns raised (see entry in left column):<br>Biosecurity management<br>The EP to be submitted will detail the management controls that will be implemented throughout the installation campaign and current controls proposed to manage ballast water management and biofouling include:<br>+ Ballast water discharges will comply with the requirements of the Australian Ballast Water Management Requirements, which implements the requirements of the *Biosecurity Act 2015* (Cth) and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for vessel class).<br>+ Vessels will have a suitable anti-fouling coating in accordance with the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) (as applicable for vessel size, type and class), including Marine Order 98.<br>+ Vessels will comply with the International Convention on the Control of Harmful Anti-fouling Systems on Ships (as appropriate to class) including vessels having a valid IAFS Certificate. Contracted pipelay vessels will have a marine growth prevention system in place. | The issues and concerns raised by the stakeholder have informed the commitments by Company related to biosecurity management. | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs. |
| 8 Feb 2019 | Follow up phone call with stakeholder. Stakeholder requested copy of fact sheet to be emailed to them. Stakeholder was interested in biosecurity management and recommended Company review and implement the Department's Offshore Instillation Biosecurity Guide. | | | |
| 12 Feb 2019 | Follow up email attaching fact sheet, providing an activity overview and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |
| 14 Feb 2019 | Email from stakeholder recommending Company follows the Australian Ballast Water Management Requirements and the Biofouling guidelines for offshore petroleum industries, which includes having a Biofouling Management Plan and Biofouling Record Book for each vessel used on the project. | | | |

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| 14 Mar 2019 | Company email confirming that the Gas Export Pipeline Installation Environment Plan to be submitted will detail the management controls that will be implemented throughout the installation campaign and current controls proposed to manage ballast water management and biofouling, including following the Australian Ballast Water Management Requirements and the Biofouling guidelines for offshore petroleum industries, which includes having a Biofouling Management Plan and Biofouling Record Book for each vessel used on the project. | + Vessels mobilising from outside Australia or from nearshore waters within Australia will be subject to an IMS risk assessment, the findings of which will determine if additional management measures are required prior to mobilisation, such as a hull inspection and cleaning as required.<br>+ The pipelay vessel stinger (equipment on the pipelay vessel that is used to lower the pipeline to the seafloor) will be raised above water level during vessel transit to the Operational Area so any potential IMS attached to the stinger will perish. | | As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation | | | |

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| | activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |
| ***Department of Defence (including Australian Hydrographic Service and Marine Border Command), Commonwealth Government*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues and concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of |
| 16 Jan 2019 | AHS acknowledged receipt of email. | | | |
| 25 Feb 2019 | Follow up phone call to DoD. Stakeholder requested fact sheet to be emailed again. Company sent reminder email with initial fact sheet with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. | | | |

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| 26 Feb 2019 | Follow up phone call to AHS. Stakeholder requested fact sheet to be emailed again. Company sent reminder email with initial fact sheet with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. | | | Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 26 Feb 2019 | Follow up phone call to MBC. Stakeholder advised that they will follow-up internally and respond to the Barossa email address if any issues. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation | | | |

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| | activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |
| 17 April 2019 | AHO acknowledgement that Company's email had been received by the AHO and the data supplied would be registered, assessed, prioritised and validated in preparation for updating Navigational Charting products. These adhere to International and Australian Charting Specifications and standards. These standards may result in some data generalisation or filtering due to the scale of existing charts, proximity to other features, and the level of risk a reported feature presents to mariners. | | | |
| **Department of Environment and Energy (including Parks Australia), Commonwealth Government** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | The following confirmations were provided by Company to the stakeholder in response to the issues and concerns raised (see entry in left column):<br>+ The final EP will reflect compliance with all the obligations and considerations cited by the DNP in its comments, including:<br>– the obligations included in the Class Approval (and Conditions) and the Licence (PA2018-00041- | The issues and concerns raised by the stakeholder have informed the commitments by Company related to proposed activity in the Oceanic Shoals Marine Park.<br>The submitted/final EP will reflect compliance with all | Company believes it has conducted the appropriate consideration of the issues and concerns raised and has made the relevant inclusions to the submitted EP.<br>Company also believes it has provided reasonable |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | 1) granted by the DNP authorising installation and operation of the pipeline in the Oceanic Shoals Marine Park Multiple Use Zone and Habitat Protection Zone<br>– consideration of information on values of the Marine Park provided in the North Marine Parks Network Management Plan 2018 and its accompanying Guidance Note and the Australian Marine Parks Science Atlas.<br>+ The submitted EP will identify and manage the potential impacts and risks on marine park values to an acceptable level and consider all options to avoid them or reduce them to as low as reasonably practicable and demonstrate that the activity will not be inconsistent with the management plan, including the condition (specifically cited in the DNP's comments) that pipeline installation must not anchor in the Habitat Protection Zone (IUCN IV) – Zone 2 unless it is required in an emergency.<br>+ The notification requirements and requests [1 (a) and (b), 2 and 3 (a), (b) and (c)] cited by DNP in its comments will be reflected in the submitted EP and Oil Pollution Emergency Plan and will also be addressed in the notification procedures that will be developed for the pipeline installation activities. | the obligations and considerations cited by the DNP. | and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is accepted and provide access to the full EP.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process and the DNP's specific notification requirements. |

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| 29/30 April | Parks Australia asked Company via email whether the request for stakeholder comment is a direct request for comment from the Director of National Parks (DNP) as a 'relevant person' as required to be provided by the titleholder/company to NOPSEMA as part of the EP to show relevant person consultation has been undertaken.<br>If so, Parks Australia requested additional time to respond given that the Easter/Anzac day break has made it difficult to prepare a response by the requested deadline.<br>Company advised that the DNP is considered as a relevant person and happy to provide an extension to the DNP to respond by Friday 17 May. | | | |
| 24 May 2019 | Email received from Parks Australia in response to Company's requests for feedback:<br>+ Noted the proposed activity is in the Oceanic Shoals Marine Park, part of the North Network of Marine Parks.<br>+ Noted the North Marine Parks Network Management Plan 2018 provides information on values for the marine park.<br>+ Advised that in preparing the EP for submittal to NOPSEMA, Company is expected to consider the impacts and risks of activities in the context of the Management Plan objectives and values, including representativeness of the | | | |

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| | relevant values and activity footprint on the representative area of the Australian marine park.<br>+ Advised that specific values for the Oceanic Shoals Marine Park include:<br>– carbonate bank and terrace systems of the Van Diemen Rise – an area characterised by terraces, banks, channels and valleys supporting sponges, soft coral, polychaetes, ascidians, turtles, snakes and sharks<br>– carbonate bank and terrace system of the Sahul Shelf – an area characterised by terraces, banks, channels and valleys, supporting sponges, soft corals, sessile filter feeders, polychaetes and ascidians<br>– pinnacles of the Bonaparte Basin – an area that contains the largest concentration of pinnacles along the Australian margin, where local upwellings of nutrient-rich water attract aggregations of fish, seabirds and turtles<br>– shelf break and slope of the Arafura Shelf – an area characterised by continental slope, patch reefs and hard substrate pinnacles that support over 280 demersal fish species.<br>+ Advised that, in the context of the management plan objectives and values, the EP should: | | | |

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| | – identify and manage the impacts and risks on marine park values to an acceptable level and consider all options to avoid them or reduce them to ALARP<br>– clearly demonstrate the activity will not be inconsistent with the management plan.<br>+ Noted that, consistent with the management plan, any vessels used for or in connection with the pipeline installation must not anchor in the Habitat Protection Zone (IUCN IV) – Zone 2 unless it is required in an emergency.<br>+ Advised the following notification requirements for the EP:<br>– The DNP requests that in the EP, the titleholder define as a reportable environmental incident, any incidents of pollution or loss of articles or equipment that have caused, or have potential to cause, moderate to significant environmental damage to a marine park or its values.<br>– The DNP should be made aware of oil/gas pollution incidences which occur within a marine park or are likely to impact on a marine park as soon as possible. As such, if the titleholder is required to notify NOPSMEA of any reportable environmental incident | | | |

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| | within or likely to impact on a marine park:<br>- notice of such an incident should be reported to the DNP's 24-hour Marine Compliance Duty Office as soon as is possible on 0419 293 465. The notification should include:<br>▪ titleholder details<br>▪ time, location and description of the incident (including name of marine park likely to be affected and what pollutants, articles or equipment have been lost in the park)<br>▪ proposed response arrangements as per the Oil Pollution Emergency Plan (e.g. dispersant, containment, etc)<br>▪ contact details for the response coordinator.<br>- provide any report prepared by the titleholder in accordance with the OPGGS Act about the incident must be provided to the DNP at the same time such report is given to NOPSEMA.<br>– The DNP request that the titleholder inform the DNP of the full details of | | | |

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| | any suspected contravention of the OPGGS Act relating to undertaking activities within the Habitat Protection Zone that are the subject of the EP and the Parks Australia licence (PA2018-00041-1), within 24 hours of becoming aware of any such suspected contravention.<br>– The DNP requests:<br>- notification of the date that the pipeline installation works will commence at least ten days prior to the start date<br>- notification of the completion of the pipeline installation within ten days of the date of completion<br>- details of any vessels used for, or in connection with, the installation activities within the marine park at the time the DNP is notified of the commencement of the activity. | | | |
| 18 June 2019 | Company provided response via email to Parks Australia's comments of 24 May (as per column right). | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| *Department of Environment and Natural Resources (Marine Section), NT Government* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs. |
| 4 Feb 2019 | DENR Environment Division provided response letter on behalf of Dep't, Minister and NT-EPA acknowledging the Development Area is outside NT jurisdiction and it has no comments on the installation of the pipeline at this time. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |
| ***Department of Foreign Affairs and Trade (DFAT), Commonwealth Government*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal. |
| 26 Feb 2019 | Follow up phone call. Voicemail left. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 28 Feb 2019 | DFAT called and advised they will follow up internally and respond to the Barossa email if any issues. | | | Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address. | | | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal. |

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| | Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| ***Department of Industry, Innovation and Science (DIIS), Commonwealth Government*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 6 Feb 2019 | Follow up phone call. DIIS advised no comments. | | | action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |

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| *Department of Infrastructure, Planning and Logistics (Marine Transport), NT Government* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | Company provided the following responses to the issues and concerns raised:<br>**1 Vessel movements and supply base**<br>Company Response: The attached presentation contains the currently available information on vessels. It is too early at this point in time to provide DIPL and Darwin Port with specific vessel details and movements. Company will keep DIPL and Darwin Ports informed as part of ongoing stakeholder consultation.<br>**2 Darwin LNG second train**<br>Company Response: It is Company' priority to ensure that gas is available to backfill the existing capacity at DLNG as the Bayu-Undan field declines. The proposed Barossa development is being progressed as a backfill option to keep DLNG supplied with gas for another 20 plus years.<br>Favourable results from our activities and from others in northern Australia, combined with the right economic conditions and cost structure, may potentially support future expansion of DLNG. We will continue to investigate how cost structure changes could be achieved, to allow expansion of DLNG to become a competitive future option. | The stakeholder's issues and concerns were assessed to have been presented as additional information requests.<br>Both requests helped inform the commitments Company has made in the ongoing communications process. | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation |
| 7 Feb 2019 | Follow up phone call. Voicemail left. | | | |
| 12 Feb 2019 | Follow up email attaching fact sheet and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |
| 12 Feb 2019 | Email response from stakeholder advising that they will provide any comments by 19 Feb 2019. | | | |
| 18 Feb 2019 | Voicemail left by stakeholder. Follow up call and voicemail left for stakeholder. | | | |
| 21 Feb 19 | Follow up phone call. Stakeholder sought clarification of the location of activities. Company advised pipeline route is in Commonwealth waters. Stakeholder advised they are interested in a meeting. | | | |
| 26-27 Mar 19 | Company follow up call to set up time for a meeting. Company followed up with email providing suggested dates and times. Email response from Stakeholder to confirm meeting on 2 April 2019. | | | |

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| 2 April 2019 | Meeting held in Darwin with representatives of Darwin Port and NT Department of Planning, Infrastructure and Logistics. | | | activities as per the ongoing communications process.<br>As a 'relevant' stakeholder for the OPEP, they will also be provided with the approved plan. |
| 4 April 2019 | Company provided a summary via email of the issues/concerns raised at the 2 April meeting and Company' responses (refer column right) and the presentation that was talked through at the meeting.<br>The issues/concerns raised were as follows:<br>+ DIPL would like more detail on vessel movements and is keen for Company to use Darwin Port as a supply base.<br>+ DIPL asked if the Barossa development would lead to a second train being built at Darwin LNG.<br>Company also advised stakeholder if they have further questions to please email or phone. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the | | | |

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| | pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |
| ***Department of Primary Industry and Resources (Fisheries), NT Government*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | Company provided the following responses to the issues and concerns raised<br>**1 Small pelagic fishery**<br>Company has provided relevant information to the stated licence-holder and advised we are available to meet. The licence-holder has not responded to date. Company will continue consultation with licence-holders | The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to potential impacts on commercial | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide |

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| 23 Jan 2019 | Department provided the following response via email:<br>+ Notes the six affected NT Fisheries are noted in **Section 5.7.12** of the Environment Plan and there is the possibility of disruption to fishery activities during the construction phase. Encourages Company to provide good communications to the commercial fishers though the NTSC of its activities, prior to and during the construction phase of the pipeline to allow commercial fishers to plan fishing in activities outside of the construction area and affected pipeline corridor.<br>+ Notes the management of invasive marine species in **Section 6** of the EP in relation to drilling platforms at the well site and vessels supporting drilling and pipeline installation. While those areas are generally in water depths where the risk is low, ballast management and antifouling are still of vital importance in case any of the vessels are required to dock at ports in the NT where the risk for possible IMS introduction will increase. | and their representative organisations and respond to any further information provided by the Department.<br>**2 Demersal trap fisher**<br>Company has provided relevant information to the stated licence-holder and advised we are available to meet. The licence-holder has not responded to date. Company will continue consultation with licence-holders and their representative organisations and respond to any further information provided by the Department.<br>**3 Assistance Program information**<br>Company thanks the Department for the information which was provided as an FYI.<br>**4 Fish/fish habitat study**<br>AIMS is currently developing the scope of this project. AIMS and Company will work with the Department and with the Tiwi Land Council to develop and finalise the project scope over the coming months.<br>**5 Peak fishing times**<br>Company will continue consultation with licence-holders and their representative organisations and respond to any further information provided by the Department.<br>**6 Development area and Timor Reef Fishery**<br>The Barossa offshore development area, within which the FPSO facility and development wells will be located, | fishing activities (1, 2, 5 and 6).<br>helped inform the consultation process and the commitments Company has made in the ongoing communications process.<br>Issues 3 and 4 were of a general nature and not related to this activity. | feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| 30 Jan 2019 | Company phone call with Department and follow-up email advising that a formal reply will be provided and will include further information re the consultation process with commercial fishers.<br>Company asked if the Department could provide further input via a meeting to assist Company with the preparation of tailored information for the NTSC. | is approximately 27 km from the nearest shoals/banks. The location of the offshore facilities/infrastructure and equipment in this area does not represent a significant portion of the area commercially fished, with primary fishing effort of the Timor Reef Fishery undertaken to the south-west. The areas actively fished by the Northern Prawn Fishery in nearshore waters are a minimum of approximately 64 km from the Barossa offshore development area.<br>Consultation with commercial fishers of the Timor Reef Fishery previously undertaken identified some concerns regarding the physical presence of vessels during periods of peak fishing activity (October and May) and the potential for disruption of their activities. Through the consultation process it was noted that potential impacts for trap fishers would have been greater if activities were over fishing grounds further to the south-west (>50 km away). | | |
| 4 Feb 2019 | Phone and email exchange with the Department to confirm meeting in Darwin. | | | |
| 7 Feb 2019 | Company met with Department and provided further information via PowerPoint presentation. Company advised it will provide Department with a written summary of the issues raised during the meeting as well as those raised in email of 23 Jan. | | | |

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| 13 Feb 2019 | Company provided Department with summary of issues at 7 Feb 2019 meeting via email along with PowerPoint presentation, current pipeline route co-ordinates and links to OPP on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.<br>Company advised it would start preparing a detailed written response to the issues and requested both organisations advise if anything had been missed in the summary or they wished to add further detail. Company advised it would ensure all items are covered in our responses.<br>Further issues raised:<br>+ A permit is in the process of being granted for a Small Pelagic Fishery Development close to the west coast of the Tiwi Islands. The Department will check internally whether there are any specific concerns related to this.<br>+ Within the Demersal Fishery there is one additional trap fisher that Company may not be aware of and the Dep't will check internally whether there may be any specific concerns related to his potential activity.<br>+ The Department has recently provided catch and effort data to Parks Australia to develop a compensation scheme for fisheries affected by the new zoning of marine parks. The 'Fisheries Assistance Program' is currently being finalised. The Department will investigate whether information can be provided to Company. | A temporary petroleum safety zone around the drill rig (500 m radius during development drilling) and pipelay vessels (500 m during installation), and exclusion zones around the offshore facilities (500m around each wellhead and the FPSO facility) in the Barossa offshore development area will exclude commercial fishing vessels from a small proportion of their current fishing and available areas<br>Company will continue to undertake consultation with Timor Reef Fishery licence-holders and their representative organisations in more detail during preparation of activity-specific EPs and on an ongoing basis in the lead-up to and during all operational activities. This includes the Development Drilling EP which is relevant to the Development Area and will be prepared later in 2019 for submittal to NOPSEMA in 2020.<br>Controls to manage risks include:<br>+ The project will comply with the OPGGS Act 2006 – Section 616 (2) Petroleum safety zones, which includes establishment and maintenance of a petroleum safety zone offshore structure or equipment which prohibits vessels entering or being present within the specified area without written consent.<br>+ Accepted procedures will be implemented to meet the requirements of Company' Marine Operations Manual (IOSC/OPS/HBK/0003), which includes details of:<br>– roles, responsibilities and competency requirements<br>– requirements (e.g. storage, transfer) for bulk cargo and bulk liquids (including bunker fuel) operations | | |

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| | + The Department advised that the department was still interested in progressing the AIMS fish/fish habitat study and enquired about Company' understanding of its status.<br>+ Discussed peak fishing times for each fishery. The Department advised that there tends to be less fishing in the wet season, but fishing occurs in the Timor Reef Fishery year-round and will send additional information regarding peak fishing times.<br>+ The Department noted that the development area is within the Timor Reef Fishery and that this is a highly fished, highly productive area. | – general requirements for entering/departure and movement within the designated exclusion or petroleum safety zones<br>– checklist required to be completed for vessels entering the exclusion zones in the development area<br>– safe and sustainable dynamic positioning operations.<br>+ The Stakeholder Engagement Plan will include consultation with commercial fisheries, shipping, AHO and other relevant stakeholders operating in the vicinity of the development area to inform them of the proposed project. Ongoing consultation will also be undertaken throughout the life of the project. | | |

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| 14 Feb 2019 | Department provided additional advice via email:<br>+ The small pelagic fisherman does fish off the south-west end of the Tiwis where the proposed pipeline will run.<br>+ Asked whether Company had included a specific Cairns-based vessel in the trap boats.<br>+ Clarified that the trap and trawlers are going all year round with a bit of a peak for demand before Christmas.<br>+ Provided information on Fisheries Business Assistance Program in relation to marine parks.<br>Company advised that both licence-holders specifically mentioned by the Department were provided with the initial information on 16 Jan and would be followed-up. Dep't provided further contact details for the fishers. | + Subsea infrastructure and pipelines will be clearly marked on nautical charts published by the AHO.<br>In addition to the above answers, Company provided the Department with a summary of key concerns identified by Company as relevant to commercial fisheries which had been supplied to the NTSC and relevant commercial fishing licence-holders.<br>The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | |
| 1 Mar 2019 | Company advised via email that it should have the information in relation to the issues discussed at the February meeting ready to send within the week. Company also provided the information tailored to the commercial fishing industry that was prepared for the NTSC. | | | |

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| 14 Mar 2019 | Company provided written responses to the questions raised at the 13 February meeting and advised it would contact again to see if the stakeholder wanted to meet again or had further feedback.<br>The Department acknowledged receipt with no further comments. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | not be published by NOPSEMA following EP submittal. | | | |
| ***Department of Primary Industry and Resources (Mines and Energy), NT Government*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs. |
| 6 Feb 2019 | Follow up phone call and email. DPIR interested in briefing on the Barossa Development. Company to follow up in the week beginning 11 Feb 2019 with suggested dates. DPIR advised that the Member for Arafura is interested in a briefing on Company engagement with Tiwi Island stakeholders. Company advised that it will offer a meeting with the Member for Arafura. | | | |
| 13 Feb 2019 | Email exchange to clarify scope of DPIR's interest for proposed meeting. | | | |
| 14 Feb 2019 | Email from DPIR confirming no specific interest in meeting to discuss the Gas Export Pipeline environment plan and that a general meeting with Company scheduled for mid-March will suffice for a broader update on the Barossa Development. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| *Eni Australia* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 8 Feb 2019 | Follow up phone call. Voicemail left. | | | |
| 12 Feb 2019 | Follow up email attaching fact sheet and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| ***Environment Centre – Northern Territory*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | Please see entry for AMCS (above) as this stakeholder raised exactly the same issues and concerns at a joint meeting held with Company on 8 February and were provided with the same responses. | The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to environmental impacts and risks (1 to 5) did not result in any specific amendments to the EP.<br>The stakeholder has expressed a general opposition to any oil and gas activity occurring in a | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is |
| 31 Jan 2019 | AMCS representative phoned Company to request a meeting which may also be attended by Environment Centre, NT. Company organised meeting to be held in Darwin on 8 Feb. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 8 Feb 2019 | Company met with representatives of AMCS and Environment Centre, NT in Darwin and provided further information via PowerPoint presentation. Company advised it will provide both organisations with a written summary of the issues raised during the meeting. | | marine park or during a turtle internesting period.<br>The submitted EP reflects both Parks Australia's conditions for its authorisation of entry to the marine park and HPZ and Company's contingency measures for the timeline for activities, dependent on the final EP conditions. | first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 13 Feb 2019 | Company emailed AMCS and EC-NT a summary of the issues discussed at 8 Feb 2019 meeting via email along with PowerPoint presentation, current pipeline route co-ordinates, Pendoley report on marine turtles from OPP and links to OPP on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.<br>Company advised it would start preparing a detailed written response to the issues and requested both organisations advise if anything had been missed in the summary or they wished to add further detail. Company advised it would ensure all items are covered in our responses. Company also advised it would follow-up with Edith Cowan University as requested.<br>Please see entry for AMCS (above) as both stakeholders raised the same issues and concerns at the meeting held with Company on 8 February. | | | |
| 14 Mar 2019 | Company provided written responses to the questions raised at the 8 February meeting and advised it would contact again to see if they had further feedback. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| ***Fischer Wholesale/H & T Investments Pty Ltd*** | | | | |
| 17 Jan 2019 | Company provided initial fact sheet via covering letter with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by |
| 27 Feb 2019 | Company emailed tailored information sent to NTSC. | | | |
| 6 Mar 2019 | Other registered companies included in letter with tailored information sent to NTSC. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| *INPEX* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 6 Feb 2019 | Follow up phone call. Will review and advise any comments. | | | |
| 7 Feb 2019 | Phone call received advising no issues to raise. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| ***Melbana Energy*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal. |
| 6 Feb 2019 | Follow up phone call. Stakeholder advised no impact on their activities. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| ***Member for Arafura*** | | | | |
| 14 Feb 2019 | Company phoned stakeholder. Stakeholder expressed interest in meeting and requested Company to provide further information and meeting date suggestions via email. | Company provided the following response in response to the issues and concerns raised:<br>**1 Pipeline route** | The stakeholder raised several issues and concerns that required consideration and written responses. | Company believes it has conducted the appropriate consideration of the issues and concerns raised. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 15 Feb 2019 | Company provided initial fact sheet and pipeline GPS co-ordinates via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. | Company can confirm there are no plans to route the pipeline anywhere other than within the operational area identified on the map included in the Notice of Consultation fact sheet provided to all stakeholders as part of the current EP consultation. This map is labelled 'Proposed gas export pipeline route within the pipeline corridor presented in the accepted OPP' and is identical to the pipeline corridor map published in the accepted Offshore Project Proposal in March 2018. As per the OPP accepted by the offshore regulator, NOPSEMA, the final pipeline route must be within the published, accepted corridor.<br>**2 Potential dredging**<br>Company can confirm the pipeline installation activities are not related in any way to potential future dredging in the area to accommodate large vessels at Port Melville for the woodchip industry. The largest vessel | The issues and concerns related to environmental impacts and risks (1, 2 and 4) did not result in any specific amendments to the EP.<br>The issue/concern related to communications (3) helped inform the commitments Company has made in the ongoing communications process.<br>The other considerations raised in issue 4 were of a general project nature. | Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. |
| 18 Feb 2019 | Thanks re info. | | | |
| 19-22 Feb 2019 | Organising meeting. | | | |
| 19 March 2019 | Meeting held. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 22 March 2019 | Company provided a summary of the issues that were raised and discussed during the 19 March meeting and a copy of the presentation and advised we would provide written responses.<br>Issues raised:<br>+ Company to confirm there are no plans to route the pipeline anywhere other than within the operational area identified on the map provided. The Member for Arafura said he had seen some previous material several years ago that showed a potential route across the Tiwi islands.<br>+ Company to advise whether its pipeline installation activities are related in any way to potential future dredging in the area to accommodate large vessels for the woodchip industry.<br>+ Company to ensure it continues to communicate with all involved stakeholders in and around the Tiwi Islands.<br>+ The project is welcome and any opportunities for local companies to provide goods and services to the project, including Port Melville for refuelling, etc, should be investigated and promoted. | that will be involved in the pipeline installation activities is the pipelay vessel and this vessel will not enter Port Melville.<br>**3 Consultation**<br>Company will continue to undertake consultation with all relevant fishing and other Tiwi-based stakeholders in more detail during preparation of activity-specific EPs and on an ongoing basis in the lead-up to and during all operational activities.<br>Controls to manage the impact of vessel movements during pipeline installation activities include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of Navigation and Emergency Procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan.<br>+ AHS Notice to Mariners and AMSA MSI will be notified prior to relevant gas export pipeline installation activities. | | The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| 10 April 2019 | Company provided written responses to the questions raised at the 8 February meeting and advised it would contact again to see if they had further feedback.<br>Company also advised in a further email that one of the responses include a change to the indicative schedule. We previously advised that the activities associated with the installation of the pipeline are expected to commence as early as Q1 2021 and finish as late as Q2 2023. The finish date is now 'as late as Q1 2024'. All other indicative schedule information is the same, including the duration period of approximately nine months for the activities. | + Subsea infrastructure and gas export pipeline will be clearly marked on Australian nautical charts published by the AHO.<br>+ The PLET at the end of the gas export pipeline where the pipeline joins the existing Bayu-Undan pipeline has been designed with anti-snag protection.<br>+ A support vessel will be present in the Operational Area at all times while the pipelay vessel is installing the pipeline to minimise the potential adverse interactions with fishing activities.<br>+ An ongoing communications plan will be implemented for engagement with commercial and recreational fishers and charter fishing operators.<br>**4 Future social/economic benefits**<br>Company acknowledges that the Tiwi Land Council has indicated a desire for Company to consider future use of facilities at Port Melville for any activities conducted offshore NT. Company has been provided with a familiarisation of the facilities by the Port Operator and will continue to assess further information from the Operator.<br>In the event a company contracted to provide vessels to the Barossa Development did advise a desire to utilise Port Melville, Company would expect Company and the port operator to liaise at the earliest possible stage with relevant stakeholders at the Tiwi Islands.<br>Barossa is primarily an offshore project and is unlikely to require new accommodation to be established onshore. During the installation, hook-up and commissioning phases an accommodation support vessel may be located in the offshore development area. The FPSO will be towed to the offshore development area and will also | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months. | | | |

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| | Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | have accommodation for approximately 150 personnel offshore.<br>The project will involve an increased number of personnel needing to transit through Darwin, particularly during the offshore installation phase. At this early planning stage, it is anticipated this increased demand would be for short-term accommodation only and could be met through existing and planned future facilities. Estimates of onshore accommodation requirements will be determined during the detailed planning stage and will be planned well in advance in consultation with local facilities.<br>In addition to directly providing Company with details of business capability, it encourages any local businesses with potential capability to formally register for the Barossa Development with the Industry Capability Network in the NT which will provide information and details of how to tender for any future potential accommodation needs related to the project.<br>Barossa's major offshore infrastructure is likely to be built at a suitably equipped major construction facility and transported and installed at the offshore development area. However, with such a large development, opportunities will exist for smaller/ domestic companies to sub-contract for specific equipment and services. Opportunities for increased local employment during the development phase will primarily occur during the installation, hook-up and commissioning phases of the project, both offshore and in Darwin for supporting logistics.<br>Company places a high priority on purchasing goods and services locally and providing local suppliers with the opportunity to participate in projects through a | | |

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| | | competitive bid process. The approved Australian Industry Participation (AIP) Plan now in place for the Barossa Offshore Project states how Barossa provides "full, fair and reasonable opportunity" to Australian industry to supply goods and services to the project and includes an indicative list of opportunities for the supply of goods and services.<br>Additional to the AIP Plan, Company has a general commitment to provide local contractors with information about employment and supply opportunities. As part of this commitment it seeks to provide real opportunities to Indigenous persons and businesses to compete for the supply of goods and services to the project, provided they are offered on competitive terms and conditions. Contractors that include an Indigenous Content Proposal (ICP) as part of any contractual offers are favourably considered.<br>As the Operator of DLNG, Company has made a long-term commitment to training and employing a residential workforce with numerous programs to develop local skills, including early career traineeships, graduate programs and operations pathways:<br>+ Company' residential workforce policy requires its DLNG staff to live in Darwin, injecting local jobs and global expertise into the region<br>+ This is supported by the Darwin Operations Trainee Academy (DOCTA) program, which trains NT residents with skills in related trades to be LNG plant operators. To be eligible for DOCTA, candidates must have lived in the NT for several years.<br>+ This program has proved to be a successful long-term investment for Company, with local recruits tending | | |

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| | | to prefer to stay in the local area and having longer-term employment.<br>+ For the NT, it has been beneficial to the local economy, resulting in greater local investment and capacity building for NT residents.<br>Company is particularly driven to support capacity building programs that develop skills which lead to career pathways in our industry. Through its community investments, Company prioritises education programs in Australia that:<br>+ engage secondary school students in science, technology, engineering and maths (STEM) disciplines<br>+ focus on introducing primary school students to science and maths<br>+ enable access to industry related skills and training-based programs<br>+ support diversity and gender in the areas above<br>+ support Indigenous communities in the areas above (NT). | | |
| ***Monsoon Aquatics*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email and letter with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further |

<table>
<tr><th>Date</th><th>Contact made/feedback received/issues raised</th><th>Assessment of issues raised</th><th>Company response (including outcomes proposed/achieved)</th><th>Summary of Company assessment and response</th></tr>
<tr><td>21/22 Feb 2019</td><td>Company left phone message. No response received.</td><td rowspan="3">summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP.</td><td rowspan="3"></td><td rowspan="3">action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process.</td></tr>
<tr><td>27 Feb 2019</td><td>Company emailed tailored information sent to NTSC.</td></tr>
<tr><td>16 April 2019</td><td>Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal.</td></tr>
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| ***Neptune Energy*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 6 Feb 2019 | Follow up phone call. Voicemail left. | | | |
| 12 Feb 2019 | Follow up email attaching fact sheet and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| *Northern Prawn Fishery* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | Company initially pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests). | The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to environmental impacts and risks (1) did not result in any specific amendments to the EP.<br>The issues and concerns related to installation activities and potential interaction with commercial fishing activity (2 and 3) helped inform the commitments Company | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the |
| 12 Feb 2019 | Company left phone message with Northern Prawn Fishery advising consultation process to date and will follow-up the following week re a meeting. | | | |
| 21/22 Feb 2019 | Company left phone message and follow-up email with pipeline route co-ordinates and request to meet. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 26 Feb 2019 | Northern Prawn Fishery thanked Company for the co-ordinates but advised they had been requested previously and not provided therefore more time was required to respond.<br>Company advised this was fine and was happy to provide more time for the Northern Prawn Fishery to respond.<br>Northern Prawn Fishery advised that the placement of this pipeline has the potential to considerably impact on both Northern Prawn Fishery prawn and scampi fishing grounds/operations so it was important they continue to be involved in this discussion. | + Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP.<br>In addition, Company provided the fooling responses to issues and concerns raised by the stakeholder in its letter of 30 April:<br>With regard to habitat disturbance, Company believes there is sufficient information available to understand the potential environmental impacts associated with pipeline installation activities. We have utilised this information in our EP and have summarised key information below in order to address NPFI's concerns.<br>In terms of disruption to, or displacement of, Northern Prawn commercial fishing activities during pipeline installation activities, while we have responded with what we believe is relevant information, we think it would be beneficial to discuss this with NPFI in more detail to help us better understand NPFI's members' activities, so that we can fully understand and assess any potential for vessel interaction during installation. | has made in the ongoing communications process. | commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 27 Feb 2019 | Company provided the information provided to the NTSC on commercial fisheries' issues and concerns relevant to the Barossa Gas Export Pipeline Installation and the PPT presentation used in discussions with Austral Fisheries management, NT-based Spanish Mackerel licence holders and the NT Department of Fisheries. | | | |
| 27 Mar 2019 | Company follow up phone call. Left voicemail referring to email on 27 Feb 2019. Asked whether Stakeholder had any questions and if they would like to meet. | | | |

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| 16 Apr 2019 | Company follow up phone call. Left voicemail referring to advice from stakeholder on 26 Feb 2019 that they wished to provide comments on the EP and requesting comments be provided as soon as practicable. | **1 Habitat disturbance**<br>Company presented a 'pipeline corridor' in the Barossa Offshore Project Proposal (OPP) and has subsequently refined the proposed pipeline route based on further surveys and engineering studies. The pipeline route selected minimises the amount of seabed installation required and eliminates secondary stabilisation requirements for pipeline installation, thus minimising potential seabed disturbance.<br>Based on mapped and modelled benthic habitat classifications, the benthic habitats along the gas export pipeline route are largely bare sediments (82.1%), with relatively small areas of burrowers/crinoids (12.6%) and filter feeders (5.3%). All of these habitat types are well represented throughout the region; these habitats along the gas export pipeline route are not unique or regionally significant.<br>Potential impacts associated with pipeline installation are expected to be short term and localised (within hundreds of metres of the pipeline), with impacts to the wider marine environment considered highly unlikely. Over the longer term, impacts associated with operating the pipeline are expected to be minimal.<br>Given the low sensitivity and broad regional representation of the habitats within the gas export pipeline route, the potential impacts associated with installation of the gas export pipeline are considered to be minor, mainly due to the length of the pipeline (262 km) and subsequent total area of potential disturbance (approximately 29 ha).<br>As identified in the OPP, it is expected that sawfish may be found within the southern end of the pipeline | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |

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| | Northern Prawn Fishery responded that it would definitely review and get additional Northern Prawn Fishery comments to Company before end of April. | corridor. The Sawfish and River Sharks Recovery Plan identifies habitat degradation and modification as one of the principal threats to these species, and the Gas Export Pipeline Installation EP specifically addresses this potential impact.<br><br><u>Installation Activities</u><br><br>Company appreciates NPFI's concern regarding disruption to, or displacement of, Northern Prawn commercial fishing activities during pipeline installation activities and wishes to further discuss the information presented so we can more fully understand NPFI's members' activities.<br><br>We note NPFI's request that all pipeline installation activity is undertaken outside of Northern Prawn fishing seasons. At this early planning stage, the exact timing and duration of pipeline installation activities is subject to pipelay vessel availability, sea state, weather conditions and operational efficiencies.<br><br>Activities associated with installation of the pipeline will occur within a 2 km buffer around the pipeline route, and 3 km radius around each endpoint of the pipeline. There will be a 500 m safety exclusion zone around the pipelay vessel during installation activities.<br><br>Company will undertake consultation with all relevant commercial fishing stakeholders on an ongoing basis in the lead-up to the pipeline installation activities to ensure disruption is minimised. In the event that pipeline installation activities overlap with Northern Prawn fishing seasons, Company is keen to engage with the Northern Prawn Fishery Industry to identify | | |
| 30 April 2019 | Company received letter from NPFI via email with the following issues and concerns:<br><br>The proposed pipeline will be installed through very productive fishing grounds for the Northern Prawn Fishery and also areas inhabited by endangered sawfish species.<br><br>1 The OPP states that based on habitat preferences of sawfish "it is highly unlikely that sawfish will occur" within the area of the project including the pipeline and corridor. Sawfish are known to occur in various habitat types across northern Australia. There are four species of sawfish in Australia. All inhabit the inshore and offshore waters of the Northern Prawn Fishery, including the area of the proposed pipeline, and when they do so depends on their life stage (i.e. pups inhabit riverine habitat and move offshore as juveniles/sub-adults).<br><br>Sawfish have been recorded by Northern Prawn Fishery operators and prawn broodstock collectors in the proposed pipeline installation area for many years and recently in significant numbers west of Bathurst Island. This could indicate an aggregation site for breeding and/or feeding though this is currently unknown. | | | |

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| | The immediate and long-term impacts of habitat disturbance on the sawfish in this area could be significant and NPFI is concerned that due consideration has not been given to this in the Environment Plan. NPFI invests considerable time and resources to better understand sawfish populations, mitigate interactions with the species and protect important sawfish habitat.<br>2 The proposed pipeline will be installed through fishing grounds accessed by many Northern Prawn Fishery operators during both of the fishing seasons (figure supplied). NPFI has previously expressed concern about the immediate and future impacts of seabed disturbance on the prawn stocks, including spawning and the recruitment to fishing grounds, given the lack of information on the impact of such activity on crustacean.<br>NPFI reiterates those concerns and urges Company to take all measures to minimise and mitigate impacts on both Northern Prawn Fishery fishing operations and prawns stock in the area as much as possible. NPFI also would encourage investment by Company in research to better understand the impacts of its activities on prawn stocks and TEP species such as sawfish.<br>3 To minimise impacts on Northern Prawn Fishery fishing operations, NPFI would request that all pipeline installation activity is undertaken outside of Northern Prawn Fishery fishing seasons. The fishery is | arrangements to ensure we can safely share this environment.<br>As advised above, Company would also like further engagement with the NPFI to better understand NPFI member's activities and any concerns on how the presence of the pipeline may affect the Northern Prawn Fishery on an ongoing basis.<br>Further detail related to both the issues you have raised was previously provided and has again been included with this response. The issues are also addressed in a consolidated FAQ developed from all stakeholder feedback and responses available on our website at this address: http://www.Company.com.au/what-we-do/our-projects-activities/barossa-project/environment/. | | |

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| | currently closed from 16 June to 31 July and from 1 December to 1 April each year. NPFI will be seeking compensation from Company on behalf of the Northern Prawn Fishery Statutory Fishing Rights holders should there be any disruption to, or displacement of, Northern Prawn commercial fishing activities from the establishment of the proposed pipeline. | | | |
| 1/2 May 2019 | Attempted call and email by Company asking whether NPFI would like to have a meeting and that we will start preparing a written response.<br>Email exchange to organise meeting. | | | |
| 21 May 2019 | Company provided written response to the issues and concerns raised. | | | |
| 30 May 2019 | Meeting held between Company and NPFI to discuss issues/concerns raised and ongoing engagement process. | | | |
| 12 June 2019 | Company emailed meeting notes and requested NPFI review for accuracy and add any other relevant information. Company advised we would then provide further response. Discussion points from meeting:<br>1 Company provided an overview of the investment decision timeframe for the Barossa Development with a final investment decision expected by Q1 2020. The decision is also dependent on Darwin LNG first selecting Barossa as the future gas supply to backfill its facility. | | | |

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| | 2 The Barossa Gas Export Pipeline (GEP) corridor presented in the OPP in March 2018 has since been refined to a preferred pipeline route. The pipeline route selection process considered a number of factors, including environmental. The final route selected is the most favourable from an environmental, engineering and economic perspective and removes the need to trench, which will reduce benthic disturbance. We are now preparing an Environment Plan (EP) to specifically address installation of the preferred pipeline route.<br>3 Company advised that we will also be preparing a number of other activity specific EPs and will be in touch with NPFI at a later date to provide details regarding these activities. Company noted that the next EP will be for drilling of the production wells, which will occur in the development area of the Barossa field, and advised that we will shortly commence stakeholder consultation regarding this EP.<br>4 Company reiterated that the pipelay will take around three months at a rate of 3 to 5 km/day depending upon the pipelay vessel contracted. The pipelay vessel will constantly be moving and will have a 500 m exclusion zone around it. Company clarified that once the pipeline was in place there will be no ongoing exclusion zone around the infrastructure. | | | |

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| | 5 NPFI reiterated its response to Company (dated 30 April 2019) that its primary concerns are interruption to fishing activities during installation and operations and potential impacts on prawn habitat and sawfish.<br>6 NPFI indicated that fishing activity at the northern end of the proposed pipeline route is predominately for scampi. Banana prawn fishing traditionally commences in the Gulf of Carpentaria region in April with vessels then moving west towards the Bonaparte and Melville statistical areas.<br>7 NPFI also mentioned that there are two broodstock vessels that operate within a discreet area towards the southern end of the proposed pipeline route. NPFI indicated that fishing tended to occur in the same grounds each season. Company reiterated that we would like to better understand when, during the two fishing seasons, NPFI member vessels operate within the proposed pipeline route, and how our activities might interrupt fishing activities, including broodstock collection.<br>8 Company reiterated that there would be a 500 m exclusion zone around the pipelay vessel as it moved along the pipeline, but no exclusion along the pipeline on an ongoing basis. Company would like to work closely with NPFI when we are closer to installation to understand how we can best manage potential access issues during installation. | | | |

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| | With regard to impacts on habitat, Company advised that the chosen pipeline installation method is unlikely to result in significant modification to benthic habitat, and that this will be addressed in the EP.<br>9 In terms of impacts on sawfish, NPFI indicated that they had seen a spike in the number of sawfish being picked up as bycatch towards the southern end of the proposed Barossa pipeline. The NPFI is working with CSIRO and CDU researchers to identify the particular species of sawfish and to understand if the increased number of interactions represents a possible aggregation/migration area. This research is expected to produce initial findings in the next 6-12 months. NPFI indicated a willingness to make swordfish interaction data available to Company as confidential information.<br>10 The NPFI has also worked with AFMA to place tighter regulations on broodstock vessels and increase monitoring and reporting efforts on sawfish interactions. Company advised that we have identified that sawfish may occur in the pipeline installation area, especially the southern section, and will address this in the EP. Company also advised that we are interested in the research conducted to date and would be grateful for more details.<br>11 NPFI expressed an interest in temperature and bathymetry data captured by Company | | | |

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| | for its Barossa baseline studies, and Company will investigate if collected information can be made available to NPFI.<br>12 Company and NPFI agreed to regular meetings on the proposed Barossa development activities as information on the timing of infrastructure installation and drilling activities becomes clearer. The meetings would also continue discussion around options to a) safely share areas where pipeline installation and fishing activities may overlap and b) assist the NPFI in responding to Company requests for information. | | | |
| ***Northern Territory Seafood Council (NTSC)*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is |
| 21/22 Jan 2019 | NTSC copied into emails between WAFIC and Company (see WAFIC entry). | | | |

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| 25 Jan 2019 | NTSC responded via email stating it agreed with WAFIC suggestion of a bespoke fact sheet addressing commercial fishing issues and concerns rather than asking for review of the fact sheet provided on 16 Jan and noted it was Company's role to address upfront any potential issues which may negatively impact the commercial fishing sector and to address these potential issues to ALARP level upfront as part of Company's consultation with potentially affected commercial fishers.<br>Advised it would be appreciated if a factsheet outlining issues, concerns and potential issues of relevance to the commercial fishing sector could be provided and in what timeframe. | + Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 30 Jan 2019 | Company emailed advising that it would be able to provide a tailored fact sheet in mid to late February based on the potential issues as Company understands them based on previous consultations. Company also asked NTSC to advise if it would like to meet in the meantime. | | | |
| 19 Feb 2019 | Further attempt made by Company via phone to contact NTSC. | | | |

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| 27 Feb 2019 | Company provided the information requested by the NTSC on commercial fisheries' issues and concerns relevant to the Barossa Gas Export Pipeline Installation and the PPT presentation used in discussions with Austral Fisheries management, NT-based Spanish Mackerel licence holders and the NT Department of Fisheries. The pipeline co-ordinates were also provided.<br>Company advised that the information had also been provided to all relevant commercial fishery licence-holders. As per the usual practice we will also provide the issues and concerns information to NTSC's licence-holder lists, as per the NTSC's requested process.<br>Company advised representatives would be in Darwin on Darwin on March 18/19/20 if NTSC was available to meet, otherwise we would work with NTSC on a convenient date. | | | |
| 27 Mar 2019 | Company follow up phone call. Left message referring to email on 27 Feb 2019. Asked whether Stakeholder had any questions and if they would like to meet. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |

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| *Northern Wildcatch Seafood Australia* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and |
| 21/22 Feb 2019 | Company left phone message and follow-up email with pipeline route co-ordinates. | | | |
| 1 Mar 2019 | Company provided the information on commercial fisheries' issues and concerns relevant to the Barossa Gas Export Pipeline Installation and a reminder to provide any feedback. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | + Impacts from the unplanned introduction of Invasive Marine Species (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| ***NT Guided Fishing Industry Association (NTGFIA)*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | Company provided the following responses to the issues and concerns raised:<br>**1 Interaction with fishing activities**<br>The pipeline will be constructed from carbon steel and have an external anti-corrosion coating, concrete weight coating and anodes to maintain integrity. It will be laid using a continuous assembly pipe-welding installation method with sections of pipe gradually lowered to the seabed behind the pipelay vessel using an S-lay method. This method is commonly used in offshore pipeline installation in comparable water depths. The use of dynamically positioned pipelay and support vessels will eliminate the need for anchoring during routine installation operations.<br>The primary method of maintaining pipeline stability on the seabed, where required, will be through the concrete weight-coating. Several seabed intervention methods could be used to manage spans and stability where concrete weight-coating alone is not sufficient. | The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to environmental impacts and risks (1) did not result in any specific amendments to the EP.<br>The issues and concerns related to potential interaction with fishing activities (2) helped inform the commitments Company has made in the ongoing communications process, including presenting to the | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and |
| 21/22 Feb 2019 | Telephone discussion on 21 Feb and Company sent follow-up email with pipeline route co-ordinates and proposed meeting date in Darwin. | | | |
| 14/15 Mar 2019 | Phone call discussion and follow-up emails re organising meeting in Darwin. | | | |
| 19 Mar 2019 | Meeting held in Darwin and presentation provided. | | | |

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| 22 Mar 2019 | Company provided a list to the stakeholder of the issues and concerns raised at the 19 March meeting:<br>+ There are fishing charter businesses on the Tiwi Islands and some mainland-based that will conduct activities from time to time around the southern section of the proposed pipeline installation area. These activities can occur at any time of the year but are more likely to occur in the earlier and later months of each year.<br>+ It is important that Company communicates its schedule and activities to marine users both in advance and during the installation program. To that end, could Company make a short presentation along the lines of this meeting to the Association's AGM in late October this year.<br>Company asked the stakeholder to advise if any issue or concern had been missed and meanwhile Company would prepare written responses. | These methods could include concrete mattresses, sand/grout bags, local modification to the seabed, steel structures, rock bolting and gravity anchors.<br>Activities associated with the installation of the pipeline are expected to commence as early as Q1 2021 and finish as late as Q1 2024. It is anticipated that the pre-lay survey could commence up to nine months earlier than pipeline installation, and pre-lay span rectification may occur up to 30 days prior to pipeline installation. The total infield duration of the offshore installation activities is expected to be approximately nine months. The schedule is indicative only; exact timing and duration of the installation activities is subject to pipelay vessel availability, sea state, weather conditions and operational efficiencies. (i.e. the pipelay vessel will be present for approximately three months).<br>Installation activities will occur within a 2 km corridor either side of the gas export pipeline (3 km around the pipeline end termination points at both ends of the pipeline). During installation activities, a 500 m safety exclusion zone will be established around the pipelay vessel. There will be no ongoing exclusion zones established around the pipeline during operations. | association's AGM later in 2019. | when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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| 10 April | Company provided written responses and reminder the stakeholder to provide further feedback if required.<br>In the response Company noted that one of the responses included a change to the indicative schedule. We previously advised that the activities associated with the installation of the pipeline are expected to commence as early as Q1 2021 and finish as late as Q2 2023. The finish date is now 'as late as Q1 2024'. All other indicative schedule information is the same, including the duration period of approximately nine months for the activities. | It is highly unlikely that the presence of the project will result in significant changes in habitat usage by marine species or to the physical environment. Within the pipeline corridor, potential impacts associated with the installation are expected to be short term and localised (within hundreds of metres) with impacts to the wider marine environment considered highly unlikely. Over the longer term, impacts over the operating life of the pipeline are expected to be minimal.<br>The pipeline route has been refined to avoid areas of significant seabed features as much as practicable, and avoid uneven seabed features wherever possible. The benthic habitat in the vicinity of the pipeline route is widely represented in the region and predominantly supports burrowers/crinoids, filter feeders and macroalgae.<br>The following potential environmental impacts were assessed in the Barossa Offshore Project Proposal (OPP) and are being further examined during the development of the Gas Export Pipeline Installation Environment Plan (EP).<br><u>Fauna</u><br>Impacts to fauna such as marine turtles, cetaceans and fishes are expected to primarily be short-term displacement from the immediate vicinity of the pipeline during installation.<br>Baseline environmental assessment has confirmed that marine mammals (cetaceans) are generally widely distributed and highly mobile in the region. Both sei and fin whales have a wide distribution throughout offshore waters and therefore may pass through the project area in low numbers. No aggregation areas or migration | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months. | | | |

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| | Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br><br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | pathways for cetaceans occur within or in the vicinity of the proposed pipeline route.<br><br>The crested tern is widespread and numerous along the NT coastline, with 20 breeding colonies reported. The colony on Seagull Island, 4 km north-west of Melville Island, supports over 50,000 birds and is considered globally significant. Significant numbers of Olive Ridley and flatback turtles are also known to nest on the beaches of Seagull Island and on the west coast of Melville Island.<br><br>A BIA for Olive Ridley turtles has been defined adjacent to this area, and the pipeline installation activities will not encroach this area. A larger area has been defined as a BIA for flatback turtles as well as ‘habitat critical to the survival of flatback and Olive Ridley turtles’. While pipeline installation activities will traverse a small part of these areas, installation activities are considered highly unlikely to impact the species use of the area as low numbers of turtles are expected in the vicinity of the pipeline due to the water depths.<br><br>During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area. Therefore, light emissions from the pipelay installation vessels are not anticipated to impact the breeding population of crested terns or turtles.<br><br>Underwater sound generated by installation activities may affect individuals passing through the area; however, impacts at a population level are considered unlikely given the area affected is highly localised. The | | |

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| | | key noise sources associated with installation activities along the pipeline will also be relatively slow moving (approximately 3 km to 5 km of the pipeline will be laid per day), thereby allowing individuals to move away from the area, and reasonably short in duration.<br>The risk of vessel strike to marine fauna is inherent to movements of all vessel types, including recreational vessels, fishing vessels, passenger ships, whale-watching boats, container ships and naval ships. Impacts from the presence of offshore infrastructure and related vessels interacting with marine fauna are not considered to present a significant risk at a population level.<br>Key controls to minimise impacts from the physical presence of offshore infrastructure and project related vessels interacting with marine fauna include:<br>Placement of pipeline infrastructure in areas where there are no regionally significant feeding, breeding or aggregation areas for marine mammals<br>Limiting the physical footprint of the pipeline area such that displacement of individual mammals is unlikely, and the likelihood of a collision is remote<br>Vessels travelling at relatively low speeds within operational areas<br>Project vessels proactively responding to potential fauna interactions in line with the requirements of the EPBC Regulation s2000 – Part 8 Division 8.1<br>Water Quality<br>During the installation campaign project vessels will routinely discharge small volumes of treated sewage, cooling water, putrescible waste, reverse osmosis brine, bilge and deck water. Any potential impacts are | | |

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| | | expected to be highly localised and temporary and will not impact environmental values/sensitivities.<br>Given the typically small volumes and temporary (i.e. instantaneous) duration of accidental discharge events, impacts to water quality would be temporary and highly localised. Subsequently, there would be limited potential for toxicity to marine fauna due to temporary exposure and low toxicity as a result of rapid dilution. Therefore, any potential impacts to marine fauna would be limited to any individuals that may be transiting within the immediate area of the discharge (within tens to several hundred metres).<br>After completion of installation, the pipeline will be FCGT with chemically-treated seawater (typically a mixture of biocides to prevent biofouling on the internal surfaces, an oxygen scavenger to control corrosion of the pipeline and a dye to allow for leaks to be detected during visual inspections). Approximately 16,000 m³ of treated seawater will be discharged over one to two days during cleaning, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>The pipeline will then be left filled with treated seawater before being dewatered and conditioned with mono ethylene glycol (MEG) (to prevent hydrate or moisture formation) and nitrogen purged (to displace moisture and oxygen within the pipeline). Approximately 85,000 m³ of treated seawater will be discharged over three to seven days during dewatering, with approximately 1,000 m³ MEG being discharged over a period of less than one day. Discharge of the dewatering fluid will only occur at the seabed through a vertically orientated diffuser at the northern end of the pipeline located in the Barossa field, which is approximately | | |

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| | | 150 km from the Tiwi Islands in ~250 m water depth. This area is also distant from known fishing activities.<br>Following cleaning, the pipeline will be pressure tested (hydrotested) to confirm pipeline integrity. Approximately 2,000 $m^3$ of treated seawater will be discharged over a half day period during hydrotesting, with discharges occurring at the seabed or the surface at either end of the pipeline.<br>Impacts from treated seawater arise mainly from the addition of biocides, corrosion inhibitors, scale inhibitors and oxygen scavengers. Given the short duration of discharges and low volumes/toxicities of chemicals used for FCGT and hydrotesting, and that biocides are readily biodegradable and do not bioaccumulate, impacts from these activities are expected to be restricted to localised short-term reductions in water quality with no significant impacts to protected or commercially important marine fauna.<br>Controls to manage this risk include:<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the potential impacts of planned discharges.<br>+ Bulk dewatering will occur at the offshore endpoint of the pipeline to maximise dilution and avoid sensitive habitats and areas of higher densities of marine fauna.<br>+ Chemical injection volumes will be metered during flooding and hydrotest operations to identify leakage and trigger activity to stop, as well as to mitigate the risk of under/over-dosage of chemical. | | |

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| | | + Contracted vessel will have dedicated FCGT procedures.<br>+ A vertically orientated diffuser will be used during dewatering to re-oxygenate treated seawater at the northern discharge point in the Barossa Field.<br><u>Introduced Marine Species</u><br>There may be an increased risk of IMS colonising areas of the pipeline corridor in the shallower water depths where there is suitable light and habitat available (particularly in the vicinity of the shoals/banks). However, the risk of this occurring is considered low given the key management controls that will be implemented throughout the life of the project including a project Quarantine Management Plan, and compliance with contemporary ballast water and biofouling requirements (see separate issue/response for further detail).<br>Controls to manage this risk include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 91 (Marine Pollution Prevention – Oil), 95 (Marine Pollution Prevention – Garbage) and 96 (Marine Pollution Prevention – Sewage).<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the area influenced by planned discharges and significance of any impacts.<br>+ OVID inspections will be conducted to ensure all contracted vessels have IMO-approved treatment systems. | | |

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| | | Impacts of pipeline installation activities on fishing activities near the proposed route are expected to be localised and short-term. Activities associated with installation of the pipeline will occur within a 2 km buffer around the pipeline route, and 3 km radius around each endpoint of the pipeline. However, support vessels may transit to and from port as required (note: vessel movements to and from the operational area are outside the scope of the EP).<br><br>Peak vessel activity is expected to occur during installation of the pipeline, when the pipelay vessel and a dedicated support vessel will be present in the operational area, while supply vessels will transit to and from the pipelay vessel regularly (expected to be daily). During the campaign, vessels will operate 24 hours a day, seven days a week.<br><br>The pipeline will overlap approximately 0.18 $km^2$ of the area actively fished in the Northern Prawn Fishery at low intensity. The pipeline corridor does not intersect any areas trawled by the NT Demersal Fishery. Once the pipeline is operational, trawl fisheries such as the Northern Prawn Fishery and NT Demersal Fishery may be affected on an ongoing basis due to the long-term presence of the pipeline and infrastructure. Recent effort for both these fisheries is concentrated outside the Operational Area and therefore impacts are expected to be minimal. Only limited recreational fishing activity occurs in or near the operational area due to the distance from the NT mainland.<br><br>Considering the relatively short duration of the pipeline installation in which higher numbers of vessels will be present), and minimal number of project related vessel movements within the pipeline corridor during | | |

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| | | operations (i.e. limited to periodic maintenance and inspection activities), the impact to commercial fishing activities from vessels movements are considered to be minor.<br>Controls to manage this risk include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of Navigation and Emergency Procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan.<br>+ AHS Notice to Mariners and AMSA MSI will be notified prior to relevant pipeline installation activities.<br>+ Subsea infrastructure and pipeline will be clearly marked on Australian nautical charts published by the AHO.<br>+ The pipeline end termination (PLET) at the southern end of the Barossa pipeline where it joins the existing Bayu-Undan pipeline has been designed with anti-snag protection.<br>+ A support vessel will always be in the Operational Area while the pipelay vessel is installing the pipeline to minimise the potential adverse interactions with commercial fishing activities. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | | + An ongoing communications plan will be implemented for engagement with potentially affected fishers.<br>The temporary presence of the pipelay vessels in the operational area will not significantly increase the volume of existing vessel traffic in the area. The area west and south-west of the Tiwi Islands is subject to regular vessel traffic.<br>Data from AMSA's craft tracking system indicates vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at distances from shore consistent with the closest point of the pipeline corridor.<br>Darwin will continue to be the main supply and maintenance hub for all Company' Australian regional offshore exploration and production operations, including the Barossa Development. Company will continue to engage with vessel contractors regarding future port and transit plans.<br>**2 Consultation**<br>Company will continue to undertake consultation with all relevant fishing stakeholders in more detail during preparation of activity-specific EPs and on an ongoing basis in the lead-up to and during all operational activities. In addition to commercial fishers this will include recreational fishers through AFANT and charter vessel operators both directly and through their association. An ongoing stakeholder engagement and communications plan will be included as part of the Gas Export Pipeline Installation EP submitted to NOPSEMA for assessment. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | | Controls to manage the risk of interaction with other vessels during pipeline installation activities include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of Navigation and Emergency Procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan.<br>+ AHS Notice to Mariners and AMSA MSI will be notified prior to relevant gas export pipeline installation activities.<br>+ Subsea infrastructure and gas export pipeline will be clearly marked on Australian nautical charts published by the AHO.<br>+ The PLET at the end of the gas export pipeline where the pipeline joins the existing Bayu-Undan pipeline has been designed with anti-snag protection.<br>+ A support vessel will always be in the Operational Area while the pipelay vessel is installing the pipeline to minimise the potential adverse interactions with fishing activities.<br>As part of these ongoing activities, Company will be pleased to attend the Association's AGM and provide a presentation. | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| *NT Port and Marine (Port Melville, Tiwi Islands)* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 27 Feb 2019 | Follow up phone call and email with stakeholder. Stakeholder advised no issues with environment impacts to raise. Stakeholder noted interest in opportunities to support Company activities in and around the Tiwi Islands. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| ***Office of Minister for Primary Industry and Resources, NT Government*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. Further consultation was conducted with the relevant departments. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | | | | Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| ***Office of Minister for Environment and Natural Resources, NT Government*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. Further consultation was conducted with the relevant department. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | | | | The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| ***Offshore Net and Line Fishery NT, Commercial Licence Holders*** | | | | |
| 17 Jan 2019 | Company provided initial fact sheet via covering letter with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders’ representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal. |
| 6 Mar 2019 | Commercial fishing tailored info sent via letter to all licence-holders | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| ***Oil Spill Response Ltd*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues and concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. |
| 7 Feb 2019 | Follow up phone call. Voicemail left. | | | |
| 8 Feb 2019 | Phone call with stakeholder. Stakeholder advised that it will respond by the closing date if they have any comments. | | | |
| 15 Feb 2019 | Follow up email attaching fact sheet and reminding stakeholder of the closing date for initial comments on the proposed EP. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| *Origin Energy* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 6 Feb 2019 | Follow up phone call. Voicemail left. | | | |
| 7 Feb 2019 | Phone conversation confirmed Origin has divested permit interests in the area and is no longer a relevant stakeholder. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| ***Paspaley Pearling Company*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal. |
| 22 Feb 2019 | Attempted call by Company to office with no answer. Company provided follow-up email. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 Apr 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| *Pearl Oyster Fishery NT, Commercial Licence Holders* | | | | |
| 17 Jan 2019 | Company provided initial fact sheet via covering letter with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 6 Mar 2019 | Commercial fishing tailored information sent via letter to all licence-holders. | | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| *Sea Turtle Foundation* | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the |
| 21/22 Feb 2019 | Company left phone message, on-line message via website and follow-up email with pipeline route co-ordinates and offer of meeting. | | | |
| 27 Mar 2019 | Attempted phone call and follow-up email reminder. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| ***Santos*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the |
| 6 Feb 2019 | Follow up phone call. Voicemail left. | | | |
| 7 Feb 2019 | Follow up email. | | | |
| 7 Feb 2019 | Emailed received confirming no feedback to provide. | | | |
| 16 Apr 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| | alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | ongoing communications process. |
| ***Shark Fishery, NT Commercial Licence Holders*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email to representative body (NTSC) with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal. |
| 6 Mar 2019 | Commercial fishing tailored information sent via letter to all licence-holders. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a potentially 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| *Spanish Mackerel Fishery NT, Commercial Licence Holders* | | | | |
| 17 Jan 2019 | Company provided initial fact sheet via covering letter with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers:<br>+ Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to environmental impacts and risks (1, 4, 5 and 6) did not result in any specific amendments to the EP.<br>The issues and concerns related to potential interaction with commercial fishing activities (2 and 3) helped inform the commitments Company has made in the ongoing communications process.<br>Any additional data that may be provided by the stakeholder will also help inform the ongoing communications process. | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of |
| 31 Jan 2019 | Chair of NTSC Mackerel Fishery Committee phoned Company requesting further information and meeting organised for 8 Feb in Darwin | | | |
| 8 Feb 2019 | Company met with Chair and Vice-Chair of NTSC Mackerel Fishery Committee and provided further information via PowerPoint presentation. Company advised it will provide a written summary of the issues raised during the meeting. | | | |
| 13 Feb 2019 | Company provided Chair and Vice-Chair with summary of issues at 8 Feb 2019 meeting via email along with PowerPoint presentation, current pipeline route co-ordinates and links to OPP on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.<br>Company advised it would start preparing a detailed written response to the issues and requested they advise if anything had been missed in the summary or they wished to add | | | |

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| | further detail. Company advised it would ensure all items are covered in our responses and they would also be provided with the tailored fact sheet being prepared for the NTSC.<br>Issues raised:<br>+ Impacts of pipeline installation activities on the sea floor and marine environment, specifically related to fish, fish habitat and fishing activities around shoals and banks, particularly Goodrich and Marie shoals. How these impacts will be mitigated and managed by Company.<br>+ Impacts of pipeline installation activities on fishing activities near the proposed route; i.e. exclusion areas, length of installation period, proposed period of year for installation. Chair and Vice-Chair advised that the proposed pipeline route closely mirrors one licence-holder (i.e. The Chairs') fishing activities, which follows a route out from Darwin north along the shoals (and as far out as the 'Timor Box'). Questioned how these impacts will be mitigated and managed by Company. Noted that seven boats working out of Darwin are known to work similar fishing grounds to Norm's.<br>+ Once the pipeline is established it's not a major concern. Of more concern is the route itself and how much it can be adjusted to accommodate the concerns of the Fishery related to proximity and | In addition, Company provided the following responses to the issues and concerns raised at a meeting with the stakeholder:<br>**1 Impacts on sea floor and marine environment**<br>The pipeline route has been refined to avoid areas of significant seabed features as much as practicable and uneven seabed features wherever possible. Benthic habitats within the pipeline corridor are expected to consist of predominantly burrowers/crinoids, filter feeders, macroalgae, with a substantial portion of the area also supporting no benthic habitat (approximately 81%).<br>No significant or restricted areas of benthic habitat are known to occur. It is considered highly unlikely that the presence of the project will result in significant changes in habitat usage by marine species or to the physical environment.<br>The pipeline will be constructed from carbon steel and have an external anti-corrosion coating, concrete weight coating and anodes to maintain integrity. It will be laid using a continuous assembly pipe-welding installation method with sections of pipe gradually lowered to the seabed behind the pipelay vessel using an S-lay method. This method is commonly used in offshore pipeline installation in comparable water depths. The use of dynamically positioned pipelay and support vessels will eliminate the need for anchoring during routine installation operations.<br>The primary method of maintaining pipeline stability on the seabed, where required, will be through the concrete weight-coating. Several seabed intervention methods could be used to manage spans and stability | | pipeline installation activities as per the ongoing communications process. |

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| | impact to banks and shoals where they operate.<br>+ Questioned how close will pipeline come to banks and shoals, bearing mind they fish up to a dozen spots between Shepparton and Goodrich, potentially all year round.<br>+ Also of concern is the level of noise, vessel movement, etc, all of which can impact on the movement of fish that are very sensitive to changes in the marine environment.<br>+ Questioned whether the pipeline in operation results in a higher temperature as this can help attract fish.<br>+ Advised they could potentially share some data with Company.<br>+ Chair and Vice-Chair advised that they hold eight out of 15 licences between them. However, they will liaise with other licensees and pass on information via the association/committee. | where concrete weight-coating alone is not sufficient. These methods could include concrete mattresses, sand/grout bags, local modification to the seabed, steel structures, rock bolting and gravity anchors.<br>Pipelay and associated offshore activities (e.g. pre-lay and post-lay surveys) are expected to take up to nine months of offshore operations to complete. Pipeline installation activities (i.e. involving the pipelay vessel) are expected to occur over approximately three months, with installation activities occurring within a 2 km corridor either side of the gas export pipeline (3 km around the pipeline end termination points at both ends of the pipeline). During pipeline installation activities, a 500 m safety exclusion zone will be established around the pipelay vessel. There will be no ongoing exclusion zones established around the pipeline during operations.<br>Within this corridor, potential impacts associated with the installation of pipeline infrastructure are expected to be short term and localised (within hundreds of metres) with impacts to the wider marine environment considered highly unlikely. Over the longer term, impacts over the operating life of the pipeline are expected to be minimal. Furthermore, the presence of the pipeline infrastructure has the potential to provide a beneficial impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna.<br>The following potential impacts on the marine environment have been assessed in the Barossa OPP (see OPP for full assessment), and will be further | | |
| 1 Mar 2019 | Company advised via email that it should have the responses to the issues raised ready to send the NTSC within the week and, in the interim, provided the information tailored to the commercial fishing industry that was requested by the NTSC. | | | |
| 6 Mar 2019 | Commercial fishing tailored information sent via letter to all Spanish mackerel Fishery licence-holders. | | | |

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| 13 Mar 2019 | Company provided written responses and reminder the stakeholder to provide further feedback if required. | examined during the development of the Gas Export Pipeline Installation EP:<br><u>Discharges</u><br>During the installation campaign project vessels will routinely discharge small volumes of treated sewage, cooling water, putrescible waste, reverse osmosis brine, bilge and deck water. Any potential impacts are expected to be highly localised and temporary and will not impact environmental values/sensitivities. Accidental spill events associated with vessel activities have also been assessed. Given the typical small volumes and temporary (i.e. instantaneous) duration of accidental discharge events, impacts to water quality would be temporary and highly localised. Subsequently, there would be limited potential for toxicity to marine fauna due to temporary exposure and low toxicity as a result of rapid dilution. Therefore, any potential impacts to marine fauna would be limited to any individuals that may be transiting within the immediate area of the discharge (within tens to several hundred metres). Underwater noise associated with the installation vessels is also expected to be highly localised and temporary and is unlikely to impact fauna in the vicinity of installation activities.<br>Controls to manage this risk include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 91 (Marine Pollution Prevention – Oil), 95 (Marine Pollution Prevention – Garbage) and 96 (Marine Pollution Prevention – Sewage).<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity | | |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |

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| | | chemicals to minimise the area influenced by planned discharges and significance of any impacts.<br>+ OVID inspections will be conducted to ensure all contracted vessels have IMO-approved treatment systems.<br>After completion of installation, the gas export pipeline will be FCGT with chemically-treated seawater (typically a mixture of biocides to prevent biofouling on the internal surfaces, an oxygen scavenger to control corrosion of the pipeline and a dye to allow for leaks to be detected during visual inspections). Approximately 16,000 $m^3$ of treated seawater will be discharged over one to two days during cleaning, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>Following cleaning, the gas export pipeline will be pressure tested (hydrotested) to confirm pipeline integrity. Approximately 2,000 $m^3$ of treated seawater will be discharged over a half day period during hydrotesting, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>Impacts from treated seawater arise mainly from the addition of biocides, corrosion inhibitors, scale inhibitors and oxygen scavengers.<br>Given the short duration of discharges and low volumes/toxicities of chemicals used for FCGT and hydrotesting, and that biocides are readily biodegradable and do not bioaccumulate, impacts from these activities are expected to be restricted to localised short-term reductions in water quality with no significant impacts to protected or commercially important marine fauna. | | |

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| | | Controls to manage this risk include:<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the potential impacts of planned discharges.<br>+ Bulk dewatering will occur at the offshore endpoint of the gas export pipeline to maximise dilution and avoid sensitive habitats and areas of higher densities of marine fauna.<br>+ Chemical injection volumes will be metered during flooding and hydrotest operations to identify leakage and trigger activity to stop, as well as to mitigate the risk of under/over-dosage of chemical.<br>+ Contracted vessel will have dedicated FCGT procedures.<br>+ A vertically orientated diffuser will be used during dewatering to re-oxygenate treated seawater at the discharge point.<br><u>Introduced Marine Species</u><br>There may be an increased risk of IMS colonising areas of the pipeline corridor in the shallower water depths where there is suitable light and habitat available (particularly in the vicinity of the shoals/banks). However, the risk of this occurring is considered low given the key management controls that will be implemented throughout the life of the project including a project Quarantine Management Plan, and compliance with contemporary ballast water and biofouling requirements.<br><u>Fauna</u><br>Impacts to fauna such as marine turtles, cetaceans and fishes are expected to primarily be short-term | | |

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| | | displacement from the immediate vicinity of the pipeline during installation. The presence of the pipeline infrastructure has the potential to provide a beneficial impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna.<br>The crested tern is widespread and numerous along the NT coastline, with 20 breeding colonies reported. The colony on Seagull Island supports over 50,000 birds and is considered globally significant.<br>Significant numbers of Olive Ridley turtles are known to nest on the beaches of Seagull Island and the north-west coast of Melville Island. As the physical presence of the gas export pipeline within internesting habitat critical to the survival of marine turtles has been minimised; i.e. approximately 0.0001% and 0.0015% of the internesting habitat critical to the survival of flatback and Olive Ridley turtles respectively, the physical presence of the gas export pipeline during is considered highly unlikely to impact the species use of the area.<br>**2 and 3 Pipeline installation**<br>During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area. Therefore, light emissions from the pipelay installation vessels are not anticipated to impact the breeding population of crested terns or Olive Ridley turtles located on the shoreline of Seagull Island. | | |

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| | | Underwater sound generated by installation activities may affect individuals passing through the area; however, impacts at a population level are considered unlikely given the area affected is highly localised. The key noise sources associated with installation activities along the gas export pipeline will also be relatively slow moving (approximately 3 km to 5 km of the gas export pipeline will be laid per day), thereby allowing individuals to move away from the area, and reasonably short in duration.<br>The risk of vessel strike to marine fauna is inherent to movements of all vessel types, including recreational vessels, fishing vessels, passenger ships, whale-watching boats, container ships and naval ships. Impacts from the presence of offshore infrastructure and related vessels interacting with marine fauna are not considered to present a significant risk at a population level.<br>Key controls to minimise impacts from the physical presence of offshore infrastructure and project related vessels interacting with marine fauna include:<br>+ placement of pipeline infrastructure in areas where there are no regionally significant feeding, breeding or aggregation areas for marine mammals<br>+ limiting of the physical footprint of the pipeline area such that displacement of individual mammals is unlikely, and the likelihood of a collision is remote<br>+ vessels travelling at relatively low speeds within operational areas<br>+ project vessels proactively responding to potential fauna interactions in line with the requirements of the EPBC Regulation s2000 – Part 8 Division 8.1.<br>**4 Impact on shoals/banks** | | |

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| | | Some of the shoals/banks in close proximity to the pipeline corridor, such as Shepparton Shoal, Marie Shoal and Goodrich Bank, may be temporarily affected by increased sediment levels. Considering the expected short duration of increased sedimentation at any one area, and that these areas have naturally highly turbid environments meaning that benthic habitats in these areas are likely to have a natural resilience to higher sediment/turbid conditions, significant impacts are considered unlikely. The outcomes of the pre-lay surveys will be used to further inform final route optimisation and reduce environmental impacts.<br>Impacts from interactions from project facilities/infrastructure and vessel movements with other marine users, including commercial fishers, throughout the project are considered remote given the relatively minor physical scale of the offshore facilities/infrastructure and presence of project-related vessels, combined with the relatively low level of activity within the open offshore waters of the project area impacts of pipeline installation activities on fishing activities near the proposed route are expected to be localised and short-term.<br>Pipelay and associated offshore activities (e.g. pre-lay and post-lay surveys) are expected to take up to nine months of offshore operations to complete. Pipeline installation activities (i.e. involving the pipelay vessel) are expected to occur over approximately three months, with installation activities occurring within a 2 km corridor either side of the gas export pipeline (3 km around the pipeline end termination points at both ends of the pipeline). During pipeline installation activities, a 500 m safety exclusion zone will be established around | | |

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| | | the pipelay vessel. There will be no ongoing exclusion zones established around the pipeline during operations.<br>Installation of the pipeline is expected to commence as early as Q3 2021 and finish as late as Q2 2023. However, pre-lay survey could commence up to nine months earlier than pipeline installation, and pre-lay span rectification may occur up to 30 days prior to pipeline installation.<br>The total infield duration of the offshore installation activities is expected to be approximately nine months. The schedule is indicative only; exact timing and duration of gas export pipeline installation activities is subject to pipelay vessel availability, sea state, weather conditions and operational efficiencies. (i.e. the pipelay vessel will be present for approximately three months). Company will continue to consult with the Mackerel Fishery representatives on operational detail, including proposed timeframes and environmental factors.<br>Peak vessel activity may occur during installation of the pipeline, when the pipelay vessel and a dedicated support vessel will be present in the operational area, while supply vessels will transit to and from the pipelay vessel regularly (expected to be daily). During the campaign, vessels will operate 24 hours a day, seven days a week.<br>Activities associated with installation of the gas export pipeline will occur within a 2 km buffer around the gas export pipeline route, and 3 km radius around each endpoint of the gas export pipeline (i.e. the Operational Area). However, support vessels may transit to and from port as required (outside the scope of the EP).<br>Vessels operating within the pipeline corridor will typically travel at speeds slower than those operating in | | |

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| | | offshore waters, and therefore exhibit a lower risk profile in terms of collisions.<br>Considering the relatively short duration of the pipeline installation in which higher numbers of vessels will be present), and minimal number of project related vessel movements within the pipeline corridor during operations (i.e. limited to periodic maintenance and inspection activities), the impact to commercial fishing activities from vessels movements are considered to be minor.<br>Company will continue to undertake consultation with all relevant commercial fishing stakeholders in more detail during preparation of activity-specific EPs and on an ongoing basis in the lead-up to and during all operational activities.<br>Controls to prevent or minimise impact include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of Navigation and Emergency Procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ Consultation with relevant and interested stakeholders will be undertaken in accordance with stakeholder consultation plan.<br>+ AHS Notice to Mariners and AMSA MSI will be notified prior to relevant gas export pipeline installation activities.<br>+ Subsea infrastructure and gas export pipeline will be clearly marked on Australian nautical charts published by the AHO. | | |

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| | | + The PLET at the end of the gas export pipeline where the pipeline joins the existing Bayu-Undan pipeline has been designed with anti-snag protection.<br>+ A support vessel will always be in the Operational Area while the pipelay vessel is installing the pipeline to minimise the potential adverse interactions with commercial fishing activities.<br>+ An ongoing communications plan will be implemented for engagement with potentially affected fishers.<br>The current proposed pipeline route is located approximately:<br>+ 3.2 km from Shepparton Shoal<br>+ 4.3 km from Marie Shoal<br>+ 2 km from Goodrich Bank<br>+ 65 km from Evans Shoal.<br>The co-ordinates for the proposed pipeline route have been provided to the Mackerel Fishery to allow the Fishery to plot the proposed route against areas actively fished.<br>The final pipeline route will be confirmed after the pre-lay survey has been completed. Company will provide the Mackerel Fishery with updated route co-ordinates as and when they are available.<br>**6 Impact of noise**<br>The area of the marine environment influenced by underwater noise associated with the installation of the gas export pipeline represents a very small proportion of the area available to be fished. No significant impacts to the catchability of fish species targeted by commercial fishers are expected given the short duration and | | |

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| | | localised nature of any potential impacts (within hundreds of metres).<br>While underwater noise generated by installation activities may affect individuals passing through the area, impacts at a population level are considered unlikely given the area affected is localised. The key noise sources associated with installation activities along the gas export pipeline will also be relatively slow moving (approximately 3 km to 5 km of the gas export pipeline will be laid per day), thereby allowing individuals to move away from the area, and reasonably short in duration as installation of the entire pipeline will take in the order of nine months. Underwater noise from rock dumping and the placement of sand/grout bags is expected to be negligible.<br>Surveys of the seabed using MBES and side scan sonar will occur during the pipeline installation campaign. Underwater noise will be generated by vessels and seabed intervention activities during the installation of the proposed pipeline and IMR activities during operation of the pipeline. While several support vessels will be present, the pipelay vessel will be the largest source of noise due to it being the largest vessel. The smaller support vessels will result in a negligible increase in overall noise emissions.<br>The temporary presence of the pipelay vessels in the area will not significantly increase the volume of existing vessel traffic in the area. The area west and south west of the Tiwi Islands is subject to considerable vessel traffic. Data from AMSA's craft tracking system indicates considerable vessel traffic routinely moving from the port of Darwin, with vessels moving north routinely navigating around the western tip of Bathurst Island at | | |

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| | | distances from shore consistent with the closest point of the pipeline corridor. These are typically commercial vessels (e.g. container vessels, tankers etc. moving to and from ports throughout southeast Asia. Vessel traffic of this nature has been operating in the region for decades.<br>**7 Seawater temperature**<br>During operations, the pipeline is expected to have no effect on the ambient temperature of seawater in the immediate vicinity. The presence of the pipeline infrastructure has the potential to provide a beneficial impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna.<br>**8 Data sharing**<br>Company would be pleased to receive any relevant data from licence-holders that could assist with our understanding of fishing activities and assist preparation of the Environment Plan.<br>The last point (8) was noted for information only. | | |
| ***Timor Reef Fishery, Commercial Licence Holders*** | | | | |
| 17 Jan 2019 | Company provided initial fact sheet via covering letter with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised.<br>On request from the licence holders' representative body, the NT Seafood Council, Company pro-actively provided a summary of key concerns identified by Company as relevant to commercial fisheries. The summary outlined the following potential impacts to commercial fishers: | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further |

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| 6 Mar 2019 | Commercial fishing tailored information sent via letter to all licence-holders. | + Impacts from the physical presence of the gas export pipeline installation campaign arising from interference with commercial fishing or exclusion of commercial fishers.<br>+ Impacts from planned discharges from vessels during the installation campaign and discharges from the gas export pipeline during flooding, cleaning and gauging, testing, and dewatering of the pipeline.<br>+ Impacts from the unplanned introduction of IMS (i.e. marine pests).<br>+ Impacts from an unplanned release of fuel from a pipelay vessel due to a vessel collision.<br>The summary addressed each key concern by providing relevant details of the activity, potential impacts arising from the activity or risk, an assessment of potential impacts to commercial fishers and a summary of the controls which will be applied to manage impacts/risks to ALARP. | | action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |

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| ***Tiwi Island Adventures*** | | | | |
| 16 Jan 2019 | Company contacted via phone and provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | Company provided the following responses to the issues and concerns raised at a meeting with the stakeholder:<br>**1 Trench west of Bathurst Island**<br>The proposed pipeline route is greater than 10 km from the trench identified by the TLC and TIA.<br>The pipeline route has been refined to avoid areas of significant seabed features as much as practicable and uneven seabed features wherever possible.<br>Benthic habitats within the pipeline corridor are expected to consist of predominantly burrowers/crinoids, filter feeders, macroalgae, with a substantial portion of the area also supporting no benthic habitat (approximately 81%).<br>No significant or restricted areas of benthic habitat are known to occur. It is considered highly unlikely that the presence of the project will result in significant changes in habitat usage by marine species transiting the area or to the physical environment, such as regional currents and food resource availability.<br>The pipeline will be constructed from carbon steel and have an external anti-corrosion coating, concrete weight coating and anodes to maintain integrity. It will be laid using a continuous assembly pipe-welding installation method with sections of pipe gradually lowered to the seabed behind the pipelay vessel using an S-lay method. This method is commonly used in offshore pipeline installation in comparable water depths. The use of dynamically positioned pipelay and support vessels will eliminate the need for anchoring during routine installation operations. | The stakeholder advised Company that it was happy with the responses to the issues and concerns raised.<br>The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to environmental impacts and risks (1 to 3) did not result in any specific amendments to the EP.<br>The request for consultation with another organisation (7) was met by Company.<br>The remaining issues and concerns (4 to 6) were related to the project generally. | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation |
| 7 Feb 2019 | Company met with representatives of Tiwi Island Adventures and Tiwi Land Council and provided further information via PowerPoint presentation. Company advised it will provide a written summary of the issues raised during the meeting. | | | |
| 13 Feb 2019 | Company met with representatives of Tiwi Island Adventures and Tiwi Land Council and provided further information via PowerPoint presentation. Company advised it will provide a written summary of the issues raised during the meeting.<br>Company provided representatives of Tiwi Island Adventures and Tiwi Land Council with summary of issues at 8 Feb 2019 meeting via email along with PowerPoint presentation, current pipeline route co-ordinates and links to OPP on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.<br>Company advised it would start preparing a detailed written response to the issues and | | | |

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| | requested both organisations advise if anything had been missed in the summary or they wished to add further detail. Company advised it would ensure all items are covered in our responses.<br>Issues raised:<br>+ Noted there was a trench approximately 20 km west of Bathurst Island and questioned how close the pipeline route is to the trench and what impact there will be on the environment specifically in that area as the new operator of the Bathurst Island Lodge is proposing to take people charter fishing in that area.<br>+ Requested more detail on the proposed discharge at the tie-in point, the potential impacts and area impacted.<br>+ Requested more detail on the precautions that will be taken to mitigate risks associated with oil leaks that could occur if vessels collide during the pipeline installation.<br>+ Use of Port Melville is encouraged by the TLC and asked what potential there was for Company to utilise the Port Melville facilities for these activities.<br>+ Would like to further discuss the potential for local employment opportunities on the project as well as potential involvement by Company in community development activities on the Tiwi Islands as part of the project. Specifically | The primary method of maintaining pipeline stability on the seabed, where required, will be through the concrete weight-coating. Several seabed intervention methods could be used to manage spans and stability where concrete weight-coating alone is not sufficient. These methods could include concrete mattresses, sand/grout bags, local modification to the seabed, steel structures, rock bolting and gravity anchors.<br>Impacts to fauna such as marine turtles, cetaceans and fishes are expected to primarily be short-term displacement from the immediate vicinity of the pipeline during installation. The presence of the pipeline infrastructure has the potential to provide a beneficial impact over time with creation of hard substrate for the settlement, growth and colonisation by marine flora and fauna assemblages, including for fish communities and other marine fauna.<br>The area of the marine environment influenced by underwater noise associated with the installation of the gas export pipeline represents a very small proportion of the area available to be fished.<br>During the installation campaign project vessels will routinely discharge small volumes of treated sewage, cooling water, putrescible waste, reverse osmosis brine, bilge and deck water. Any potential impacts are also expected to be highly localised and temporary and will not affect non-transitory environmental values/sensitivities<br>Given the short duration of the pipeline installation campaign, the minimal volumes which will be discharged from vessels and the low toxicity chemicals proposed to be used, impacts are expected to be restricted to | | activities as per the ongoing communications process. |

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| | mentioned Tiwi College which supports around 100 high school students via week boarding.<br>+ Asked about helicopter numbers and time of operations.<br>+ Requested Company liaise with new operator of Bathurst Island Lodge. | localised short-term reductions in water quality with no significant impacts to protected or commercially important species.<br>Given the typical small volumes and temporary (i.e. instantaneous) duration of accidental discharge events, impacts to water quality would be temporary and highly localised. Subsequently, there would be limited potential for toxicity to marine fauna due to temporary exposure and low toxicity as a result of rapid dilution. Therefore, any potential impacts to marine fauna would be limited to any individuals that may be transiting within the immediate area of the discharge (within tens to several hundred metres).<br>Controls to prevent or minimise impact include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 91 (Marine Pollution Prevention – Oil), 95 (Marine Pollution Prevention – Garbage) and 96 (Marine Pollution Prevention – Sewage).<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the area influenced by planned discharges and significance of any impacts.<br>+ OVID inspections will be conducted to ensure all contracted vessels have IMO-approved treatment systems.<br>There may be an increased risk of IMS colonising areas of the pipeline corridor in the shallower water depths where there is suitable light and habitat available (particularly in the vicinity of the shoals/banks). However, the risk of this occurring is considered low | | |
| 14 Feb 2019 | Email acknowledgement of Company's email of 13 Feb and advised looking forward to hearing more in relation to the questions raised and any opportunities for Tiwi employment pathways. | | | |
| 14 Mar 2019 | Company provided written responses and reminded the stakeholder to provide further feedback if required. | | | |
| 18 Mar 2019 | Responded advising they were happy with the responses. | | | |
| 16 Apr 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the | | | |

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| | previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | given the key management controls that will be implemented throughout the life of the project including a project Quarantine Management Plan, and compliance with contemporary ballast water and biofouling requirements.<br>During the installation period, the pipelay vessel will continuously traverse along the pipeline alignment (i.e. not a stationary vessel), therefore the small area of light spill will not impact any one location for an extended duration and is not expected to have any impacts additional to existing vessel traffic traversing the area. Therefore, light emissions from the pipelay installation vessels are not anticipated to impact the breeding population of crested terns or Olive Ridley turtles located on the shoreline of Seagull Island.<br>Significant numbers of Olive Ridley turtles are known to nest on the beaches of Seagull Island and the north-west coast of Melville Island. As the physical presence of the gas export pipeline within internesting habitat critical to the survival of marine turtles has been minimised; i.e. approximately 0.0001% and 0.0015% of the internesting habitat critical to the survival of flatback and Olive Ridley turtles respectively, the physical presence of the gas export pipeline during is considered highly unlikely to impact the species use of the area.<br>The risk of vessel strike to marine fauna is inherent to movements of all vessel types, including recreational vessels, fishing vessels, passenger ships, whale-watching boats, container ships and naval ships. Impacts from the presence of offshore infrastructure and related vessels interacting with marine fauna are not considered to present a significant risk at a population level. | | |

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| | | Key controls to managing risks associated with the physical presence of offshore infrastructure and project related vessels interacting with marine fauna include:<br>+ placement of pipeline infrastructure in areas where there are no regionally significant feeding, breeding or aggregation areas for marine mammals<br>+ limiting of the physical footprint of the pipeline area such that displacement of individual mammals is unlikely, and the likelihood of a collision is remote<br>+ vessels travelling at relatively low speeds within operational areas<br>+ project vessels proactively responding to potential fauna interactions in line with the requirements of the OPBC Regulation s2000 – Part 8 Division 8.1.<br>**2 Impact/risk to environment at discharge point**<br>After completion of installation, the gas export pipeline will be FCGT with chemically-treated seawater (typically a mixture of biocides to prevent biofouling on the internal surfaces, an oxygen scavenger to control corrosion of the pipeline and a dye to allow for leaks to be detected during visual inspections). Approximately 16,000 $m^3$ of treated seawater will be discharged over one to two days during cleaning, with discharges occurring at either end of the pipeline and at the seabed or the surface.<br>Following cleaning, the gas export pipeline will be pressure tested (hydrotested) to confirm pipeline integrity. Approximately 2,000 $m^3$ of treated seawater will be discharged over a half day period during hydrotesting, with discharges occurring at either end of the pipeline and at the seabed or the surface. | | |

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| | | Impacts from treated seawater arise mainly from the addition of biocides, corrosion inhibitors, scale inhibitors and oxygen scavengers. Given the short duration of discharges and low volumes/toxicities of chemicals used for FCGT and hydrotesting, and that biocides are readily biodegradable and do not bioaccumulate, impacts from these activities are expected to be restricted to localised short-term reductions in water quality with no significant impacts to protected or commercially important marine fauna.<br>Controls to manage risks include:<br>+ A chemical selection procedure will be applied to ensure selection preference of lowest toxicity chemicals to minimise the potential impacts of planned discharges.<br>+ Bulk dewatering will occur at the offshore endpoint of the gas export pipeline to maximise dilution and avoid sensitive habitats and areas of higher densities of marine fauna.<br>+ Chemical injection volumes will be metered during flooding and hydrotest operations to identify leakage and trigger activity to stop, as well as to mitigate the risk of under/over-dosage of chemical.<br>+ Contracted vessel will have dedicated FCGT procedures.<br>+ A vertically orientated diffuser will be used during dewatering to re-oxygenate treated seawater at the discharge point.<br>**3 Impact/risk from potential oil spill**<br>Company has conducted a detailed examination of the potential impacts from an accidental fuel spill from installation vessels, including: | | |

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| | | + reductions in water quality<br>+ direct toxic or physiological effects on marine fauna, including corals, mammals, reptiles, birds and fish<br>+ hydrocarbon contact with shoals/banks, reefs and islands at concentrations that will result in adverse impacts<br>+ changes in biological communities because of the effects on key marine fauna.<br>Although the magnitude of the potential impacts is significant, given the remote likelihood of a vessel collision occurring, the collision resulting in a fuel tank rupture and a complete release of this tank while it is at full capacity, and the management controls which will be implemented, the risk is considered medium. Company will continue to investigate additional controls and mitigations during the development of the EP to manage this risk.<br>Controls to manage risks include:<br>+ Project vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (Cth) (as applicable for vessel size, type and class), including Marine Orders 21 (Safety of navigation and emergency procedures), 27 (Radio Equipment), 30 (Prevention of Collisions) and 71 (Masters and Deck Officers).<br>+ A dedicated OPEP will be prepared and implemented throughout the gas export pipeline installation campaign.<br>+ All vessels will have a dedicated SOPEP.<br>+ A support vessel will always be within the Operational Area while the pipelay vessel is installing | | |

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| | | the pipeline to minimise the potential for vessel collision.<br>+ The pipelay vessel will be double-hulled and with internal fuel tanks protected from a potential vessel collision.<br>**4 Port Melville and logistics**<br>Company acknowledges the Tiwi Land Council has indicated a desire for Company to consider future use of facilities at Port Melville for any activities conducted offshore NT. Company has been provided with a familiarisation of the facilities by the Port Operator and will continue to assess further information from the Operator.<br>In the event a company contracted to provide vessels to the Barossa Development did advise a desire to utilise Port Melville, Company would expect Company and the port operator to liaise at the earliest possible stage with relevant stakeholders at the Tiwi Islands.<br>Barossa is primarily an offshore project and is unlikely to require new accommodation to be established onshore. During the installation, hook-up and commissioning phases an accommodation support vessel may be located in the offshore development area. The FPSO will be towed to the offshore development area and will also have accommodation for approximately 150 personnel offshore.<br>The project will involve an increased number of personnel needing to transit through Darwin, particularly during the offshore installation phase. At this early planning stage, it is anticipated this increased demand would be for short-term accommodation only and could be met through existing and planned future | | |

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| | | facilities. Estimates of onshore accommodation requirements will be determined during the detailed planning stage and will be planned well in advance in consultation with local facilities.<br>**5 Local employment opportunities**<br>In addition to directly providing Company with details of business capability, the Tiwi Land Council should encourage any local businesses with potential capability to formally register for the Barossa Development with the Industry Capability Network in the NT which will provide information and details of how to tender for any future potential accommodation needs related to the project.<br>Company is pleased to discuss the potential for these opportunities with the Tiwi Land Council. Barossa's major offshore infrastructure is likely to be built at a suitably equipped major construction facility and transported and installed at the offshore development area. However, with such a large development, opportunities will exist for smaller/domestic companies to sub-contract for specific equipment and services. Opportunities for increased local employment during the development phase will primarily occur during the installation, hook-up and commissioning phases of the project, both offshore and in Darwin for supporting logistics.<br>Company places a high priority on purchasing goods and services locally and providing local suppliers with the opportunity to participate in projects through a competitive bid process. The approved Australian Industry Participation (AIP) Plan now in place for the Barossa Offshore Project states how Barossa provides "full, fair and reasonable opportunity" to Australian | | |

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| | | industry to supply goods and services to the project and includes an indicative list of opportunities for the supply of goods and services.<br>Additional to the AIP Plan, Company has a general commitment to provide local contractors with information about employment and supply opportunities. As part of this commitment it seeks to provide real opportunities to Indigenous persons and businesses to compete for the supply of goods and services to the project, provided they are offered on competitive terms and conditions. Contractors that include an Indigenous Content Proposal (ICP) as part of any contractual offers are favourably considered.<br>As the Operator of DLNG, Company has made a long-term commitment to training and employing a residential workforce with numerous programs to develop local skills, including early career traineeships, graduate programs and operations pathways:<br>+ Company' residential workforce policy requires its DLNG staff to live in Darwin, injecting local jobs and global expertise into the region.<br>+ This is supported by the Darwin Operations Trainee Academy (DOCTA) program, which trains NT residents with skills in related trades to be LNG plant operators. To be eligible for DOCTA, candidates must have lived in the NT for several years.<br>+ This program has proved to be a successful long-term investment for Company, with local recruits tending to prefer to stay in the local area and having longer term employment. | | |

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| | | + For the NT, it has been beneficial to the local economy, resulting in greater local investment and capacity building for NT residents.<br>Company is particularly driven to support capacity building programs that develop skills which lead to career pathways in our industry. Through its community investments, Company prioritises education programs in Australia that:<br>+ engage secondary school students in STEM disciplines<br>+ focus on introducing primary school students to science and maths<br>+ enable access to industry related skills and training-based programs<br>+ support diversity and gender in the areas above<br>+ support Indigenous communities in the areas above (NT).<br>**6 Helicopters**<br>Helicopter transfers will occur during all stages of the project. The flight path to the development area 300 km north of Darwin passes over Melville Island. Helicopters will fly higher than regulation heights and only in daylight hours, apart from circumstances caused by an emergency. Flight frequency can be expected to increase from low levels starting from 2021 to highest frequency during hook-up and commissioning of the facilities in the Development Area during 2023. Accurate estimates of flight frequency will be known in 2020 when tender and award of helicopter services is scheduled.<br>**7 Consultation** | | |

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| | | Company has met with the Lodge's new operators and provided them with all relevant information, including direct responses to their queries. The Operators will be provided with relevant information and opportunities to provide input on an ongoing basis. | | |
| ***Tiwi Land Council*** | | | | |
| 9-15 Aug 2018 | Company' liaison with TLC via phone and email re attendance at TLC Executive Meeting to request permission to conduct workshop to verify and map cultural and environmental sensitivities.<br>Meeting held with TLC Executive on 15 August 2018 at which permission for workshop mapping was granted. | The information sought by Company and provided during the workshops by TO and Ranger groups was fully incorporated into the mapping exercise. | The resulting maps were provided by Company to the TLC in digital format for use as the Council sees fit. | The information provided through the workshops assisted Company to verify existing database records and gather a deeper understanding of the cultural and environmental sensitivities. |
| 25 Oct 2018 | Mapping Workshop #1 conducted on Bathurst Island with representatives of Traditional Owners. | | | |
| 13 Dec 2018 | Mapping Workshop #2 conducted on Bathurst Island with TLC Sea and Land Rangers. | | | |
| 19-22 Sept 2019 | Mapping Workshop outcomes and produced maps presented to TLC. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 Jan 2019 | Company contacted via phone and provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | Please see entry for Tiwi Island Adventures (above) as this stakeholder raised exactly the same issues and concerns at a joint meeting held with Company on 8 February and were provided with the same responses. | The stakeholder advised Company that it was happy with the responses to the issues and concerns raised.<br>The stakeholder raised several issues and concerns that required consideration and written responses.<br>The issues and concerns related to environmental impacts and risks (1 to 3) did not result in any specific amendments to the EP.<br>The request for consultation with another organisation (7) was met by Company.<br>The remaining issues and concerns (4 to 6) were | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. |
| 30 Jan 2019 | TLC invited Lodge operators to attend meeting with Company in Darwin on 7 Feb. Note: Company met with other operators separately during same week due to their availability. | | | |
| 8 Feb 2019 | Company met with representatives of Tiwi Island Adventures and Tiwi Land Council and provided further information via PowerPoint presentation. Company advised it will provide a written summary of the issues raised during the meeting. | | | |

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| 13 Feb 2019 | Company provided representatives of Tiwi Island Adventures and Tiwi Land Council with summary of issues at 8 Feb 2019 meeting via email along with PowerPoint presentation, current pipeline route co-ordinates and links to OPP on NOPSEMA website. Company offered assistance to locate any specific information in the OPP.<br>Company advised it would start preparing a detailed written response to the issues and requested both organisations advise if anything had been missed in the summary or they wished to add further detail. Company advised it would ensure all items are covered in our responses. Company also advised it would arrange a meeting with the new operators of Bathurst Island Lodge, as requested.<br>For issues raised see entry above for Tiwi Island Adventures. | | related to the project generally. | The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |
| 14 Feb 2019 | Email acknowledgement of Company's email of 13 Feb and advised looking forward to hearing more in relation to the questions raised and any opportunities for Tiwi employment pathways. | | | |
| 14 Mar 2019 | Company provided written responses and reminded the stakeholder to provide further feedback if required. | | | |
| 18 Mar 2019 | TLC advised via email that they were happy with the responses. | | | |

| Date | Contact made/feedback received/issues raised | Assessment of issues raised | Company response (including outcomes proposed/achieved) | Summary of Company assessment and response |
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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | |

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| *Top End Sports Fishing* | | | | |
| 21 Feb 2019 | Telephone discussion and Company sent follow-up email with initial fact sheet and pipeline co-ordinates. Stakeholder advised they were not likely to fish in the area but were happy to be kept informed. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a potentially 'relevant' stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per |
| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that | | | |

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| | should not be published by NOPSEMA following EP submittal. | | | the ongoing communications process. |
| *WA Fishing Industry Council* | | | | |
| 21 Jan 2019 | Company emailed WAFIC to ensure our understanding that they were not relevant to the activity was correct.<br>Company provided initial fact sheet to WAFIC in capacity as an 'interested' stakeholder, including the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections.<br>Company advised which organisations it was consulting with, including Commonwealth-managed fisheries (Northern Prawn , NWSTF, SBTF, WSF and WTBF) as well as NT-managed fisheries and a range of commercial licence-holders, including WA-based Austral Fisheries Company also advised we were happy to meet with WAFIC and/or receive any feedback and would respond. | WAFIC advised it is not a relevant or interested stakeholder for Barossa activities and had no comments.<br>WAFIC queried and provided comments and advice re the consultation process that should be undertaken by Company.<br>Company answered these queries and thanked WAFIC for its comments and advice and stated we would do our best to tailor the process to meet each stakeholder's individual needs and situation, providing the specific information they require and appropriate time to respond.<br>The NTSC agreed with WAFIC that it would prefer to receive a bespoke fact sheet addressing commercial fishing industry issues and concerns and Company agreed to provide this. | The stakeholder raised one issue/concern related to the consultation process and this was followed by Company, as requested. | Company believes it has conducted the appropriate consideration of the issues and concerns raised.<br>Company also believes it has provided reasonable and adequate time and information for the stakeholder to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA. |

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| | WAFIC provided email response confirming it was not a relevant or interested party to the activity and noted the following:<br>If the EMBA extends into WA waters then the fisheries which are in part or all of the EMBA need to be addressed within the EP. They do not need to be consulted with.<br>The NT Seafood Council would be a key part of Company consultation process.<br>Company consultation needs to be updated and addressed to the needs of key offshore stakeholders – i.e. bespoke fact sheets addressing issues and concerns of the commercial fishing sector – not a "one size fits all" technical jargon infused information document seeking commercial fisher review.<br>It is the role of the Company to address upfront any potential issues which may negatively impact the commercial fishing sector and to address these potential issues to ALARP level upfront as part of the consultation with potentially affected commercial fishers. | | | |
| 22 Jan 2019 | Company provided further information re consultation being followed in response to WAFIC emails of 21 and 22 Jan which queried the process being followed. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal | | | |

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| ***WA Seafoods*** | | | | |
| 16 Jan 2019 | Company provided initial fact sheet via covering email with the following information: project overview; development concept; current status; pipeline route, installation, operational area and timing/schedule; regulatory and consultation process; and links to Offshore Project Proposal sections. Initial feedback was requested by 19 February 2019. | No issues or concerns raised. | No response required. | No issues/concerns have been raised.<br>Company believes it has provided the stakeholder with reasonable and adequate time and information to provide feedback and no further action is required prior to EP submittal.<br>Company will advise the stakeholder when an EP is |
| 21-22 Feb 2019 | Company left phone message and follow-up email with pipeline route co-ordinates. | | | |

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| 16 April 2019 | Company provided follow-up email advising that it was seeking to finalise preparation of the EP prior to its submittal for formal assessment to NOPSEMA.<br>Company advised that Information provided to individual stakeholders during the consultation period had been summarised and consolidated on the Company website and provided the website address.<br>Stakeholder was advised that the documentation on the Company website included a new potential end date of Q1, 2024 in the indicative schedule for the pipeline installation activities, rather than the previously advised Q3, 2023, but this did not alter the previously advised overall activity timeframe of nine months.<br>Company advised that as project planning progressed, the timeframe for installation activities would firm up, and we would provide more specific timelines.<br>Any further feedback was requested by 30 April 2019 and stakeholder should advise any information previously provided that should not be published by NOPSEMA following EP submittal. | | | first published by NOPSEMA at the commencement of the assessment process and when the EP is accepted by NOPSEMA.<br>The stakeholder will continue to be notified of Barossa activities through project updates and provided opportunity to provide feedback during the preparation of all EPs.<br>As a potentially ‘relevant’ stakeholder, they will also be engaged by Company in advance of pipeline installation activities as per the ongoing communications process. |

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Santos

# APPENDIX A – RELEVANT ENVIRONMENTAL REQUIREMENTS

| Legislation | Summary | Relevance to gas export pipeline Installation |
|---|---|---|
| Aboriginal and Torres Strait Islander Heritage Protection Act 1984 | This Act provides for the preservation and protection from injury or desecration areas and objects that are of significance to Aboriginal people, under which the Minister may make a declaration to protect such areas and objects. The Act also requires the discovery of Aboriginal remains to be reported to the Minister. | No known 'significant Aboriginal areas' within the meaning of the ATSIHPA Act within operational area. Refer to Section 4.6.6. |
| *Australian Maritime Safety Authority Act 1990* (Cth) | This Act establishes AMSA, which manages the National Plan for Maritime Environmental Emergencies in coordination with industry. AMSA is also responsible for administering the Marine Orders in Commonwealth waters. | AMSA has been consulted as part of the stakeholder engagement process.<br>Santos will adhere to incident reporting requirements regarding pollution. |
| *Australian Ballast Water Requirements, Version 8* | Australian Ballast Water Management Requirements outline the mandatory ballast water management requirements to reduce the risk of introducing harmful aquatic organisms into Australia's marine environment through ballast water from international vessels. These requirements are enforceable under the *Biosecurity Act 2015*.<br>https://www.agriculture.gov.au/biosecuritytrade/aircraft-vessels-military/vessels/marine-Pestbiosecurity/ballast/australian-ballast-Watermanagement-requirements | Potential internationally sourced vessel operating in Australian Waters which could have the potential for introduction of Invasive Marine Species and potential ballast water exchange. Refer Section 5.3.2. |
| *Biosecurity Act 2015* (Cth) | This Act relates to the management of diseases and pests that may cause harm to human, animal or plant health or the environment. The Act includes provisions for ballast water management plans and certificates, record-keeping obligations and powers to ensure compliance. | Santos will ensure activity vessels comply with the requirements of this Act. Refer Section 5.3.2. |

| Legislation | Summary | Relevance to gas export pipeline Installation |
|---|---|---|
| *Environment Protection and Biodiversity Conservation Act 1999* (Cth)<br>Environment Protection and Biodiversity Conservation Regulations 2000 (Cth) | While the Environment Regulations under the OPGGS Act (see below) manage day to day petroleum activities and apply to any activity that may have an impact on the environment, the EPBC Act (Chapter 4) regulates assessment and approval of proposed actions that are likely to have a significant impact on a matter of National Environmental Significance (NES). Actions that are likely to have a significant impact on a matter of NES require approval by the Commonwealth Environment Minister; the assessment process is administered by the Department of Climate Change, Energy, the Environment and Water. The Barossa Development, including the GEP activities, will be undertaken in accordance with the 'class approval' granted by the Commonwealth Environment Minister under the EPBC Act on 27 February 2014. This 'class approval' applies to petroleum activities that are taken in Commonwealth waters in accordance with an endorsed program (being the environmental management authorisation process administered by NOPSEMA under the OPGGS Act and the OPGGS (E) Regulations).<br>Australian Marine Parks (AMPs) are regulated under the EPBC Act and its regulations. Licences granted by the Director of National Parks are required for all commercial activities in AMPs. The GEP transects the Ocean Shoals Marine Park.<br>.<br>Schedule 8 of the EPBC Regulations outlines the Australian IUCN Reserve Management Principles. | Santos will adhere to the requirements of the EPBC Act and Regulations, as relevant to the installation of the Gas Export Pipeline.<br>A Commercial Activity Licence from the Director of National Parks has been granted in April 2019. The ‘Licensed Activities’ include “the construction, installation, operation, inspection, maintenance, repair and decommissioning of the GEP and the related capture of images, video and sound within or of the Park”.<br>Santos will have regard to the Australian IUCN Reserve Management Principles, where relevant. |
| EPBC Regulations – Part 8 Division 8.1 Interacting with cetaceans | These Regulations provide for the protection and conservation of cetaceans. | Described requirements for vessel interactions with cetaceans. Refer to Section 5.3.3. |
| *Maritime Legislation Amendment (Prevention of Air Pollution from Ships) Act 2007* (Cth) | This Act amends the Protection of the Sea (Prevention of Pollution from Ships) Act 1983 (Cth) (see below) to implement the requirements of MARPOL 73/78 Annex VI for shipping in Commonwealth waters. | Santos, in consultation with the vessel owners, shall induct the vessel masters to this Act as relevant to the installation of the gas export pipeline. Vessel owners/contractors are to ensure MARPOL and this Act are adhered to as relevant to the installation of the gas export pipeline. |

| Legislation | Summary | Relevance to gas export pipeline Installation |
|---|---|---|
| *Navigation Act 2012* (Cth) | A number of Marine Orders enacted under this Act apply directly to offshore petroleum activities:<br>+ Marine Order 21 (Safety of navigational and emergency procedures)<br>+ Marine Order 30 (Prevention of collisions)<br>+ Marine Order 70 (Seafarer certification)<br>+ Marine Order 71 (Masters and deck officers)<br>+ Marine Order 91 (Marine pollution prevention – oil)<br>+ Marine Order 94 (Pollution prevention – packaged harmful substances)<br>+ Marine Order 95 (Marine pollution prevention – garbage)<br>+ Marine Order 96 (Marine pollution prevention – sewage)<br>+ Marine Order 97 (Marine pollution prevention – air pollution)<br>AMSA has the authority and responsibility for the operational activities under the Act, including vessel certification, seafarers' qualifications, marine pollution prevention, monitoring and enforcement activities. | Santos, in consultation with the vessel owners/contractor shall induct the vessel masters to this Act and relevant Marine Orders as relevant to the installation of the gas export pipeline.<br>Vessel owners are to ensure this Act and relevant port state Marine Orders are adhered to as relevant to the installation of the gas export pipeline. |
| *National Greenhouse and Energy Reporting Act 2007* (Cth) | Introduces a single national reporting framework for the reporting and dissemination of information about greenhouse gas emissions, greenhouse gas projects and energy use and production of corporations. | This Act applies to the atmospheric emissions through combustion engine use to operate the vessels associated with the activity.<br>Implementation of the Act will reduce the impact of GHG emissions associated with vessel use for the installation and commissioning activity, through compliance with MARPOL Annex VI (Marine Order Part 97: Marine Pollution Prevention – Air Pollution), and require the use of low sulphur fuel. |
| *Protection of the Sea (Harmful Antifouling Systems) Act 2006* (Cth) | 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. | Activity vessels will comply with the relevant requirements of this Act. Refer to Section 5.3.2 |

| Legislation | Summary | Relevance to gas export pipeline Installation |
|---|---|---|
| *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (Cth)<br>Protection of the Sea (Prevention of Pollution from Ships) (Orders) Regulations 1994 (Cth) | This Act and Regulations relate to the protection of the sea from pollution by oil and other harmful substances discharged from ships. This Act disallows any harmful discharge of sewage, oil and noxious substances into the sea and sets the requirements for a shipboard waste management plan.<br>The following Marine Orders relating to marine pollution prevention have been put in place to give effect to relevant regulations of Annexes I, II, III, IV, V and VI of MARPOL 73/78:<br>+ Marine Order 91 (Marine pollution prevention – oil)<br>+ Marine Order 94 (Pollution prevention – packaged harmful substances)<br>+ Marine Order 95 (Marine pollution prevention – garbage)<br>+ Marine Order 96 (Marine pollution prevention – sewage)<br>+ Marine Order 97 (Marine pollution prevention – air pollution)<br>+ Marine Order 98 (Marine pollution prevention – anti-fouling systems) | Santos, in consultation with the vessel owners/contractor shall induct the vessel masters to this Act and relevant Marine Orders as relevant the installation of the gas export pipeline.<br>Vessel owners/contractor are to ensure the requirements of MARPOL 73/78, this Act and Regulations, and relevant port state Marine Orders are adhered to as relevant to the installation of the gas export pipeline. |
| *Underwater Cultural Heritage Act 2018* (Cth) | This Act replaces the *Historic Shipwrecks Act* 1976 and extends protection to other wrecks such as submerged aircraft and human remains. It also increases penalties applicable to damaged sites.<br>Protects the heritage values of shipwrecks and relics for shipwrecks over 75 years. It is an offence to interfere with a shipwreck covered by this Act. | Santos has undertaken maritime heritage assessments to ensure protected heritage is not impacted by the Gas Export pipeline activities. Refer to Section 4.6.5. |

# APPENDIX B – ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION PROTECTED MATTERS SEARCH REPORT

Australian Government

Department of Climate Change, Energy, the Environment and Water

# 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. Please see the caveat for interpretation of information provided here.

Report created: 15-Feb-2023

# Summary

## Matters of National Environment 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 (Ramsar | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | 2 |
| Listed Threatened Ecological Communities: | None |
| Listed Threatened Species: | 46 |
| Listed Migratory Species: | 52 |

## 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 https://www.dcceew.gov.au/parks-heritage/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 Lands: | None |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 87 |
| Whales and Other Cetaceans: | 25 |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | 3 |
| Habitat Critical to the Survival of Marine Turtles: | 2 |

## Extra Information

This part of the report provides information that may also be relevant to the area you have

| | |
|---|---|
| State and Territory Reserves: | None |
| Regional Forest Agreements: | None |
| Nationally Important Wetlands: | None |
| EPBC Act Referrals: | 32 |
| Key Ecological Features (Marine): | 2 |
| Biologically Important Areas: | 7 |
| Bioregional Assessments: | None |
| Geological and Bioregional Assessments: | None |

# 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 a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

| Feature Name |
| --- |
| EEZ and Territorial Sea |
| Extended Continental Shelf |

### Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| BIRD | | |
| Calidris canutus<br>Red Knot, Knot [855] | Endangered | Species or species habitat known to occur within area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat known to occur within area |
| Erythrotriorchis radiatus<br>Red Goshawk [942] | Vulnerable | Species or species habitat known to occur within area |
| Falco hypoleucos<br>Grey Falcon [929] | Vulnerable | Species or species habitat may occur within area |
| Geophaps smithii smithii<br>Partridge Pigeon (eastern) [64441] | Vulnerable | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Limosa lapponica baueri<br>Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380] | Vulnerable | Species or species habitat may occur within area |
| Melanodryas cucullata melvillensis<br>Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092] | Critically Endangered | Species or species habitat likely to occur within area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| Rostratula australis<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat may occur within area |
| Tyto novaehollandiae melvillensis<br>Tiwi Masked Owl, Tiwi Islands Masked Owl [26049] | Endangered | Species or species habitat known to occur within area |
| MAMMAL | | |
| Antechinus bellus<br>Fawn Antechinus [344] | Vulnerable | Species or species habitat likely to occur within area |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Species or species habitat likely to occur within area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Species or species habitat likely to occur within area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Species or species habitat likely to occur within area |
| Conilurus penicillatus<br>Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132] | Vulnerable | Species or species habitat known to occur within area |
| Macroderma gigas<br>Ghost Bat [174] | Vulnerable | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Mesembriomys gouldii melvillensis<br>Black-footed Tree-rat (Melville Island) [87619] | Vulnerable | Species or species habitat known to occur within area |
| Phascogale pirata<br>Northern Brush-tailed Phascogale [82954] | Vulnerable | Species or species habitat likely to occur within area |
| Saccolaimus saccolaimus nudicluniatus<br>Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889] | Vulnerable | Species or species habitat may occur within area |
| Sminthopsis butleri<br>Butler's Dunnart [302] | Vulnerable | Species or species habitat known to occur within area |
| Trichosurus vulpecula arnhemensis<br>Northern Brushtail Possum [83091] | Vulnerable | Species or species habitat known to occur within area |
| Xeromys myoides<br>Water Mouse, False Water Rat, Yirrkoo [66] | Vulnerable | Species or species habitat known to occur within area |
| PLANT | | |
| Burmannia sp. Bathurst Island (R.Fensham 1021)<br>[82017] | Endangered | Species or species habitat likely to occur within area |
| Elaeocarpus miegei<br>[65147] | Endangered | Species or species habitat likely to occur within area |
| Hoya australis subsp. oramicola<br>a vine [55436] | Vulnerable | Species or species habitat known to occur within area |
| Mitrella tiwiensis<br>a vine [82029] | Vulnerable | Species or species habitat likely to occur within area |
| Tarennoidea wallichii<br>[65173] | Endangered | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Typhonium jonesii<br>a herb [62412] | Endangered | Species or species habitat likely to occur within area |
| Typhonium mirabile<br>a herb [79227] | Endangered | Species or species habitat likely to occur within area |
| Xylopia monosperma<br>a shrub [82030] | Endangered | Species or species habitat known to occur within area |
| REPTILE | | |
| Acanthophis hawkei<br>Plains Death Adder [83821] | Vulnerable | Species or species habitat may occur within area |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat known to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Breeding known to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area |
| Eretmochelys imbricata<br>Hawksbill Turtle [1766] | Vulnerable | Breeding known to occur within area |
| Lepidochelys olivacea<br>Olive Ridley Turtle, Pacific Ridley Turtle [1767] | Endangered | Breeding known to occur within area |
| Natator depressus<br>Flatback Turtle [59257] | Vulnerable | Breeding known to occur within area |
| SHARK | | |
| Carcharodon carcharias<br>White Shark, Great White Shark [64470] | Vulnerable | Species or species habitat may occur within area |
| Glyphis garricki<br>Northern River Shark, New Guinea River Shark [82454] | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Glyphis glyphis<br>Speartooth Shark [82453] | Critically Endangered | Species or species habitat may occur within area |
| Pristis clavata<br>Dwarf Sawfish, Queensland Sawfish [68447] | Vulnerable | Species or species habitat known to occur within area |
| Pristis pristis<br>Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756] | Vulnerable | Species or species habitat likely to occur within area |
| Pristis zijsron<br>Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442] | Vulnerable | Species or species habitat known to occur within area |
| Rhincodon typus<br>Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |
| Sphyrna lewini<br>Scalloped Hammerhead [85267] | Conservation Dependent | Species or species habitat likely to occur within area |

## Listed Migratory Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Migratory Marine Birds | | |
| Anous stolidus<br>Common Noddy [825] | | Species or species habitat may occur within area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area |
| Calonectris leucomelas<br>Streaked Shearwater [1077] | | Species or species habitat known to occur within area |
| Fregata ariel<br>Lesser Frigatebird, Least Frigatebird [1012] | | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Fregata minor | | |
| Great Frigatebird, Greater Frigatebird [1013] | | Species or species habitat likely to occur within area |
| Phaethon lepturus | | |
| White-tailed Tropicbird [1014] | | Species or species habitat may occur within area |
| **Migratory Marine Species** | | |
| Anoxypristis cuspidata | | |
| Narrow Sawfish, Knifetooth Sawfish [68448] | | 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 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 |
| 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 known to occur within area |
| Chelonia mydas | | |
| Green Turtle [1765] | Vulnerable | Breeding known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Crocodylus porosus<br>Salt-water Crocodile, Estuarine Crocodile [1774] | | Species or species habitat likely to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area |
| Dugong dugon<br>Dugong [28] | | Species or species habitat known to occur within area |
| Eretmochelys imbricata<br>Hawksbill Turtle [1766] | Vulnerable | Breeding known to occur within area |
| Isurus oxyrinchus<br>Shortfin Mako, Mako Shark [79073] | | Species or species habitat likely to occur within area |
| Isurus paucus<br>Longfin Mako [82947] | | Species or species habitat likely to occur within area |
| Lepidochelys olivacea<br>Olive Ridley Turtle, Pacific Ridley Turtle [1767] | Endangered | Breeding known to occur within area |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area |
| Mobula alfredi as Manta alfredi<br>Reef Manta Ray, Coastal Manta Ray [90033] | | Species or species habitat likely to occur within area |
| Mobula birostris as Manta birostris<br>Giant Manta Ray [90034] | | Species or species habitat likely to occur within area |
| Natator depressus<br>Flatback Turtle [59257] | Vulnerable | Breeding known to occur within area |
| Orcaella heinsohni<br>Australian Snubfin Dolphin [81322] | | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat may occur within area |
| Physeter macrocephalus<br>Sperm Whale [59] | | Species or species habitat may occur within area |
| Pristis clavata<br>Dwarf Sawfish, Queensland Sawfish [68447] | Vulnerable | Species or species habitat known to occur within area |
| Pristis pristis<br>Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756] | Vulnerable | Species or species habitat likely to occur within area |
| Pristis zijsron<br>Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442] | Vulnerable | Species or species habitat known to occur within area |
| Rhincodon typus<br>Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |
| Sousa sahulensis as Sousa chinensis<br>Australian Humpback Dolphin [87942] | | Species or species habitat known to occur within area |
| Tursiops aduncus (Arafura/Timor Sea populations)<br>Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900] | | Species or species habitat known to occur within area |
| Migratory Terrestrial Species | | |
| Cecropis daurica<br>Red-rumped Swallow [80610] | | Species or species habitat may occur within area |
| Cuculus optatus<br>Oriental Cuckoo, Horsfield's Cuckoo [86651] | | Species or species habitat may occur within area |
| Hirundo rustica<br>Barn Swallow [662] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Rhipidura rufifrons | | |
| Rufous Fantail [592] | | Species or species habitat known 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 |
| 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 known to 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 |
| 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 |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Numenius madagascariensis | | |
| Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| Pandion haliaetus | | |
| Osprey [952] | | Species or species habitat known to occur within area |
| Thalasseus bergii | | |
| Greater Crested Tern [83000] | | Breeding likely to occur within area |

## Other Matters Protected by the EPBC Act

### Listed Marine Species [ Resource Information ]

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Bird | | |
| Acrocephalus orientalis | | |
| Oriental Reed-Warbler [59570] | | Species or species habitat may occur within area overfly marine area |
| Actitis hypoleucos | | |
| Common Sandpiper [59309] | | Species or species habitat known to occur within area |
| Anous stolidus | | |
| Common Noddy [825] | | Species or species habitat may occur within area |
| Apus pacificus | | |
| Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area |
| Bubulcus ibis as Ardea ibis | | |
| Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area |
| Calidris acuminata | | |
| Sharp-tailed Sandpiper [874] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Calidris canutus<br>Red Knot, Knot [855] | Endangered | Species or species habitat known to occur within area overfly marine area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area overfly marine area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area |
| Calonectris leucomelas<br>Streaked Shearwater [1077] | | Species or species habitat known to occur within area |
| Cecropis daurica as Hirundo daurica<br>Red-rumped Swallow [80610] | | Species or species habitat may occur within area overfly marine area |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat known to occur within area |
| Charadrius veredus<br>Oriental Plover, Oriental Dotterel [882] | | Species or species habitat may occur within area overfly marine area |
| Fregata ariel<br>Lesser Frigatebird, Least Frigatebird [1012] | | Species or species habitat likely to occur within area |
| Fregata minor<br>Great Frigatebird, Greater Frigatebird [1013] | | Species or species habitat likely to occur within area |
| Glareola maldivarum<br>Oriental Pratincole [840] | | Species or species habitat may occur within area overfly marine area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Haliaeetus leucogaster<br>White-bellied Sea-Eagle [943] | | Species or species habitat likely to occur within area |
| Hirundo rustica<br>Barn Swallow [662] | | Species or species habitat may occur within area overfly marine area |
| Limosa lapponica<br>Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| Merops ornatus<br>Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area |
| Phaethon lepturus<br>White-tailed Tropicbird [1014] | | Species or species habitat may occur within area |
| Rhipidura rufifrons<br>Rufous Fantail [592] | | Species or species habitat known to occur within area overfly marine area |
| Rostratula australis as Rostratula benghalensis (sensu lato)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat may occur within area overfly marine area |
| Thalasseus bergii as Sterna bergii<br>Greater Crested Tern [83000] | | Breeding likely to occur within area |
| Fish | | |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Bhanotia fasciolata<br>Corrugated Pipefish, Barbed Pipefish [66188] | | Species or species habitat may occur within area |
| Campichthys tricarinatus<br>Three-keel Pipefish [66192] | | Species or species habitat may occur within area |
| Choeroichthys brachysoma<br>Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194] | | Species or species habitat may occur within area |
| Choeroichthys suillus<br>Pig-snouted Pipefish [66198] | | Species or species habitat may occur within area |
| Corythoichthys amplexus<br>Fijian Banded Pipefish, Brown-banded Pipefish [66199] | | Species or species habitat may occur within area |
| Corythoichthys flavofasciatus<br>Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200] | | Species or species habitat may occur within area |
| Corythoichthys haematopterus<br>Reef-top Pipefish [66201] | | Species or species habitat may occur within area |
| Corythoichthys intestinalis<br>Australian Messmate Pipefish, Banded Pipefish [66202] | | Species or species habitat may occur within area |
| Corythoichthys schultzi<br>Schultz's Pipefish [66205] | | Species or species habitat may occur within area |
| Cosmocampus banneri<br>Roughridge Pipefish [66206] | | Species or species habitat may occur within area |
| Doryrhamphus dactyliophorus<br>Banded Pipefish, Ringed Pipefish [66210] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Doryrhamphus excisus<br>Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211] | | Species or species habitat may occur within area |
| Doryrhamphus janssi<br>Cleaner Pipefish, Janss' Pipefish [66212] | | Species or species habitat may occur within area |
| Festucalex cinctus<br>Girdled Pipefish [66214] | | Species or species habitat may occur within area |
| Filicampus tigris<br>Tiger Pipefish [66217] | | Species or species habitat may occur within area |
| Halicampus brocki<br>Brock's Pipefish [66219] | | Species or species habitat may occur within area |
| Halicampus dunckeri<br>Red-hair Pipefish, Duncker's Pipefish [66220] | | Species or species habitat may occur within area |
| Halicampus grayi<br>Mud Pipefish, Gray's Pipefish [66221] | | Species or species habitat may occur within area |
| Halicampus spinirostris<br>Spiny-snout Pipefish [66225] | | Species or species habitat may occur within area |
| Haliichthys taeniophorus<br>Ribboned Pipehorse, Ribboned Seadragon [66226] | | Species or species habitat may occur within area |
| Hippichthys cyanospilos<br>Blue-speckled Pipefish, Blue-spotted Pipefish [66228] | | Species or species habitat may occur within area |
| Hippichthys parvicarinatus<br>Short-keel Pipefish, Short-keeled Pipefish [66230] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Hippichthys penicillus<br>Beady Pipefish, Steep-nosed Pipefish [66231] | | Species or species habitat may occur within area |
| Hippocampus histrix<br>Spiny Seahorse, Thorny Seahorse [66236] | | Species or species habitat may occur within area |
| Hippocampus kuda<br>Spotted Seahorse, Yellow Seahorse [66237] | | Species or species habitat may occur within area |
| Hippocampus planifrons<br>Flat-face Seahorse [66238] | | Species or species habitat may occur within area |
| Hippocampus spinosissimus<br>Hedgehog Seahorse [66239] | | Species or species habitat may occur within area |
| Micrognathus micronotopterus<br>Tidepool Pipefish [66255] | | Species or species habitat may occur within area |
| Solegnathus hardwickii<br>Pallid Pipehorse, Hardwick's Pipehorse [66272] | | Species or species habitat may occur within area |
| Solegnathus lettiensis<br>Gunther's Pipehorse, Indonesian Pipefish [66273] | | Species or species habitat may occur within area |
| Solenostomus cyanopterus<br>Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183] | | Species or species habitat may occur within area |
| Syngnathoides biaculeatus<br>Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279] | | Species or species habitat may occur within area |
| Trachyrhamphus bicoarctatus<br>Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Trachyrhamphus longirostris<br>Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281] | | Species or species habitat may occur within area |
| **Mammal** | | |
| Dugong dugon<br>Dugong [28] | | Species or species habitat known to occur within area |
| **Reptile** | | |
| Acalyptophis peronii<br>Horned Seasnake [1114] | | Species or species habitat may occur within area |
| Aipysurus duboisii<br>Dubois' Seasnake [1116] | | Species or species habitat may occur within area |
| Aipysurus eydouxii<br>Spine-tailed Seasnake [1117] | | Species or species habitat may occur within area |
| Aipysurus laevis<br>Olive Seasnake [1120] | | Species or species habitat may occur within area |
| Astrotia stokesii<br>Stokes' Seasnake [1122] | | Species or species habitat may occur within area |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat known to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Breeding known to occur within area |
| Chitulia inornata as Hydrophis inornatus<br>Plain Seasnake [87379] | | Species or species habitat may occur within area |
| Chitulia ornata as Hydrophis ornatus<br>Spotted Seasnake, Ornate Reef Seasnake [87377] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| [Crocodylus porosus]<br>Salt-water Crocodile, Estuarine Crocodile [1774] | | Species or species habitat likely to occur within area |
| [Dermochelys coriacea]<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area |
| [Disteira kingii]<br>Spectacled Seasnake [1123] | | Species or species habitat may occur within area |
| [Disteira major]<br>Olive-headed Seasnake [1124] | | Species or species habitat may occur within area |
| [Enhydrina schistosa]<br>Beaked Seasnake [1126] | | Species or species habitat may occur within area |
| [Eretmochelys imbricata]<br>Hawksbill Turtle [1766] | Vulnerable | Breeding known to occur within area |
| [Hydrelaps darwiniensis]<br>Black-ringed Seasnake [1100] | | Species or species habitat may occur within area |
| [Hydrophis atriceps]<br>Black-headed Seasnake [1101] | | Species or species habitat may occur within area |
| [Hydrophis elegans]<br>Elegant Seasnake [1104] | | Species or species habitat may occur within area |
| [Hydrophis macdowelli as Hydrophis mcdowelli]<br>Small-headed Seasnake [75601] | | Species or species habitat may occur within area |
| [Lapemis curtus as Lapemis hardwickii]<br>Spine-bellied Seasnake [83554] | | Species or species habitat may occur within area |
| [Leioselasma coggeri as Hydrophis coggeri]<br>Black-headed Sea Snake, Slender-necked Seasnake [87373] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Leioselasma pacifica as Hydrophis pacificus | | |
| Large-headed Seasnake, Pacific Seasnake [87378] | | 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 ]

| Current Scientific Name | Status | Type of Presence |
| --- | --- | --- |
| Mammal | | |
| 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 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 |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| Globicephala macrorhynchus<br>Short-finned Pilot Whale [62] | | Species or species habitat may occur within area |
| Grampus griseus<br>Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area |
| Kogia breviceps<br>Pygmy Sperm Whale [57] | | Species or species habitat may occur within area |
| Kogia sima as Kogia simus<br>Dwarf Sperm Whale [85043] | | Species or species habitat may occur within area |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area |
| Orcaella heinsohni as Orcaella brevirostris<br>Australian Snubfin Dolphin [81322] | | Species or species habitat known to occur within area |
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat may occur within area |
| Peponocephala electra<br>Melon-headed Whale [47] | | Species or species habitat may occur within area |
| Physeter macrocephalus<br>Sperm Whale [59] | | Species or species habitat may occur within area |
| Pseudorca crassidens<br>False Killer Whale [48] | | Species or species habitat likely to occur within area |
| Sousa sahulensis as Sousa chinensis<br>Australian Humpback Dolphin [87942] | | Species or species habitat known to occur within area |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| Stenella attenuata<br>Spotted Dolphin, Pantropical Spotted Dolphin [51] | | Species or species habitat may occur within area |
| Stenella coeruleoalba<br>Striped Dolphin, Euphrosyne Dolphin [52] | | Species or species habitat may occur within area |
| Stenella longirostris<br>Long-snouted Spinner Dolphin [29] | | Species or species habitat may occur within area |
| Steno bredanensis<br>Rough-toothed Dolphin [30] | | Species or species habitat may occur within area |
| Tursiops aduncus<br>Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | | Species or species habitat likely to occur within area |
| Tursiops aduncus (Arafura/Timor Sea populations)<br>Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900] | | Species or species habitat known to occur within area |
| Tursiops truncatus s. str.<br>Bottlenose Dolphin [68417] | | Species or species habitat may occur within area |
| Ziphius cavirostris<br>Cuvier's Beaked Whale, Goose-beaked Whale [56] | | Species or species habitat may occur within area |

## Australian Marine Parks

[ Resource Information ]

| Park Name | Zone & IUCN Categories |
|---|---|
| Oceanic Shoals | Habitat Protection Zone (IUCN IV) |
| Oceanic Shoals | Multiple Use Zone (IUCN VI) |
| Oceanic Shoals | Special Purpose Zone (Trawl) (IUCN VI) |

## Habitat Critical to the Survival of Marine Turtles

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Aug - Sep | | |

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Natator depressus<br>Flatback Turtle [59257] | Nesting | Known to occur |
| May - Jul | | |
| Lepidochelys olivacea<br>Olive Ridley Turtle [1767] | Nesting | Known to occur |

## Extra Information

| EPBC Act Referrals | | | [ Resource Information ] |
|---|---|---|---|
| Title of referral | Reference | Referral Outcome | Assessment Status |
| | | | |
| Darwin Pipeline Duplication (DPD) Project | 2022/09372 | | Assessment |
| Tiwi H2 Project | 2022/09347 | | Assessment |
| Controlled action | | | |
| Andranangoo Creek & Lethbridge Bay mineral sand mining | 2005/2155 | Controlled Action | Completed |
| Australia-ASEAN Power Link | 2020/8818 | Controlled Action | Proposed Decision |
| Hardwood Plantation | 2001/229 | Controlled Action | Post-Approval |
| Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline | 2008/4208 | Controlled Action | Post-Approval |
| Kilimiraka Mineral Sands and Associated Infrastructure (Bathurst Island), NT | 2012/6587 | Controlled Action | Assessment Approach |
| Snake Bay Barramundi Sea Cage Farm | 2005/2150 | Controlled Action | Completed |
| Not controlled action | | | |
| Construction and operation of Radar Infrastructure | 2004/1406 | Not Controlled Action | Completed |
| Marine Survey for the Australia-ASEAN Power Link AAPL | 2020/8714 | Not Controlled Action | Completed |
| Not controlled action (particular manner) | | | |
| 2D Marine Seismic Survey | 2009/4728 | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| 2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile | 2006/2917 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic survey | 2009/5076 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic Survey - Petroleum Exploration Area NT/P68, Eastern Bonaparte Basin | 2006/2922 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D Seismic Survey | 2006/2729 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D Seismic Survey (NT/P68) | 2006/2980 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D Seismic Survey (NT/P68) | 2008/4121 | Not Controlled Action (Particular Manner) | Post-Approval |
| Bonaparte 3D & 2D Seismic Survey, in NT/P82, Timor Sea | 2012/6398 | Not Controlled Action (Particular Manner) | Post-Approval |
| Bonaparte Basin Seabed Mapping Survey | 2009/4951 | Not Controlled Action (Particular Manner) | Post-Approval |
| Bonaparte Seismic and Bathymetric Survey | 2012/6295 | Not Controlled Action (Particular Manner) | Post-Approval |
| Caldita 3D Marine Seismic Survey - NT/P61, NT/P69, and acreage release area NT06-5 | 2006/3142 | Not Controlled Action (Particular Manner) | Post-Approval |
| Eni Bathurst 3D Seismic Survey | 2011/6118 | Not Controlled Action (Particular Manner) | Post-Approval |
| Joseph Bonaparte Gulf Seabed mapping survey | 2010/5517 | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| Kingtree & Ironstone-1 Exploration Wells | 2011/5935 | Not Controlled Action (Particular Manner) | Post-Approval |
| Marine Environmental Survey 2012 | 2012/6310 | Not Controlled Action (Particular Manner) | Post-Approval |
| Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT | 2014/7223 | Not Controlled Action (Particular Manner) | Post-Approval |
| Panda NT/P76 3D Seismic Acquisition Survey Program | 2009/4992 | Not Controlled Action (Particular Manner) | Post-Approval |
| Port Melville marine supply base, Melville Island | 2015/7510 | Not Controlled Action (Particular Manner) | Post-Approval |
| Removal of Potential Unexploded Ordnance within NAXA | 2012/6503 | Not Controlled Action (Particular Manner) | Post-Approval |
| Westralia SPAN Marine Seismic Survey, WA & NT | 2012/6463 | Not Controlled Action (Particular Manner) | Post-Approval |
| Referral decision | | | |
| 2D Marine Seismic Survey | 2008/4623 | Referral Decision | Completed |
| 3D Seismic Survey (NT/P68) | 2006/2949 | Referral Decision | Completed |

## Key Ecological Features [ 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 Diemen Rise | North |
| Shelf break and slope of the Arafura Shelf | North |

## Biologically Important Areas

| Scientific Name | Behaviour | Presence |
| --- | --- | --- |
| **Marine Turtles** | | |
| Chelonia mydas<br>Green Turtle [1765] | Foraging | Known to occur |
| Chelonia mydas<br>Green Turtle [1765] | Internesting | Likely to occur |
| Lepidochelys olivacea<br>Olive Ridley Turtle [1767] | Foraging | Known to occur |
| Lepidochelys olivacea<br>Olive Ridley Turtle [1767] | Internesting | Likely to occur |
| Natator depressus<br>Flatback Turtle [59257] | Internesting | Likely to occur |
| **Seabirds** | | |
| Thalasseus bergii<br>Crested Tern [83000] | Breeding (high numbers) | Known to occur |
| **Whales** | | |
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Distribution | Known to occur |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

## 3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# 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. Please see the caveat for interpretation of information provided here.

Report created: 13-Feb-2023

# Summary

## Matters of National Environment 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 (Ramsar | None |
| Great Barrier Reef Marine Park: | None |
| Commonwealth Marine Area: | 2 |
| Listed Threatened Ecological Communities: | None |
| Listed Threatened Species: | 46 |
| Listed Migratory Species: | 52 |

## 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 https://www.dcceew.gov.au/parks-heritage/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 Lands: | None |
| Commonwealth Heritage Places: | None |
| Listed Marine Species: | 87 |
| Whales and Other Cetaceans: | 25 |
| Critical Habitats: | None |
| Commonwealth Reserves Terrestrial: | None |
| Australian Marine Parks: | 3 |
| Habitat Critical to the Survival of Marine Turtles: | 2 |

## Extra Information

This part of the report provides information that may also be relevant to the area you have

| | |
|---|---|
| State and Territory Reserves: | None |
| Regional Forest Agreements: | None |
| Nationally Important Wetlands: | None |
| EPBC Act Referrals: | 32 |
| Key Ecological Features (Marine): | 2 |
| Biologically Important Areas: | 7 |
| Bioregional Assessments: | None |
| Geological and Bioregional Assessments: | None |

# 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 a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

| Feature Name |
|---|
| EEZ and Territorial Sea |
| Extended Continental Shelf |

### Listed Threatened Species [ Resource Information ]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| BIRD | | |
| Calidris canutus<br>Red Knot, Knot [855] | Endangered | Species or species habitat known to occur within area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat known to occur within area |
| Erythrotriorchis radiatus<br>Red Goshawk [942] | Vulnerable | Species or species habitat known to occur within area |
| Falco hypoleucos<br>Grey Falcon [929] | Vulnerable | Species or species habitat may occur within area |
| Geophaps smithii smithii<br>Partridge Pigeon (eastern) [64441] | Vulnerable | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Limosa lapponica baueri<br>Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380] | Vulnerable | Species or species habitat may occur within area |
| Melanodryas cucullata melvillensis<br>Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092] | Critically Endangered | Species or species habitat likely to occur within area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| Rostratula australis<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat may occur within area |
| Tyto novaehollandiae melvillensis<br>Tiwi Masked Owl, Tiwi Islands Masked Owl [26049] | Endangered | Species or species habitat known to occur within area |
| MAMMAL | | |
| Antechinus bellus<br>Fawn Antechinus [344] | Vulnerable | Species or species habitat likely to occur within area |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Species or species habitat likely to occur within area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Species or species habitat likely to occur within area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Species or species habitat likely to occur within area |
| Conilurus penicillatus<br>Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132] | Vulnerable | Species or species habitat known to occur within area |
| Macroderma gigas<br>Ghost Bat [174] | Vulnerable | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Mesembriomys gouldii melvillensis<br>Black-footed Tree-rat (Melville Island) [87619] | Vulnerable | Species or species habitat known to occur within area |
| Phascogale pirata<br>Northern Brush-tailed Phascogale [82954] | Vulnerable | Species or species habitat likely to occur within area |
| Saccolaimus saccolaimus nudicluniatus<br>Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889] | Vulnerable | Species or species habitat may occur within area |
| Sminthopsis butleri<br>Butler's Dunnart [302] | Vulnerable | Species or species habitat known to occur within area |
| Trichosurus vulpecula arnhemensis<br>Northern Brushtail Possum [83091] | Vulnerable | Species or species habitat known to occur within area |
| Xeromys myoides<br>Water Mouse, False Water Rat, Yirrkoo [66] | Vulnerable | Species or species habitat known to occur within area |
| PLANT | | |
| Burmannia sp. Bathurst Island (R.Fensham 1021)<br>[82017] | Endangered | Species or species habitat likely to occur within area |
| Elaeocarpus miegei<br>[65147] | Endangered | Species or species habitat likely to occur within area |
| Hoya australis subsp. oramicola<br>a vine [55436] | Vulnerable | Species or species habitat known to occur within area |
| Mitrella tiwiensis<br>a vine [82029] | Vulnerable | Species or species habitat likely to occur within area |
| Tarennoidea wallichii<br>[65173] | Endangered | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Typhonium jonesii<br>a herb [62412] | Endangered | Species or species habitat likely to occur within area |
| Typhonium mirabile<br>a herb [79227] | Endangered | Species or species habitat likely to occur within area |
| Xylopia monosperma<br>a shrub [82030] | Endangered | Species or species habitat known to occur within area |
| REPTILE | | |
| Acanthophis hawkei<br>Plains Death Adder [83821] | Vulnerable | Species or species habitat may occur within area |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat known to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Breeding known to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area |
| Eretmochelys imbricata<br>Hawksbill Turtle [1766] | Vulnerable | Breeding known to occur within area |
| Lepidochelys olivacea<br>Olive Ridley Turtle, Pacific Ridley Turtle [1767] | Endangered | Breeding known to occur within area |
| Natator depressus<br>Flatback Turtle [59257] | Vulnerable | Breeding known to occur within area |
| SHARK | | |
| Carcharodon carcharias<br>White Shark, Great White Shark [64470] | Vulnerable | Species or species habitat may occur within area |
| Glyphis garricki<br>Northern River Shark, New Guinea River Shark [82454] | Endangered | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Glyphis glyphis<br>Speartooth Shark [82453] | Critically Endangered | Species or species habitat may occur within area |
| Pristis clavata<br>Dwarf Sawfish, Queensland Sawfish [68447] | Vulnerable | Species or species habitat known to occur within area |
| Pristis pristis<br>Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756] | Vulnerable | Species or species habitat likely to occur within area |
| Pristis zijsron<br>Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442] | Vulnerable | Species or species habitat known to occur within area |
| Rhincodon typus<br>Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |
| Sphyrna lewini<br>Scalloped Hammerhead [85267] | Conservation Dependent | Species or species habitat likely to occur within area |

## Listed Migratory Species

[ Resource Information ]

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Migratory Marine Birds | | |
| Anous stolidus<br>Common Noddy [825] | | Species or species habitat may occur within area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area |
| Calonectris leucomelas<br>Streaked Shearwater [1077] | | Species or species habitat known to occur within area |
| Fregata ariel<br>Lesser Frigatebird, Least Frigatebird [1012] | | Species or species habitat likely to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Fregata minor<br>Great Frigatebird, Greater Frigatebird [1013] | | Species or species habitat likely to occur within area |
| Phaethon lepturus<br>White-tailed Tropicbird [1014] | | Species or species habitat may occur within area |
| **Migratory Marine Species** | | |
| Anoxypristis cuspidata<br>Narrow Sawfish, Knifetooth Sawfish [68448] | | Species or species habitat likely to occur within area |
| Balaenoptera borealis<br>Sei Whale [34] | Vulnerable | Species or species habitat likely to occur within area |
| Balaenoptera edeni<br>Bryde's Whale [35] | | Species or species habitat may occur within area |
| Balaenoptera musculus<br>Blue Whale [36] | Endangered | Species or species habitat likely to occur within area |
| Balaenoptera physalus<br>Fin Whale [37] | Vulnerable | Species or species habitat likely to occur within area |
| Carcharhinus longimanus<br>Oceanic Whitetip Shark [84108] | | Species or species habitat may occur within area |
| Carcharodon carcharias<br>White Shark, Great White Shark [64470] | Vulnerable | Species or species habitat may occur within area |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat known to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Breeding known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Crocodylus porosus<br>Salt-water Crocodile, Estuarine Crocodile [1774] | | Species or species habitat likely to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area |
| Dugong dugon<br>Dugong [28] | | Species or species habitat known to occur within area |
| Eretmochelys imbricata<br>Hawksbill Turtle [1766] | Vulnerable | Breeding known to occur within area |
| Isurus oxyrinchus<br>Shortfin Mako, Mako Shark [79073] | | Species or species habitat likely to occur within area |
| Isurus paucus<br>Longfin Mako [82947] | | Species or species habitat likely to occur within area |
| Lepidochelys olivacea<br>Olive Ridley Turtle, Pacific Ridley Turtle [1767] | Endangered | Breeding known to occur within area |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area |
| Mobula alfredi as Manta alfredi<br>Reef Manta Ray, Coastal Manta Ray [90033] | | Species or species habitat likely to occur within area |
| Mobula birostris as Manta birostris<br>Giant Manta Ray [90034] | | Species or species habitat likely to occur within area |
| Natator depressus<br>Flatback Turtle [59257] | Vulnerable | Breeding known to occur within area |
| Orcaella heinsohni<br>Australian Snubfin Dolphin [81322] | | Species or species habitat known to occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat may occur within area |
| Physeter macrocephalus<br>Sperm Whale [59] | | Species or species habitat may occur within area |
| Pristis clavata<br>Dwarf Sawfish, Queensland Sawfish [68447] | Vulnerable | Species or species habitat known to occur within area |
| Pristis pristis<br>Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756] | Vulnerable | Species or species habitat likely to occur within area |
| Pristis zijsron<br>Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442] | Vulnerable | Species or species habitat known to occur within area |
| Rhincodon typus<br>Whale Shark [66680] | Vulnerable | Species or species habitat may occur within area |
| Sousa sahulensis as Sousa chinensis<br>Australian Humpback Dolphin [87942] | | Species or species habitat known to occur within area |
| Tursiops aduncus (Arafura/Timor Sea populations)<br>Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900] | | Species or species habitat known to occur within area |
| Migratory Terrestrial Species | | |
| Cecropis daurica<br>Red-rumped Swallow [80610] | | Species or species habitat may occur within area |
| Cuculus optatus<br>Oriental Cuckoo, Horsfield's Cuckoo [86651] | | Species or species habitat may occur within area |
| Hirundo rustica<br>Barn Swallow [662] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Rhipidura rufifrons | | |
| Rufous Fantail [592] | | Species or species habitat known 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 |
| 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 known to 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 |
| 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 |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area |
| Thalasseus bergii<br>Greater Crested Tern [83000] | | Breeding likely to occur within area |

## Other Matters Protected by the EPBC Act

| Listed Marine Species | | [ Resource Information ] |
| --- | --- | --- |
| Scientific Name | Threatened Category | Presence Text |
| Bird | | |
| Acrocephalus orientalis<br>Oriental Reed-Warbler [59570] | | Species or species habitat may occur within area overfly marine area |
| Actitis hypoleucos<br>Common Sandpiper [59309] | | Species or species habitat known to occur within area |
| Anous stolidus<br>Common Noddy [825] | | Species or species habitat may occur within area |
| Apus pacificus<br>Fork-tailed Swift [678] | | Species or species habitat likely to occur within area overfly marine area |
| Bubulcus ibis as Ardea ibis<br>Cattle Egret [66521] | | Species or species habitat may occur within area overfly marine area |
| Calidris acuminata<br>Sharp-tailed Sandpiper [874] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Calidris canutus<br>Red Knot, Knot [855] | Endangered | Species or species habitat known to occur within area overfly marine area |
| Calidris ferruginea<br>Curlew Sandpiper [856] | Critically Endangered | Species or species habitat may occur within area overfly marine area |
| Calidris melanotos<br>Pectoral Sandpiper [858] | | Species or species habitat may occur within area overfly marine area |
| Calonectris leucomelas<br>Streaked Shearwater [1077] | | Species or species habitat known to occur within area |
| Cecropis daurica as Hirundo daurica<br>Red-rumped Swallow [80610] | | Species or species habitat may occur within area overfly marine area |
| Charadrius leschenaultii<br>Greater Sand Plover, Large Sand Plover [877] | Vulnerable | Species or species habitat known to occur within area |
| Charadrius veredus<br>Oriental Plover, Oriental Dotterel [882] | | Species or species habitat may occur within area overfly marine area |
| Fregata ariel<br>Lesser Frigatebird, Least Frigatebird [1012] | | Species or species habitat likely to occur within area |
| Fregata minor<br>Great Frigatebird, Greater Frigatebird [1013] | | Species or species habitat likely to occur within area |
| Glareola maldivarum<br>Oriental Pratincole [840] | | Species or species habitat may occur within area overfly marine area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Haliaeetus leucogaster<br>White-bellied Sea-Eagle [943] | | Species or species habitat likely to occur within area |
| Hirundo rustica<br>Barn Swallow [662] | | Species or species habitat may occur within area overfly marine area |
| Limosa lapponica<br>Bar-tailed Godwit [844] | | Species or species habitat known to occur within area |
| Merops ornatus<br>Rainbow Bee-eater [670] | | Species or species habitat may occur within area overfly marine area |
| Numenius madagascariensis<br>Eastern Curlew, Far Eastern Curlew [847] | Critically Endangered | Species or species habitat known to occur within area |
| Pandion haliaetus<br>Osprey [952] | | Species or species habitat known to occur within area |
| Phaethon lepturus<br>White-tailed Tropicbird [1014] | | Species or species habitat may occur within area |
| Rhipidura rufifrons<br>Rufous Fantail [592] | | Species or species habitat known to occur within area overfly marine area |
| Rostratula australis as Rostratula benghalensis (sensu lato)<br>Australian Painted Snipe [77037] | Endangered | Species or species habitat may occur within area overfly marine area |
| Thalasseus bergii as Sterna bergii<br>Greater Crested Tern [83000] | | Breeding likely to occur within area |
| **Fish** | | |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Bhanotia fasciolata<br>Corrugated Pipefish, Barbed Pipefish [66188] | | Species or species habitat may occur within area |
| Campichthys tricarinatus<br>Three-keel Pipefish [66192] | | Species or species habitat may occur within area |
| Choeroichthys brachysoma<br>Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194] | | Species or species habitat may occur within area |
| Choeroichthys suillus<br>Pig-snouted Pipefish [66198] | | Species or species habitat may occur within area |
| Corythoichthys amplexus<br>Fijian Banded Pipefish, Brown-banded Pipefish [66199] | | Species or species habitat may occur within area |
| Corythoichthys flavofasciatus<br>Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200] | | Species or species habitat may occur within area |
| Corythoichthys haematopterus<br>Reef-top Pipefish [66201] | | Species or species habitat may occur within area |
| Corythoichthys intestinalis<br>Australian Messmate Pipefish, Banded Pipefish [66202] | | Species or species habitat may occur within area |
| Corythoichthys schultzi<br>Schultz's Pipefish [66205] | | Species or species habitat may occur within area |
| Cosmocampus banneri<br>Roughridge Pipefish [66206] | | Species or species habitat may occur within area |
| Doryrhamphus dactyliophorus<br>Banded Pipefish, Ringed Pipefish [66210] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Doryrhamphus excisus<br>Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211] | | Species or species habitat may occur within area |
| Doryrhamphus janssi<br>Cleaner Pipefish, Janss' Pipefish [66212] | | Species or species habitat may occur within area |
| Festucalex cinctus<br>Girdled Pipefish [66214] | | Species or species habitat may occur within area |
| Filicampus tigris<br>Tiger Pipefish [66217] | | Species or species habitat may occur within area |
| Halicampus brocki<br>Brock's Pipefish [66219] | | Species or species habitat may occur within area |
| Halicampus dunckeri<br>Red-hair Pipefish, Duncker's Pipefish [66220] | | Species or species habitat may occur within area |
| Halicampus grayi<br>Mud Pipefish, Gray's Pipefish [66221] | | Species or species habitat may occur within area |
| Halicampus spinirostris<br>Spiny-snout Pipefish [66225] | | Species or species habitat may occur within area |
| Haliichthys taeniophorus<br>Ribboned Pipehorse, Ribboned Seadragon [66226] | | Species or species habitat may occur within area |
| Hippichthys cyanospilos<br>Blue-speckled Pipefish, Blue-spotted Pipefish [66228] | | Species or species habitat may occur within area |
| Hippichthys parvicarinatus<br>Short-keel Pipefish, Short-keeled Pipefish [66230] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Hippichthys penicillus<br>Beady Pipefish, Steep-nosed Pipefish [66231] | | Species or species habitat may occur within area |
| Hippocampus histrix<br>Spiny Seahorse, Thorny Seahorse [66236] | | Species or species habitat may occur within area |
| Hippocampus kuda<br>Spotted Seahorse, Yellow Seahorse [66237] | | Species or species habitat may occur within area |
| Hippocampus planifrons<br>Flat-face Seahorse [66238] | | Species or species habitat may occur within area |
| Hippocampus spinosissimus<br>Hedgehog Seahorse [66239] | | Species or species habitat may occur within area |
| Micrognathus micronotopterus<br>Tidepool Pipefish [66255] | | Species or species habitat may occur within area |
| Solegnathus hardwickii<br>Pallid Pipehorse, Hardwick's Pipehorse [66272] | | Species or species habitat may occur within area |
| Solegnathus lettiensis<br>Gunther's Pipehorse, Indonesian Pipefish [66273] | | Species or species habitat may occur within area |
| Solenostomus cyanopterus<br>Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183] | | Species or species habitat may occur within area |
| Syngnathoides biaculeatus<br>Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279] | | Species or species habitat may occur within area |
| Trachyrhamphus bicoarctatus<br>Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Trachyrhamphus longirostris<br>Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281] | | Species or species habitat may occur within area |
| **Mammal** | | |
| Dugong dugon<br>Dugong [28] | | Species or species habitat known to occur within area |
| **Reptile** | | |
| Acalyptophis peronii<br>Horned Seasnake [1114] | | Species or species habitat may occur within area |
| Aipysurus duboisii<br>Dubois' Seasnake [1116] | | Species or species habitat may occur within area |
| Aipysurus eydouxii<br>Spine-tailed Seasnake [1117] | | Species or species habitat may occur within area |
| Aipysurus laevis<br>Olive Seasnake [1120] | | Species or species habitat may occur within area |
| Astrotia stokesii<br>Stokes' Seasnake [1122] | | Species or species habitat may occur within area |
| Caretta caretta<br>Loggerhead Turtle [1763] | Endangered | Species or species habitat known to occur within area |
| Chelonia mydas<br>Green Turtle [1765] | Vulnerable | Breeding known to occur within area |
| Chitulia inornata as Hydrophis inornatus<br>Plain Seasnake [87379] | | Species or species habitat may occur within area |
| Chitulia ornata as Hydrophis ornatus<br>Spotted Seasnake, Ornate Reef Seasnake [87377] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
|---|---|---|
| Crocodylus porosus<br>Salt-water Crocodile, Estuarine Crocodile [1774] | | Species or species habitat likely to occur within area |
| Dermochelys coriacea<br>Leatherback Turtle, Leathery Turtle, Luth [1768] | Endangered | Breeding likely to occur within area |
| Disteira kingii<br>Spectacled Seasnake [1123] | | Species or species habitat may occur within area |
| Disteira major<br>Olive-headed Seasnake [1124] | | Species or species habitat may occur within area |
| Enhydrina schistosa<br>Beaked Seasnake [1126] | | Species or species habitat may occur within area |
| Eretmochelys imbricata<br>Hawksbill Turtle [1766] | Vulnerable | Breeding known to occur within area |
| Hydrelaps darwiniensis<br>Black-ringed Seasnake [1100] | | Species or species habitat may occur within area |
| Hydrophis atriceps<br>Black-headed Seasnake [1101] | | Species or species habitat may occur within area |
| Hydrophis elegans<br>Elegant Seasnake [1104] | | Species or species habitat may occur within area |
| Hydrophis macdowelli as Hydrophis mcdowelli<br>Small-headed Seasnake [75601] | | Species or species habitat may occur within area |
| Lapemis curtus as Lapemis hardwickii<br>Spine-bellied Seasnake [83554] | | Species or species habitat may occur within area |
| Leioselasma coggeri as Hydrophis coggeri<br>Black-headed Sea Snake, Slender-necked Seasnake [87373] | | Species or species habitat may occur within area |

| Scientific Name | Threatened Category | Presence Text |
| --- | --- | --- |
| Leioselasma pacifica as Hydrophis pacificus | | |
| Large-headed Seasnake, Pacific Seasnake [87378] | | 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 ]

| Current Scientific Name | Status | Type of Presence |
| --- | --- | --- |
| Mammal | | |
| 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 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 |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| Globicephala macrorhynchus<br>Short-finned Pilot Whale [62] | | Species or species habitat may occur within area |
| Grampus griseus<br>Risso's Dolphin, Grampus [64] | | Species or species habitat may occur within area |
| Kogia breviceps<br>Pygmy Sperm Whale [57] | | Species or species habitat may occur within area |
| Kogia sima as Kogia simus<br>Dwarf Sperm Whale [85043] | | Species or species habitat may occur within area |
| Megaptera novaeangliae<br>Humpback Whale [38] | | Species or species habitat likely to occur within area |
| Orcaella heinsohni as Orcaella brevirostris<br>Australian Snubfin Dolphin [81322] | | Species or species habitat known to occur within area |
| Orcinus orca<br>Killer Whale, Orca [46] | | Species or species habitat may occur within area |
| Peponocephala electra<br>Melon-headed Whale [47] | | Species or species habitat may occur within area |
| Physeter macrocephalus<br>Sperm Whale [59] | | Species or species habitat may occur within area |
| Pseudorca crassidens<br>False Killer Whale [48] | | Species or species habitat likely to occur within area |
| Sousa sahulensis as Sousa chinensis<br>Australian Humpback Dolphin [87942] | | Species or species habitat known to occur within area |

| Current Scientific Name | Status | Type of Presence |
|---|---|---|
| Stenella attenuata<br>Spotted Dolphin, Pantropical Spotted Dolphin [51] | | Species or species habitat may occur within area |
| Stenella coeruleoalba<br>Striped Dolphin, Euphrosyne Dolphin [52] | | Species or species habitat may occur within area |
| Stenella longirostris<br>Long-snouted Spinner Dolphin [29] | | Species or species habitat may occur within area |
| Steno bredanensis<br>Rough-toothed Dolphin [30] | | Species or species habitat may occur within area |
| Tursiops aduncus<br>Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418] | | Species or species habitat likely to occur within area |
| Tursiops aduncus (Arafura/Timor Sea populations)<br>Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900] | | Species or species habitat known to occur within area |
| Tursiops truncatus s. str.<br>Bottlenose Dolphin [68417] | | Species or species habitat may occur within area |
| Ziphius cavirostris<br>Cuvier's Beaked Whale, Goose-beaked Whale [56] | | Species or species habitat may occur within area |

## Australian Marine Parks

[ Resource Information ]

| Park Name | Zone & IUCN Categories |
|---|---|
| Oceanic Shoals | Habitat Protection Zone (IUCN IV) |
| Oceanic Shoals | Multiple Use Zone (IUCN VI) |
| Oceanic Shoals | Special Purpose Zone (Trawl) (IUCN VI) |

## Habitat Critical to the Survival of Marine Turtles

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Aug - Sep | | |

| Scientific Name | Behaviour | Presence |
|---|---|---|
| Natator depressus Flatback Turtle [59257] | Nesting | Known to occur |
| **May - Jul** | | |
| Lepidochelys olivacea Olive Ridley Turtle [1767] | Nesting | Known to occur |

## Extra Information

EPBC Act Referrals [ Resource Information ]

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Darwin Pipeline Duplication (DPD) Project | 2022/09372 | | Assessment |
| Tiwi H2 Project | 2022/09347 | | Assessment |
| **Controlled action** | | | |
| Andranangoo Creek & Lethbridge Bay mineral sand mining | 2005/2155 | Controlled Action | Completed |
| Australia-ASEAN Power Link | 2020/8818 | Controlled Action | Proposed Decision |
| Hardwood Plantation | 2001/229 | Controlled Action | Post-Approval |
| Ichthys Gas Field, Offshore and onshore processing facilities and subsea pipeline | 2008/4208 | Controlled Action | Post-Approval |
| Kilimiraka Mineral Sands and Associated Infrastructure (Bathurst Island), NT | 2012/6587 | Controlled Action | Assessment Approach |
| Snake Bay Barramundi Sea Cage Farm | 2005/2150 | Controlled Action | Completed |
| **Not controlled action** | | | |
| Construction and operation of Radar Infrastructure | 2004/1406 | Not Controlled Action | Completed |
| Marine Survey for the Australia-ASEAN Power Link AAPL | 2020/8714 | Not Controlled Action | Completed |
| **Not controlled action (particular manner)** | | | |
| 2D Marine Seismic Survey | 2009/4728 | Not Controlled Action (Particular Manner) | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| 2D marine seismic survey of Braveheart,Kurrajong,Sunshine and Crocodile | 2006/2917 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic survey | 2009/5076 | Not Controlled Action (Particular Manner) | Post-Approval |
| 2D Seismic Survey - Petroleum Exploration Area NT/P68, Eastern Bonaparte Basin | 2006/2922 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D Seismic Survey | 2006/2729 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D Seismic Survey (NT/P68) | 2006/2980 | Not Controlled Action (Particular Manner) | Post-Approval |
| 3D Seismic Survey (NT/P68) | 2008/4121 | Not Controlled Action (Particular Manner) | Post-Approval |
| Bonaparte 3D & 2D Seismic Survey, in NT/P82, Timor Sea | 2012/6398 | Not Controlled Action (Particular Manner) | Post-Approval |
| Bonaparte Basin Seabed Mapping Survey | 2009/4951 | Not Controlled Action (Particular Manner) | Post-Approval |
| Bonaparte Seismic and Bathymetric Survey | 2012/6295 | Not Controlled Action (Particular Manner) | Post-Approval |
| Caldita 3D Marine Seismic Survey - NT/P61, NT/P69, and acreage release area NT06-5 | 2006/3142 | Not Controlled Action (Particular Manner) | Post-Approval |
| Eni Bathurst 3D Seismic Survey | 2011/6118 | Not Controlled Action (Particular Manner) | Post-Approval |
| Joseph Bonaparte Gulf Seabed mapping survey | 2010/5517 | Not Controlled Action (Particular | Post-Approval |

| Title of referral | Reference | Referral Outcome | Assessment Status |
|---|---|---|---|
| Not controlled action (particular manner) | | | |
| | | Manner) | |
| Kingtree & Ironstone-1 Exploration Wells | 2011/5935 | Not Controlled Action (Particular Manner) | Post-Approval |
| Marine Environmental Survey 2012 | 2012/6310 | Not Controlled Action (Particular Manner) | Post-Approval |
| Offshore Fibre Optic Cable Network Construction & Operation, Port Hedland WA to Darwin NT | 2014/7223 | Not Controlled Action (Particular Manner) | Post-Approval |
| Panda NT/P76 3D Seismic Acquisition Survey Program | 2009/4992 | Not Controlled Action (Particular Manner) | Post-Approval |
| Port Melville marine supply base, Melville Island | 2015/7510 | Not Controlled Action (Particular Manner) | Post-Approval |
| Removal of Potential Unexploded Ordnance within NAXA | 2012/6503 | Not Controlled Action (Particular Manner) | Post-Approval |
| Westralia SPAN Marine Seismic Survey, WA & NT | 2012/6463 | Not Controlled Action (Particular Manner) | Post-Approval |
| Referral decision | | | |
| 2D Marine Seismic Survey | 2008/4623 | Referral Decision | Completed |
| 3D Seismic Survey (NT/P68) | 2006/2949 | Referral Decision | Completed |

## Key Ecological Features [ 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 Diemen Rise | North |
| Shelf break and slope of the Arafura Shelf | North |

## Biologically Important Areas

| Scientific Name | Behaviour | Presence |
|---|---|---|
| **Marine Turtles** | | |
| Chelonia mydas<br>Green Turtle [1765] | Foraging | Known to occur |
| Chelonia mydas<br>Green Turtle [1765] | Internesting | Likely to occur |
| Lepidochelys olivacea<br>Olive Ridley Turtle [1767] | Foraging | Known to occur |
| Lepidochelys olivacea<br>Olive Ridley Turtle [1767] | Internesting | Likely to occur |
| Natator depressus<br>Flatback Turtle [59257] | Internesting | Likely to occur |
| **Seabirds** | | |
| Thalasseus bergii<br>Crested Tern [83000] | Breeding (high numbers) | Known to occur |
| **Whales** | | |
| Balaenoptera musculus brevicauda<br>Pygmy Blue Whale [81317] | Distribution | Known to occur |

# Caveat

## 1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

## 2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

## 3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

## 4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

# 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 C – PRE-SPILL NET ENVIRONMENTAL BENEFIT ANALYSIS ASSESSMENT AND AS LOW AS REASONABLY PRACTICABLE ASSESSMENT OF RESPONSE STRATEGIES

The objective of the net environmental benefit analysis (NEBA) process is to identify the potential net environmental benefit to key sensitive receptors associated with the implementation of potential spill response options. The process allows a comparison of response options and identifies potential impacts to sensitive receptors of implementing these options, compared to the unmitigated impacts of the spill. The process also allows assessment of the value of implementing multiple response options.

The NEBA process comprised two main parts:

1. Pre-spill (or strategic) NEBA of response options, which included consideration of the credible spill scenarios, feasible response options and sensitive environmental receptors to determine primary and secondary response options. The pre-spill NEBA determined the suite of response options that are selected in the OPEP.
2. Spill response (operational) NEBA of response options, which includes a review of the pre-spill NEBA and incorporation of spill surveillance observations, spill trajectory data and operational monitoring information.

The pre-spill NEBA was preceded by an oil spill response workshop that identified the feasible suite of response options that were assessed in the pre-spill NEBA. Outputs from the pre-spill NEBA will be incorporated into the spill response (operational) NEBA during an incident.

**Pre-spill NEBA**

The following tasks are undertaken during the planning phase:

Task A: Define sensitive receptors

The aim of Task A was to determine the spatial extent of the adverse exposure zone defined by the spill modelling and identify the sensitive environmental receptors within this zone. The outputs from the pre-spill modelling of the worst-case credible hydrocarbon spill scenarios (**Sections 5.3.7** and **5.3.8**) were used to define the adverse exposure zone and identify sensitive receptor locations.

The aim of Task A was to determine the spatial extent of the adverse exposure zone defined by the spill modelling and identify the sensitive environmental receptors within this zone. The outputs from the pre-spill modelling of the worst-case credible hydrocarbon spill scenarios (**Sections 5.3.7** and **5.3.8**) were used to define the adverse exposure zone and identify sensitive receptor locations.

Task B: Understand and rank key sensitivities

Environmental, socio-economic and cultural values and sensitivities (e.g. mangroves, turtles, commercial fisheries, tourism) within the adverse exposure zone were allocated a priority value/ranking based on their sensitivity/vulnerability to hydrocarbon pollution.

Task C: Assign ranking to known locations in marine bioregions where sensitive receptors occur

The occurrence of specific values and sensitivities (e.g. hard corals, commercial shipping) were identified for each sensitive receptor within the adverse exposure zone. The priority value/ranking (Task B) were assigned to each asset/value.

Task D: Assess spill response options

Potential impacts of response options on assets/values were identified for each spill response option for each spill scenario. As part of determining the most suitable response options, consideration was given to the:

+ benefits and drawbacks of each response option, when compared to the 'no intervention' option – this included consideration of feasibility and effectiveness
+ specific impacts and risks of applying the response option to the credible spill scenarios listed in **Sections 5.3.7** and **5.3.8**.

A summary of this information is provided in Table C-1, which forms part of the ALARP assessment for response options.

**Spill response NEBA**

The modelling outputs and spill observations to be used during this process will be both the preparedness modelling (using the credible hydrocarbon spill scenario most appropriate to the nature and scale of the release), the oil spill trajectory modelling (OSTM) and observations of the spill. The OSTM will be used to "ground-truth" pre-spill credible hydrocarbon spill scenario modelling outputs, identify risk to sensitive receptors and to identify spill response priorities for implementation of spill response options.

Task 1: Identify spill response priorities

Validate or re-evaluate spill response priorities based on actual spill trajectory modelling, to make sure that the priorities are representative of the actual spill.

Task 2: Complete NEBA matrix for actual spill

Review the preparedness NEBA. Where necessary, repeat the process to provide a revised spill-specific NEBA matrix.

Task 3: Undertake spill response

Identify the most appropriate spill response option/s based on the NEBA outcomes. The response option/s will then be implemented.

*Table C-1: Net environmental benefit analysis and as low as reasonably practicable evaluation of response options*

| Response Option | NEBA Considerations | | | Summary of ALARP Conclusions |
|---|---|---|---|---|
| | Benefits | Drawbacks | Specific Risks/Impacts of the Response Option | |
| Monitor and evaluate | + Provides situational awareness<br>+ Some components (e.g. tracking buoys, oil spill trajectory monitoring) can be rapidly mobilised/implemented and provide early data back to the IMT<br>+ Supports a coordinated response effort<br>+ Allows re-evaluation of response priorities<br>+ Can identify significant changes in risk and presence of key sensitivities, which may trigger a revision of the NEBA<br>+ Provides information on the efficacy and potential impacts (positive or negative) of other response options<br>+ May be suitable option if there is a low threat to environment and/or people<br>+ Minimal waste footprint | + No direct effect on the spill; oil remains in the environment<br>+ Visual methods typically constrained to daylight hours<br>+ Some methods can be limited by provision of information at small spatial scales (e.g. vessel-based observations) or by environmental/weather conditions (e.g. aerial and satellite photo/video imagery)<br>+ Limited resource availability (e.g. vessels, aircraft) immediately after spill detection<br>+ Range in the time required to receive data from different components, from two hours (e.g. satellite tracking buoy) to up to two days (e.g. modelling)<br>+ Public perception of 'no response' | + Potential health and safety risks to responders close to the release location; e.g. from VOCs | The requirement for situational awareness is critical to implementing a coordinated, focussed and effective spill response. Implementation of other response options will be informed by information collected by monitor and evaluate tactics. Monitor and evaluate tactics typically present little or no environmental risk. The suite of tactics within the monitor and evaluate option allow the response to be scaled and customised based on the nature and scale of the spill.<br>The benefits of undertaking this response outweigh the potential environmental risks/impacts. Hence, monitor and evaluate is a primary response strategy. |
| Wildlife response – hazing | + Potential to reduce risk of wildlife being contacted by hydrocarbons | + Dependent on monitor and evaluate response identifying aggregations, and therefore likely to be reactive rather than proactive, thereby limiting effectiveness<br>+ Many species may not be visible during monitor and evaluate due to | + Wildlife aggregations identified from the monitor and evaluate option are likely to have moved during the period required to mobilise a response, | Although this approach may reduce environmental risk from a spill, success rate is likely to be low due to the time to mobilise a response and likelihood of finding the target, particularly given there are unlikely to be significant aggregations of wildlife amenable to hazing. |

| Response Option | NEBA Considerations | | | Summary of ALARP Conclusions |
|---|---|---|---|---|
| | Benefits | Drawbacks | Specific Risks/Impacts of the Response Option | |
| | | the lack of time they spend on the ocean surface<br>+ Limited resources in the response area to support this response, resulting in delays in relocating individuals to suitable rehabilitation facilities<br>+ Potential regulatory issues with regards to disturbance of protected species (e.g. potential permit requirements)<br>+ Time to respond to reports of aggregations may be prolonged due to distance from the point of mobilisation – aggregations may have been exposed to hydrocarbons, moved or dispersed in the intervening period<br>+ Of limited use in remote offshore locations | making it difficult to relocate the target<br>+ May cause additional stress and disorientation to hazed wildlife<br>+ Wildlife may become acclimatised to hazing, which may reduce hazing effectiveness | Competing needs for limited resources may mean that this response is unlikely to be actionable at all times throughout the response phase.<br>The benefits of undertaking this response, in accordance with the conditions discussed above, outweigh the potential environmental risks/impacts in some circumstances. Hence, wildlife response – hazing is a secondary response strategy. This means that this response would not be automatically triggered but will be considered where it is safe and practicable to implement, and where significant aggregations of wildlife are detected during the monitor and evaluate response.<br>Implementing wildlife hazing on the shoreline would result in health and safety risks to personnel due to the remote tropical location and lack of infrastructure (e.g. access roads). Shoreline-based hazing is likely to be effective for birds, which are not at high risk from spilled oil as little MDO is predicted to accumulate on shorelines. Displacing seabirds from the shoreline may expose them to floating oil at sea. Hence, the wildlife hazing secondary response strategy would only be implemented in offshore or nearshore waters. |

| Response Option | NEBA Considerations | | | Summary of ALARP Conclusions |
|---|---|---|---|---|
| | Benefits | Drawbacks | Specific Risks/Impacts of the Response Option | |
| Pre-emptive capture/ post-contact wildlife response | + Potential to reduce risk of wildlife being contacted by hydrocarbons<br>+ Potential to rehabilitate some oiled fauna | + Time to respond to reports of aggregations may be prolonged due to distance from the point of mobilisation (e.g. oiled fauna may be deceased prior to arrival of oiled wildlife personnel)<br>+ Limited resources in the response area to support this response<br>+ Potential regulatory issues with regards to disturbance of protected species (e.g. potential permit requirements)<br>+ Of limited use in remote offshore locations | + Wildlife aggregations identified from the monitor and evaluate option may have moved (pre-emptive) or are deceased (post-contact), limiting effectiveness<br>+ Pre-emptive capture and oiled wildlife activities may cause additional stress or mortality to wildlife<br>+ Not practicable for many marine fauna (e.g. cetaceans) | Wildlife that have been exposed to spilled oil may be captured, treated and subsequently released, potentially reducing the effects of oil exposure. Spilled MDO is expected to spread rapidly due to its low viscosity in tropical waters, forming very thin surface slicks. Given the nature of MDO, significant oiling (i.e. such at capture and cleaning would be effective) is likely to be restricted to the area immediately around the release location.<br>Likewise, pre-emptive capture is likely to be restricted to the area immediately around the release location. The effectiveness of this strategy will be highly dependent on the receptors present and the nature and scale of the hydrocarbon spill.<br>The benefits of undertaking this response, in accordance with the conditions discussed above, outweigh the potential environmental risks/impacts in some circumstances. Pre-emptive capture/post contact wildlife response is a secondary response strategy. This means that this response would not be automatically triggered but will be considered where it is safe and practicable to implement, and where significant aggregations of wildlife are detected during the monitor and evaluate response. |

| Response Option | NEBA Considerations | | | Summary of ALARP Conclusions |
|---|---|---|---|---|
| | Benefits | Drawbacks | Specific Risks/Impacts of the Response Option | |
| (Mechanical) physical dispersion | + Easy to complete where support/response vessels are already in place<br>+ No additional equipment required<br>+ Minimal waste footprint<br>+ Potential for vessel collision with marine fauna | + Entrained fuel will weather more slowly – better to leave it on the surface to enhance weathering<br>+ Only suitable for small spills<br>+ Limited effects of the technique in highly volatile, rapidly evaporating spills<br>+ Vessel may be diverted to support additional response operations<br>+ Does not remove oil from the environment | + Practice may be dangerous for response personnel given the volatile nature of MDO | Mechanical dispersion may result in increased entrainment of MDO in the water column, which may reduce weathering as the oil is no longer exposed to the atmosphere. Given MDO is expected to weather rapidly at the surface, physical dispersion may slow down the weathering process and prolong the period during which the spill may harm environmental receptors.<br>Hence, mechanical dispersion is not an effective response option and has been excluded from implementation. |
| Chemical dispersants (surface application) | + Potential reduction of hydrocarbon on sea surface, thereby protecting sensitive surface-dwelling and shoreline receptors<br>+ Potential reduction in exposure of responders to VOCs<br>+ No recovered oil storage and therefore waste<br>+ Less labour intensive than other options | + Potential impacts from toxicity of dispersed oil on sub-surface marine fauna and habitats<br>+ Limited window of opportunity for instantaneous spills and long mobilisation times (due to remote location)<br>+ Does not directly remove hydrocarbons from the environment, but disperses them into the water column<br>+ Potential impact to market confidence for fisheries | + MDO will weather rapidly following release and will naturally disperse in most conditions. Application of dispersant may result in the dispersed droplets dropping through the thin film on the surface and into the water column causing 'herding/clumping' of hydrocarbons | Chemical dispersion may result in increased entrainment of MDO in the water column, which may reduce weathering as the oil is no longer exposed to the atmosphere. Given MDO is expected to weather rapidly at the surface, chemical dispersion may slow down the weathering process, which may prolong the period during which the spill may harm environmental receptors.<br>Hence, chemical dispersion is not an effective response option and has been excluded from implementation. |

Santos

| Response Option | NEBA Considerations | | | Summary of ALARP Conclusions |
|---|---|---|---|---|
| | Benefits | Drawbacks | Specific Risks/Impacts of the Response Option | |
| Containment and recovery | + Deployment of boom may contain surface hydrocarbons for recovery<br>+ Low potential for adverse environmental impacts<br>+ Will reduce the volume of the surface slick, reducing potential impact | + Limited window of opportunity for instantaneous spills as spilled MDO is expected to spread rapidly<br>+ Resource intensive and requires specialised equipment and trained personnel<br>+ Containment boom not suited to strong currents (0.8 knots and greater), winds (<15 knots) or high sea state (Beaufort scale 3 to 4) (i.e. offshore)<br>+ Skimmers capacity may be reduced for low viscosity hydrocarbons. Skimmer types that may be effective offshore for low viscosity hydrocarbons include oleophilic or screw weir skimmers.<br>+ Disposal of recovered product and contaminated boom require allocation of resources and transport to registered disposal sites (potentially interstate or internationally)<br>+ Most effective close to source, where there are likely to be HSE considerations (re: VOCs at the surface) | + Potential risk of deploying this option from VOCs<br>+ Open, offshore environment and properties of MDO would reduce the efficacy of this option | Not practicable for smaller spills, as the time to mobilise would be too long to be able to respond as the spill will have dispersed to a point where containment and recovery is no longer practicable. Booming is likely to be of low efficacy, as recovery rates of MDO are low, especially in open offshore waters.<br>Hence, containment and recovery is not an effective response option and has been excluded from implementation. |

| Response Option | NEBA Considerations | | | Summary of ALARP Conclusions |
|---|---|---|---|---|
| | Benefits | Drawbacks | Specific Risks/Impacts of the Response Option | |
| Shoreline protection and deflection | + Protective booming may mitigate or prevent shoreline impacts<br>+ Can combine with shoreline clean-up or wildlife response activities to reduce cumulative impacts | + Labour intensive and typically requires constant tending or monitoring, which may not be feasible in remote locations<br>+ Not feasible in many remote coastal environments due to access constraints and high tidal ranges<br>+ Significant health and safety risks when working on remote Tiwi Islands shorelines (e.g. crocodiles, feral pigs, remote locations, high temperatures)<br>+ Very little infrastructure in the region (e.g. roads, access points to beaches, etc)<br>+ Secondary contamination is possible from equipment and/or personnel involved in the activities | + Potential for disturbance to nearshore and shoreline habitats (e.g. turtle nesting beaches, bird nesting/feeding areas) from equipment and personnel, especially if several teams are deployed | Modelling indicates low probability of shoreline contact by non-persistent hydrocarbons. Shoreline protection and deflection activities involve mobilising personnel and equipment to remote coastal environments, which can result in physical disturbance to intertidal and shoreline habitats. Leaving the product to degrade naturally would cause less harm than active methods of protection and deflection.<br>Given the nature of the hydrocarbon and the shoreline environments of the Tiwi Islands, shoreline protection and deflection is not expected to be an effective response strategy.<br>The benefits of undertaking this response, in accordance with the conditions discussed above, do not outweigh the potential risks/impacts in most circumstances. Considerable health and safety risks would need to be managed in implementing this response and may preclude implementation of this response.<br>Hence, shoreline protection and deflection has been excluded from implementation. |
| Shoreline clean-up | + Removes hydrocarbons from the environment<br>+ Reduces potential for remobilisation of the hydrocarbons<br>+ Reduces potential of oiling of fauna | + Labour, logistics and equipment intensive, which may not be feasible in remote locations | + Potential to damage sensitive shoreline receptors if clean-up activities are initiated for shoreline accumulation | Modelling indicates low probability of shoreline contact and contact exposure levels well below thresholds that would cause significant impact. Shoreline clean-up activities involve mobilising personnel and equipment to remote coastal |

| Response Option | NEBA Considerations | | | Summary of ALARP Conclusions |
|---|---|---|---|---|
| | Benefits | Drawbacks | Specific Risks/Impacts of the Response Option | |
| | | + Not feasible in many remote coastal environments due to access constraints and high tidal ranges<br>+ Some clean-up methods are harmful and create longer-term damage than natural degradation (particularly for small volumes)<br>+ Significant waste generation<br>+ Significant health and safety risks when working on remote Tiwi Islands shorelines (e.g. crocodiles, feral pigs, remote locations, high temperatures)<br>+ Very little infrastructure in the region (e.g. roads, access points to beaches, etc)<br>+ Can result in direct and indirect impacts (e.g. trampling, secondary waste contamination, disturbance to wildlife and changes to the geomorphological form of the shoreline) | concentrations <100 g/m².<br>+ Potential for disturbance to nearshore and shoreline habitats (e.g. turtle nesting beaches, bird nesting/feeding areas) from equipment and personnel<br>+ Large numbers of clean-up teams have potential of causing longer term damage to sensitive receptors than if the hydrocarbons were left to degrade naturally<br>+ Remote shorelines in the region reduce effectiveness due to the lack of infrastructure (e.g. roads, access points, etc)<br>+ Considerable health and safety risks due to fauna and remote tropical location | environments, which can result in physical disturbance to intertidal and shoreline habitats. Given the small volumes and area of shoreline predicted to be impacted, leaving the product to degrade naturally would cause less harm than active methods of clean-up.<br>Given the nature of the hydrocarbon and the shoreline environments of the Tiwi Islands, shoreline clean-up is not expected to be an effective response strategy. The benefits of conducting this response option do not outweigh the potential risks/impacts.<br>Hence, shoreline protection and deflection has been excluded from implementation. |

**Barossa Gas Export Pipeline Installation Pre-spill NEBA Outcomes**

Table C-2 presents a summary of the outcomes of the NEBA process and outlines response options which may result in a net environmental benefit for the credible hydrocarbon spill scenarios defined in **Sections 5.3.7** and **5.3.8**.

***Table C-2: Proposed spill response options for each credible hydrocarbon spill scenario following the net environmental benefit analysis***

| Response Option | Scenario 1 – Vessel Collision Resulting in 700 m³ Release of MDO | Scenario 2 – Bunkering Incident Resulting in 10 m³ Release Of MDO |
|---|---|---|
| Monitor and evaluate | + Primary response option | |
| Wildlife response – hazing | + Secondary response option. Only likely to be applied where wildlife is identified as being at risk of being oiled | N/A |
| Pre-emptive capture/ post-contact wildlife response strategy | + Secondary response option. Only likely to be applied where wildlife is identified as being at risk of being/have been oiled | N/A |
| (Mechanical) physical dispersion | N/A | N/A |
| Chemical dispersion – surface application | N/A | N/A |
| Chemical dispersion – subsurface application | N/A | N/A |
| Containment and recovery | N/A | N/A |
| Protection and deflection | N/A | N/A |
| Shoreline clean-up | N/A | N/A |

\+ – possible positive environmental benefit

\- – likely to have a negative environmental benefit or are not feasible or practicable

N/A – Response option excluded after ore-spill NEBA

# APPENDIX D – NATIONAL OFFSHORE PETROLEUM SAFETY AND ENVIRONMENTAL MANAGEMENT AUTHORITY REPORTING FORMS

**Appendix D1: Recordable Environmental Incident Monthly Report**

**Appendix D2: Report of an accident, dangerous occurrence or environmental incident**

See https://www.nopsema.gov.au/environmental-management/environment-resources/

# APPENDIX E – STAKEHOLDER CONSULTATION

# APPENDIX F– COMPARISON OF OFFSHORE PROJECT PROPOSAL AND THE ENVIRONMENT PLAN

As described in **Section 2** of the EP, engineering design has progressed since NOPSEMA accepted the OPP in March 2018. Further engineering work has been completed for the pipeline and more details are known about the gas export pipeline installation campaign based on further discussions with potential installation contractors, which has resulted in some changes to the way the Activity was described in the OPP. Table G-1 presents the changes and details why there is no overall change in environmental impacts or risks. The changes are not considered major and the overall activity description, risk assessment and conclusions in this EP are consistent with those presented in the OPP. Table G-2 provides a comparison of the EPOs presented in the OPP and this EP and evaluates

***Table G-1: Comparison of the project description in the Offshore Project Proposal to the differences identified in the activity description in this Environment Plan***

| Project Description in the Barossa OPP | Activity Description in this EP | Comparison between Barossa OPP and this EP |
|---|---|---|
| Discharge of Fluids<br>+ Total volumes of fluids (gas export pipeline and in-field flowlines) in the order of approximately 107,500 $m^3$ and 145,000 $m^3$<br>+ Dewatering will include ~97,000 $m^3$ of treated seawater released subsea at the FPSO facility end of the gas export pipeline (e.g. within the Barossa offshore development area)<br>+ Hydrotest conducted to test structural integrity of the gas export pipeline, treated seawater ~1,300$m^3$ in one event up to a total of 3,000 $m^3$. Hydrotest water will be released at the sea surface at either the FPSO facility end of the export pipeline or at the Bayu-Undan pipeline tie-in end of the export pipeline. | Volumes have been refined as follows:<br>+ Dewatering ~85,000 $m^3$<br>+ During flooding ~12,000 $m^3$ or ~15,000 $m^3$, depending on release location<br>+ Hydrotest ~2000 $m^3$<br>+ MEG ~1,000 $m^3$<br>+ Total ~102,000 $m^3$<br>There is the potential for the FCGT water (12,000 $m^3$ or 15,000 $m^3$) to be a surface release. | The OPP stated that<br>*'EPs will detail dewatering requirements, including locations and volumes'*.<br>As per the OPP commitment the bulk dewatering (~85,000 $m^3$) will be discharged at the FPSO PLET location. However, all other treated seawater discharges may occur at either end of the pipeline, subject to contractor methodology. The volumes have been refined based on more detailed information. The dewatering volume has decreased from the OPP, however the volumes for the FCGT were not specified in the OPP as they were unknown at the time. The total volume of treated seawater is still within the total volume that was used for the impact assessment in the OPP and there has been no change to the severity of the consequence level for this impact (**Section 5.2.7**) |

*Table G-2: Comparison of environmental performance outcomes in the Offshore Project Proposal and the Environment Plan*

| Environmental Impacts/Risks | Relevant EPOs from the Barossa OPP (Section/Table reference) | EPOs in this EP (Section reference) | Comparison between Barossa OPP and this EP |
|---|---|---|---|
| Interaction with other marine users | No vessel collisions or significant adverse interactions with other marine users (Table 6-9). | No substantial adverse effect on other marine users (EP **Section 5.2.1**). | Level of environment protection/outcome as included in the OPP EPO has been maintained for the EP. |
| Seabed disturbance | No permanent disturbance to benthic habitats beyond the physical footprint of offshore facilities/infrastructure within the Barossa offshore development area and gas export pipeline, as relevant to both direct and indirect sources of disturbance to seabed and associated benthic habitats (Table 6-15). | Direct impacts to benthic habitats will be restricted to the footprint of the pipeline and supporting structures.<br>Beyond the footprint of the pipeline and supporting structures impact will be limited to localised, short-term disturbance associated with suspension and deposition of surface sediment (EP **Section 5.2.2**). | Wording of the EP EPO is consistent with the OPP EPO. |
| | No anchoring or mooring of the FPSO facility and MODU/vessels on shoals/banks, except in emergency conditions (Table 6-15). | | This has been included as a control within the EP (C2.6) |
| | The gas export pipeline route will be designed to minimise, where practicable, impacts to areas of seabed that are associated with the seafloor features/values of KEFs and shoals/banks (Table 6-15). | | Gas export pipeline route selection has been detailed in the risk assessment and is not considered an EPO for the EP. |
| | To minimise impact to representative species, assemblages and associated values of the Oceanic Shoals marine park, further studies will be used to inform final pipeline routing so the pipeline will not be installed on those representative species, assemblages and associated values if they have not been found in the marine park outside the pipeline corridor (Table 6-15). | | |

| Environmental Impacts/Risks | Relevant EPOs from the Barossa OPP (Section/Table reference) | EPOs in this EP (Section reference) | Comparison between Barossa OPP and this EP |
|---|---|---|---|
| | No significant impacts to turtle or dugong populations from impacts (direct or indirect) associated with installation of the gas export pipeline (Table 6-15). | | As detailed in the impact assessment no significant impacts are expected from the activity. |
| Underwater noise | No significant impacts to turtle populations from noise generated during installation of the gas export pipeline (Table 6-26). | No significant impacts to marine fauna from noise generated during the gas export pipeline installation campaign.<br>No displacement of marine turtles from habitat critical to the survival of marine turtles during the pipelay installation activities and biologically important behaviour to continue in BIAs (**Section 5.2.3**). | EPO in the EP is consistent with the OPP and has been expanded to include all marine fauna, resulting in a better level of environment outcome than the OPP. |
| Light emissions | Light spill from the MODUs/drill ships, FPSO facility and project vessels will be limited to that required for safe operations and working requirements (Table 6-31). | No significant impacts to marine fauna from the gas export pipeline installation campaign.<br>No displacement of marine turtles from habitat critical to the survival of marine turtles during the pipelay installation activities and biologically important behaviour to continue in BIAs. (**Section 5.2.4**). | This has not been included as an EPO in the EP because it is a legislative requirement related to health and safety risks. |
| | No significant impacts to turtle populations from installation of the gas export pipeline (Table 6-31). | | EPO in the EP is consistent with the OPP and has been expanded to include all marine fauna, resulting in a better level of environment outcome than the OPP. |
| Atmospheric emissions | Atmospheric emissions associated with the project will meet all regulatory source emission standards (Table 6-28). | No substantial change in air quality during the pipeline installation campaign that may adversely impact biodiversity, ecological integrity, social amenity or human health. (**Section 5.2.5**). | EPO in the EP is consistent with the OPP and has been further refined for the activity, resulting in the same level of environmental protection outcome as the OPP. |
| | Combustion engines and flaring equipment will be maintained according to vendor specifications to achieve optimal performance (Table 6-28). | | This is not an EPO and is achieved through the vessel vetting procedure which is detailed in the implementation strategy. |

| Environmental Impacts/Risks | Relevant EPOs from the Barossa OPP (Section/Table reference) | EPOs in this EP (Section reference) | Comparison between Barossa OPP and this EP |
| --- | --- | --- | --- |
| Planned discharges: treated seawater | Dewatering discharges will not extend beyond the Barossa offshore development area and will not impact areas of seabed that are associated with the seafloor features/values of KEFs or the nearest shoals/banks of Lynedoch Bank, Tassie Shoal or Evans Shoal (Table 6-39). | No substantial change in water quality during the pipeline installation campaign that may adversely impact biodiversity, ecological integrity, social amenity or human health (**Section 5.2.6**). | Has not been included as an EPO however the impact assessment and modelling impacts demonstrate that this will be achieved. |
| | Reduce impacts to the marine environment from planned discharges through the application of a chemical assessment process, which includes an environment risk assessment (Table 6-39). | | Has not been included as an EPO in the EP however it has been incorporated as a control for the risk. |
| Dropped object | Minimise disturbance beyond the physical footprint by preventing the loss of significant equipment/cargo overboard from the MODU/drill ship, FPSO facility or vessels (Table 6-15). | No loss of equipment/cargo overboard from vessels resulting in a Consequence Severity greater than Minor (**Section 5.3.1**). | Wording is consistent with the intent of the EPO meeting the level of environmental protection as provided in the OPP. |
| IMS | Prevent the displacement of native marine species as a result of the introduction and establishment of IMS via project-related activities, facilities and vessels (Table 6-17). | No introduction of IMS (**Section 5.3.2**). | Wording is consistent with the intent of the EPO meeting the level of environmental protection as provided in the OPP. |
| Collision with marine fauna | Vessel speeds restricted in defined operational areas within the project area, to reduce the risk of physical interactions between cetaceans/marine reptiles and project vessels (Table 6-12). | Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with activity vessels operating within the Operational Area (**Section 5.3.3**). | This is a control to achieve the EPO and has been included. |
| | Zero incidents of injury/mortality of cetaceans/marine reptiles from collision with project vessels operating within the project area (Table 6-12). | | EPO has been adopted for the activity. |

| Environmental Impacts/Risks | Relevant EPOs from the Barossa OPP (Section/Table reference) | EPOs in this EP (Section reference) | Comparison between Barossa OPP and this EP |
|---|---|---|---|
| Unplanned subsea release: treated seawater | Reduce impacts to the marine environment from planned discharges through the application of a chemical assessment process, which includes an environment risk assessment (Table 6-39). | Zero unplanned discharge of chemicals to the marine environment as a result of gas export pipeline installation activities (**Section 5.3.4**). | This has been included as a control to minimise any impacts; however, the adopted EPO results in a better environmental outcome than that presented in the OPP. |
| Deck and minor subsea spills | Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of project activities (Table 6-48). | Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of gas export pipeline installation activities (**Section 5.3.5**). | EPO has been adopted for the activity. |
| Loss of hazardous and non-hazardous waste | Zero unplanned discharge of hazardous and non-hazardous wastes into the marine environment as a result of project activities (Table 6-42). | Zero unplanned discharge of hazardous and non-hazardous wastes into the marine environment as a result of project activities. (**Section 5.3.6**). | EPO has been adopted for the activity. |
| | Hazardous waste will be transported onshore for treatment and/or disposal at licenced treatment and disposal facilities (Table 6-42). | | EPO has not explicitly been adopted as Activities outside the operational area are out of the scope of this EP. |
| Vessel diesel spill | Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of project activities (Table 6-48). | Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of a vessel collision (**Section 5.3.7**). | EPO has been adopted for the activity. |
| | An activity specific OPEP that demonstrates adequate arrangements for responding to and monitoring oil pollution, in the event of a major unplanned release, will be accepted by NOPSEMA prior to commencing the activity (Table 6-48). | | This has been included as a control to minimise impacts. |
| Bunkering diesel spill | Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of project activities (Table 6-48). | Zero unplanned discharge of hydrocarbons or chemicals to the marine environment as a result of bunkering (**Section 5.3.8**). | EPO has been adopted for the activity. |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| *Gas Export Pipeline Route* | | | |
| The project will be undertaken in accordance with ConocoPhillips' CPMS, which provides the framework to achieve acceptable health, safety and environment outcomes such as:<br>+ design planning throughout concept select phase to avoid placement of facilities/infrastructure within the Barossa offshore development area in areas of regional environmental importance (e.g. shoals/banks, coral reefs, islands, and known regionally important feeding and breeding/nesting biologically important areas for marine mammals and marine reptiles)<br>+ use of gas export pipeline selection route surveys to inform route optimisation and reduce environmental impact. | 6.4.2<br>6.4.3<br>6.4.5 | A number of additional studies were undertaken to better understand the bathymetry and natural environment along the pipeline route (see **Section 4.2**). This information was used to inform route optimisation and reduce environmental impacts as described in **Section 5.2.2**. | **Section 4.2** and **5.2.2** |
| Pre-lay surveys of the gas export pipeline installation route will be used to identify areas of seabed that are associated with the seafloor features/values of the shelf break and slope of the Arafura Shelf and carbonate bank and terrace system of the Van Diemen Rise KEFs, seabed related conservation values associated with the Oceanic Shoals marine park or nearby shoals and banks (including Goodrich Bank, Marie Shoal and Shepparton Shoal). The outcomes of the pre-lay surveys will be used to inform route optimisation and reduce environmental impacts. | 6.4.3 | | |
| Further surveys within the pipeline corridor will be used to supplement existing knowledge from habitat assessments to date, to support an evaluation of the representativeness of species and species assemblages found within the portion of the gas export pipeline corridor that intersects the Oceanic Shoals marine park, with other areas of the marine park. | 6.4.3 | | |
| *Planned discharges* | | | |
| All planned discharges from vessels will comply with relevant MARPOL 73/78 and Australian Marine Order requirements (as appropriate for vessel classification). | 6.4.8.7 | The following controls have been included:<br>+ All wastes managed in accordance with vessel waste management plan (**C 13.1**)<br>+ Routine discharges of treated sewage, grey-water, putrescible waste, deck drainage, | **Section 5.2.6** and **5.2.7** |
| Oily bilge water from machinery space drainage is treated to a maximum concentration of 15 ppm OIW prior to discharge from vessels, as specified in MARPOL 73/78 (Annex I). | 6.4.8.7 | | |
| Offshore discharge of sewage from vessels will be in accordance with MARPOL 73/78 (Annex IV) and Marine Order 96. | 6.4.8.7 | | |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| Food wastes from vessels will be macerated to <25 mm diameter prior to discharge, in accordance with MARPOL 73/78 (Annex V) and Marine Order 95. | 6.4.8.7 | and bilge water in accordance with standard maritime practice (**C 6.1**) | |
| All wastes generated offshore will be managed in accordance with relevant legal requirements, including MARPOL 73/78 and Australian Marine Order requirements (as appropriate for vessel classification). | 6.4.9 | | |
| Detailed performance criteria for planned discharges will be defined in the activity-specific EPs. | 6.4.8.7 | See **Section 5.3.6** and **5.3.7** for detailed EPSs for planned discharges. | **Section 5.2.6** and **5.2.7** |
| The location of the dewatering discharge will be selected to minimise impact on areas of regional environmental importance (e.g. shoals, banks, coral reefs, islands, etc) to the extent practicable. | 6.4.8.7 | A control requiring bulk dewatering will occur at the FPSO PLET location (**C 7.3**) | **Section 5.2.7** |
| The dewatering of flooding fluid will be detailed in the relevant activity-specific EPs developed during the detailed engineering and design studies for the project. The EPs will detail dewatering requirements, including definition of discharge characteristics (i.e. chemical additives and concentrations), discharge location and volumes, methodology and species thresholds. | 6.4.8.7 | The details on dewatering are provided in **Section 5.2.7** | **Section 5.2.7** |
| Products that meet at least one of the following environmental criteria are considered suitable by ConocoPhillips for use and controlled discharged to the marine environment is permitted:<br>+ rated as Gold or Silver under OCNS CHARM model<br>+ if not rated under the CHARM model, have an OCNS group rating of D or E (i.e. are considered inherently biodegradable and non-bioaccumulative).<br>The use of products that do not meet these criteria will only be considered following assessment and approval through a chemical assessment process, as outlined above. The assessment will also be informed by an environmental risk assessment which will help ensure that any potential environmental impacts resulting from chemical use and discharge are minimised. | 6.4.8.7 | All chemicals planned to be discharged to the marine environment will be assessed through the chemical selection procedure<br>**C 7.1** – Chemical selection procedure for all chemicals planned to be release to the marine environment | **Section 5.2.7** |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| Flooding fluid chemicals (e.g. biocide, oxygen scavengers and dye) will be selected for environmental performance (i.e. low toxicity chemicals), whilst maintaining technical performance requirements, and follow the chemical assessment process (as detailed above). | 6.4.8.7 | | |
| Subsea infrastructure and pipelines will be clearly marked on Australian nautical charts published by the AHO. | 6.4.1 | The following has been included in the EP:<br>**EPS 1.2.3**<br>Subsea infrastructure and gas export pipeline will be clearly marked on Australian nautical charts published by the AHO | **Section 5.2.1** |
| Project-vessels operating within the Barossa offshore development area and gas export pipeline corridor will comply with maritime standards such as COLREGS, Chapter V of SOLAS, Marine Order 21 (Safety of Navigational and Emergency Procedures) and Marine Order 30 (Prevention of collisions) (as appropriate to vessel class). | 6.4.1 | The following controls have been included:<br>+ Activity vessels equipped and crewed in accordance with Australian Maritime requirements (**C 1.1**) | **Section 5.2.1** |
| The interaction of the vessels associated with the project with listed cetacean species will be consistent with the EPBC Regulations - Part 8 Division 8.1 Interacting with cetaceans (except in emergency conditions or when manoeuvring is not possible, such as in the case of pipelay activities), which include:<br>+ vessels will not knowingly travel >6 knots within 300 m of a whale<br>+ vessels will not knowingly approach closer than 100 m to a whale<br>+ vessels will not knowingly restrict the path of cetaceans. | 6.4.2 | The suggested control has been included in the EP (**C 10.1**) | **Section 5.3.3** |
| Vessel speed restrictions will be implemented within the defined operational area of the gas export pipeline route, except where necessary to preserve the safety of human life at sea. This will be reinforced through training of selected vessel crew to sight and manage interactions with turtles. | 6.4.2 | These controls have been adopted in the EP:<br>+ Vessel speed restrictions within the Operational Area (**C 10.3**)<br>+ Crew inductions (**C 10.2**) | **Section 5.3.3** |
| Personnel associated with vessel activities will be subject to project inductions which will address the requirements for vessel operators in relation to interactions with marine fauna. | 6.4.2 | | |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| No pipeline installation activities will occur within the internesting BIA for Olive Ridley turtles at any time, including peak nesting and hatchling emergence periods. | 6.4.2 | This control has been adopted in the EP (**C 2.8**) | **Section 5.2.2**, **5.2.3**, **5.2.4** |
| No pipeline installation activities will occur within the internesting BIA for Olive Ridley turtles at any time, including peak nesting and hatchling emergence periods. | 6.4.3 | | |
| Installation schedule of the gas export pipeline will take into consideration seasonal presence/activity of marine turtles to prevent significant adverse impacts during peak seasonal internesting period for flatback (June to September) and Olive Ridley turtles (April to August) in proximity to the Tiwi Islands. Should pipeline installation activities be required to be undertaken during this period, within proximity (60 km) of the Tiwi Islands, the following process will be undertaken to identify how the pipeline will be installed to reduce impacts to ALARP and acceptable levels:<br>1. Identify the pipeline installation methods that can achieve the technical requirements of the project and use this to define the operational area within which all pipeline installation activities will be undertaken and within which all environmental impacts and risks relating to pipeline installation will be assessed and managed to achieve the EPOs.<br>2. Update of latest knowledge on marine turtle density and seasonal movements within the internesting habitat critical to the survival of flatback and Olive Ridley turtles, drawing on latest literature, any field observations from future pipeline survey work and advice from discipline experts – building on the information presented in this OPP.<br>3. Combine the outputs from items 1 and 2 above with understanding of the existing environment to identify key environmental values/sensitivities at risk from pipeline installation activities with consideration of any seasonal presence.<br>4. Undertake an additional impact assessment that builds on the assessment presented in this OPP and incorporates the information from items 1, 2 and 3 above to evaluate the environmental impacts and risks and verify the impact assessment conclusions are consistent with those presented in this OPP. Note: if required, additional controls and/or mitigation measures will be identified to demonstrate consistency with the impact assessment presented in this OPP. | 6.4.2 | The timing of the campaign is dependent on a number of factors, including the availability of vessels, contracting and mobilisation process, project approvals. Therefore, the actual timing of the campaign is still subject to a planning process | |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| As part of the development and implementation of the gas export pipeline installation EP, measures will be defined including no anchoring on shoals/banks, definition of speed limits that will be enforced during pipeline installation, and implementation of practical controls for key aspects (e.g. sedimentation/turbidity, underwater noise emissions and light emissions). | 6.4.3 | The following controls have adopted in the EP:<br>+ No anchoring on shoals and banks (**C 2.7**)<br>+ Vessel speed restrictions within the Operational Area (**C 10.3**)<br>+ See **Section 5.2.3** and **5.2.4** for controls around noise and light emissions | **Section 5.2.2** and **5.2.4** |
| The location of subsea infrastructure within the Barossa offshore development area will be informed by pre-installation surveys/studies that identify and avoid areas of seabed that are associated with the seafloor features/values of the shelf break and slope of the Arafura Shelf KEF (i.e. patch reefs and hard substrate pinnacles). | 6.4.3 | The following controls have been adopted in the EP:<br>+ Confirmation of gas export pipeline route prior to and during installation (**C 2.2**)<br>+ Anchoring plan for PLET installation to avoid sensitive benthic habitats and mitigate anchor dragging (**C 2.6**) | **Section 5.2.2** |
| A Vessel Anchoring Plan will be prepared which will take into consideration anchoring locations and will confirm no anchoring on shoals/banks. | 6.4.3 | A PLET anchoring plan has been included as a control **C 2.6** and no anchoring on shoals and banks has been included as a control (**C 2.7**) | **Section 5.2.2** |
| Dredging/trenching activities for the gas export pipeline installation (if required) will occur outside the peak flatback (June to September) and Olive Ridley (April to August) turtle internesting period when within the internesting habitat critical to the survival of these species. | 6.4.3 | Not applicable – the pipeline route remains within the Oceanic Shoals marine park and therefore there is no requirement for dredging or trenching | NA |
| If trenching/dredging activities for the gas export pipeline installation are required, i.e. if the pipeline has to remain outside the Oceanic Shoals marine park in the shallow water area of the pipeline corridor, they will occur outside the peak flatback (June to September) and Olive Ridley (April to August) turtle internesting period. The following process will be used to identify how the pipeline in the section to be trenched/dredged will be installed to reduce impacts and risks to ALARP and acceptable levels:<br>5. Undertake numerical modelling to predict the extent, intensity and persistence of sediment plumes arising from trenching/dredging activity. | 6.4.3 | | |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| 6. Use the outputs of the numerical modelling to identify key environmental values/sensitivities at risk from trenching/dredging activities with consideration of background/baseline conditions and any seasonal presence.<br>7. Update of latest knowledge of how aspects arising from trenching/dredging activities can impact the marine environment, including marine turtles and benthic communities.<br>8. Undertake an additional impact assessment that builds on the assessment presented in this OPP and incorporates the information from items 1, 2 and 3 above with the understanding of the environment (e.g. benthic habitat maps) to evaluate the environmental impacts and risks and verify the impact assessment conclusions are consistent with those presented in this OPP, i.e. confirm impacts from trenching/dredging will be temporary and localised. Note: if required, additional controls and/or mitigation measures will be identified to demonstrate consistency with the impact assessment presented in this OPP.<br>9. Develop a dredge management plan that:<br>– details how trenching/dredging will be undertaken (which will be informed by the information derived from items 1 to 4 above)<br>– identifies the control and mitigations measures, environmental performance outcomes, environmental performance standards and measurement criteria that demonstrate the environmental impacts and risks can be reduced to ALARP and acceptable levels<br>– includes an adaptive management strategy for how trenching/dredging activity will be managed, including what information and/or data will be used to provide early warning of adverse trends and trigger adaptive management before environmental performance outcomes are compromised | | | |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| A Quarantine Management Plan will be developed and implemented, which will include as a minimum:<br>+ compliance with all relevant Australian legislation and current regulatory guidance<br>+ outline of when an IMS risk assessment is required and the associated inspection, cleaning and certification requirements<br>+ implementation of management measures commensurate with the level of risk (based on the outcomes of the IMS risk assessment), such as inspections and movement restrictions<br>+ anti-fouling prevention measures including details on maintenance and inspection of anti- fouling coatings. | 6.4.4 | Has been included as **C 9.3** | **Section 5.3.2** |
| Ballast water exchange operations will comply with the IMO International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004 – MARPOL 73/78 (as appropriate to vessel class), Australian Ballast Water Management Requirements (DoAWR 2017) and *Biosecurity Act 2015* (Cth), including:<br>+ all ballast water exchanges conducted >12 nm from land and in >200 m water depth<br>+ vessel Ballast Water Management Plan stipulating that ballast water exchange records will be maintained<br>+ completion of DoAWR Ballast Water Management Summary sheet for any ballast water discharge in Australian waters. | 6.4.4 | **C 9.2** requires all vessels to undertake ballast water management | **Section 5.3.2** |
| The International Convention on the Control of Harmful Anti-fouling Systems on Ships will be complied with, including vessels (of appropriate class) having a valid IAFS Certificate. | 6.4.4 | **C 9.1** requires all vessel, appropriate to class, to be equipped with effective anti-fouling coating | **Section 5.3.2** |
| Key noise-generating equipment will be maintained in accordance with the manufacturer's specifications, facility planned maintenance system and/or regulatory requirements. | 6.4.5 | This is achieved through the implementation strategy and the marine vetting and auditing process | **Section 7** |
| All MODUs/drill ships and vessels (as appropriate to vessel class) will comply with Marine Order 97 (Marine pollution prevention – air pollution), which requires vessels to have a valid IAPP Certificate (for vessels >400 tonnage) and use of low sulphur diesel fuel, when possible. | 6.4.6 | **C 5.1** requires all atmospheric emissions form combustion engines to be in accordance with standard maritime practice | Table 6.1 |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| The sulphur content of fuel used by project vessels will comply with Regulation 14 of MARPOL Annex VI (appropriate to vessel class) in order to control SOx and particulate matter emissions. | 6.4.6 | **C 5.1** requires all atmospheric emissions form combustion engines to be in accordance with standard maritime practice | **Table 6-1** |
| A preventative maintenance system will be implemented, which includes regular inspections and maintenance of engines and key emission sources and emissions control equipment in accordance with the vendor specifications. | 6.4.6 | This is achieved the implementation strategy and the marine vetting and auditing process | **Section 7** |
| All vessels in Australian waters adhere to the navigation safety requirements contained within COLREGS, Chapter 5 of SOLAS, the *Navigation Act 2012* (Cth) and subordinate Marine Order 30 (Prevention of Collisions) (as appropriate to vessel class) with respect to navigation and workplace safety equipment (including lighting). | 6.4.7 | **C 1.1** requires all activity vessels equipped and crewed in accordance with Australian maritime requirements | **Table 6-1** |
| A project Waste Management Plan will be developed and implemented, and will include details of:<br>+ the types of waste that will be generated by the project and will require containment, transport to, and disposal at, a licensed facility onshore<br>+ management protocols for the handling, segregation and responsible disposal of wastes. For example, non-hazardous and hazardous solid and liquid wastes will be transported safely to shore and disposed onshore at licensed treatment and disposal facilities.<br>+ measurable performance criteria<br>+ competency and training<br>+ audits, reporting and review, including compliance checks via waste manifests. | 6.4.9 | A waste management plan has been adopted as a control in the EP (**C 13.1**) | **Section 5.3.6** |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| Hydrocarbon and chemical storage and handling procedures will be implemented, including:<br>+ secure storage of bulk hydrocarbons and chemicals in areas with secondary containment<br>+ storage of hydrocarbon and chemical residues in appropriate containers<br>+ stocks of SOPEP spill response kits readily available to respond to deck spills of hazardous liquids and personnel trained to use them<br>+ planned maintenance system including maintenance of key equipment used to store and handle hydrocarbons/chemicals (e.g. bulk transfer hoses, bunding)<br>+ MSDS available on board for all hazardous substances. | 6.4.9<br>6.4.10.13 | **C 12.1** requires Chemical and hydrocarbon storage areas designed to contain leaks and spills | **Table 6-1** |
| Non-hazardous and hazardous wastes will be managed, handled and stored in accordance with their MSDS, and tracked from source to their final destination at an appropriately licensed waste facility. | 6.4.9 | **C 13.1** requires All wastes managed in accordance with vessel waste management plan | **Table 6-1** |
| Bunkering procedures will be implemented, which include:<br>+ use of bulk hoses that have dry break couplings, weak link break-away connections, vacuum breakers and floats<br>+ correct valve line-up<br>+ defined roles and responsibilities – bunkering to be undertaken by trained staff<br>+ visual inspection of hose prior to bunkering to confirm they are in good condition<br>+ testing emergency shutdown mechanism on the transfer pumps<br>+ assessment of weather/sea state<br>+ maintenance of radio contact with vessel during bunkering operations. | 6.4.10.13 | **C 13.2** requires Vessel-specific bunkering procedures and equipment consistent with ConocoPhillips marine vessel vetting requirements | **Table 6-1** |
| Vessel specific controls will align with MARPOL 73/78 and Australian Marine Orders (as appropriate for vessel classification), which includes managing spills aboard, emergency drills and waste management requirements. | 6.4.10.13 | All relevant Marine Orders have been adopted as controls in the EP | **Section 5.3.5** |
| Vessel movements will comply with maritime standards such as COLREGS and Chapter V of SOLAS. | 6.4.10.13 | All relevant Marine Orders (which implement COLREGS and SOLAS) have been adopted as controls in the EP | Throughout **Sections 5.2 and 5.3** |

| Key management controls included in the OPP | OPP Section Reference | How the Barossa OPP controls are addressed in the EP | EP Section Reference |
|---|---|---|---|
| All marine contracted vessels will undergo the ConocoPhillips Global Marine vetting process, which involves inspection, audit and a review assessment for acceptability for use, prior to working on the project. | 6.4.10.13 | Included in the implementation strategy in **Section 7** | **Section 7.3.2** |
| Vessel selection criteria will make considerations for designs and operations which reduce the likelihood of hydrocarbon spills to the marine environment as a result of a vessel collision. | 6.4.10.13 | Included in the implementation strategy in **Section 7** | **Section 7.3.2** |
| All vessels involved in the project will have a valid SOPEP or SMPEP (as appropriate for vessel classification). | 6.4.10.13 | This control has been adopted in the EP (**C 14.1**) | **Section 5.3.7** |
| Spill response in the event of a hydrocarbon or chemical spill will be implemented safely and be commensurate with the type, nature, scale and risks of the spill to key values and sensitivities, as defined in activity-specific OPEPs. | 6.4.10.13 | A tiered response will be implemented in the event of a spill (**C 14.2**) | **Section 5.3.7** |
| A Crisis Management Plan will be implemented in the event of a spill, which includes:<br>+ emergency response planning<br>+ emergency management structure<br>+ incident notification<br>+ emergency response responsibilities and support providers. | 6.4.10.13 | Details of incident (including spills) management is provided in the implementation strategy | **Section 7** |
| An OSMP will be initiated and implemented as appropriate to the nature and scale of the spill and the existing environment, as informed by a net environmental benefit assessment. | 6.4.10.13 | OPEP | **Appendix G** |
| The Stakeholder Engagement Plan will include consultation with commercial fisheries, shipping, Australian Hydrographic Office (AHO) and other relevant stakeholders operating in the Barossa offshore development and gas export pipeline to inform them of the proposed project. Ongoing consultation will also be undertaken throughout the life of the project. | 6.4.1 | **Section 7.11.8** details the stakeholder consultation undertaken for the Gas Export Pipeline Installation EP | **Section 7.11.8** |

# APPENDIX G – OIL POLLUTION EMERGENCY PLAN

# APPENDIX H – SANTOS ENVIRONMENT CONSEQUENCE DESCRIPTORS

| | Consequence Level | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|---|
| | Acceptability | Acceptable | Acceptable | Unacceptable | Unacceptable | Unacceptable | Unacceptable |
| | Severity Description | *Negligible*<br>*No impact or Negligible impact* | *Minor*<br>*Detectable but insignificant change to local population, industry or ecosystem factors. Localised effect* | *Moderate*<br>*Significant impact to local population, industry or ecosystem factors* | *Major*<br>*Major long-term effect on local population, industry or ecosystem factors* | *Severe*<br>*Complete loss of local population, industry or ecosystem factors AND/ OR extensive regional impacts with slow recovery* | *Critical*<br>*Irreversible impact to regional population, industry or ecosystem factors* |
| Environmental Receptors | Fauna<br>In particular, EPBC Act listed threatened/migratory fauna or *WA Biodiversity Conservation Act 2016* specially protected fauna | Short-term behavioural impacts only to small proportion of local population and not during critical lifecycle activity.<br>No decrease in local population size.<br>No reduction in area of occupancy of species.<br>No loss/disruption of habitat critical to survival of a species.<br>No disruption to the breeding cycle of any individual.<br>No introduction of disease likely to cause a detectable population decline. | Detectable but insignificant decrease in local population size.<br>Insignificant reduction in area of occupancy of species.<br>Insignificant loss/disruption of habitat critical to survival of a species.<br>Insignificant disruption to the breeding cycle of local population. | Significant decrease in local population size but no threat to overall population viability.<br>Significant behavioural disruption to local population.<br>Significant disruption to the breeding cycle of a local population.<br>Significant reduction in area of occupancy of species.<br>Significant loss of habitat critical to survival of a species.<br>Modify, destroy, remove, isolate or decrease availability of quality of habitat to the extent that a significant decline in local population is likely.<br>Introduce disease likely to cause a significant population decline. | Long-term decrease in local population size and threat to local population viability.<br>Major disruption to the breeding cycle of local population.<br>Major reduction in area of occupancy of species.<br>Fragmentation of existing population.<br>Major loss of habitat critical to survival of a species.<br>Modify, destroy, remove, isolate or decrease availability of quality of habitat to the extent that a long-term decline in local population is likely.<br>Introduce disease likely to cause a long-term population decline. | Complete loss of local population.<br>Complete loss of habitat critical to survival of local population.<br>Wide-spread (regional) decline in population size or habitat critical to regional population. | Complete loss of regional population.<br>Complete loss of habitat critical to survival of regional population. |
| | Physical Environment/Habitat<br>Includes: air quality; water quality; benthic habitat (biotic/abiotic), particularly habitats that are rare or unique; habitat that represents a Key Ecological Feature[8]; habitat within a protected area; habitats that include benthic primary producers[9] and/or epi-fauna[10] | No or *Negligible* reduction in physical environment/habitat area/function. | Detectable but localised and insignificant loss of area/function of physical environment/habitat. Rapid recovery evident within approximately two years (two season recovery). | Significant loss of area and/or function of local physical environment/habitat. Recovery over medium-term (two to ten years). | Major, large-scale loss of area and/or function of physical environment/local habitat. Slow recovery over decades. | Extensive destruction of local physical environment/habitat with no recovery.<br>Long-term (decades) and wide-spread loss of area or function of primary producers on a regional scale. | Complete destruction of regional physical environment/habitat with no recovery.<br>Complete loss of area or function of primary producers on a regional scale. |
| | Threatened ecological communities<br>(EPBC Act listed ecological communities) | No decline in threatened ecological community population size, diversity or function.<br>No reduction in area of threatened ecological community.<br>No introduction of disease likely to cause decline in threatened ecological community population size, diversity or function. | Detectable but insignificant decline in threatened ecological community population size, diversity or function.<br>Insignificant reduction in area of threatened ecological community. | Significant decline in threatened ecological community population size, diversity or function.<br>Significant reduction in area of threatened ecological community.<br>Introduction of disease likely to cause significant decline in threatened ecological community population size, diversity or function. | Major, long-term decline in threatened ecological community population size, diversity or function.<br>Major reduction in area of threatened ecological community.<br>Fragmentation of threatened ecological community.<br>Introduce disease likely to cause long-term decline in threatened ecological community population size, diversity or function. | Extensive, long-term decline in threatened ecological community population size, diversity or function.<br>Complete loss of threatened ecological community. | Complete loss of threatened ecological community with no recovery. |

[8] As defined by the Department of Agriculture, Water and Environment (DaWE)
[9] Benthic photosynthetic organisms such as seagrass, algae, hard corals and mangroves
[10] Fauna attached to the substrate including sponges, soft corals and crinoids.

| Consequence Level | I | II | III | IV | V | VI |
|---|---|---|---|---|---|---|
| Acceptability | Acceptable | Acceptable | Unacceptable | Unacceptable | Unacceptable | Unacceptable |
| Severity Description | *Negligible*<br>*No impact or Negligible impact* | Minor<br>*Detectable but insignificant change to local population, industry or ecosystem factors. Localised effect* | Moderate<br>*Significant impact to local population, industry or ecosystem factors* | Major<br>*Major long-term effect on local population, industry or ecosystem factors* | Severe<br>*Complete loss of local population, industry or ecosystem factors AND/ OR extensive regional impacts with slow recovery* | Critical<br>*Irreversible impact to regional population, industry or ecosystem factors* |
| Protected Areas<br>Includes: World Heritage Properties; Ramsar wetlands; Commonwealth/ National Heritage Areas; Land/ Marine Conservation Reserves. | No or *Negligible* impact on protected area values.<br>No decline in species population within protected area.<br>No or *Negligible* alteration, modification, obscuring or diminishing of protected area values.* | Detectable but insignificant impact on one of more of protected area's values.<br>Detectable but insignificant decline in species population within protected area.<br>Detectable but insignificant alteration, modification, obscuring or diminishing of protected area values.* | Significant impact on one of more of protected area's values.<br>Significant decrease in population within protected area.<br>Significant alteration, modification, obscuring or diminishing of protected area values. | Major, long-term effect on one of more of protected area's values.<br>Long-term decrease in species population contained within protected area and threat to that population's viability.<br>Major alteration, modification, obscuring or diminishing of protected area values. | Extensive loss of one or more of protected area's values.<br>Extensive loss of species population contained within protected area. | Complete loss of one or more of protected area's values with no recovery.<br>Complete loss of species population contained within protected area with no recovery. |
| Socio-economic receptors<br>Includes: fisheries (commercial and recreational); tourism; oil and gas; defence; commercial shipping. | No or *Negligible* loss of value of the local industry.<br>No or *Negligible* reduction in key natural features or populations supporting the activity. | Detectable but insignificant short-term loss of value of the local industry. Detectable but insignificant reduction in key natural features or population supporting the local activity. | Significant loss of value of the local industry.<br>Significant medium-term reduction of key natural features or populations supporting the local activity. | Major long-term loss of value of the local industry and threat to viability.<br>Major reduction of key natural features or populations supporting the local activity. | Shutdown of local industry or widespread major damage to regional industry.<br>Extensive loss of key natural features or populations supporting the local industry. | Permanent shutdown of local or regional industry.<br>Permanent loss of key natural features or populations supporting the local or regional industry. |