Santos

Bayu-Undan to Darwin Gas Export Pipeline Decommissioning & Preservation Environment Plan

DCOM-652-EN-EPP-00002

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Revision History

Revision	Date	Description	Preparer & Title	Reviewer & Title	Approver & Title
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* Approver signature only required for release of new revision.

Authorisations

Document approval and release for distribution

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1 INTRODUCTION

1.1 OVERVIEW

Santos NA Darwin Pipeline Pty Ltd (Santos) is the operator of the Bayu-Undan to Darwin Gas Export Pipeline (herein referred to as the Pipeline) in the Timor Sea. The Pipeline transports dry natural gas from the Bayu-Undan Field located in Timor-Leste offshore waters to the Darwin liquefied natural gas (DLNG) Plant near Darwin, Northern Territory (NT), Australia. The Pipeline has been in operation since 2005.

The Bayu-Undan Field is approaching the end of its commercially productive life. In anticipation of the end of Bayu-Undan production, the DLNG infrastructure owners are currently assessing multiple options to backfill the facility's existing liquefied natural gas (LNG) train. One option for new supply of feed gas is connection of a new upstream gas supply at or near kilometre point (KP) 380, referred to hereon as the 'tie-in point'[1] (**Figure 1-1**). Accordingly, Santos is preparing to decommission the Pipeline between the Bayu-Undan Platform and the future location of the tie-in point for an upstream party to connect to. Santos are proposing to preserve the section of Pipeline downstream of the tie-in point to the DLNG Plant (KP502), for future use by an upstream party.

The *Treaty Between Australia and the Democratic Republic of Timor-Leste Establishing Their Maritime Boundaries in the Timor Sea* (the Treaty) was signed in March 2018 and ratified on 30 August 2019. This Treaty transfers exclusive jurisdiction of the Pipeline to Australia, and hence the National Offshore Petroleum Safety and Environmental Management Authority's (NOPSEMA's) regulatory jurisdiction. Refer to **Section 2.3** for further information about the Treaty. Under Schedule 8 to the *Offshore Petroleum Greenhouse Gas Act 2006* (as amended by Part 18 of the *Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019)*, the Pipeline section within the Bayu-Undan Pipeline International Offshore Area (BUPIOA) in Timor-Leste offshore waters is required to be decommissioned by complete removal to the satisfaction of NOPSEMA in order to surrender the licence for the Pipeline in whole or in part.

The decommissioning of the Pipeline will take place within Timor-Leste offshore waters (Bayu-Undan Platform to approximately KP34.2) and Australian Commonwealth waters (approximately KP34.2 to the tie-in point), while the preservation of the Pipeline will take place across Australian Commonwealth waters (tie-in point to KP404) and NT waters (KP404 to the DLNG Plant). The Pipeline section in Timor-Leste offshore waters commences from the downstream flange of the subsea isolation valve (SSIV) manifold downstream of the Bayu-Undan Central Production and Processing (CPP) complex to the Timor-Leste – Australia maritime boundary. This section of the Pipeline lies entirely within the BUPIOA defined by the *Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019*. The point at which the Pipeline crosses the maritime boundary lies between points TA-5 and TA-6 (as established in the Treaty), which is approximately KP34.2.

The Commonwealth waters section of the Pipeline under consideration for decommissioning activities extends from approximately KP34.2 to the tie-in point, and the Pipeline under consideration for preservation extends from the tie-in point to the DLNG Plant across Australian Commonwealth waters and NT waters, as shown in **Figure 1-1**.

[1] The 'tie-in point' refers to a target location with a range of plus or minus 2 km from KP380 (i.e. KP378 to KP382), based on future tie-in installation requirements which will be addressed in a separate EP. The figures in this EP use KP380 as an indication of the tie-in point for simplicity.

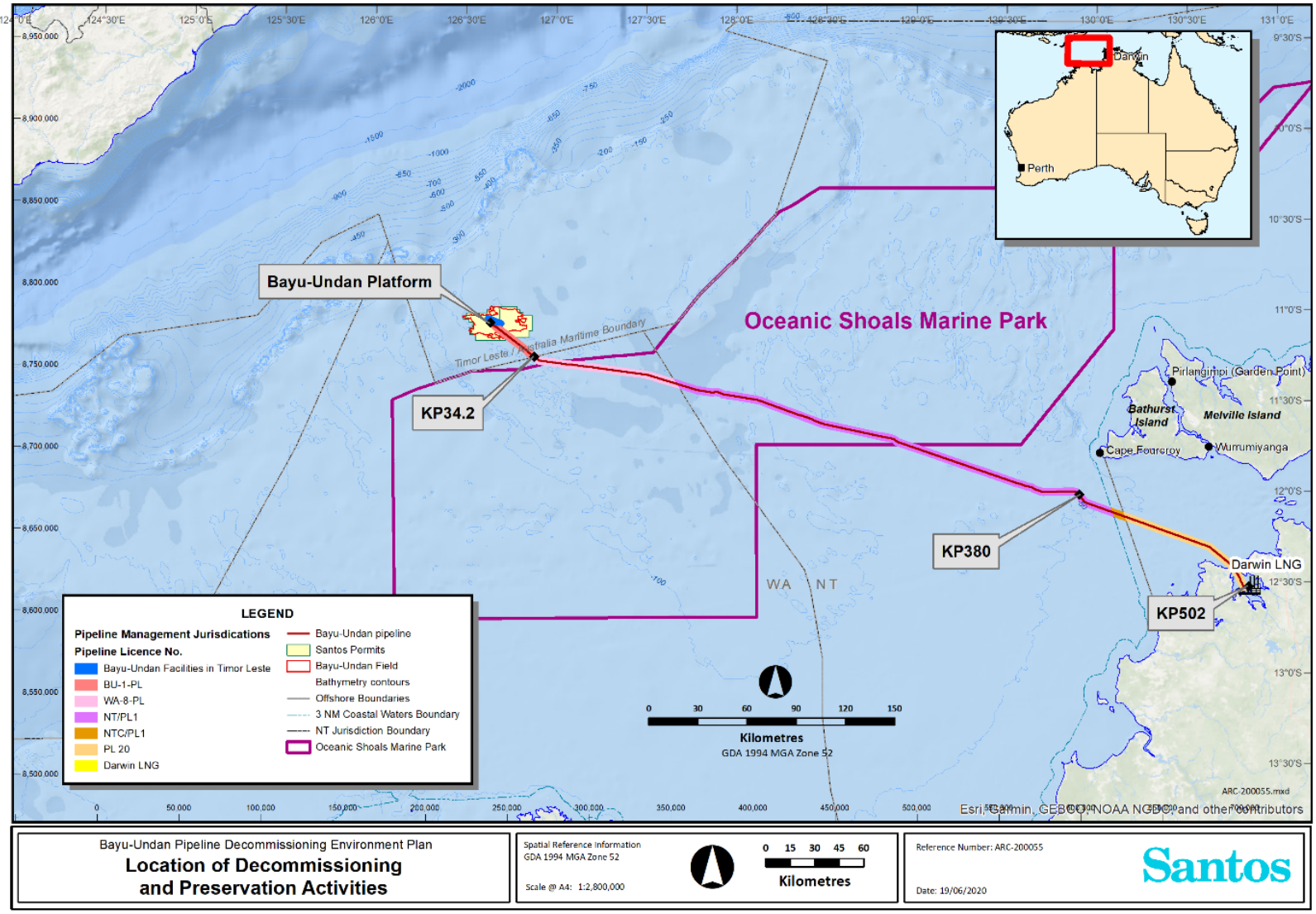


Figure 1-1: Location of Decommissioning and Preservation Activities

1.2 SCOPE

The Petroleum Activity, as defined in this EP, consists of activities associated with the decommissioning of the Pipeline between the Bayu-Undan Platform and the tie-in point, and the preservation activities from the tie-in point to the DLNG Plant. The activities within the scope of this EP are described in **Section 4** and comprise:

- Pipeline isolation at Bayu-Undan Field production cessation by either:
    - Installing either a High-Pressure Isolation Tool (HPIT) or Local Line Stops at the tie-in point as described and assessed in the Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan[2], OR
    - Flooding from the DLNG Plant to the Bayu-Undan Platform, including:
        - Pipeline depressurisation through use as fuel gas for Bayu-Undan Platform topsides decommissioning activities,
        - Flooding the Pipeline with filtered, treated seawater,
        - Flaring remaining residual gas at the Bayu-Undan Platform, and
        - Isolating the Pipeline (filled with treated seawater) at both the Bayu-Undan Platform and the DLNG Plant.
- Pipeline cutting and section removal at the tie-in point, including:
    - Sediment displacement, removal of concrete coating and cutting an approximate 100 - 200 metre (m) section of the Pipeline,
    - Removal of the cut section for disposal onshore, and
    - Installation of an end cap on the downstream and upstream sections of the pipeline.
- Pipeline cleaning activities, including:
    - Chemical cleaning pig train pushed with either treated seawater from the DLNG Plant or untreated seawater from the tie-in point (after pipeline cutting and section removal),
    - If pipeline cleaning is executed from the tie-in point, a mechanical end connector and temporary upstream skid/pig launcher-receiver (PLR) on the section of the pipeline upstream of the cut will be installed and then be replaced by an end cap, and
    - Recovery of the pig train at the Bayu-Undan Platform with disposal of chemical slugs / contaminants / flooding water ahead of the chemical cleaning pig train via a disposal well.
- Pipeline section removal from the Bayu-Undan Platform (including the spools) to approximately KP34.2. One of two methods for removal of this Pipeline section may be used:
    - Reverse s-lay, and
    - Cut and lift.
- In situ decommissioning of the Pipeline from approximately KP34.2 to the tie-in point (Australian Commonwealth waters), including:
    - Removal of subsea equipment such as the upstream skid/PLR at the tie-in point,
    - Leaving the Pipeline in place on the seabed, capped at both ends and filled with

[2] The Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan (Document reference: DCOM-652-EN-EPP-00001) was accepted by NOPSEMA on 18 September 2019.

treated seawater (if cleaned from the DLNG Plant), or untreated seawater (if cleaned from the tie-in point), and

- Installation of anti-snagging protection at the tie-in point.

- Pipeline section preservation from the tie-in point to the DLNG Plant (Australian Commonwealth waters and NT waters) with either production gas for the HPIT or Local Line Stops isolation approach or treated seawater for the flooding isolation approach, pending future use from a new upstream gas supply activity, and
- External asset integrity risks will remain during the Pipeline preservation period. External inspection would be conducted at the current established risk-based inspection (RBI) maximum target interval of five years. The external survey would address fatigue or buckling risk at span locations, third party impact, and cathodic protection (CP) system status. The Darwin Harbour section would be surveyed at the current two-year interval.

The activities within this EP will take place within an Operational Area, which is defined as a 2,000 m buffer on either side of the Pipeline centreline between the Bayu-Undan Platform and KP34.2, and a 500 m buffer on either side of the Pipeline centreline between KP34.2 and the DLNG Plant. The EP considers both planned and unplanned activities (including accidents and emergencies) and environmental impacts and risks that may credibly occur as a result of these activities.

Pipeline decommissioning and preservation is planned to commence after reaching Bayu-Undan production cessation, which is estimated to commence as early as 2021 or as late as 2023 and is planned to be completed during the in-force period of this EP. It is anticipated that the decommissioning and preservation activities are expected to take place as five subcomponents following Bayu-Undan production cessation. The five subcomponents and indicative durations comprise:

- Pipeline isolation at Bayu-Undan Field production cessation by either
  - Installing a HPIT or Local Line Stops at the tie-in point as described and assessed in the accepted Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan, OR
  - Flooding and cleaning from the DLNG Plant, including onshore set-up and testing – approximately 8-10 weeks (flooding only is approximately 3 weeks),
- Pipeline section cutting and end capping and installation of temporary upstream skid/PLR (upstream skid/PLR only required if cleaning from the tie-in point is selected) at the tie-in point – approximately 4 weeks,
- Pipeline cleaning from the tie-in point (if cleaning from the tie-in point is selected) – approximately 8 weeks,
- Pipeline removal in Timor-Leste waters (Bayu-Undan Platform to approximately KP34.2) – approximately 20 weeks, and
- Pipeline section in-situ decommissioning in Australian Commonwealth waters (approximately KP34.2 to the tie-in point) with snagging protection at the upstream pipeline end at the tie-in point – approximately 4 weeks.
- Preservation of the pipeline section from the tie-in point to DLNG – approximately 2 years.

The indicative duration of these activities is based on Santos' current planning and includes provisional allowance of downtime based on Santos' operational experience. However, the duration of these activities may change. The assessment of environmental impacts and risks in this EP is based upon the indicative timings outlined above.

The petroleum activities in this EP consists of Pipeline operations in Commonwealth waters and NT Coastal Waters. The EP is intended to be assessed against the requirements of the O*ffshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009* (OPGGS(E) Regulations) and the NT *Energy Pipelines Act 1981.* This EP is a new submission; however, there are elements of this EP which complement and follow on from activities accepted in the Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan. Unless

otherwise stated, all references to an EP contained herein refer to this document. Activities outside the Operational Area (e.g. transits to and from port) are beyond the scope of this EP.

All downstream activities associated with the tie-in from the point at which the Pipeline is cut and end capped at the tie-in point, including dewatering and reconditioning of the Pipeline from the tie-in point to DLNG for future gas export service, are beyond the scope of this EP and will be addressed in a subsequent EP at a later date.

This EP may be in force for up to five years from the date it is accepted by NOPSEMA. Santos will notify NOPSEMA when the activities covered by the EP has commenced and ended in accordance with regulations 25A and 29 of the OPGGS(E) Regulations.

1.3 PURPOSE AND OBJECTIVE

The purpose of this EP is to:

- Provide a plan that meets the relevant requirements of:
    - The Commonwealth OPGGS(E) Regulations 2009, as administered by NOPSEMA; under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act),
    - The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) in Commonwealth waters, as administered by NOPSEMA[3]; including relevant management and recovery plans and conservation advice for Matters of National Environmental Significance (MNES) and Commonwealth Marine Reserves Network Management Plans,
    - The NT *Energy Pipelines Act 1981* and Energy Pipelines Regulations 2001 as administered by NT Department of Primary Industry and Resources,
    - International agreements, conventions, guidelines and codes of practice, and
    - Santos' Australia West Business Unit (ABU-West) Health, Safety and Environment Management System (HSEMS).
- Provide the workforce with a document that details how the Petroleum Activity is to be undertaken to reduce the potential environmental impacts and risks to a level that is 'as low as reasonably practicable' (ALARP) and acceptable.

Refer to **Section 2** for relevant requirements of these pieces of legislation in relation to the Petroleum Activity. Refer to **Section 8** for further information on Santos' HSEMS.

1.4 STRUCTURE OF THE ENVIRONMENT PLAN

As outlined above in **Section 1.3**, this EP is intended to meet the requirements of the Commonwealth OPGGS (E) Regulations 2009 and the NT Energy Pipelines Regulations 2001. During consultation in support of a revision to the Bayu-Undan to Darwin Gas Export Pipeline Operations EP, the Department of Primary Industry and Resources noted the NT Energy Pipeline Regulations 2001 do not provide a framework consistent with their current environmental regulatory practices and requested the titleholder structure the EP in accordance with the NT Petroleum (Environment) Regulations. The NT Petroleum (Environment) Regulations are consistent with the Department's current environmental assessment practices and are aligned with the OPGGS(E) Regulations, ISO 14001 and ISO 31000 in relation to several key concepts relevant to the EP, including (but not limited to):

- Management of environmental risks and impacts to a level that is:
    - ALARP, and

[3] As of 28 February 2014, NOPSEMA has been endorsed as the sole environmental regulator for petroleum activities in Commonwealth waters. This is the result of arrangements intended to streamline environmental regulation of petroleum activities in Commonwealth waters.

  - Acceptable.

- Content requirements, including:
  - A description of the activity,
  - A description of the environment,
  - An environmental risk assessment,
  - Environmental performance outcomes (EPOs), environmental performance standards (EPSs) and measurement criteria (MCs), and
  - An implementation strategy.
- Reporting requirements, and
- Consultation requirements.

The structure of the EP in relation to the OPGGS(E) Regulations, the NT Petroleum (Environment) Regulations and the NT Energy Pipeline Regulations 2001 is provided in **Table 1-1**.

A table summarising the content of the EP in accordance with template and instructions provided by NOPSEMA's *Environment Plan Summary Statement Form (N-04750-FM1848 Rev 0)* is provided in **Table 1-2**.

Table 1-1: EP content in relation to Division 2.2A and Division 2.3 of the OPGGS(E) Regulations, Petroleum (Environment) Regulations and NT Energy Pipeline Regulations 2001

Environment Plan Section	EP Section Reference	OPGGS(E) Regulations 2009	Petroleum (Environment) Regulations	NT Energy Pipeline Regulations 2001
Introduction	**1**	Not applicable	Not applicable	Not applicable
Overview	**1.1**	6 – Accepted environment plan required for an activity	Not applicable	Not applicable
Scope	**1.2**	7 – Operations must comply with the accepted environment plan 10A – Criteria for acceptance of environment plan 13(1) Environmental assessment – Description of the activity 29(1) & 29(2) – notifying start and end of activity	8(2) – Form and content of plan 14 – Duration of current plan	Not applicable
Purpose and Objective	**1.3**	10A – Criteria for acceptance of environment plan	4 – Principles of ecologically sustainable development 9(1) & 9(2) – Approval criteria for plan	Not applicable
Structure of the Environment Plan	**1.4**	Not applicable	Not applicable	Not applicable
Description of Titleholder	**1.5**	15(1), 15(2) & 15(3) – Details of titleholder and liaison person	8(1) – Form and content of plan	Not applicable
Environmental Legislation and Other Requirements	**2**	13(4) Environmental assessment – Requirements	Schedule 1(1) – Legislative requirements	Not applicable
Decommissioning Options Assessment	**3**	Not applicable	Not applicable	Not applicable
Description of the Activity	**4**	13(1) Environmental assessment – Description of the activity	8(4) – Form and content of plan Schedule 1(1) – Description of regulated activity	Not applicable
Description of the Environment	**5**	13(2) & 13(3) Environmental assessment – Description of the environment	Schedule 1(2) – Description of existing environment	Not applicable
Description of Environmental Risks and Impacts	**6**	13(5) & 13(6) Environmental assessment – Evaluation of environmental impacts and risks	Schedule 1(3) – Assessment of environmental impacts and risks	43 – Reportable incidents

Environment Plan Section	EP Section Reference	OPGGS(E) Regulations 2009	Petroleum (Environment) Regulations	NT Energy Pipeline Regulations 2001
Environmental Performance Outcomes, Performance Standards and Measurement Criteria	**7**	13(7) Environmental assessment – Environmental performance outcomes and standards	Schedule 1(4) – Environmental outcomes and environmental performance standards	Not applicable
Implementation Strategy	**8**	8(1) Operations must not continue if new or increased environmental risk identified; 14(1), 14(2), 14(3), 14(4), 14(5), 14(6), 14(7), 14(8A), 14(8B), 14(8C), 14(9) & 14(10) – Implementation strategy for the environment plan 16 – Other information in the environment plan 26(4) & 26(6) – Notifying reportable incidents 26A (4) & 26A(5) – Written report of reportable incidents 26B(4) – Reporting recordable incidents 26C(1) – Reporting environmental performance	17 (1) & 17(2) – Revision required for new or increased environmental impact or environmental risk 22(2) – Modification to regulated activity 23(2) – Change in existing environment 33(3) & 33(4) – Notice of reportable incident 34(3), 34(4), 34(5), 34(6) & 34(7) – Report about reportable incident 35(3) – Report about recordable incident Schedule 1(5) – Requirement for implementation strategy Schedule 1(6) – Details of systems, monitoring, tests etc. Schedule 1(7) – Personnel Schedule 1(8) – Emergency Contingency Plan	43 – Reportable incidents
Stakeholder Consultation	**9**	11A Consultation with relevant authorities, persons and organisations, etc. 14(9) – Implementation strategy for the environment plan 16 – Other information in the environment plan	6(2) – Submission of plan for approval 7(1) & 7(2) – Stakeholder engagement Schedule 1(9) – Stakeholder engagement	Not applicable
Oil Pollution Emergency Plan (OPEP) (DCOM-652-EN-OPE-00002)	N/A	14(8), 14(8AA), 14(8D) & 14(8E) – Implementation strategy for the environment plan	Schedule 1(8) – Emergency Contingency Plan	Not applicable

Table 1-2: EP summary table

EP Summary Material Requirement	Relevant Section of EP containing EP Summary Material
The location of the activity	**Section 4.2** and **Figure 4-1**
A description of the receiving environment	**Section 5**
A description of the activity	**Section 4**
Details of the environmental impacts and risks	Risk assessment methodology – **Section 6.2** Assessment of planned impacts – **Section 6.3** Assessment of unplanned risks – **Section 6.4**
The control measures for the activity	Assessment of planned impacts – **Section 6.3** Assessment of unplanned risks – **Section 6.4** Summary of controls – **Section 7**, **Table 7-1** and **Table 7-2**
The arrangements for ongoing monitoring of the titleholder's environmental performance	Summary of controls – **Section 7**, **Table 7-1** and **Table 7-2** Monitoring, audit and management of non-conformances – **Section 8.5**
Response arrangements in the OPEP	OPEP – **Section 8.9.3** Operational and Scientific Monitoring Plan – **Section 8.9.5**
Consultation already undertaken and plans for ongoing consultation	Stakeholder consultation – **Section 9**
Details of the titleholders nominated liaison person for the activity	Nominated Liaison Person details – **Section 1.5.2**

1.5 DESCRIPTION OF THE TITLEHOLDER

Santos is one of the leading independent oil and gas producers in the Asia-Pacific region, supplying the energy needs of homes, businesses and major industries. Santos is an Australian company, founded in 1954 and underpinned by a portfolio of LNG, pipeline gas and oil assets across Australia and Asia.

In May 2020, Santos completed its acquisition of ConocoPhillips' ABU-West, which operates the Bayu-Undan Field, the Bayu-Undan Gas Export Pipeline and the DLNG Plant. This has the effect that ConocoPhillips Pipeline Australia Pty Ltd has now become Santos NA Darwin Pipeline Pty Ltd. The acquisition has resulted in the ConocoPhillips entity changing their name; however, the Australian Company Number (ACN) remains the same. Santos will be responsible for all commitments and obligations in this EP.

Further information about Santos can be found at https://www.santos.com/.

Details of the titleholder and liaison person are described below in accordance with Regulation 15 of the *OPGGS (E) Regulations*.

Santos will notify NOPSEMA should there be 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.

1.5.1 Titleholder

The Pipeline within the scope of this EP is operated under the following licences granted by the National Offshore Petroleum Titles Administrator (NOPTA):

- Timor-Leste offshore waters (pursuant to the Treaty): BU-1-PL (former Production Sharing Contracts JPDA 03-12),

- Australian Commonwealth waters: WA-8-PL and NT/PL1, and
- NT waters: NTC/PL1 and PL20 (except within the three nautical mile limit, which is operated by the NT Department of Primary Industries and Resources).

Santos is the titleholder of each of the pipeline licences listed above. Contact details for the titleholder are provided below.

Santos NA Darwin Pipeline Pty Ltd

Address:	60 Flinders Street, Adelaide, SA 5000
Telephone:	+61-8-8116-5000
ACN:	093-316-959

As a titleholder, Santos operates the Pipeline on behalf of the other titleholders, being affiliates of co-venturers INPEX, Eni, Tokyo Timor Sea Resources, a consortium of Tokyo Gas and JERA (a joint venture between Tokyo Electric and Chibu Electric).

1.5.2 Nominated Liaison Person

Name:	Norman Scott
Title:	HSE Lead, Bayu-Undan Decommissioning
Address:	1 Cambridge St, West Leederville WA 6007
Telephone:	+61-8-6363-2321
Email:	ABUW.pipeline2@santos.com

2 ENVIRONMENTAL LEGISLATION AND OTHER REQUIREMENTS

In accordance with Regulation 13(4) of the OPGGS(E) Regulations and the NT Energy Pipelines Regulations, this section provides an overview of the legislative requirements, standards and guidelines that are applicable to the petroleum activities within the scope of this EP including:

- Commonwealth legislation (**Section 2.1**),
- NT legislation (**Section 2.2**),
- Relevant international guidelines, standards and technical guidance, and
- Relevant provisions from international conventions to which Australia is a signatory (**Section 2.3**).

The ABU-W HSEMS (Element 3, **Section 8**) establishes requirements for maintaining a process to monitor changing laws / regulations and site activities, and assigning responsibilities to help assure compliance with legal requirements and standards of operation applicable to the ABU-W.

The ABU-W HSE Legal Requirements Identification and Monitoring Procedure (ALL/HSE/PRO/087) outlines the process for monitoring changing legal requirements to ensure ongoing legal compliance.

2.1 COMMONWEALTH LEGISLATION

Four key Commonwealth Acts, and subsidiary legislation, are relevant to the environmental management of the petroleum activities considered in this EP. These are the:

- OPGGS Act,
- EPBC Act,
- *Environmental Protection (Sea Dumping) Act 1981*, and
- *Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019*.

The relevance of these Acts, and subsidiary legislation, to the petroleum activities within the scope of this EP is described below. Additional Commonwealth legislation relevant to the petroleum activities within the scope of this EP are considered in **Table 2-2**.

2.1.1 OPGGS Act 2006

The OPGGS Act provides the regulatory framework for all offshore petroleum exploration, production and greenhouse gas activities in Commonwealth waters. The OPGGS Act is supported by a range of subsidiary legislation, including the:

- Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009,
- Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011, and
- OPGGS (E) Regulations.

Of particular relevance to this EP are the OPGGS (E) Regulations, which require the environmental impacts and risks of offshore petroleum and greenhouse gas storage activities be managed to a level that is acceptable and ALARP.

The requirements of Section 572(3) of the OPGGS Act state that "*a titleholder must remove from the title area all structures that are, and all equipment and other property that is, neither used nor to be used in connection with the operations in which the titleholder is or will be engaged and that are authorised by the permit, lease, licence or authority*." However, options other than complete removal may be considered if the titleholder can demonstrate that the alternative decommissioning approach delivers equal or better environmental and safety outcomes compared to complete removal, and that the approach complies with all other requirements (Department of Industry, Science, Energy and Resources 2020). More information on the assessment of alternatives to full removal is provided in the Pipeline decommissioning options evaluation (**Section 3**).

The OPGGS (E) Regulations provide for the protection of the environment in Commonwealth waters by requiring that petroleum and greenhouse gas storage activities be managed in a way that:

- Reduces the environmental impacts and risks of the activity to a level that is ALARP,
- Reduces the environmental impacts and risks of the activity to an acceptable level, and
- Is consistent with the principles of ecologically sustainable development (ESD), as defined 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, and
    - Improved valuation, pricing and incentive mechanisms should be promoted.

The OPGGS (E) Regulations include requirements for the consideration of matters protected under Part 3 of the EPBC Act, including:

- 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 (TEC) within the meaning of that Act,
- The presence of a listed migratory species within the meaning of that Act, and
- 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.

The acceptance criteria, 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 EPOs, 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, and
- Demonstrates that:
    - The titleholder has carried out the consultations required by Division 2.2A,

- The measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate, and
- Complies with the OPGGS Act and the OPGGS (E) Regulations.

2.1.2 EPBC Act 1999

The EPBC Act and supporting regulations provide for the protection of the environment and conservation of biodiversity in Australia. Amendments to the OPGGS Act and OPGGS (E) Regulations in February 2014, undertaken as part of the streamlining of environmental approvals for petroleum activities in Commonwealth waters, require matters protected under Part 3 of the EPBC Act to be considered in EPs submitted for assessment under the OPGSS (E) Regulations.

Following the streamlining arrangements, NOPSEMA became the sole environmental regulator for petroleum activities (i.e. regulates activities under the OPGGS Act and EPBC Act) in Commonwealth waters.

Environmental approval to construct, operate and decommission the Pipeline (including preservation) pre-dates the EPBC Act. Hence, the construction, operation and decommissioning (including preservation) of the Pipeline was not assessed under the EPBC Act. No requirements (e.g. particular manners) determined by an EPBC Act assessment process apply to the Pipeline.

2.1.2.1 Marine Parks

Part of the Pipeline lies within the Multiple Use and Special Purpose (trawling) zones of the Oceanic Shoals Marine Park proclaimed under the EPBC Act. Both of these zones have an International Union for the Conservation of Nature (IUCN) protected area category of “VI - Protected area with sustainable use of natural resources”.

Mining operations, including oil and gas operations, may be conducted in an IUCN category VI zones within the Oceanic Shoals Marine Park, subject to the class approval and prescriptions within the Marine Parks - North Marine Parks Network Management Plan 2018 (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 plans for Marine Parks. The conditions of the Class Approval for the North Marine Network Management Plan that are relevant to the scope of this EP are provided in **Table 2-1**. These conditions have been considered by Santos in planning the environmental management of the petroleum activities within the scope of this EP.

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
1	Approved action must be conducted in accordance with: • An Environment Plan accepted under the OPGGS (E) Regulations • The EPBC Act • The EPBC Regulation • North Marine Parks Network Management Plan 2018 • Any prohibitions, restrictions or determinations made under the EPBC Regulations by the Director of National Parks • 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 to e)
2	If requested by the Director of National Parks, an Approved Person must notify the Director prior to conducting Approved Actions within Approved Zones. Note: the timeframe for prior notice will be agreed to by the Director of National Parks and the Approved person

Condition Number	Condition
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.

2.1.2.2 Recovery Plans

The EPBC Act provides for the development of recovery plans for species listed as threatened under the EPBC Act. Recovery plans are intended to ensure the recovery of threatened species by setting recovery objectives. These objectives are informed by:

- Descriptions of the state of the threatened species in Australia and globally,
- Identification of threats to the species, and
- Identification of actions by which these threats may be mitigated, and the recovery objectives achieved.

A number of threatened species have been identified as potentially being affected by the planned and unplanned impacts and risks that may arise from the petroleum activities within the scope of this EP. Santos has considered the recovery plans in place for these species when describing the existing environment (**Section 5**) and assessment the environmental impacts and risks (**Section 6**) from the petroleum activities within the scope of this EP.

2.1.2.3 Conservation Advice

Conservation advice for threatened species and communities may be published under the EPBC Act. This advice is developed in consultation with the Threatened Species Scientific Committee. Conservation advice:

- Describes the threatened species, including its distribution, habitat and conservation status,
- Described threats to the recovery of the species, and
- Outlines research priorities and conservation actions to prevent further decline of the threated species.

A number of threatened species have been identified as potentially occurring within the environment that may be affected by the planned and unplanned activities that comprise the petroleum activities within the scope of this EP. Santos has considered the conservation advice (listed in **Section 5.3.3.1**) in place for these species when describing the existing environment and assessment of the environmental impacts and risks from the petroleum activities within the scope of this EP.

2.1.2.4 Wildlife Conservation Plans

Wildlife conservation plans may be made under the EPBC Act for the protection, conservation and management of species protected under the Act.

One wildlife conservation plan is relevant to the petroleum activities within the scope of this EP – the Wildlife conservation plan for migratory shorebirds (Commonwealth of Australia 2015a). This plan applies to a number of shorebirds listed as Migratory under the EPBC Act. The objectives of the plan are to protect important habitat, address knowledge gaps and reduce anthropogenic risks to migratory shorebirds.

2.1.2.5 Threat Abatement Plans

Threat abatement plans may be made under the EPBC Act for threatening processes on native species and ecological communities. These plans describe objectives for the mitigation of threatening processes and the actions intended to achieve these objectives.

One threat abatement plan is relevant to the petroleum activities within the scope of this EP – the Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (Commonwealth of Australia 2018). The assessment of environmental impacts and risks from the petroleum activities within the scope of this EP presented in **Section 6** includes controls to prevent the release of debris to the marine environment.

2.1.3 Environment Protection (Sea Dumping) Act 1981

The *Environment Protection (Sea Dumping) Act 1981* prevents pollution of the sea by prohibiting the discharge of controlled materials to the sea. The Act gives effect to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (commonly referred to as the London Convention) under Commonwealth law. The Act and associated regulations are administered by the Department of Agriculture, Water and the Environment (DAWE) on behalf of the Minister for the environment.

Santos is liaising with DAWE regarding any relevant requirements under the *Environment Protection (Sea Dumping) Act 1981* for the proposed activities described in this EP (**Section 4**), including the in-situ decommissioning of the Pipeline between approximately KP34.2 and the tie-in point. Santos will comply with all requirements under the *Environment Protection (Sea Dumping) Act 1981* in relation to activities covered under this EP.

2.1.4 Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019

The *Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019* makes amendments to a range of Australian legislation to give effect to the Treaty.

The Act extends Commonwealth jurisdiction to include the BUPIOA, with Australia having exclusive jurisdiction within the BUPIOA. Under Schedule 8 to the *Offshore Petroleum Greenhouse Gas Act 2006* (as amended by Part 18 of the *Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019)*, the Pipeline section within the BUPIOA in Timor-Leste offshore waters is required to be decommissioned by complete removal to the satisfaction of NOPSEMA in order to surrender the licence for the Pipeline in whole or in part.

2.2 NORTHERN TERRITORY LEGISLATION

2.2.1 NT Energy Pipelines Act

The NT Energy Pipelines Act and subsidiary Energy Pipelines Regulations require the titleholder to operate[4] licensed pipelines in accordance with an accepted Pipeline Management Plan (PMP). The Energy Pipelines Regulations do not require the PMP to explicitly consider environmental impacts and risks. The scope of this EP includes NT Coastal Waters and environmental risks associated with the preservation of the Pipeline within this jurisdiction. The EP will constitute a component of the PMP, as per the NT Energy Pipelines Act and Energy Pipelines Regulations. Consultation with the NT Department of Primary Industry and Resources in relation to a previous EP submission for the Pipeline has indicated this approach is acceptable to the Department.

2.3 OTHER AUSTRALIAN LEGISLATION

In addition to the Acts and subsidiary legislation considered above, a range of other legislation is relevant to the environmental management of the petroleum activities within the scope of this EP. These are listed in **Table 2-2** along with a description of their relevance to this EP.

[4] Consent under the NT Energy Pipelines Act and subsidiary Regulations is also required for construction, modification and decommissioning of licensed pipelines. These activities are beyond the scope of this EP.

Table 2-2: Summary of Commonwealth, NT and International legislation applicable to the petroleum activities within the scope of this EP

Legislation	Description	Relevance to this EP
Commonwealth		
Australian Heritage Council Act 2003	This Act identifies and protects areas of heritage value, including those listed on the World Heritage List, National Heritage List and the Commonwealth Heritage List (all of which are MNES under the EPBC Act).	Heritage values protected under the Act that may be impacted by the unplanned events within the scope of this EP. These values are described in **Section 5** and considered in the assessment of environmental impacts and risks (**Section 6**). No impacts to heritage values will occur as a result of the planned activities within the scope of this EP.
Australian Maritime Safety Authority Act 1990	Provides that a function of the Australian Maritime Safety Authority (AMSA) is to combat pollution in the marine environment. AMSA is the control agency for vessel-based spills in commonwealth waters.	Vessel emergencies and maritime pollution incidents in Commonwealth waters may require interface with AMSA. Refer to the OPEP (DCOM-652-EN-OPE-00002) for this EP for further information.
Biosecurity Act 2015	This Act and its supporting legislation are intended to manage the risk of pests and diseases entering Australian territory. The Act creates requirements intended to reduce the risk of the introduction of invasive marine species (IMS).	Controls to reduce the risk of the introduction of IMS as a result of the petroleum activities within the scope of this EP are provided in **Section 6**. These controls are consistent with the requirements of the Act.
Hazardous Waste (Regulation of Exports and Imports) Act 1989	This Act regulates the export, import and transport of hazardous waste to ensure that hazardous waste is managed appropriately so that human health and the environment are protected from the harmful effects of the waste. The Act gives effect to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1972 (commonly referred to as the Basel Convention) under Commonwealth law.	The petroleum activities within the scope of this EP will comply with the requirements of the Act for the export, import and transport of hazardous waste.
National Environment Protection (National Pollutant Inventory) Measure 1998 (established under the *National Environment Protection Council Act 1994*)	This measure provides the framework for the development and establishment of the National Pollutant Inventory (NPI), which provides publicly available information on the types and amounts of numerous toxic substances being emitted into the Australian environment. These substances have been identified as important due to their possible effect on human health and the environment.	The petroleum activities within the scope of this EP will comply with the NPI National Environment Protection Measure through the reporting of relevant NPI substances.
Navigation Act 2012, Marine Order 21 (Safety of navigation and emergency procedures) 2012, Marine Order 27 (Radio Equipment) 2009,	This Act, and subsidiary Marine Orders, give effect to several international conventions relating to maritime safety to which Australia is a signatory, including: • International Convention for the Safety of Life at Sea (commonly referred to as the SOLAS Convention),	All vessels and facilities undertaking activities within the scope of this EP will comply with the requirements of the Act. These requirements reduce the risk of accidents and unplanned interactions with other users of the marine environment and infrastructure in the Operational Area, including the use of nautical charts under Chapter V of the SOLAS Convention (relevant to in-situ snagging risk on in-situ Pipeline).

Legislation	Description	Relevance to this EP
Marine order 28 (Operations standards and procedures), Marine Order 30 (Prevention of Collisions) 2009, Marine Order 71 (Masters and Deck Officers) 2014.	• International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (commonly referred to as the STCW Convention), and • International Regulations for Preventing Collisions at Sea, 1972 (commonly referred to as the COLREGS).	
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 Marine Order 98 (Marine pollution – anti-fouling systems)	The Act and subsidiary Marine Order prohibits the use of organotin compounds in anti-fouling coatings on ships. These compounds have been shown to result in deformations and sex changes in molluscs. The Act gives effect to the Convention on the Control of Harmful Anti-fouling Systems on Ships.	All vessels undertaking activities within the scope of this EP are required to comply with the requirements of the Act and subsidiary Marine Order.
Protection of the Sea (Prevention of Pollution from Ships) Act 1983, Marine Order 91 (Marine pollution prevention — oil) 2014, Marine Order 93 (Marine pollution prevention — noxious liquid substances) 2014, Marine Order 94 (Marine pollution prevention — packaged harmful substances) 2014, Marine Order 95 (Marine pollution prevention — garbage) 2018, Marine Order 96 (Marine pollution prevention — sewage) 2018, and Marine Order 97 (Marine pollution prevention — air pollution) 2013	The Act controls discharges from ships to protect the sea from pollution. This includes regulation of discharges of oil or oily mixtures, noxious liquid substances, packaged harmful substances, sewage and garbage to the sea. The Act imposes a duty to report certain incidents involving prohibited discharges and to maintain record books and management plans. The Act and subsidiary Marine Orders enact the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (commonly referred to as the MARPOL 73/78 Convention).	All vessels undertaking activities within the scope of this EP are required comply with the requirements of the Act.
Northern Territory		
Territory Parks and Wildlife Conservation Act 1976	This Act protects and conserves the natural values and fauna of the NT.	Species listed as threatened under this Act have been considered in assessing the environmental impacts and risks of the Pipeline decommissioning and preservation.

2.4 INTERNATIONAL TREATIES, AGREEMENTS AND CONVENTIONS

Australia is a signatory to various international agreements and conventions that are relevant to the management of environmental risks and impacts considered in this EP. Of particular relevance to this EP is the Treaty, which is discussed below. Additional international treaties, agreements and conventions relevant to the environmental management of the petroleum activities within the scope of this EP are summarised in **Table 2-3**. These international treaties, agreement and conventions may have associated Commonwealth legislation which gives effect under Commonwealth law.

2.4.1 Treaty between Australia and the Democratic Republic Timor-Leste Establishing their Maritime Boundaries in the Timor Sea

Australia and Timor-Leste signed the *Treaty Between Australia and the Democratic Republic Timor-Leste Establishing Their Maritime Boundaries in the Timor Sea* (the Treaty) in March 2018 to establish maritime boundaries between the two signatory countries. This Treaty replaces the 2003 Timor Sea Treaty and the 2003 International Unitisation Agreement for Greater Sunrise and establishes permanent maritime boundaries between Australia and Timor-Leste.

It encompasses the delimitation between Timor-Leste and Australia of both the continental shelf (which entails rights to exploit seabed resources, such as petroleum) and the exclusive economic zone in the Timor Sea.

Under the Treaty (Article 3 of Treaty Annex D) Australia exercises exclusive jurisdiction over the Pipeline, and in exercising this exclusive jurisdiction shall cooperate with the relevant Timor-Leste statutory authority in relation to the Pipeline. Consequently, NOPSEMA is the regulator of the environmental management of the Pipeline in Timor-Leste and Commonwealth waters. Given Australia has exclusive jurisdiction over the Pipeline, all Australian relevant environmental requirements are assumed to apply within the BUPIOA in Timor-Leste offshore waters.

Some activities considered within the scope of this EP may occur beyond the BUPIOA. These activities will occur within Timor-Leste waters and will be subject to an environmental management plan accepted by the Autoridade Nacional do Petróleo e Minerais (ANPM).

Table 2-3: Summary of international conventions relevant to the petroleum activities within the scope of this EP

International Agreement / Convention	Description
Agreement between the Government of Australia and the Government of Japan for the Protection of Migratory Birds in Danger of Extinction and their Environment, 1974 (commonly referred to as JAMBA)	JAMBA provides for cooperation between Japan and Australia to minimise harm to major areas used by birds which migrate between the two countries. The EPBC Act gives effect to JAMBA by listing migratory birds recognised by the agreement as migratory under the EPBC Act. Migratory species are MNES.
Agreement between the Government of Australia and the Government of the People's Republic of China for the Protection of Migratory Birds and their Environment, 1986 (commonly referred to as CAMBA)	CAMBA provides for cooperation between China and Australia to minimise harm to major areas used by birds which migrate between the two countries. The EPBC Act gives effect to CAMBA by listing migratory birds recognised by the agreement as migratory under the EPBC Act. Migratory species are MNES.
Agreement between the Government of Australia and the Government of the Republic for Korea for the Protection of Migratory Birds and their Environment, 2002 (commonly referred to as ROKAMBA)	ROKAMBA provides for cooperation between the Republic of Korea and Australia to minimise harm to major areas used by birds which migrate between the two countries. The EPBC Act gives effect to ROKAMBA by listing migratory birds recognised by the agreement as migratory under the EPBC Act. Migratory species are MNES.
Convention on the Conservation of Migratory Species of Wild Animals, 1979 (Bonn Convention)	The Bonn Convention aims to conserve migratory species within their migratory ranges. The Bonn Convention provides specific protection for migratory species threatened with extinction or requiring international cooperation to conserve effectively. The EPBC Act gives effect to the Bonn Convection through listing species as migratory under Part 3 of the Act. Migratory species are MNES.
Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001	The Convention prohibits the use of harmful organotins in anti-fouling paints used on ships and establishes a mechanism to prevent the potential future use of other harmful substances in anti-fouling systems. The Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 and subsidiary Marine Order gives effect to the Convention.
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972 (London Convention)	The London Convention is an agreement to control pollution of the sea by dumping. The *Environment Protection (Sea Dumping) Act 1981* gives effect to the London Convention. Under the London Convention protocol, manmade structures may be considered for dumping at sea via a stringent assessment and permitting process. The section of the Pipeline that is relevant under the London Convention is the in-situ decommissioning between approximately KP34.2 and the tie-in point.
International Convention for the Control and Management of Ships' Ballast Water and Sediment, 2004	The Convention aims to prevent the spread of harmful aquatic organisms from one region to another via ballast water and sediment. The Biosecurity Act 2015 gives effect to the Convention.
International Convention for the Prevention of Pollution from Ships, 1973/1978 (MARPOL 73/78)	MARPOL 73/78 aim to minimise pollution of the sea from ships. All ships flagged under countries that are signatories to MARPOL 73/78 are subject to its requirements, regardless of where they sail and member nations are responsible for vessels registered on their national ship registry. Several Annexes apply directly to offshore petroleum activities: • MARPOL 73/78 Annex I (Prevention of pollution by oil), • MARPOL 73/78 Annex II (Control of pollution by noxious liquid substances in bulk), • MARPOL 73/78 Annex III (Prevention of pollution by harmful substances carried by sea in packaged form), • MARPOL 73/78 Annex IV (Pollution by sewage from ships), • MARPOL 73/78 Annex V (Pollution by garbage from ships), and • MARPOL 73/78 Annex VI (Prevention of air pollution from ships).

International Agreement / Convention	Description
	The Protection of the Sea (Prevention of Pollution from Ships) Act 1983 and subsidiary Marine Orders give effect to MARPOL 73/78.
International Convention for the Safety of Life at Sea, 1974 (SOLAS)	SOLAS sets minimum safety standards for construction, equipment and operation of merchant ships. The convention requires signatory flag states to ensure that ships flagged by them comply with these standards as a minimum. The Navigation Act 2012 and subsidiary Marine Orders give effect to SOLAS.
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Convention)	The STCW Convention sets out minimum standards for master, officers and watch personnel on merchant vessels. The Navigation Act 2012 and subsidiary Marine Orders give effect to the STCW Convention.
International Convention on Wetlands of International Importance (Ramsar Convention)	The Ramsar Convention provides for the conservation and sustainable use of wetlands. The EPBC Act gives effect to the Ramsar Convention by providing specific protection for wetlands recognised by the Convention under Part 3 of the EPBC Act. These wetlands are termed “Wetlands of International Importance” and are MNES.
The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1972 (Basel Convention)	The Basel Convention reduces the movement of hazardous wastes (excluding radioactive wastes) between nations, particularly from developed to less developed countries. The Hazardous Waste (Regulation of Exports and Imports) Act 1989 gives effect to the Convention.
The Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGS)	The COLREGS outline internationally recognised navigation rules to be used by vessels at sea to avoid collisions. The COLREGS are published by the International Maritime Organisation (IMO). The Navigation Act 2012 and subsidiary Marine Orders give effect to the COLREGS.
The Minamata Convention on Mercury	The Minamata Convention on Mercury requires Parties to address adverse effects of mercury to protect human health and the environment. Australia is a signatory to, but has not yet ratified, the Convention. As such, there is no Commonwealth legislation that specifically gives effect to the Convention.

2.5 HISTORICAL CONTEXT OF THIS ENVIRONMENTAL PLAN

The installation, operation and in-situ decommissioning of the Pipeline was originally assessed under the *Environment Protection (Impact of Proposals) Act 1974* (subsequently superseded by the EPBC Act 1999) in an Environmental Impact Statement. The Environmental Impact Statement included a recommendation from the then Federal Minister for the Environment to decommission the Pipeline in situ at the end of the life of the Project, which was subsequently accepted as part of the FIRB approval of the Pipeline. Correspondence between Santos (then ConocoPhillips Australia Pty Ltd) and NOPSEMA on this matter includes letters dated 2nd August 2018 (ref: 180604-HSE-OGL-00387) and 6th September 2018 (ref: A626388).

3 PIPELINE DECOMMISSIONING OPTIONS EVALUATION

Santos undertook a Decommissioning Options Evaluation (DOE) to evaluate options for decommissioning the Pipeline, with respect to removal or alternative strategies and methods for recommended strategies (Advisian 2020) (**Appendix A**). The DOE was facilitated by a third party external to Santos, to strengthen the independence and impartiality of the assessment. The DOE considered alternatives to Pipeline removal between approximately KP34.2 and the tie-in point (Australian waters).

The Pipeline section from the Bayu-Undan Platform to approximately KP34.2 (i.e. Timor-Leste waters, within the BUPIOA) is required to be removed entirely under the requirements of the Treaty. Only one decommissioning strategy applies to this section of the Pipeline – removal of the Pipeline. Therefore, only alternative removal methodologies were considered in the evaluation.

Decommissioning strategies that Santos may pursue between approximately KP34.2 and the tie-in point include removing the Pipeline, retain the Pipeline in-situ and a hybrid alternative (e.g. partial removal). More than one strategy may be implemented on discrete sections of the Pipeline and each strategy may be implemented using different methodologies. The combination of a decommissioning strategy and methodology is referred to as a 'decommissioning option'.

The DOE process mirrored the comparative assessment process used in the North Sea, involving multidisciplinary assessments across five criteria: environment, safety, society, technical feasibility and economic (Oil and Gas UK 2015).

Santos used the DOE process to assess alternatives and identify the recommended decommissioning option for the Pipeline in Commonwealth waters. The recommended decommissioning option forms the basis of the activities described and assessed in this EP.

3.1 DECOMMISSIONING OPTIONS EVALUATION PROCESS

The DOE process applies to the section of the Pipeline in Commonwealth waters between approximately KP34.2 and the tie-in point. The DOE process involved the following steps:

- Develop a framework for the DOE by:
    - Identifying decommissioning options (i.e. strategies and methodologies), and
    - Defining primary criteria and sub-criteria and scoring system to assess various decommissioning options.
- Score the decommissioning strategies and provide a recommendation on preferred strategy,
- Score the decommissioning methodologies for the recommended strategies and provide a recommendation on preferred decommissioning method,
- Hold internal DOE discipline meetings and workshops with input from internal and external subject matter experts to review/validate scoring,
- Perform primary criteria sensitivity analysis (i.e. removing the economic criteria from the scoring),
- Document the process and the results, and
- Public consultation with relevant stakeholders and adjustments to scoring and recommendations to address consultation outputs, where required.

The process was iterative where the outputs of certain steps necessitated the review and update of preceding steps. Further detail on the DOE process applied, including primary criteria, sub-criteria and scoring, is provided in Section 4 of **Appendix A.**

3.2 DECOMMISSIONING OPTIONS

Decommissioning alternatives can be split into two main elements to streamline the DOE process. The first includes the selection of a recommended decommissioning strategy, such as full removal, partial removal or leaving in-situ. Once a recommended strategy is selected using

the DOE process, methodologies for undertaking the decommissioning strategy are assessed and selected (e.g. trench and bury, leave Pipeline in-situ with minimal intervention).

3.2.1 Decommissioning Strategies

Decommissioning strategies for the Pipeline in Commonwealth waters (approximately KP34.2 to the tie-in point) comprise removal, partial removal and leaving in-situ. In assessing different strategies, the DOE takes a holistic approach by taking into account the removal objective (full removal, partial removal, leave in-situ) as well as the final disposal location (onshore, offshore, reefing or leave in-situ).

Decommissioning strategies that were screened out from the DOE in the first instance included full removal with offshore disposal or reefing options, as well as partial removal (all disposal options). Full or partial removal with offshore disposal or reefing is not considered preferable on the basis that offshore reefing and disposal locations were within Timor-Leste offshore waters, which is contrary to the Treaty requirements and unlikely to be considered satisfactory by the regulators.

Decommissioning strategies that were considered feasible included full removal with onshore disposal or leaving the Pipeline in-situ. The assumptions for the purpose of the DOE were that onshore disposal of the Pipeline would be in South East Asia, and that the leave in-situ strategy would not include any Pipeline movement to a new location.

The DOE process determined the recommended decommissioning strategy was to leave the Pipeline in-situ, with onshore disposal receiving a score of -1.99 compared to the in-situ score of -0.58 (preferred strategies receive a higher score). A summary of the assessment for each primary criterion is described below:

- **Environment**: The full removal of the Pipeline will have high short-term and long-term impacts resulting from the extensive duration and extent of the removal campaign (increased emissions, disturbance to sensitive habitats as discussed in **Section 5**). The leave in-situ strategy would leave a large piece of infrastructure on the seabed with some risks of contamination but will be cleaned to reduce risk to ALARP and will avoid removing a complex habitat providing ecological benefits.
- **Safety**: The leave in-situ strategy is recommended due to the lower short-term safety risks compared to the full removal strategy which will require an extensive duration offshore campaign to complete. While there are potentially long-term risks involved in leaving the structure in-situ (potential for snagging of trawl nets), the Santos anti-snagging study determined the likelihood of this occurring is remote.
- **Society**: While there is a better short-term societal benefit of an increased workforce for the full removal strategy compared to the leave in-situ strategy, leaving the Pipeline in place would provide improved long-term societal benefits as the Pipeline would continue to provide marine habitat and benefits for commercial fisheries operating in the area.
- **Technical Feasibility**: The complexity, lack of technical maturity of approach and limited market capability of removing ~345 km of Pipeline from Australian Commonwealth waters scored worse than the leave in-situ option.
- **Economic**: Despite some potential post decommissioning monitoring costs of leaving the Pipeline in-situ, the high capital investment cost of implementing full removal (>AUD$200M) makes this the least recommended strategy compared to the leave in-situ strategy (between AUD$10M-$100M).

Further details on the decommissioning strategies considered and how these were defined for the DOE, including primary criteria, sub-criteria and weightings, is included in Section 4 of Appendix A.

3.2.2 Decommissioning Methodologies

Once a recommended strategy comparison for the Pipeline was completed, various decommissioning methodologies were identified and underwent an evaluation process to determine a recommended methodology. Decommissioning methodologies that were considered

for the recommended strategy (leave in-situ) included:

- 'Trench and bury', where the Pipeline is trenched below seabed level and/or rock dump is placed to bury the Pipeline, and
- 'In-situ with minimal intervention (cleaning and implementation of snagging measures, as required)', where the Pipeline is cleaned to an ALARP and acceptable level, disconnected, flooded and left in-situ with only minor anti-snagging measures, as required (e.g. mattresses).

The DOE process determined the recommended decommissioning methodology was 'in-situ with minimal intervention', receiving a score of -0.62 compared to the 'trench and bury' score of -1.95 (preferred strategies received a higher score). A summary of the assessment for each primary criterion is described below:

- **Environment**: The 'trench and bury' option for the Pipeline will have higher short-term and long-term impacts compared to the 'in-situ with minimal intervention' option, as the Pipeline would be buried and therefore the habitat benefit it currently provides would be lost. The longer duration to 'trench and bury' would also increase emissions and the activity would impact water quality through extensive sediment disturbance, some of which has the potential to occur in sensitive habitats along the Pipeline.
- **Safety**: The 'in-situ with minimal intervention' methodology will have lower safety risks compared to the 'trench and bury' methodology which will require an extensive offshore campaign to complete. While there are potentially long-term risks involved in leaving the structure in-situ (potential for snagging of trawl nets), the Santos anti-snagging study determined the likelihood of this occurring is remote.
- **Society**: While there is a better short-term societal benefit of an increased workforce for the 'trench and bury' methodology, the 'in-situ with minimal intervention' methodology would provide improved long-term societal benefits as the Pipeline would maintain the marine habitat it provides, including beneficial habitat for commercial fisheries operating in the area.
- **Technical Feasibility**: The complexity, maturity of approach and market capability of the 'trench and bury' methodology scored worse than the 'in-situ with minimal intervention' option.
- **Economic**: Given the length of the Pipeline (~345 km), the high capital investment cost of a 'trench and bury' methodology (>AUD$200M) is substantially more expensive to implement than the 'in-situ with minimal intervention' methodology (between AUD$10M-$100M).

3.3 DECOMMISSIONING OPTIONS EVALUATION RECOMMENDATION

The DOE process, through the use of a multi-criteria decision analysis, has recommended the leave in-situ strategy with minimal intervention methodology (cleaning and implementation of snagging measures, as required) for the section of the Pipeline within Commonwealth waters.

This recommendation is driven by the potential long-term environmental benefits of leaving a large structure in-situ that provides valuable habitat for fish and other marine life and the reduction of short-term impacts by reducing decommissioning activities in the field (e.g. reduction in emissions, decommissioning operational risks). While the cost of leaving the Pipeline in-situ with minimal intervention is the lowest between the various strategies and methodologies assessed, a sensitivity analysis that eliminated weighting for the economic primary criteria, concluded that cost is not a driving factor in the selection of the recommended option.

The DOE demonstrates that the environmental benefits of alternatives to the leave in-situ strategy with minimal intervention are grossly disproportionate to the cost of implementing these alternatives. As such, the DOE demonstrates that the environmental impacts and risks of preferred leave in-situ strategy are ALARP compared to the alternatives considered.

Section 6 of this EP assesses full removal against in-situ across individual risks to demonstrate and confirm that in-situ is the ALARP option for decommissioning the pipeline section from KP34.2 to the tie-in point.

4 DESCRIPTION OF THE ACTIVITY

This section has been prepared in accordance with Regulation 13(1) of the OPGGS(E) Regulations 2009. It describes the activities that will be undertaken within the scope of this EP in Timor-Leste offshore waters within the BUPIOA, Australian Commonwealth and NT waters. The following sub-sections provide a detailed description of all activities to inform the assessment of environmental impacts and risks that may credibly arise from the activity.

4.1 ACTIVITY OVERVIEW

Table 4-1 provides an overview of the activities within the scope of this EP. Each of these attributes are described in further detail below.

Table 4-1: Summary of attributes within the scope of this EP

Attribute	Summary
Pipeline Licenses	Timor-Leste offshore waters: BU-1-PL (former Production Sharing Contract JPDA 03-12) Australian Commonwealth waters: WA-8-PL and NT/PL1 NT waters: NTC/PL1 and PL 20
Hydrocarbon Type	At the time of Bayu-Undan Field production cessation the pipeline will be filled with production gas which will be subsequently managed according to the isolation approach selected (see details below). At the completion of decommissioning activities, the production gas in the decommissioned pipeline section will have been displaced by either untreated/treated seawater and flared at the Bayu-Undan Platform or isolated in the preserved pipeline section downstream of the tie-in point.
Activity Location	The pipeline section in Timor-Leste offshore waters within the BUPIOA to be decommissioned commences from the Bayu-Undan Platform (downstream flange of the Bayu-Undan Facility CPP SSIV) to the Timor-Leste – Australia maritime boundary between points TA-5 and TA-6 (as established in the Treaty) at KP 34.2. The Commonwealth waters section of the pipeline to be decommissioned extends from approximately KP34.2 to the tie-in point, as shown in **Figure 4-1**. The section of the pipeline from the tie-in point to the DLNG Plant (KP502, upstream of the DLNG beach valve) crosses both Commonwealth and NT waters and will be preserved with treated seawater or production gas depending on the isolation method selected for future gas export service from a new upstream gas supply. Santos has defined an Operational Area as a 2000 m buffer on the Pipeline centreline, from the Bayu-Undan Platform to KP34.2, and a 500 m buffer on either side of the Pipeline centreline between KP35 and the DLNG Plant.
Activity Description	<u>Pipeline Isolation at Bayu-Undan Production Cessation by either:</u> Installing either a High-Pressure Isolation Tool (HPIT) or Local Line Stops at the tie-in point as accepted in the Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan; OR Flooding from the DLNG Plant to the Bayu-Undan Platform, including: • Pipeline depressurisation through use as fuel gas for Bayu-Undan Platform topsides decommissioning activities. The location of gas flaring during depressurisation at the Bayu-Undan Platform is outside the BUPIOA and so is beyond the scope of this EP. Authorisation and management of this flaring activity is subject to an equivalent EMP for Timor-Leste offshore waters and authorisation by the ANPM. • Flooding the Pipeline with a pumping spread from the DLNG Plant to the Bayu-Undan Platform with filtered, treated seawater. • Flare remaining residual gas pushed in front of pipeline flooding train at the Bayu-Undan Platform. • Isolate the pipeline at both the DLNG Plant and Bayu-Undan Platform filled with treated seawater. <u>Pipeline Cutting and Section Removal at the tie-in point</u> • Seabed survey prior to cutting and removal. • Displacement of sediment and removal of concrete coating around the Pipeline at the cutting locations at the tie-in point.

	• Cut out an approximately 100m - 200 m section of the pipeline at the tie-in point. • Removal of the cut section of Pipeline to vessel for onshore disposal. • Installation of caps on the upstream and downstream ends of the Pipeline at the tie-in point within seven days after the section cut. • Post removal / recovery seabed survey. <u>Pipeline Cleaning</u> Pipeline cleaning activities within the scope of this EP includes the following. • Chemical cleaning pig train launched from either onshore at the DLNG Plant or at the tie-in point (after pipeline cutting and section removal at that location). • If Pipeline cleaning to the Bayu-Undan Platform is to be executed from the tie-in point, an upstream skid / pig launcher and receiver (PLR) will be installed on the upstream section of Pipeline to execute the Pipeline cleaning campaign. • Recover cleaning pig train at the Bayu-Undan Platform with cleaning chemicals, contaminants and flooding water ahead of the cleaning pig train disposed via a disposal well(s) in the Bayu-Undan Field. The location of disposal well(s) is outside the BUPIOA and so is beyond the scope of this EP. Authorisation and management of this downhole disposal activity will be subject to an equivalent EMP for Timor-Leste offshore waters authorised by the ANPM. Note: Onshore activities at the DLNG Plant (e.g. onshore pump spread, treated seawater/cleaning chemicals mobilisation/storage, pig launch and water winning) does not form part of the scope of this EP, and will be covered by DLNG environmental and safety authorisations administered by the NT onshore Regulators. <u>Pipeline section removal from the Bayu-Undan Platform to approximately KP34.2</u> Under the provisions of the *Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019*, the Pipeline section within the BUPIOA in Timor-Leste offshore waters is required to be decommissioned by full removal. The removal activities are: • Pipeline decommissioning pre-works for full removal section - sediment displacement, seabed and pipeline preparation. • Rigid spool removal by cut, disconnect and lift process from downstream flange of the SSIV at the Bayu-Undan platform to the spool/ pipeline interface and removal of the sections from the operational area for subsequent onshore disposal. • Pipeline removal between the Bayu-Undan Platform and approximately KP34.2 either by reverse S-lay or cut and lift methods and removal of the cut pipeline sections from the operational area for subsequent onshore disposal. • The KP34.2 end will be terminated within the boundaries of a pre-defined target zone located sufficiently inside Australian waters to minimise risks associated with legal international fishing vessels interacting with the cut end. <u>Pipeline section in-situ from approximately KP34.2 to the tie-in point (Australian Commonwealth waters)</u> The Pipeline section to be decommissioned in Australian Commonwealth waters will use the in-situ method. The activities are: • Removal of any temporary subsea equipment such as the upstream skid/PLR at the tie-in point. • Leave pipeline in place on the seabed, capped at both ends and filled with treated seawater if cleaned and flooded from the DLNG Plant or with untreated seawater if cleaned from the tie-in point. • Installation of anti-snagging protection at upstream cut end at the tie-in point. <u>Pipeline section preservation from the tie-in point downstream to the DLNG Plant (KP502) (Australian Commonwealth and NT waters).</u> The activities are either: • The downstream pipeline section remains filled with production gas for the accepted HPIT or Local Line Stops isolation approaches pending a return to gas export service after a new upstream gas supply is connected and commissioned; OR

	• The section of the pipeline remains flooded with treated seawater and is left in a preserved state pending future dewatering and reconditioning before returning to gas export service from a new upstream gas supply. External asset integrity risks will remain during the preservation period. External inspection would be conducted at the current established RBI maximum target interval of 5 years. The external survey would address fatigue or buckling risk at span locations, third party impact and CP system status. The harbour section would be surveyed at the current 2-year interval.
Vessels. Vessel Activities and Helicopter Activities	Vessels and vessel activities involved in Pipeline decommissioning and preservation activities include: • Pipeline pigging/flushing - CSV with ROVs, flushing spread and subsea downline. • Pipelay vessel or lay barge if the reverse S-lay method for Pipeline removal in Timor-Leste waters is used. • Anchor handling tugs in event an anchored lay barge is selected and if the reverse S-lay method for Pipeline removal in Timor-Leste offshore waters is used. • CSV/HLV suitable for preparatory work (e.g. subsea survey, sediment displacement, seabed and pipeline preparation) and pipe section cutting and recovery with ROV capability and suitable crane capacity to lift pipe spool sections and pipeline sections if the cut and lift method for Pipeline removal in Timor-Leste offshore waters and tie-in point location is used. A similar type vessel would be anticipated for installation of snagging protection measures. • Pipe transportation vessels / barges to transport recovered Pipeline sections from the operational area to the nominated onshore disposal site. • Survey/Touch Down Monitoring (TDM) vessel. • Dive Support Vessel (DSV) and associated Hyperbaric Rescue Vessel (HRV) for pig launcher installation at the tie-in point. • Support Vessels – e.g. offshore refuelling and supply operations. • Platform Supply Vessel (PSV) for chemical transportation and storage. The vessels will use Group II hydrocarbon fuels such as marine gas oil (diesel). Helicopters will be used for offshore crew changes.
Proposed Duration / Schedule	Pipeline decommissioning and preservation is planned to start after Bayu-Undan production cessation, which may commence as early as 2021 or as late as 2023 and is planned to be completed during the in-force period of this EP. The duration of Pipeline decommissioning and preservation activities are estimated as follows: Pipeline isolation at Bayu-Undan Field production cessation by either: (a) installing a HPIT or Local Line Stops at the tie-in point as described and assessed in the accepted Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan; OR (b) Flooding and cleaning from the DLNG plant, including onshore set-up and testing – approximately 8-10 weeks (flooding only is approximately 3 weeks) • Pipeline section cutting, removal and end-capping at the tie-in point – approximately 4 weeks • Pipeline cleaning from the tie-in point (if required) – approximately 8 weeks • Pipeline removal in Timor-Leste waters – approximately 20 weeks • Pipeline section in-situ in Commonwealth waters with equipment removal, end-capping and snagging protection at the upstream end of the tie-in point – approximately 4 weeks. • Preservation of the pipeline section from the tie-in point to DLNG – approximately 2 years.

4.2 LOCATION AND TENURE

The Pipeline section in Timor-Leste offshore waters is located from the Bayu-Undan Platform (downstream flange of the Bayu-Undan CPP SSIV) to the Timor-Leste – Australia maritime boundary between points TA-5 and TA-6 (as established in the Treaty) at approximately KP34.2 (KP34.2 coordinates are 266555.28 mE and 8754465.49 mN, which are based on Geocentric Datum of Australia (GDA94) and UTM zone 52). The Pipeline section in Australian Commonwealth and NT Waters from approximately KP34.2 to the DLNG Plant (KP502) includes

pipeline licences WA-8-PL, NT/PL1, NTC/PL1 and PL20.

The section of the Pipeline from the Bayu-Undan Platform lies in approximately 80 m water. The depths of the seafloor over the course of the Pipeline reach a maximum depth of 134 m around KP131, rising to less than 100 m in the vicinity of KP180 and following a general shallowing trend towards Darwin after reaching a depth of approximately 50 m at the tie-in point. The nearest land to the Pipeline is Bathurst Island, located approximately 20 km to the north-east of the tie-in point.

Approximately 221 km of the Pipeline is located on the seabed within the Oceanic Shoals Marine Park. The Pipeline enters the Marine Park Multiple Use Zone at coordinates 277744.22mE and 8751077.71mN (Geocentric Datum of Australia (GDA94) and UTM zone 52). Approximately halfway along the Pipeline section within the Marine Park, it exits the Multiple Use Zone and enters the adjacent Special Purpose Zone (Trawl). The Pipeline exits the Special Purpose Zone (Trawl) and the Marine Park boundary at coordinates 492339.42mE and 8701089.59mN.

4.2.1 Operational Area

Santos has defined an Operational Area as a 2000 m buffer on the Pipeline centreline, from the Bayu-Undan Platform to KP34.2, and a 500 m buffer on either side of the Pipeline centreline between KP34.2 and the DLNG Plant. .

Vessels that may be required to carry out Pipeline decommissioning and preservation activities include:

- Pipeline pigging/flushing - CSV with ROVs, flushing spread and subsea downline,
- Pipelay vessel or lay barge if the reverse S-lay method for Pipeline removal in Timor-Leste waters is used,
- Anchor handling tugs in event an anchored lay barge is selected and if the reverse S-lay method for Pipeline removal in Timor-Leste offshore waters is used,
- CSV/HLV suitable for preparatory work (e.g. subsea survey, sediment displacement, seabed and pipeline preparation) and pipe section cutting and recovery with ROV capability and suitable crane capacity to lift pipe spool sections and pipeline sections if the cut and lift method for Pipeline removal in Timor-Leste offshore waters and tie-in point location is used. A similar type vessel would be anticipated for installation of snagging protection measures,
- Survey/TDM vessel,
- Pipe transportation vessels / barges to transport recovered Pipeline sections from the operational area to the nominated onshore disposal site,
- DSV and associated HRV for pig launcher installation at the tie-in point,
- Support Vessels – e.g. offshore refuelling and supply operations, and
- PSV for chemical transportation and storage.

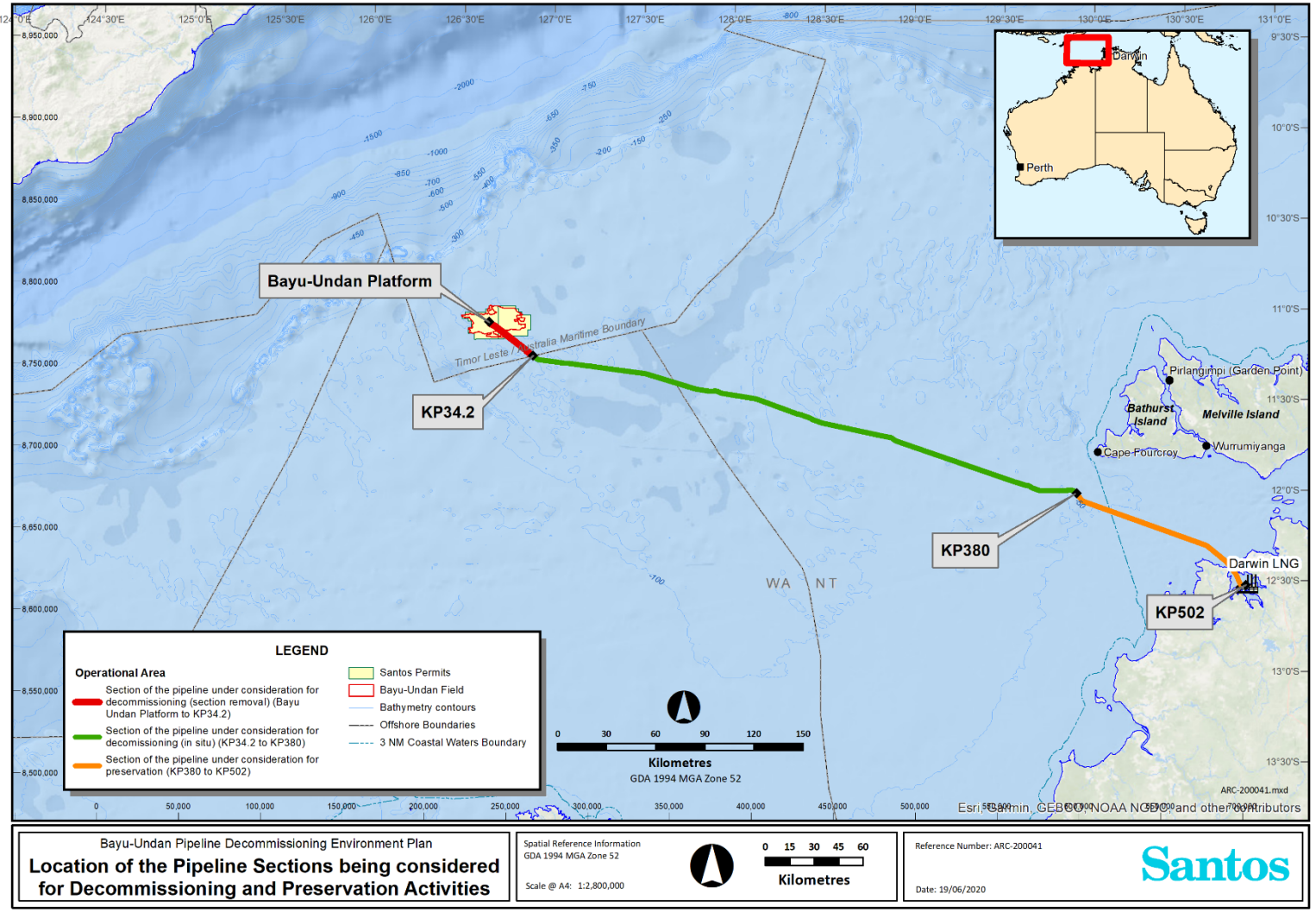


Figure 4-1: Location of the Pipeline section being considered for decommissioning and preservation activities

4.3 PIPELINE DESIGN AND CONSTRUCTION

The section of the Pipeline within the scope of this EP is a 26" concrete weight coated (CWC) carbon steel pipeline (with the exception of all sections upstream of the flange reducer which are 28" nominal diameter) with internal flow coating (except for 100 mm field joints) and associated spools extending from the Bayu-Undan Platform in Timor-Leste offshore waters (downstream flange of the SSIV) to the DLNG Plant (KP502, upstream of the DLNG beach valve). The Pipeline system was designed and installed in accordance with DNV-OS-F101 DNV Submarine Pipeline Systems. The Pipeline properties are summarised in **Table 4-2**.

The Pipeline was laid directly on the seabed and has been in operation since September 2005.

Table 4-2: Structural Design Parameters for the Pipeline

Parameter	Units / Details	Description / Value
Line pipe specification		API 5L SAW Gr X65
Pipeline nominal OD	mm	660.0
Pipeline nominal ID	mm	619.8 (constant ID)
Pipeline overall OD	mm	770.0
Nominal wall thickness	mm	20.1
Line pipe	Pipeline OD	Max 665 mm Min 658 mm
	Wall thickness	20.7mm (KP 0.327 to KP 34) 20.1mm (KP 34 to KP 502.42)
Internal coating type / thickness	-	Epoxy flow coat / 0.075 mm
External corrosion coating type / thickness	-	2.5mm, 3-layer polypropylene (KP0 to KP 15) 5mm asphalt enamel (KP15 to KP 502.42)
Concrete coating thickness	-	High density concrete 3040kg/m^3 (Varying from 40 mm to 110 mm in thickness)
Steel density	Kg/m^3	7850
Design Life	Years	25 (2005 to 2030). Verification/validation for an additional 25 years (to approximately 2048 from 2023) will be sought for the preserved section from the tie-in point to the DLNG Plant.

The Pipeline cathodic protection anode system provides the protection against external corrosion of the Pipeline. The system has been designed in accordance with DNVGL-RP-B401. The latest CP survey results (2017 & 2019) confirmed that the CP system is functioning as designed, and there is not noticeable coating breakdown. The current remaining life for the CP anode system is > 100 years.

4.4 DECOMMISSIONING ACTIVITIES

4.4.1 Pipeline Isolation at Bayu-Undan Field Production Cessation by either:

Installing a HPIT or Local Line Stops at the Tie-in Point

This activity is described in the Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan (Document reference DCOM-652-EN-EPP-00001) accepted by NOPSEMA on 18 September 2019; or

Pipeline Flooding from the DLNG Plant to the Bayu-Undan Platform

The cleaning / flooding pig train will be pushed with filtered, treated seawater sourced from

Darwin Harbour, resulting in flooding of the Pipeline from the DLNG Plant to the Bayu-Undan Platform. A water extraction licence application will be lodged with the NT Government for authorisation to access this water supply. If pipeline cleaning occurs from the tie-in point, the Pipeline will be flooded independently of the cleaning pig train campaign. Treated seawater will be pushed with a pumping spread located and operated onshore at the DLNG Plant. Once the Pipeline is flooded with treated seawater, it will be isolated at both the DLNG Plant and Bayu-Undan Platform ends.

4.4.2 Pipeline Cleaning

As part of the precautionary management approach, the pipeline will be chemically cleaned to reduce any potential long-term risk associated with methylation of any residual insoluble mercury to a soluble form above acceptable limits during the Pipeline degradation process to ALARP. Pipeline cleaning activities within the scope of this EP include chemical cleaning of the Pipeline by use of a pig train pushed with treated seawater from onshore at the DLNG Plant or with untreated seawater from a subsea pig launcher deployed by a CSV at the tie-in point to the Bayu-Undan Platform.

As the Pipeline chemical cleaning pig train is pushed towards the Bayu-Undan Platform, any residual production gas in front of the cleaning pig train will be flared at the Bayu-Undan Platform (flood and clean from DLNG or Local Line Stops isolation approaches only).

If the flooded Pipeline is cleaned from the tie-in point, the flooding water in the Pipeline between the tie-in point and the Bayu-Undan Platform will be pushed by the cleaning pig train to the Bayu-Undan Platform. The flooding water, the cleaning chemicals and any associated contaminants will be disposed of via a disposal well once the cleaning pigs have been recovered on Bayu-Undan platform. The cleaning pig train from the tie-in point will be pushed by untreated seawater, which will be left in the Pipeline at the conclusion of cleaning activities.

4.4.3 Pipeline Cutting and Section Removal at the Tie-in Point

In preparation for cutting of the Pipeline at the tie-in point, seabed sediment at the cutting location will be displaced in order to expose the Pipeline, and concrete coating removed in readiness for cutting. An approximately 200 m section of the Pipeline will be cut into a number of smaller sections and recovered to a vessel for subsequent onshore disposal.

Following cutting, caps will be installed on both the upstream and downstream ends of the Pipeline at the tie-in point within seven days after the section cut.

If Pipeline cleaning is to be executed from the tie-in point, the upstream end cap will be replaced with a mechanical connector and upstream skid/PLR, pre-loaded with pigs for the Pipeline cleaning activities and then be removed and replaced by an end cap.

4.4.4 Pipeline section between the Bayu-Undan Platform and approximately KP34.2

Under the provisions of the *Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019*, the Pipeline section within the BUPIOA in Timor-Leste offshore waters is required to be decommissioned by full removal. The two methods considered for full removal of this Pipeline section are (a) reverse S-lay or (b) cut and lift.

The activities associated with removing the Pipeline by the reverse S-lay method include the following steps:

- Position CSV/HLV over the Bayu-Undan Platform (downstream flange of the SSIV), deploy cutting, disconnecting and lifting equipment and commence cutting, disconnecting and removing rigid spools between the SSIV and pipeline end flange at the Bayu-Undan Platform. CSV/HLV to also make cut at or near approximately KP34.2 (if required) to allow removal to commence at either end and Pipeline to free drain during removal,
- Position S-lay vessel at either the Bayu-Undan Platform or at approximately KP34.2 and deploy abandonment and recovery (A&R) winch wire complete with Pipeline recovery tooling,

- Install mechanism for Pipeline recovery such as a Pipeline recovery tool with internal clamping mechanism and recover Pipeline from the seabed into the removal vessel stinger and pipe-lay tunnel by using the A&R winch on board the pipelay vessel,
- Use high pressure water cleaning to remove marine growth, returning majority back to environment, to ensure suitable grip through the tensioners,
- Commence cutting of the Pipeline into manageable section lengths once on board the pipelay vessel,
- Offload Pipeline lengths onto pipe transportation vessels/barges for removal to nominated onshore disposal facility,
- Once the tensioner has pulled the maximum length of Pipeline onto the deck of the pipelay vessel, the vessel will offset accordingly either on its anchors or through the use of its Dynamic Positioning (DP) system,
- Continue this Pipeline recovery process until all Pipeline sections within Timor-Leste offshore waters have been recovered, and
- After the final Pipeline section has been recovered, the Pipeline will be returned to seabed and capped within the target zone at approximately KP34.2. The Pipeline between approximately KP34.2 and the tie-in point will be left in-situ, capped and flooded with treated seawater (in case of flooding and cleaning from DLNG) or capped and filled with untreated seawater (in case of cleaning from the tie-in point. The treated seawater inventory will chemically breakdown prior to degradation of the end caps or corrosive breakthrough of the in-situ Pipeline structure.

The activities associated with removing Pipeline section by the cut and lift method include the following steps:

- Position CSV/HLV over the Bayu-Undan Platform (downstream flange of the SSIV), deploy cutting equipment and commence cutting, disconnecting and removing rigid spools between SSIV and Pipeline end flange,
- Position CSV/HLV at either the Bayu-Undan Platform or approximately KP34.2,
- Deploy subsea cutting tool and commence cutting Pipeline into manageable lengths,
- Where necessary, sediment displacement equipment will be deployed to allow access to areas of the Pipeline where full or partial burial has occurred,
- Position a second CSV/HLV (vessel with sufficient crane and deck capacity to handle pipe segments) near first Pipeline section cut,
- Deploy subsea grapple / pipe removal tool and ROV to support position and engagement of grapple / pipe removal tool on pipe section,
- Engage grapple / pipe removal tool with pipe section as close to centre point as possible,
- Lift cut pipe sections to surface and transfer / offload onto pipe transportation vessel for removal to nominated disposal facility,
- Continue this Pipeline recovery process until all Pipeline sections are removed from Timor-Leste offshore waters, and
- After the final Pipeline section has been recovered, subsea cutting will be stopped and the Pipeline end section will be capped within the target zone at approximately KP34.2. The Pipeline between approximately KP34.2 and the tie-in point will be left in-situ, capped and flooded with treated seawater (in case of flooding and cleaning from DLNG) or capped and filled with untreated seawater (in case of cleaning from the tie-in point. The treated seawater inventory will chemically breakdown prior to degradation of the end caps or corrosive breakthrough of the in-situ pipeline structure.

4.4.5 Pipeline section in-situ decommisioning: approximately KP34.2 to the tie-in point (Australian Commonwealth waters)

The proposed decommissioning strategy for the Pipeline section in Australian Commonwealth waters from approximately KP34.2 to the tie-in point is to leave it in-situ with minimal intervention, following completion of the required Pipeline cleaning program (see **Section 4.4.1**).

Any remaining temporary equipment such as the upstream skid/PLR at the tie-in point, if required, will be recovered for onshore disposal. Following equipment removal, the Pipeline will be left in-situ on the seabed, capped and flooded with treated seawater with anti-snagging protection installed on the cut end of the pipeline upstream of the tie-in point.

4.4.6 Pipeline section preservation: Tie-in point to the DLNG Plant (KP502) (Australian Commonwealth and Northern Territory waters)

The Pipeline from the section downstream of the tie-in point to the DLNG Plant (KP502) will be preserved either with production gas if the HPIT or Local Line Stops isolation approach is used or flooded with treated seawater if the flooding isolation approach is used to maintain the integrity of the Pipeline, pending a return to gas export service from a new upstream gas supply. Treated seawater dosing will be sufficient to preserve the Pipeline for the preservation period which will be approximately 2 years. External asset integrity risks will remain during the preservation period. External inspection will be conducted at the current established RBI maximum target interval of 5 years. The external survey would address fatigue or buckling risk at span locations, third party impact, and CP system status. The harbour section would be surveyed at the 2-year current interval.

4.5 POST-DECOMMISSIONING ACTIVITIES

Following in-situ decommissioning, it is estimated that it will take between 200 to 500 years for external corrosion to cause the Pipeline to start to break apart (see **Section 6.3** for further detail). Prior to corrosive breakthrough, residual contaminants within the Pipeline are contained within the Pipeline structure and there is no release pathway to the marine environment. In addition, the Pipeline is expected to self-bury to a varying extent based on flexibility, weight and bottom hardness with increased weight following Pipeline flooding. With pipeline cleaning to minimise any potential long-term contaminant risk during the Pipeline degradation process to ALARP with no credible environmental release pathways expected for over 200 years following in-situ decommissioning, post-decommissioning environmental monitoring is not required and is not proposed following decommissioning of the Pipeline.

4.6 CHEMICAL SELECTION AND USE

The chemicals required for post-cessation cleaning will be subject to the ABU-W chemical selection process described below before being permitted for use.

Subsea chemicals will, at a minimum, be assessed in accordance with the United Kingdom Offshore Chemical Notification Scheme (OCNS) Ranked List of Notified Chemicals. The Chemical Hazard and Risk Management (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 (PEC) against the predicted no effect concentration (PNEC) (i.e. the PEC:PNEC ratio) and expresses this as a Hazard Quotient (HQ), which is then used to rank the product (**Table 4-**). 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 4-**). The overall ranking is determined by that substance having the worst case OCNS ranking scheme assignment in terms of biodegradability and bioaccumulation 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 not bioaccumulative.

Table 4-3: OCNS CHARM HQ 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 4-4: OCNS groupings

OCNS grouping	Aquatic toxicity (LC50) (mg/L)	Sediment Toxicity (LC50) (mg/L)	Hazard
A	<1	<10	Highest
B	>1-10	>10-100	
C	>10-100	>100-1000	
D	>100-1000	>1000-10,000	
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, and
- If not rated under the CHARM model, has an OCNS group rating of D or E.

(Note: pipeline cleaning chemicals will be disposed of downhole rather than discharged to the marine environment as part of planned activities).

The use of non-rated (under the OCNS CHARM model) subsea chemicals will only be considered following approval from the Subsea Engineer, in consultation with the Santos Decommissioning Environment Lead, after the completion of an environmental risk assessment. The environmental risk assessment will include the following:

- Technical justification for the usage,
- Consideration of additional controls,
- How each chemical may be used, and
- Quantity to be used.

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

- Evaluation of the receiving marine environmental characteristics, values and sensitivities, with respect to the nature and scale of the proposed chemical product to be discharged,
- Review of alternative chemical products that are equivalent in meeting the technical requirements of the scope of work and selection of the least hazardous chemical, and
- Evaluation of ecotoxicity thresholds and application of OCNS ratings which may include:
    - Establishment of 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 test guidelines, Organisation for Economic Cooperation and Development test guidelines, and OSPAR guidelines), or
    - Use of alternative similar toxicity data if insufficient toxicity information is available on the non-rated chemicals.

Approval of non-rated chemical products will be subject to an ALARP demonstration following

the risk assessment.

4.7 DURATION

Pipeline decommissioning is planned to commence after reaching Bayu-Undan production cessation, which is estimated to commence as early as 2021 or as late as 2023 and is planned to be completed during the in-force period of this EP.

The duration of Pipeline decommissioning and preservation activities is estimated as follows:

- Pipeline isolation at Bayu-Undan Field production cessation by either:
  - Installing a HPIT or Local Line Stops at the tie-in point as described and assessed in the accepted Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan, OR
  - Flooding and cleaning from the DLNG Plant, including onshore set-up and testing – approximately 8-10 weeks (flooding only is approximately 3 weeks),
- Pipeline section cutting and end capping at the tie-in point – approximately 4 weeks,
- Pipeline cleaning from the tie-in point (if required) – approximately 8 weeks,
- Pipeline removal in Timor-Leste waters – approximately 20 weeks, and
- Pipeline section in-situ in Commonwealth waters with equipment removal, end-capping and snagging protection of the upstream section at the tie-in point – approximately 4 weeks.
- Preservation of the pipeline section from the tie-in point to DLNG – approximately 2 years.

4.8 COMPARISON OF GEP ISOLATION AND DECOMMISSIONING APPROACHES

Santos has identified two technically feasible methods of isolating the pipeline at production cessation as an initial part of the pipeline decommissioning activities. They are: (1) the HPIT or Local Line stops method described in the Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan (DCOM-652-EN-EPP-00001) accepted by NOPSEMA on September 18, 2019; and (2) Flooding the entire gas export pipeline which is described and assessed in this EP. While only one of these isolation methods will be used, neither can be eliminated at the time of submission of this EP due to technical requirements and schedule uncertainties around the timing of Bayu-Undan production cessation and availability of the new upstream gas supply. The environmental aspects and associated risks and impact for the two isolation methods differ in some regards but they also share most of the subsequent decommissioning activities and associated environmental risks and impacts. Neither isolation approach poses materially greater environmental risk or impact.

Santos has assessed the environmental impacts and risks of the two isolation approaches and subsequent decommissioning activities as summarised in Table 4-5 with consideration for the key differentiating environmental aspects. The purpose of the assessment is to demonstrate that there is little or no material difference in environmental risk between these two isolation approaches across the overall decommissioning activity scope.

Table 4-5 Comparison of Environmental Aspects of GEP Isolation and Decommissioning Approaches

Activities	HPIT or Local Line Stops	Flooding
Pipeline Isolation at Bayu-Undan Field Production Cessation *	*Description:* Platform launched HPIT set at the tie-in point or local line stops installed at the tine-in point. *Environmental aspects and impacts:* HPIT approach - approximately 700m^3 of untreated seawater will be discharged at the Bayu-Undan platform during the process of setting the HPIT. Local line stops approach – flaring at	*Description:* Flooding of the Pipeline from DLNG to BU Platform with treated seawater. *Environmental aspects and impacts:* Flooding approach - flaring at BU platform from pipeline depressurisation in preparation for flooding and any residual gas remaining in pipeline during the flooding activity (approximately equivalent to 8,644 tonnes of CO_2-e).

Activities	HPIT or Local Line Stops	Flooding
	BU platform from pipeline depressurisation after line stops set as well as any residual gas remaining in the pipeline during cleaning from KP380 (approximately equivalent to 9,950 tonnes of CO_2-e).	
Pipeline Cutting and Section Removal at Tie-in Point *	<u>*Description:*</u> Cut and remove 100 – 200m pipeline section at the tie-in point, install caps on upstream and downstream cut ends, install pig launcher/receiver on upstream cut end for cleaning from the tie-in point to BU platform. <u>*Environmental aspects and impacts:*</u> similar for both HPIT or Local Line Stops and Flooding approaches – approximately 60m^3 to 600m^3 of treated seawater containing biocide, corrosion inhibitor and oxygen scavenger will be released to the marine environment at the tie-in point over a seven day period when the pipeline is cut and a section is removed prior to caps being installed on both cut ends. Undiluted treated seawater is expected to be acutely toxic to marine biota. However, the toxicity of the treated seawater will decrease as it is diluted in the marine environment following release. Modelling indicates that 1,000 dilutions (0.5 mg/L concentration) will be reached within approximately 250m of the release point for the larger 600m^3 volume. The local line stops approach will result in a relatively small amount of dry gas (largely methane) being vented from the section of the pipeline between the local line stops prior to the cut and section removal.	
Operational Pipeline Section Preserved State *	<u>*Description:*</u> Gas filled pipeline section downstream of the tie-in point (KP380 to DLNG).	<u>*Description:*</u> Treated water filled pipeline section downstream of the tie-in point.
Pipeline Cleaning	<u>*Description:*</u> Cleaning of pipeline section from the tie-in point to BU platform or from DLNG as part of pipeline flooding to remove scale and dust using a pig train with multiple chemical slugs. Downhole disposal of all cleaning chemicals, contaminants and flooding water ahead of the pig train. <u>*Environmental aspects and impacts:*</u> similar for both HPIT / Line Stops and Flooding approaches – no planned release of chemicals, contaminants (all approaches) or flooding water.	
Pipeline Section Removal in Timor-Leste Offshore Waters	<u>*Description:*</u> Cutting and removal of the cleaned pipeline section in Timor-Leste offshore waters (BU Platform to KP34.2) by either cut and lift or reverse s-lay method with onshore disposal of the removed pipeline section at a licenced waste management facility. <u>*Environmental aspects and impacts:*</u> similar for HPIT / Line Stops and Flooding (clean from the tie-in point) approaches. Untreated seawater will be released from the cleaned pipeline as the sections are removed. The Flooding and Clean from DLNG approach will result in release of treated seawater from the cleaned pipeline as the sections are removed. The environmental risk of this release will be mitigated by three factors: • the chemical dosing of treated seawater in the pipeline section to be decommissioned (tie-in point to BU platform) will be approximately one-third of the amount used for the preserved section (tie-in point to DLNG) • the release of treated water during the pipeline section removal activity will be gradual and intermittent over an approximately 20-week period. For the cut and lift method this would consist of an approximately 9m^3 release for each 30m section removed • the delay between flooding and pipeline section removal, which is planned to be several years, will significantly degrade the initial toxicity and associated environmental risk of the lightly dosed treated water chemicals in this section.	
Pipeline Section In-situ Decommissioning in Australian Commonwealth Waters	<u>*Description:*</u> In-situ decommissioning of cleaned, seawater filled pipeline section from KP34.2 to the tie-in point, capped, with anti-snagging measures installed at the upstream end of the tie-in point.	

Activities	HPIT or Local Line Stops	Flooding
	Environmental aspects and impacts: similar for HPIT / Line Stops and clean from the tie-in point approaches – the in-situ decommissioned section will be filled with untreated seawater. The Flooding and Clean from DLNG approach will result in lightly dosed treated seawater remaining in the in-situ decommissioned section rather than untreated seawater which will degrade to the point of negligible toxicity before the end caps or pipeline degradation commences.	

***** These activities have been authorised for HPIT or Local Line Stops Approach through acceptance of the Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan (DCOM-652-EN-EPP-00001) by NOPSEMA on 18 September 2019.

Assessment and demonstration that the environmental risks associated with both approaches are managed to an ALARP and acceptable level is further addressed in Section 6 of this EP.

4.9 ACTIVITIES BEYOND THE SCOPE OF THIS ENVIRONMENT PLAN

The following activities are outside the scope of this EP and will either be addressed in other Environment Plans or will be addressed through regulatory authorisation processes in other jurisdictions:

- Pipeline pigging / cleaning operations prior to production cessation which are authorised under the in-force Bayu-Undan to Darwin Gas Export Pipeline Operations Environment Plan,
- Flooding and cleaning pigging and pumping spread activities at the DLNG Plant will be covered by DLNG environmental and safety authorisations administered by the NT onshore Regulators,
- Gas flaring and downhole disposal of Pipeline chemicals/fluids at the Bayu-Undan CPP facilities associated with flooding / cleaning will be the subject of environmental and safety authorisations administered by the Timor-Leste offshore waters Regulator,
- Dewatering and reconditioning of the Pipeline from the tie-in point to the DLNG Plant, and tie-in to the new upstream gas supply and associated vessel activities will be the subject of a future Environment Plan. Dewatering and reconditioning of the Pipeline is expected to take place from the onshore DLNG Plant to one of the following locations:
    - Discharge via jumper at the tie-in point to a dispersion skid located to minimise impacts to sensitive receptors,
    - Transfer via jumper into the decommissioned section of the Pipeline between the tie-in point and the Bayu-Undan Platform for storage in the decommissioned section of pipeline or disposal at the Bayu-Undan Platform, or
    - Transfer via the Barossa Pipeline, when connected at the tie-in point, for discharge by dispersion skid at a location in the Barossa Field,
- Onshore disposal of the cut and removed Pipeline sections from the Bayu-Undan Platform to approximately KP34.2 and at the tie-in point, will be subject to jurisdiction-specific authorisations and consents from Regulatory Authorities at the disposal destination.
- Installation of a downstream tie-in skid or direct connection at the tie-in point, connection of the upstream gas supplier pipeline and installation of anti-snagging protection measures on the Pipeline section to be preserved at the tie-in point.
- Pipeline commissioning and operations downstream of the tie-in point with new upstream gas supply.

5 DESCRIPTION OF THE ENVIRONMENT

In accordance with regulations 13(2) and 13(3) of the OPGGS(E) Regulations 2009, a description of the environment that may be affected (EMBA) by both routine/planned and non-routine/unplanned activities undertaken during the activity is presented in this section. The description includes relevant physical, biological, socio-economic and cultural values and sensitivities (also referred to in the EP as receptors). The information contained in this section has been used to inform the assessment of environmental impacts and risks presented in **Section 6**.

The EMBA encompasses the environment that may be affected by sources of risk from both routine/non-routine planned and unplanned activities in Commonwealth waters. The EMBA is comprised of two elements (**Figure 5-1**):

- The Operational Area (refer to **Section 4**), and
- The area potentially impacted by the worst-case credible hydrocarbon spill scenarios that may credibly arise (refer to **Section 6.4.6**), referred to as the Moderate Exposure Zone (MEZ).

The existing environment description considers a range of information sources, including:

- Information collected during consultation,
- Relevant literature (e.g. scientific journal articles),
- Environmental data collected by Santos, and
- Material published by the Department of Agriculture and Water Resources (DAWE) (e.g. EPBC Protected Matters Search Tool (PMST) reports, species profile and threats (SPRAT) database and the Conservation Values Atlas).

A description of the regional environment is also included to provide context for the characteristics of the existing environment values and sensitivities within the Operational Area and EMBA.

The EPBC Act PMST was used to identify environmental receptors protected under the Act. Three EPBC Act PMST reports were generated; one based on the Operational Area and two based on MEZ for the worst-case credible hydrocarbon spill scenarios at approximately KP34.2 and the tie-in point. All PMST reports are provided in **Appendix B**.

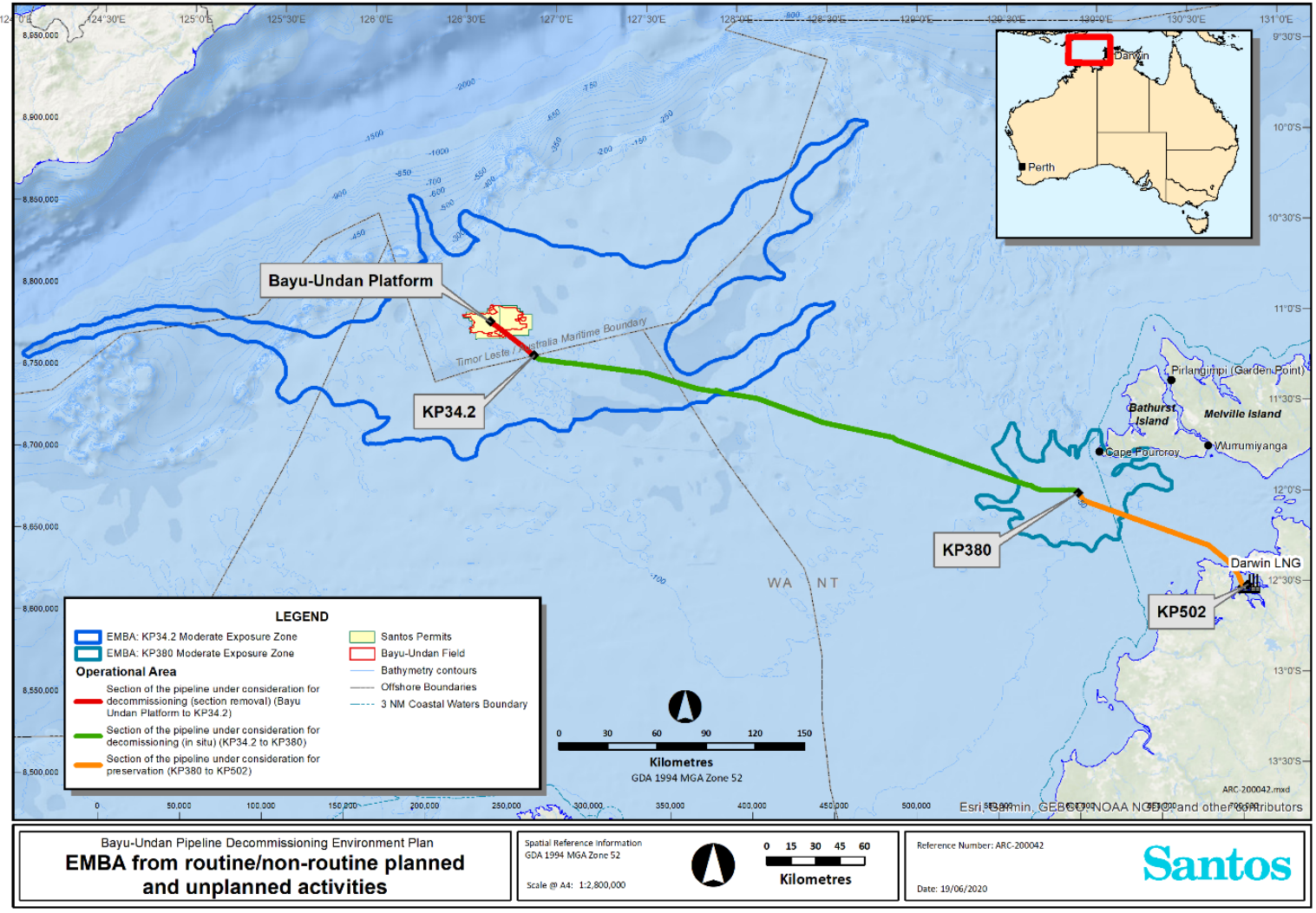


Figure 5-1: EMBA from routine/non-routine planned and unplanned activities

5.1 REGIONAL SETTING

Most of the Operational Area (73%) lies within Commonwealth waters in the North Marine Region (NMR) and 7% of the Operational Area lies within Timor-Leste offshore waters similar to the NMR due to their relatively close proximity. The remaining 20% of the Operational Area occurs within NT coastal waters, where the Pipeline terminates in Darwin Harbour. The NMR encompasses several regionally important marine communities and habitats which support a high biodiversity of marine life and feeding and breeding aggregations.

The key physical characteristics of the NMR include (Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2012a):

- 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. This feature 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 – 100 m deep and 20 km wide) in the northern section of the region,
- Numerous limestone pinnacles within the Bonaparte Basin that can extend up to tens of kilometres in length and width,
- The Arafura Shelf, which is up to 350 km wide and has an average water depth of 50 m – 80 m. The shelf is characterised by features such as canyons and terraces,
- Reefs around the perimeter of the Gulf of Carpentaria,
- The Gulf of Carpentaria coastal zone, which is characterised by comparatively high levels of productivity and biodiversity, and
- Currents driven predominantly by winds and tides.

5.1.1 Bioregions

The Pipeline within Commonwealth waters lies entirely within the Northwest Shelf Transition provincial-scale bioregion, which covers an area of 305,463 km^2. 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 is mainly influenced by the Indonesian Throughflow (ITF) current, which varies in strength seasonally (Department of the Environment, Water, Heritage and the Arts (DEWHA) 2008). Water depths average between 10 to 100 m, with a max depth of 330 m.

Topography of the Northwest Shelf Transition is considered complex and comprises a diversity of features, including submerged terraces, carbonate banks, pinnacles, reefs and sand banks (DEWHA 2008). Key Ecological Features (KEFs) within the bioregion, such as the Carbonate Banks and Pinnacles of the Joseph Bonaparte Gulf, are considered distinct features of the Northwest Shelf Transition and likely support higher diversity of marine species compared to the surrounding seabed. KEFs overlapping the EMBA are discussed in greater detail in **Section 5.3.2.4**. Species occurring within the Northwest Shelf Transition are typical of Indo-west Pacific tropical flora and fauna (DEWHA 2008), and the region includes a number of BIAs for marine turtles and dolphins. BIAs overlapping the EMBA are outlined in **Section 5.3.3**.

Within the Northwest Shelf Transition, the EMBA overlaps four distinct meso-scale bioregions (**Figure 5-2**):

- Oceanic Shoals,
- Bonaparte Gulf,
- Anson-Beagle, and
- The Tiwi Island bioregions.

The Oceanic Shoals meso-scale bioregion is relatively large and overlaps much of the outer

continental shelf in the North marine region. This relatively large bioregion includes several oceanic shoals and banks that host diverse biological communities, however all the shoals and banks in this bioregion lie beyond the EMBA. The two KEFs that overlap the EMBA are mostly located within this bioregion. Much of this bioregion is overlapped by the Oceanic Shoals Marine Park (**Section 5.4.2.1**). Approximately 279 km (73%) of the Pipeline between the Bayu-Undan Platform and the tie-in point lies within this meso-scale bioregion.

The Bonaparte Gulf meso-scale bioregion is relatively flat and featureless compared to the Oceanic Shoals meso-scale bioregion. It consists of mid- and inner- continental shelf waters, which are typically more turbid. Approximately 58.4 km (15%) of the Pipeline between the Bayu-Undan Platform and the tie-in point lies within this meso-scale bioregion.

The Anson-Beagle meso-scale bioregion comprises inshore Commonwealth and NT coastal waters, from the high-water mark to the 30 m depth profile. This bioregion supports various intertidal habitats including mudflats and extensive mangrove forests. Approximately 57 km (11%) of the Pipeline between the tie-in point and the DLNG Plant lies within this meso-scale bioregion, entirely within NT coastal waters.

The Tiwi meso-scale bioregion does not overlap the Pipeline but lies within the EMBA determined by the hydrocarbon spill modelling. This bioregion contains nearshore waters and coastal habitats such as mangroves and beaches.

No bioregions have been determined in the Timor-Leste offshore waters overlapped by the EMBA, which lies on the outer continental shelf. Given the proximity of the EMBA in Timor-Leste waters to Oceanic Shoals bioregion, the EMBA in Timor-Leste offshore waters is likely to be similar. No named offshore oceanic shoals or banks are known to occur within the EMBA in Timor-Leste offshore waters.

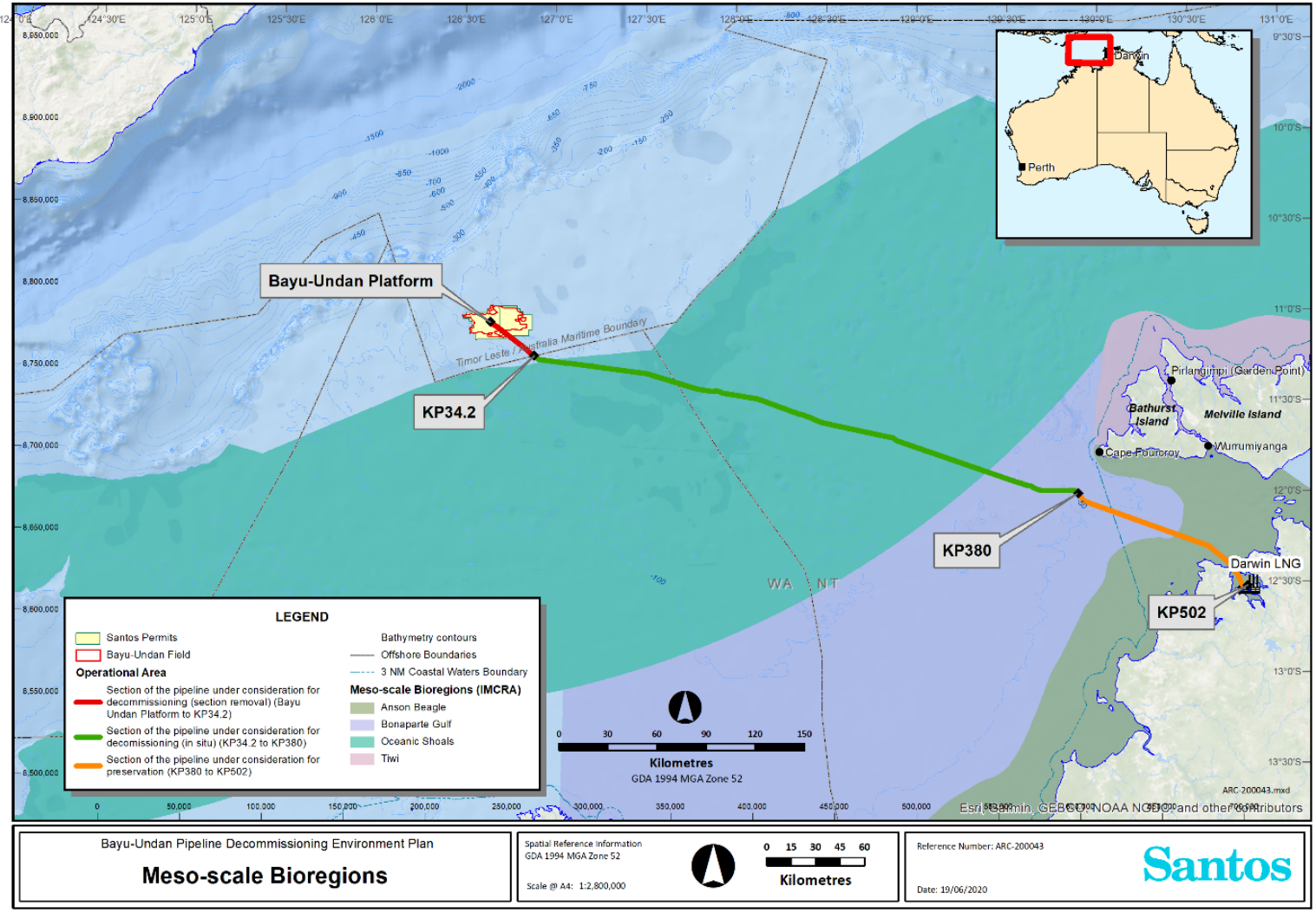


Figure 5-2: Meso-scale bioregions

5.2 PHYSICAL ENVIRONMENT

5.2.1 Climate

The NMR experiences a tropical climate and a distinct summer monsoonal wet season from December to March, followed by a typically cooler winter dry season from April to September. 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.

The variation in seasonal air temperatures in the region is small. The mean maximum summer and winter air temperatures recorded at Point Fawcett, Melville Island (the closest meteorological station to the majority of the EMBA) range between 33.3 °C in November to 29.9 °C in June (BoM, 2020). The annual mean maximum temperature is 31.8 °C and the mean minimum temperature is 22.6 °C (Bureau of Meteorology 2020).

5.2.2 Oceanography

5.2.2.1 Currents and tides

The large-scale currents of the Timor Sea are dominated by the ITF current system. This current is generally strongest during the south-east monsoon season (DEWHA 2008). The ITF 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 2008). The strength of the ITF 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 – 200 m depth, also influences the seas in the area (DEWHA 2008). The direction of the current changes seasonally with the monsoon, flowing towards the north-east in summer and the south-west in winter (DEWHA 2008).

Water movement on the outer and mid-continental shelf in the NMR is influenced primarily by wind and tidal activity and less by ocean currents. Surface currents reflect seasonal wind activity, flowing easterly to north-easterly during the wet season and west to south-westerly during the dry season (Heyward et al. 1997). Local wind driven surface currents can reach speeds of 0.6 m/s during monsoonal wind surges, however, more typical speeds are in the range of 0.2 to 0.3 m/s (Heyward et al. 1997).

Tides in the EMBA are typically semi-diurnal, with two high and low tides each day; diurnal tides occur during a relatively small portion of the moon phase. Tides within the Oceanic Shoals bioregion are macrotidal (4 – 6 m) and range from 2 – 3 m within offshore areas and 3 – 4 m within the Bonaparte Gulf bioregion (INPEX Browse 2010). Tides within the Anson-Beagle bioregion, including NT coastal waters and Darwin Harbour, typically range from 6 – 8 m. However, this can increase as a result of turbulent wave action during the monsoon season (INPEX Browse 2010). Tidal currents dominate flow in continental shelf waters in the region, with maximum spring tidal current velocities of up to 1.0 m/s (3.6 km/hr) and neap tidal currents of 0.4 m/s (1.4 km/hr).

Although the offshore currents are predominantly tidal, there is a pronounced seasonal cycle of drift currents present. During the northwest monsoon the flow weakens and even reverses direction over the inshore part of the shelf. Drift current speeds vary between 0.1 and 0.3 m/s (0.4-1 km/hr) with a mean yearly current of less than 0.05 m/s (0.2 km/hr) tending to the southwest.

5.2.2.2 Waves

In general, 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. The passage of cyclones results in increased wave heights and increased barometric tides due to the low atmospheric pressure.

5.2.2.3 Temperature

The sea surface temperature in the region 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.

5.2.3 Bathymetry and Seabed Features

The Pipeline between the Bayu-Undan Platform and the tie-in point has an average depth of approximately 74 m, with maximum and minimum depths of approximately 134 m and 13 m respectively (**Figure 5-3**). From the north-western end, the Operational Area initially descends a slope from 60 to 100 m before reaching a maximum water depth of 134 m. The seabed then becomes shallower, with much of the Pipeline between KP180 and the tie-in point in approximately 100 m of water. Within the Anson-Beagle bioregion (NT Coastal Waters) the Operational Area lies on the continental shelf, in water depths of typically less than 30 m to its termination in Darwin Harbour.

One named shoal, Newby Shoal, is apparent on the Pipeline depth profile near the tie-in point (**Figure 5-4**). Another named shoal, Shepparton Shoal, lies within the EMBA near the tie-in point. These are the only named seabed features within the EMBA, although several others occur within the region (**Figure 5-4**).

Several of the bathymetric features within the EMBA are recognised as KEFs; these are described in **Section 5.3.2.4**.

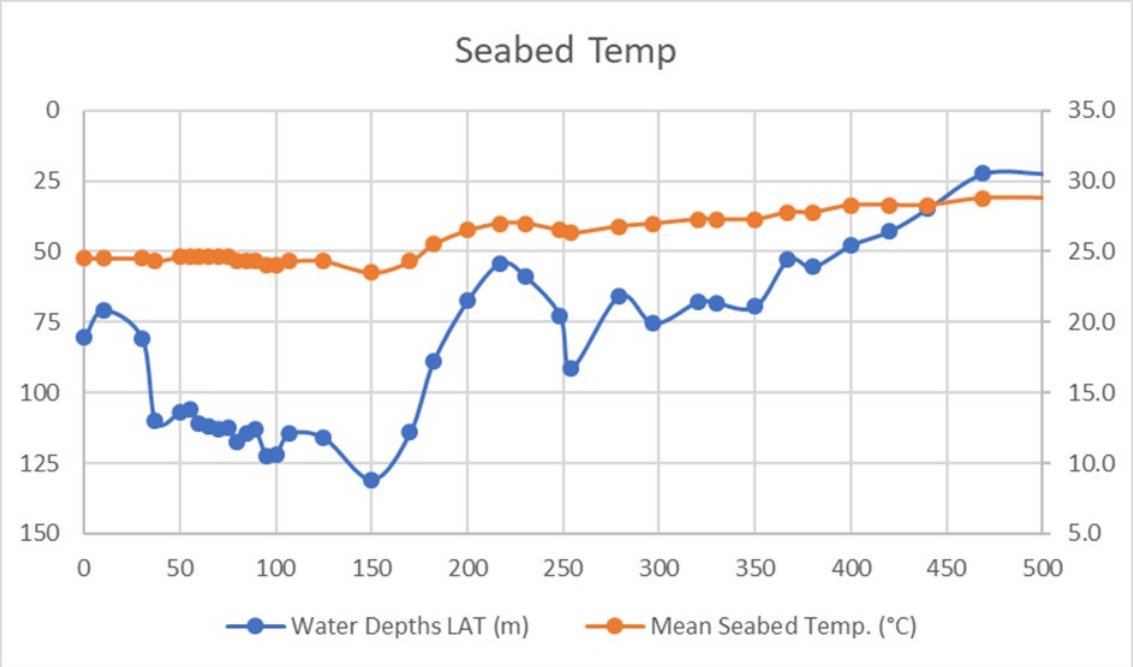


Figure 5-3: Depth profile and seabed temperature of the entire Pipeline

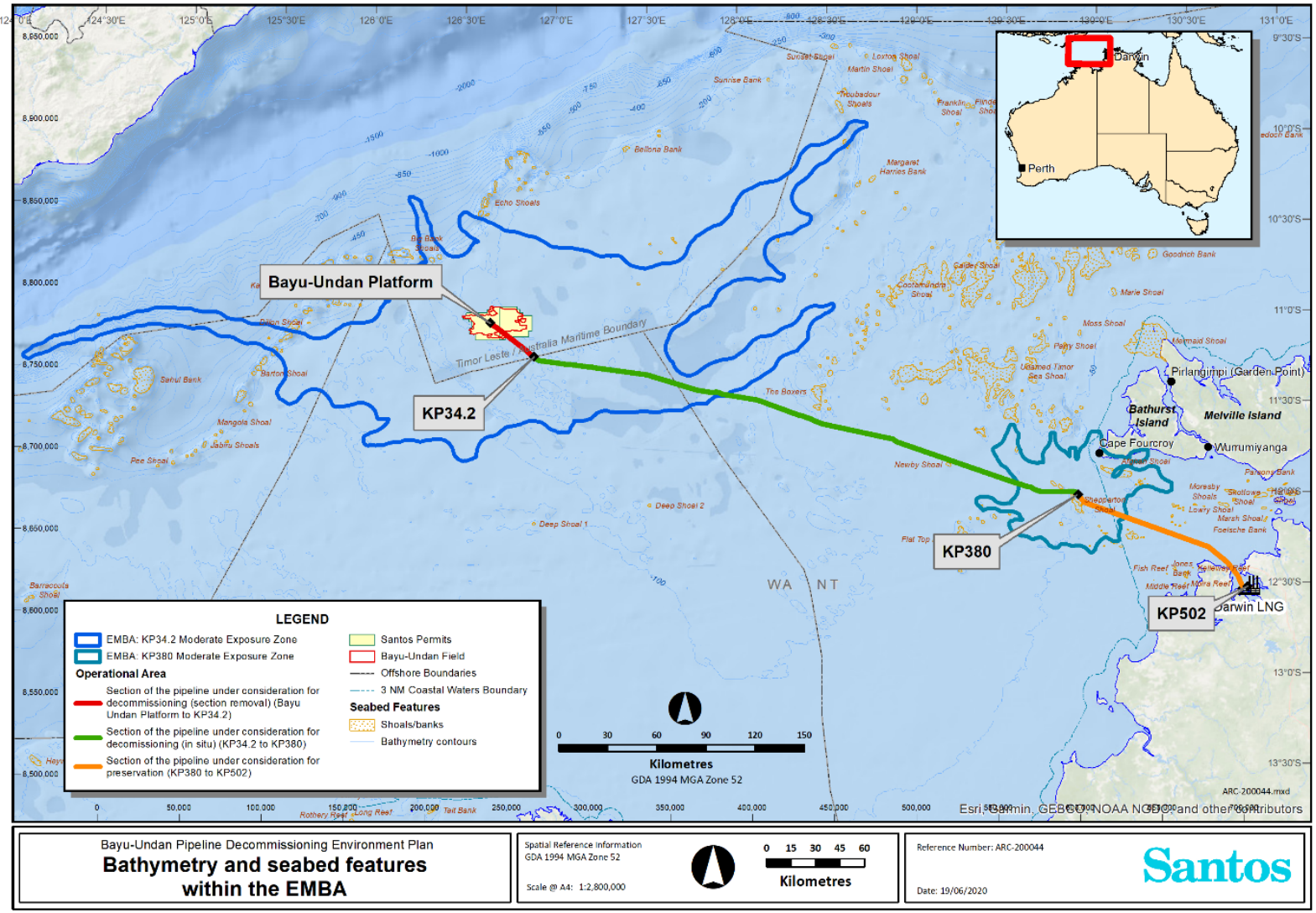


Figure 5-4: Bathymetry and seabed features within the EMBA

5.2.4 Water Quality

Water quality in the Northwest Shelf Transition is influenced predominately by the ITF, which brings warm, low salinity, oligotrophic (low in nutrients) waters into the region from Indonesia(DEWHA 2008). Environmental monitoring at the Bayu-Undan field showed surface water quality is generally high, with low levels of contaminants, nutrients and turbidity (CDM Smith 2020). Water quality changes along the Pipeline as it crosses the continental shelf, becoming considerably more turbid as the Pipeline approaches coastal waters. The increased turbidity is the result of strong tidal currents on the mid- and inner continental shelf within the Joseph Bonaparte Gulf region of the Northwest Shelf Transition, particularly in coastal areas (Przeslawski et al. 2011).

Seasons and large tidal variations influence water quality within Darwin Harbour, which is naturally turbid but is generally considered to be of high quality (INPEX Browse 2010). From November to March (can extend into April/May) spring tides and the wet season brings high levels of runoff and sediment from mangroves and catchments. Water quality is typically clearest during neap tide and during the dry season (April to September) (INPEX Browse 2010).

5.2.5 Sediment Quality

The dominant sediments within the EMBA in Commonwealth waters 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. Sediment quality in the region is typically high, with low levels of contaminants. Sediment monitoring results from the Bayu-Undan facility and within the Barossa Pipeline environmental survey areas indicated most potential contaminants, such as metals and hydrocarbons, were below the interim sediment quality guidelines low trigger values and higher concentrations of contaminants were likely to be associated with finer sediments (CDM Smith 2020, Jacobs 2017, 2016).

Within NT coastal waters, the Anson-Beagle bioregion has a mixture of gravelly, sandy sediment (Rochester et al. 2007). In Darwin Harbour, sediments have been classified into four types: terrigenous gravels (which occur predominately within the main channel), calcareous sands with greater than 50% biogenic carbonate (mainly surrounding small coral communities and shoals), terrigenous sands occurring on beaches and spits, and mud and fine sand within the intertidal mudflats (low current and tidal areas) (Larson et al. 1988). Each of these diverse substrates will influence the biotic structure, chemistry and communities within them. In summary, sediments across the Operational Area are generally fine in offshore deep habitats (silts) and become coarser (gravels and sands) towards more shallow and coastal areas.

A high abundance of bioturbator burrows were observed in unconsolidated sediments at two locations along the Pipeline during the marine habitat survey (McLean et al. 2020); one within the Special Purpose Zone (Trawl) of the Oceanic Shoals Marine Park, and one outside of the Oceanic Shoals Marine Park. The presence of bioturbators and infauna communities may suggest these species may be useful bioindicators for assessing the quality of soft-sediment and any environmental change or impacts to these substrates across the region (McLean et al. 2020).

5.2.6 Air Quality

Air quality within the EMBA is expected to be of very high quality, with only localised anthropogenic influences. Emissions from the Bayu-Undan Field (e.g. fugitive, combustion engine and flaring emissions) are the only point source atmospheric emissions within the offshore and remote areas of the EMBA. These emissions will be reduced considerably during production cessation (i.e. before the activities within the scope of this EP) and will cease following completion of decommissioning of the Bayu-Undan Field.

Air quality within the NT coastal waters, including Darwin Harbour, is affected from a number of anthropogenic sources such as industrial facilities and vehicles, as well as from bushfires (INPEX Browse 2010).

5.3 BIOLOGICAL ENVIRONMENT

5.3.1 Matters of National Environmental Significance

MNES that could potentially occur within the EMBA (i.e. the Operational Area and the MEZ) were identified using the PMST. Three EPBC Act PMST reports were generated; one based on the Operational Area and two based on MEZ for the worst-case credible hydrocarbon spill scenarios at approximately KP34.2 and the tie-in point. The PMST reports are provided in **Appendix B**.

Several MNES that will not credibly be impacted by the petroleum activity were identified by the PMST for the EMBA (e.g. obligate terrestrial species). These species have been excluded from further consideration as they are an artefact of the method used to drive the spatial extent of the EMBA.

The PMST database search results are summarised in **Table 5-1**.

Table 5-1: Summary of MNES within the EMBA identified by PMST reports

MNES Categories	Number of MNES
World Heritage Places	0
National Heritage Places	0
Wetlands of International Importance (Ramsar wetlands)	0
Listed threatened ecological communities	0
Listed threatened species	28
Listed migratory species	54

5.3.2 Habitats and Communities

5.3.2.1 Threatened Ecological Communities

No TECs listed under the EPBC Act are known to occur within the EMBA, as indicated by the EPBC Act PMST reports in Appendix B .

5.3.2.2 Ramsar Wetlands

No Wetlands of International Importance (Ramsar wetlands) are known to occur within the EMBA, as indicated by the EPBC Act PMST reports in Appendix B. The nearest Ramsar wetland, Cobourg Peninsula, lies approximately 135 km from the MEZ at the closest point.

5.3.2.3 Nationally Important Wetlands

One Nationally Important Wetland, Port Darwin, was identified by the PMST as occurring within the coastal areas of the EMBA. This wetland covers 48,800 ha, which includes at least 16,000 ha of mangroves (Department of Agriculture, Water and the Environment n.d.). The wetland encompasses the entire embayment (where <6m deep at low tide) of Port Darwin, to the usual high-water mark, and has significant ecological and social and cultural values. The area provides an important nursey area for estuarine and offshore fish and crustacean species, as well as supporting a high diversity of flora and fauna species, including shorebirds, dolphins and turtles (Department of Agriculture, Water and the Environment n.d.).

5.3.2.4 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 DAWE Conservation Values Atlas to identify the KEFs that occur within the EMBA. These are described in **Table 5-2** and shown in **Figure 5-5**.

Table 5-2: KEFs overlapping the EMBA

KEF	Spatial Relationship to MEZ	Spatial Relationship to Operational Area	Description
Carbonate bank and terrace system of the Sahul Shelf	11% of this KEF lies within the MEZ	0.02% of this KEF overlaps Operational Area.	*Unique seafloor feature with ecological properties of regional significance* While there is limited scientific information available on the bank and terrace system of the Sahul Shelf, it is considered regionally important because of its likely ecological role in enhancing biodiversity and local productivity relative to its surrounds. The banks are characterised by hard substrate and flat tops with each bank generally being < 10 km^2 in area and separated from each other by narrow meandering channels which are up to 150 m deep. The banks are thought to support a high diversity of organisms including reef fish, sponges, soft and hard corals, gorgonians, bryozoans, ascidians and other filter feeders. The banks are known to provide foraging areas for loggerhead, olive ridley and flatback turtles, with cetaceans and green and largetooth sawfish likely to occur in the area also.
Carbonate bank and terrace system of the Van Diemen Rise	3% of this KEF lies within the MEZ	0.26% of this KEF overlaps Operational Area.	*Unique seafloor feature with ecological properties of regional significance* The bank and terrace system of the Van Diemen Rise covers approximately 31,278 km2 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, with variability in water depth and substrate composition considered to contribute to the presence of unique ecosystems in the channels. The feature provides 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.
Pinnacles of the Bonaparte Basin	17% of this KEF lies within the MEZ	0.01% of this KEF overlaps Operational Area.	*Unique seafloor feature with ecological properties of regional significance* The pinnacles of the Bonaparte Basin cover more than 520 km^2 and are thought to be the eroded remnants of underlying strata. These vertical walls of the pinnacles are considered to generate local upwelling of nutrient-rich water, leading to phytoplankton productivity that attracts aggregations of planktivorous and predatory fish, seabirds and foraging turtles. The pinnacles also provide areas of hard substrate in an otherwise relatively featureless environment and are therefore considered likely to support a high number of species, although further scientific information is required.

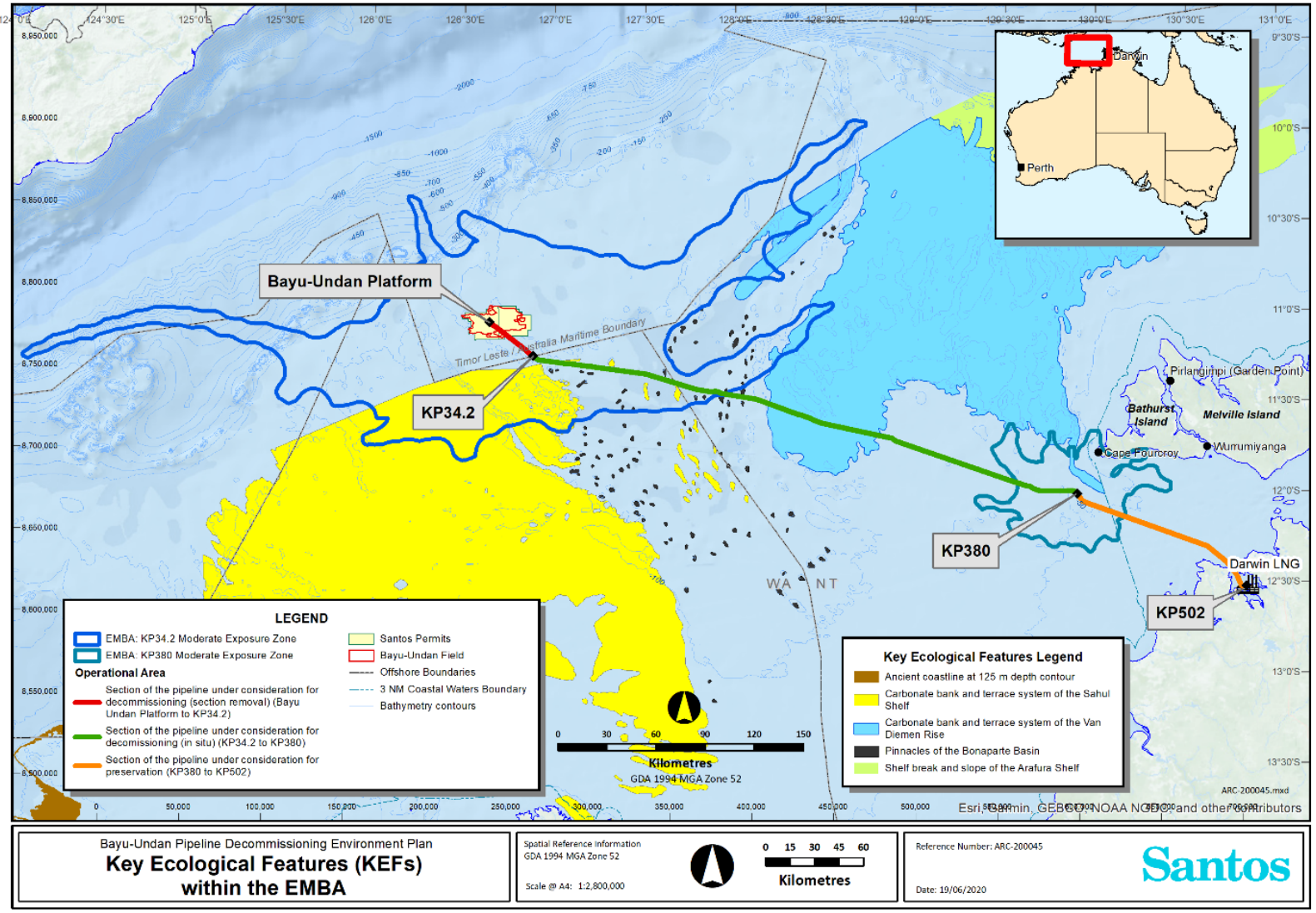


Figure 5-5: KEFs within the EMBA

5.3.2.5 Intertidal and Benthic Communities

5.3.2.5.1 Corals

Coral reefs provide habitat for a range of marine fauna and are associated with high levels of biodiversity. Coral reefs in the Oceanic Shoals bioregion are typically associated with shallow features in clear offshore waters, such as the shoals and banks on the outer continental shelf (beyond the EMBA). Shoals and banks are uncommon within the EMBA in the Oceanic Shoals bioregion, with only two named shoals (Newby Shoal and Shepparton Shoal) identified within the EMBA. Benthic habitat surveys found average macroalgae and hard coral cover from 14-16% at both these locations, with similar composition to offshore shoals such as Blackwood, Evans and Tassie Shoals (McLean et al. 2020).

Within the shallow NT coastal waters of the Anson-Beagle bioregion, there are a number of coralline fringing reefs and patch reefs, as well as a number of rocky reefs which may support coral reef communities (Department of the Environment, Water, Heritage and the Arts 2008). A number of shoals and banks also overlap the EMBA in this bioregion, mainly within Darwin Harbour and between the Tiwi Islands and NT mainland. In Darwin Harbour, Bladin Point and Wickham Point support communities of soft and hard corals (INPEX Browse 2010). The inshore region of the Operational Area also supports low levels of coral habitat, with studies observing >5% hard-coral cover (INPEX Browse 2010). Coral communities are considered one of the nine regionally important communities/habitats of the NMR.

5.3.2.5.2 Seagrasses/Macroalgae

Seagrass and macroalgae communities provide important habitat for various marine species. Like coral reefs, these communities are light restricted and generally occur only within shallow coastal areas. Relatively high levels of turbidity, combined with deep water, result in much of the Operational Area and MEZ being unsuitable for seagrass and macroalgae growth. Extensive seagrass and macroalgae communities are unlikely to occur within the EMBA; however, small discrete patches of seagrass may be present within areas of Darwin Harbour and near Bathurst Island.

Benthic studies within Darwin Harbour did not identify any extensive seagrass beds, which suggests that the turbid waters would restrict seagrass growth to waters > 5 m in depth (INPEX Browse 2010).

5.3.2.5.3 Mangroves/Saltmarshes

Mangroves provide important habitat for a number of species, including nesting, feeding and staging areas for seabirds, waterbirds, waders, and migratory birds (INPEX Browse 2010). Mangroves and saltmarshes are confined to shoreline habitats. Within the EMBA, mangroves are only known to occur within NT coastal waters, in nearshore environments of the Anson-Beagle bioregion. Within this bioregion are extensive fringing mangrove communities which support a diverse array of species (INPEX Browse 2010).

5.3.2.5.4 Other Benthic Communities

Based on habitat modelling by the Australian Institute of Marine Science (AIMS) (Heyward et al. 2017), the majority of the benthic habitats with the Operational Area are bare sediments (75%), with burrowers / crinoids and filter feeders comprising 23% and 2% respectively (**Figure 5-6**). Benthic habitats below the Pipeline around the tie-in point and the Pipeline section in Timor-Leste offshore waters, where planned seabed disturbance will occur, are bare sediments. These habitats are very widely represented within the region and are not considered to be particularly sensitive or of high conservation value.

A marine habitat survey of five study locations, undertaken by AIMS (McLean et al. 2020), identified a number of benthic habitats growing along the Pipeline itself. The benthic composition of the Pipeline comprised < 3% of bare benthic habitat, < 20% of sand habitat, and > 75% coverage of biota. Several biotic groups were present: turfing; low complexity groups such as coralline algae, ascidians, bryozoans, sponges and soft coral (36-72%); and mixed filter feeders (11-27%) (McLean et al. 2020). Benthic communities on the Pipeline reflected the morphological complexity of surrounding natural habitats and communities. The study locations on the outer shelf occurring in sparse low relief areas predominantly supported low diversity turfing

communities, whereas shallower areas comprising of adjacent raised geomorphic features (e.g. Newby Shoal and Shepparton Shoal) typically hosted more abundant and diverse communities of morphologically complex taxa (e.g. erect branching sponges and soft corals) (McLean et al. 2020). The proximity of these raised shoal features could potentially result in inter-habitat interactions such as larval exchange and colonisation, between benthic communities on the Pipeline and those in adjacent natural habitats at the local scale (McLean et al. 2020). Therefore, these findings suggest there may be association between benthic habitats along the Pipeline and habitats occurring naturally in surrounding areas.

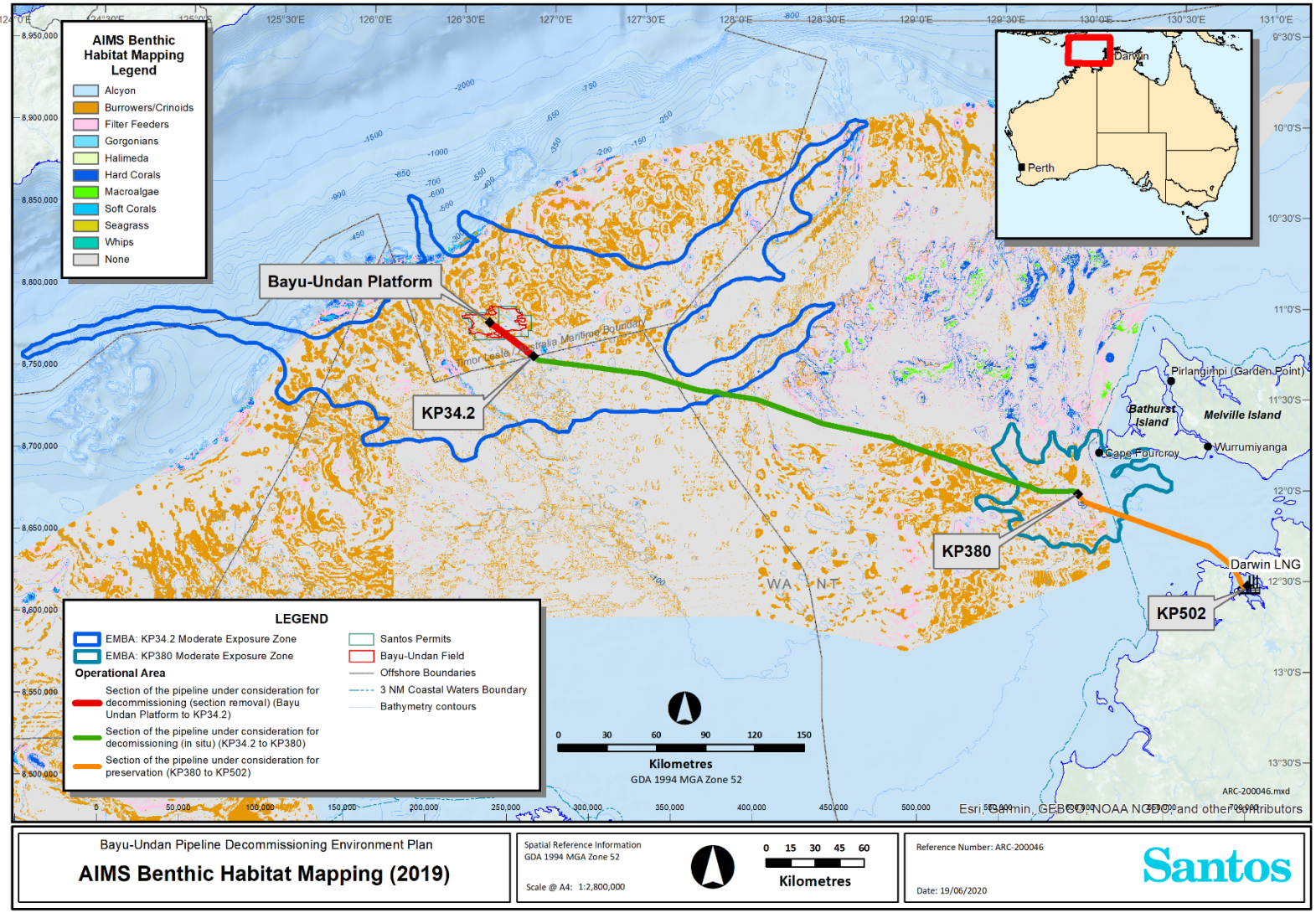


Figure 5-6: Benthic habitat mapping (after Heyward et al. 2017)

5.3.2.6 Plankton

In offshore Commonwealth waters of the NMR (deeper than 50 m), plankton communities are dominated by dinoflagellates, *Dinophysis*, *Ceratium*, *Prorocentrum* and *Caratocorys*. Shallower offshore waters support cyanobacterium *Trichodesmium* and the diatoms *Rhizosolenia* and *Thalassonema* and inshore NT coastal waters support diatoms *Rhizosolenia* and *Thalassonema* (DEWHA 2008). Environmental monitoring in the Bayu-Undan Field has recorded consistently low concentrations of photosynthetic pigments and nutrients, suggesting that phytoplankton productivity is typically low in outer continental shelf waters in the region (CDM Smith 2020).

5.3.2.7 Pelagic and Demersal Fish Communities

Given the widespread tropical open water habitat throughout the region, pelagic fish within the EMBA are expected to be tropical species that are broadly distributed in the Timor Sea and Indo-Pacific region. Several pelagic fish that occur in the region, such as marlin and mackerel, are important for commercial and recreational fisheries, although fishing effort in the EMBA is very low (**Section 5.4.3**). Several pelagic sharks listed as migratory may occur within the EMBA, such as makos, whale sharks and manta rays; refer to **Section 5.3.3.7** for further information.

Demersal fish assemblages are typically associated with benthic habitat types. As bare sands and, to a lesser extent, burrowers / crinoids, comprise the main habitat types within the EMBA, the demersal fish assemblages will include species that are not typically site-attached, such as some species of shark, tropical snappers (Lutjanidae) and cod (*Epinephelus* spp.) (Radford et al. 2018). Several demersal fish species are targeted by commercial and recreational fishers (**Section 5.4.3**).

In Darwin Harbour, fish occupy a wide range of habitats, with the Harbour supporting an abundance of resident and transient species (INPEX Browse 2010). Fish species within the Harbour are diverse, ranging from small gobies, cardinals and pipefish to commercially and recreationally important pelagic species such as trevallies, mackerel, salmon, grunter, and barramundi (INPEX Browse 2010). Juveniles of these latter species utilise mangrove habitats within the Harbour, which support an abundance of other fish species, particularly during high tides (INPEX Browse 2010).

The presence of the Pipeline is likely to provide artificial reef habitat that hosts fish assemblages distinct from the surrounding predominant bare sediment habitat. Studies of fish assemblages associated with pipelines on the North West Shelf have shown significantly higher species richness and relative abundance compared to the surrounding habitat (Bond et al. 2018).

A recent Pipeline habitat study, undertaken by AIMS for Santos (McLean et al. 2020), found that the abundance and composition of fish communities associated with the Pipeline differed from those in adjacent high and low complexity habitats. The Pipeline is situated in predominantly sand/mud areas, however the study sites included a range of natural habitats within and outside the Oceanic Shoals Marine Park, between KP50 and the tie-in point. This included deep sediment-dominated plains on the outer shelf, as well as shallower areas surrounded by raised shoals (e.g. Newby and Shepparton Shoals) to the west of the Tiwi Islands (McLean et al. 2020). Depth and visibility (turbidity) were found to influence fish assemblages along the Pipeline. McLean et al. (2020) discovered that the Pipeline supports a distinct fish assemblage characterised by commercially important fish species. This was indicated by the total abundance of fish and biomass of the top 10 commercially fished species (bioindicator species) decreasing with increased distance from the Pipeline. This could be attributed to the Pipeline providing shelter and a hard substrate supporting benthic habitats, as well as greater availability of prey (e.g. small fish and invertebrates) (McLean et al. 2020). Commercial and recreational fishing activity is scarce at the outer and mid-shelf locations surveyed in this study.

5.3.3 Marine Fauna of Conservation Significance

The EPBC Act PMST reports identified a total of 61[5] threatened or migratory species considered

[5] The PMST reports identified 29 threatened or migratory species that are obligate terrestrial species. These will not credibly be impacted by the activities within the scope of this EP, including unplanned events such as hydrocarbon spills. Their identification

to be MNES (7 listed as threatened, 33 listed as migratory and 21 listed as both threatened and migratory) as potentially occurring within the EMBA (**Table 5-3**). The full list of marine species identified from the PMST database search is provided in **Appendix B**.

Table 5-3: EPBC listed threatened and migratory species potentially occurring within the EMBA

Species Name	Common Name	Threatened Status	Migratory Status	Operational Area / MEZ
Mammals				
Balaenoptera borealis	Sei whale	Vulnerable	Migratory	Ops Area & MEZ
Balaenoptera edeni	Bryde's whale	N/A	Migratory	Ops Area & MEZ
Balaenoptera musculus	Blue whale	Endangered	Migratory	Ops Area & MEZ
Balaenoptera physalus	Fin whale	Vulnerable	Migratory	Ops Area & MEZ
Dugong dugon	Dugong	N/A	Migratory	Ops Area & MEZ
Megaptera novaeangliae	Humpback whale	Vulnerable	Migratory	Ops Area & MEZ
Orcaella heinsohni	Australian snubfin dolphin	N/A	Migratory	Ops Area & MEZ
Orcinus orca	Killer whale, orca	N/A	Migratory	Ops Area & MEZ
Physeter macrocephalus	Sperm whale	N/A	Migratory	MEZ only
Sousa chinensis	Indo-Pacific humpback dolphin	N/A	Migratory	Ops Area & MEZ
Tursiops aduncus (Arafura/Timor Sea populations)	Spotted bottlenose dolphin (Arafura/Timor Sea populations)	N/A	Migratory	Ops Area & MEZ
Reptiles				
Aipysurus apraefrontalis	Short-nosed sea snake	Critically endangered	N/A	MEZ only
Caretta caretta	Loggerhead turtle	Endangered	Migratory	Ops Area & MEZ
Chelonia mydas	Green turtle	Vulnerable	Migratory	Ops Area & MEZ
Crocodylus porosus	Salt-water crocodile, estuarine crocodile	N/A	Migratory	Ops Area & MEZ
Dermochelys coriacea	Leatherback turtle, leathery turtle, luth	Endangered	Migratory	Ops Area & MEZ
Eretmochelys imbricata	Hawksbill turtle	Vulnerable	Migratory	Ops Area & MEZ
Lepidochelys olivacea	Olive Ridley turtle, pacific ridley turtle	Endangered	Migratory	Ops Area & MEZ
Natator depressus	Flatback turtle	Vulnerable	Migratory	Ops Area & MEZ
Sharks and Rays				
Anoxypristis cuspidata	Narrow sawfish, knifetooth sawfish	N/A	Migratory	Ops Area & MEZ
Carcharodon carcharias	White shark, great white shark	Vulnerable	Migratory	Ops Area & MEZ
Glyphis garricki	Northern river shark, New Guinea river shark	Endangered	N/A	Ops Area & MEZ
Glyphis glyphis	Speartooth shark	Critically endangered	N/A	Ops Area & MEZ

within the PMST reports is an artefact of the method by which the EMBA boundaries are generated for the PMST query, which results in some minor overlap of onshore areas that are not credibly impacted. These obligate terrestrial species are not considered in this EP.

Species Name	Common Name	Threatened Status	Migratory Status	Operational Area / MEZ
Isurus oxyrinchus	Shortfin mako, mako shark	N/A	Migratory	Ops Area & MEZ
Isurus paucus	Longfin mako	N/A	Migratory	Ops Area & MEZ
Manta alfredi	Reef manta ray, coastal manta ray, inshore manta ray, Prince Alfred's ray, resident manta ray	N/A	Migratory	Ops Area & MEZ
Manta birostris	Giant manta ray, chevron manta ray, Pacific manta ray, pelagic manta ray, oceanic manta ray	N/A	Migratory	Ops Area & MEZ
Pristis clavata	Dwarf sawfish, Queensland sawfish	Vulnerable	Migratory	Ops Area & MEZ
Pristis pristis	Freshwater sawfish, largetooth sawfish, river sawfish, Leichhardt's sawfish, northern sawfish	Vulnerable	Migratory	Ops Area & MEZ
Pristis zijsron	Green sawfish, dindagubba, narrowsnout sawfish	Vulnerable	Migratory	Ops Area & MEZ
Rhincodon typus	Whale shark	Vulnerable	Migratory	Ops Area & MEZ
Birds				
Acrocephalus orientalis	Oriental reed-warbler	N/A	Migratory	Ops Area & MEZ
Actitis hypoleucos	Common sandpiper	N/A	Migratory	Ops Area & MEZ
Anous stolidus	Common noddy	N/A	Migratory	Ops Area & MEZ
Anous tenuirostris melanops	Australian lesser noddy	Vulnerable	N/A	MEZ only
Apus pacificus	Fork-tailed swift	N/A	Migratory	Ops Area only
Arenaria interpres	Ruddy turnstone	N/A	Migratory	Ops Area only
Calidris acuminata	Sharp-tailed sandpiper	N/A	Migratory	Ops Area & MEZ
Calidris alba	Sanderling	N/A	Migratory	Ops Area only
Calidris canutus	Red knot, knot	Endangered	Migratory	Ops Area & MEZ
Calidris ferruginea	Curlew sandpiper	Critically endangered	Migratory	Ops Area & MEZ
Calidris melanotos	Pectoral sandpiper	N/A	Migratory	Ops Area & MEZ
Calidris tenuirostris	Great knot	Critically endangered	Migratory	Ops Area only
Calonectris leucomelas	Streaked shearwater	N/A	Migratory	Ops Area & MEZ
Charadrius leschenaultii	Greater sand plover	Vulnerable	Migratory	Ops Area only
Charadrius mongolus	Lesser sand plover	Endangered	Migratory	Ops Area only
Charadrius veredus	Oriental plover, oriental dotterel	N/A	Migratory	Ops Area & MEZ
Fregata ariel	Lesser frigatebird, least frigatebird	N/A	Migratory	Ops Area & MEZ
Fregata minor	Great frigatebird, greater frigatebird	N/A	Migratory	Ops Area & MEZ
Glareola maldivarum	Oriental pratincole	N/A	Migratory	Ops Area & MEZ

Species Name	Common Name	Threatened Status	Migratory Status	Operational Area / MEZ
Limosa lapponica	Bar-tailed godwit	N/A	Migratory	Ops Area & MEZ
Limosa lapponica baueri	Bar-tailed godwit (baueri), western Alaskan bar-tailed godwit	Vulnerable	N/A	Ops Area & MEZ
Limosa lapponica menzbieri	Northern Siberian bar-tailed godwit, bar-tailed godwit (menzbieri)	Critically endangered	N/A	Ops Area & MEZ
Limosa limosa	Black-tailed godwit	N/A	Migratory	Ops Area only
Numenius madagascariensis	Eastern curlew, far eastern curlew	Critically endangered	Migratory	Ops Area & MEZ
Numenius phaeopus	Whimbrel	N/A	Migratory	Ops Area only
Pandion haliaetus	Osprey	N/A	Migratory	Ops Area & MEZ
Pluvialis squatarola	Grey plover	N/A	Migratory	Ops Area only
Rostratula australis	Australian painted snipe	Endangered	N/A	Ops Area & MEZ
Sternula albifrons	Little tern	N/A	Migratory	Ops Area only
Tringa nebularia	Common greenshank, greenshank	N/A	Migratory	Ops Area only

5.3.3.1 Threatened Species Recovery Plans and Conservation Advice

The DAWE publishes recovery plans and conservation advice for a number of species listed as threatened under the EPBC Act. These documents are intended to assist in preventing the decline, and enhance the recovery, of threatened species. The requirements of the recovery plans and conservation advice (**Table 5-4**) for threatened species that could potentially occur within the EMBA were considered to identify any aspects that may be applicable to the risk assessment (**Section 6**).

Table 5-4: Summary of EPBC Act recovery plans and conservation advice relevant to the Petroleum Activity

Species	EPBC Act Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/conservation advice	EP risk assessment section
Mammals			
Sei whale	Conservation Advice for *Balaenoptera borealis* (sei whale) (Threatened Species Scientific Committee 2015a)	Noise interference	**6.3.11**
		Vessel disturbance	**6.4.3**
Blue whale	Conservation Management Plan for the Blue Whale (Commonwealth of Australia 2015b)	Noise interference	**6.3.11**
		Vessel disturbance	**6.4.3**
Fin whale	Conservation Advice for *Balaenoptera physalus* (fin whale) (Threatened Species Scientific Committee 2015b)	Noise interference	**6.3.11**
		Vessel disturbance	**6.4.3**
Humpback whale	Conservation Advice for *Megaptera novaeangliae* (humpback whale)	Noise interference	**6.3.11**
		Vessel disturbance	**6.4.3**

Species	EPBC Act Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/conservation advice	EP risk assessment section
	(Threatened Species Scientific Committee 2015c)		
Reptiles			
Short-nosed sea snake	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (Threatened Species Scientific Committee 2010)	Habitat degradation	**6.4.6**
Leatherback turtle	Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (Threatened Species Scientific Committee 2008a)	Vessel disturbance	**6.4.3**
Loggerhead turtle Green turtle Hawksbill turtle Flatback turtle Olive ridley turtle	Recovery Plan for Marine Turtles in Australia (Commonwealth of Australia 2017)	Vessel disturbance	**6.4.3**
		Light pollution	**6.3.6**
		Marine debris	**6.3.4** **6.4.9**
		Acute chemical discharge	**6.4.6**
Sharks and Rays			
Whale shark	Conservation advice for *Rhincodon typus* (whale shark) (Threatened Species Scientific Committee 2015d)	Vessel disturbance	**6.4.3**
		Marine debris	**6.3.4** **6.4.9**
Great white shark	Recovery Plan for the White Shark (*Carcharodon carcharias*) (Department of Sustainability, Environment, Water, Population and Communities 2013)	Marine debris	**6.3.4** **6.4.9**
Dwarf sawfish	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia 2015c)	Habitat degradation	**6.3.4** **6.4.6**
	Approved conservation advice for *Pristis clavata* (dwarf sawfish) (Threatened Species Scientific Committee 2009)	Habitat degradation	**6.3.4** **6.4.6**
Green sawfish	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia 2015c)	Habitat degradation	**6.3.4** **6.4.6**

Species	EPBC Act Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/conservation advice	EP risk assessment section
	Approved conservation advice for green sawfish (Threatened Species Scientific Committee 2008b)	Habitat degradation	**6.3.4** **6.4.6**
Freshwater sawfish	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia 2015c)	Habitat degradation	**6.3.4** **6.4.6**
	Approved conservation advice for *Pristis pristis* (largetooth sawfish) (Threatened Species Scientific Committee 2014a)	Habitat degradation	**6.3.4** **6.4.6**
Northern river shark	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia 2015c)	Habitat degradation	**6.3.4** **6.4.6**
	Approved conservation advice for *Glyphis garracki* (northern river shark) (Threatened Species Scientific Committee 2014b)	Habitat degradation	**6.3.4** **6.4.6**
Speartooth shark	Sawfish and River Sharks Multispecies Recovery Plan (Commonwealth of Australia 2015c)	Habitat degradation	**6.3.4** **6.4.6**
	Approved conservation advice for *Glyphis plyphis* (speartooth shark) (Threatened Species Scientific Committee 2014c)	Habitat degradation	**6.3.4** **6.4.6**
Birds			
Australian lesser noddy	Conservation advice *Anous tenuirostris melanops* Australian lesser noddy (Threatened Species Scientific Committee 2015e)	Habitat degradation	**6.4.6**
Bar-tailed godwit (baueri), western Alaskan bar-tailed godwit	Conservation Advice for *Limosa lapponica baueri* (bar-tailed godwit - western Alaskan) (Threatened Species Scientific Committee 2016a)	Habitat degradation	**6.4.6**
Northern Siberian bar-tailed godwit,	Conservation advice *Limosa lapponica menzbieri* bar-tailed godwit (northern	Habitat degradation	**6.4.6**

Species	EPBC Act Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/conservation advice	EP risk assessment section
bar-tailed godwit (menzbieri)	Siberian) (Threatened Species Scientific Committee 2016b)		
Australian painted snipe	Approved conservation advice for *Rostratula australis* (Australian painted snipe) (Threatened Species Scientific Committee 2013)	Habitat degradation	**6.4.6**
Red knot, knot	Conservation Advice for *Calidris canutus* (red knot) (Threatened Species Scientific Committee 2016c)	Habitat degradation	**6.4.6**
Curlew sandpiper	Conservation Advice for *Calidris ferruginea* (curlew sandpiper) (Threatened Species Scientific Committee 2015f)	Habitat degradation	**6.4.6**
Eastern curlew, far eastern curlew	Conservation Advice for *Numenius madagascariensis* (eastern curlew) (Threatened Species Scientific Committee 2015g)	Habitat degradation	**6.4.6**
Great knot	Conservation Advice for *Calidris tenuirostriss* (great knot) (Threatened Species Scientific Committee 2016d)	Habitat loss and degradation	**6.4.6**
		Pollution/contaminants	**6.4.6**
Greater sand plover	Conservation Advice for *Charadrius leschenaultii* (greater sand plover) (Threatened Species Scientific Committee 2016e)	Habitat loss and degradation	**6.4.6**
		Pollution/contaminants	**6.4.6**
Lesser sand plover	Conservation Advice for *Charadrius mongolus* (lesser sand plover) (Threatened Species Scientific Committee 2016f)	Habitat loss and degradation	**6.4.6**
		Pollution/contaminants	**6.4.6**
Sharp-tailed sandpiper, pectoral sandpiper, common sandpiper, red knot, oriental plover, oriental pratincole, bar-tailed godwit, ruddy turnstone, sanderling,	Wildlife conservation plan for migratory shorebirds (Commonwealth of Australia 2015a)	Habitat degradation	**6.4.6**

Species	EPBC Act Recovery plan/conservation advice (date issued)	Key threats identified in the recovery plan/conservation advice	EP risk assessment section
black-tailed godwit, whimbrel, grey plover, common greenshank.			

5.3.3.2 Biologically Important Areas

The DAWE has established a series of biologically important areas (BIAs) for regionally significant marine species (which are typically listed as threatened under the EPBC Act). BIAs identify areas where biologically significant behaviours may occur, such as nesting, breeding, migrating, foraging or resting. BIAs were established during the development of bioregional plans utilising a range of data, such as expert advice and published literature. BIAs are intended to assist decision-making under the EPBC Act. While BIAs do not receive specific protection under the EPBC Act, the threatened and migratory species associated with them are MNES and are protected under the EPBC Act.

The BIAs within or overlapping the EMBA are discussed in fauna-specific sections below.

5.3.3.3 Habitat Critical to the Survival of a Species

Habitats critical for the survival of several species of marine turtles were identified in the *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia 2017). Like BIAs, these critical habitats identify areas where biologically significant behaviours may occur. Unlike BIAs, habitats that are critical for the survival of a species receive specific protection under the EPBC Act.

The habitats that are critical for the survival of marine turtles within or overlapping the EMBA are discussed in fauna-specific sections below.

5.3.3.4 Seasonality

The presence of several EPBC Act listed threatened and/or migratory species identified as potentially occurring within the EMBA is seasonal in nature. The expected periods during which threatened and/or migratory species could occur within the EMBA are provided in **Table 5-5**.

Table 5-5: Seasonal presence of EPBC Act listed threatened and/or migratory species within the EMBA

Species	Month											
	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Flatback turtles (presence, nesting/breeding)												
Olive ridley turtles (presence, nesting/breeding)												
Green turtles (presence, nesting/breeding)												
Hawksbill turtles (presence)												
Leatherback turtles (presence)												

Species	Month											
	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*
Streaked shearwater												
Migratory shorebirds (aggregation, breeding)												
Legend												
	Peak presence/occurrence (presence of animals reliable and predictable each year)											
	Species likely to be present in the region											

5.3.3.5 Marine Mammals

The EPBC Act PMST reports identified 11 species of marine mammal that may occur within the EMBA (**Table 5-3**). The nearshore NT coastal waters of the EMBA, including Darwin Harbour, provide BIAs for three species of inshore dolphins: Australian snubfin dolphin, Indo-Pacific humpback dolphin and spotted bottlenose dolphin (Arafura/Timor Seas populations). The EMBA is not known to include any critical habitat for any of the identified mammal species.

5.3.3.5.1 Sei Whale

Sei whales have a worldwide oceanic distribution but have only been infrequently recorded in Australian waters (Bannister et al. 1996). Sei whales are expected to undertake seasonal migrations between low latitude wintering areas and high latitude summer feeding grounds (Bannister et al. 1996, Prieto et al. 2012); however, their distributional limits in Australia are uncertain. This is largely due to the rare occurrence of sightings, and their similar appearance to Bryde's whales leading to them often being incorrectly identified, particularly in higher latitudes (Bannister et al. 1996).

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 (< 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 Act listed critical habitat or BIAs for sei whales in Australian waters. Given the rare occurrence of sightings in the NMR and NWMR, sei whales are unlikely to occur within the EMBA.

5.3.3.5.2 Bryde's Whale

Bryde's whales occur in temperate to tropical waters, between 40 °S and 40 °N year round (Bannister et al. 1996). 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. Little is known about the population abundance of Bryde's whale and there are no estimates of the exact breeding and calving grounds.

A few individuals of Bryde's whale were detected in the Barossa marine studies program from January to early October (approximately 200 km north-east of the EMBA at its closest point) (McPherson et al. 2016). McPherson et al. (2016) 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; however, they are not expected to be present in significant numbers.

There are no listed BIAs or other EPBC Act listed critical habitat for this species in Australian waters.

5.3.3.5.3 Blue Whale

In the Southern Hemisphere, the blue whale has two distinct sub-species, the southern (or 'true') blue whale and the pygmy blue whale (Commonwealth of Australia 2015b). 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 NWMR and NMR are likely to be pygmy blue whales.

Tagging studies (Double et al. 2014) indicate the general migration pattern, timing and key areas for pygmy blue whales in Commonwealth waters are the Perth Canyon/Naturaliste Plateau and Ningaloo Reef/North West Cape (beyond the EMBA). Satellite tagging of pygmy blue whales off the Perth Canyon confirmed the general distribution of migrating pygmy blue whales was offshore in water depths over 200 m and commonly over 1,000 m (Double et al. 2012). These data showed that whales tagged during March and April migrated northwards post tag deployment. The tagged whales travelled relatively near to the Australian coastline (100 ± 2 km) until reaching North West Cape after which they travelled offshore (238 ± 14 km). Whales reached the northern terminus of their migration and potential breeding grounds in Indonesian waters by June (Double et al. 2014). The southbound migration is thought to terminate in the Southern Ocean, where the species feeds.

A noise monitoring study conducted as part of the Barossa marine studies program (approximately 200 km north-east of the EMBA at its closest point) recorded pygmy blue whales moving in a northward direction in August 2014 and between late-May to early July 2015 (McPherson et al. 2016). No detections of the species were made during the period of their southward migration, indicating that they may utilise a different migration path.

No BIAs or critical habitats for pygmy blue whales occur within the Operational Area. A migration BIA partially overlaps the MEZ (**Figure 5-7**). This BIA is approximately 58 km from the Operational Area at the closest point. Given pygmy blue whales are known to travel in waters beyond the depth profile and further west and north of the Operational Area, it is unlikely that they will occur within the Operational Area. They may be seasonally present in the MEZ in deeper waters north-west of the Bayu-Undan Field.

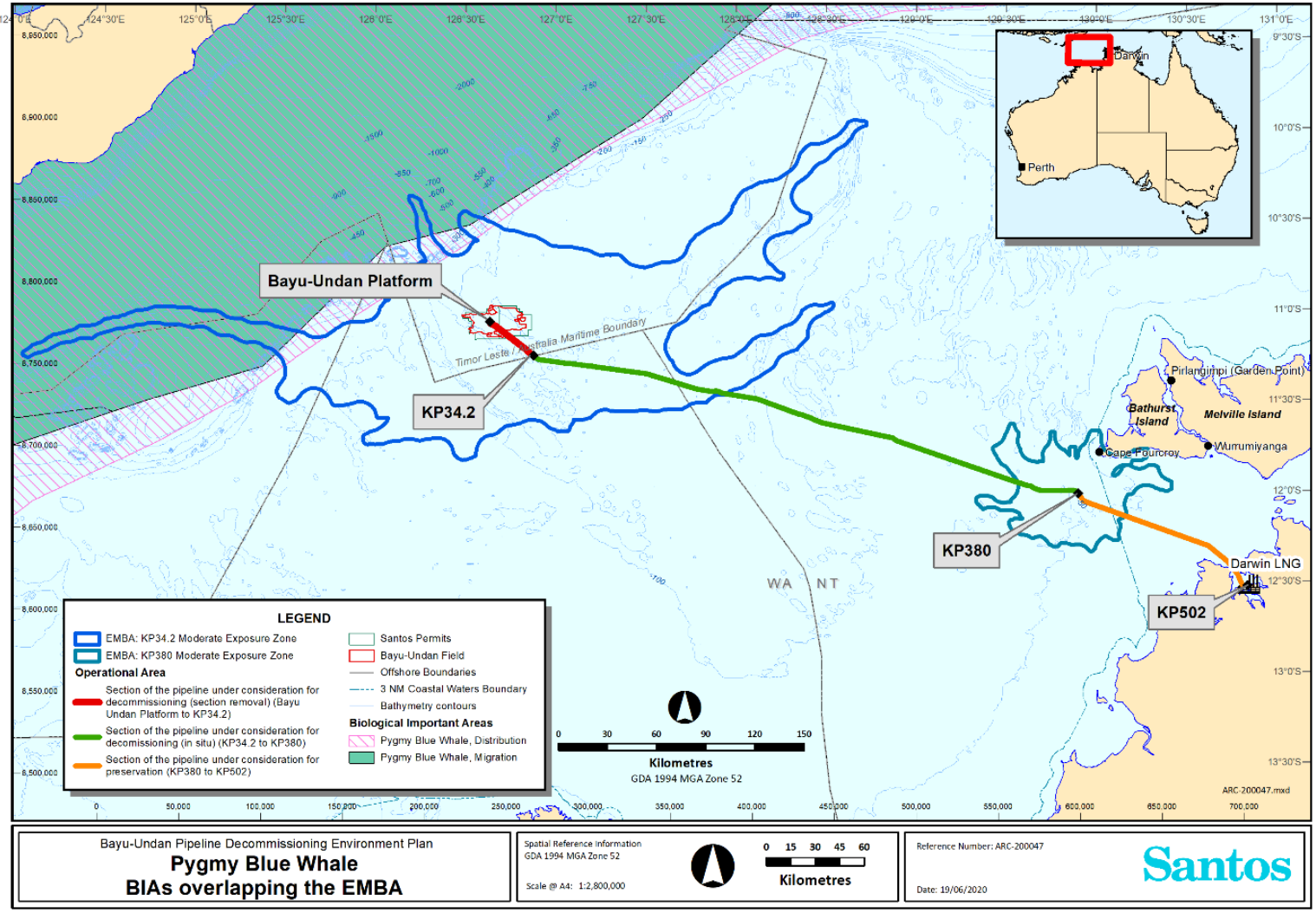


Figure 5-7: Blue whale BIAs overlapping the EMBA

5.3.3.5.4 Fin Whale

Fin whales are widely distributed from polar to tropical waters and have been recorded in all Australian states, other than New South Wales and the NT (Bannister et al. 1996).

Fin whales are rarely observed in inshore waters and displays migratory movements (essentially north-south) between polar, temperate and tropical waters (Bannister et al. 1996). Migration within Australian waters does not appear to follow a clear route and is thought to occur in summer and autumn. Breeding in the Southern hemisphere occurs in tropical and sub-tropical latitudes between May and July.

Fin whales feed on planktonic crustacea, such as Antarctic krill, and primarily forage in high latitudes (Bannister et al. 1996). Within Australian waters, Antarctic waters and the Bonney Upwelling are thought to be important foraging grounds for this species.

There are no recognised BIAs or critical habitats for fin whales within the EMBA. The species is unlikely to occur within the EMBA.

5.3.3.5.5 Dugong

Dugongs occur in tropical and sub-tropical waters broadly coincident with the distribution of seagrasses (Marsh et al. 2002), which typically occur in shallow intertidal zone areas to water depths of around 25 m. 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. The movements of most individuals are limited to within tens of kilometres within the vicinity of seagrass beds. However, some individuals have been observed to travel large distances of up to 600 km over a few days (Marsh et al. 2002).

Dugongs and areas of potential dugong habitat exist along the majority of the northern Australian coastline from Shark Bay in Western Australia (WA) to Moreton Bay in Queensland. Except for a small population of approximately 50 individuals occupying the Ashmore Reef (beyond the EMBA), all known dugong populations are associated with shallow coastal waters hosting seagrass meadows.

No BIAs or critical habitats have been identified for dugongs within the EMBA. Considering the habitat preference of the species, dugongs are very unlikely to occur within the Operational Area but may occur in coastal waters within the EMBA around Bathurst Island.

5.3.3.5.6 Humpback Whale

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).

No BIAs or other EPBC Act listed critical habitat for humpback whales occur 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 (approximately 200 km north-east of the EMBA at its closest point) (McPherson et al. 2016). Given this, the species is highly unlikely to occur within the EMBA.

5.3.3.5.7 Killer Whale

Killer whales have a global distribution and utilise a wide range of habitats. However, they appear to be primarily concentrated in temperate coastal waters and cooler regions of high productivity (Bannister et al. 1996).

This species has been sporadically sighted throughout Australian waters, with higher concentrations off southern Australia, from New South Wales to western Victoria, and from the south-east to the mid-north coast of WA (Wellard et al. 2016). Off Australia, the species is typically observed moving along the continental slope and shelf, and near seal colonies

(Bannister et al. 1996). Globally killer whales are known to migrate; however, specific routes and seasonal movement patterns are not known in detail and are thought to relate to prey availability (Bannister et al. 1996).

Based on their known distribution and movements, killer whales are unlikely to be encountered within the EMBA.

5.3.3.5.8 Sperm Whale

Sperm whales (*Physeter macrocephalus*) are the largest of the toothed whales and are distributed worldwide in deep waters (greater than 200 m) off continental shelves and sometimes near shelf edges (Bannister et al. 1996). The sperm whale is listed as a Migratory species under the EPBC Act. Sperm whales have been recorded in all Australian state waters and are known to migrate northward in winter and southwards in summer the detailed information on their distribution around Australia is described in (Bannister et al. 1996).

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 off the Australian coast is not available. Given the wide distribution of sperm whales and their preference for deeper oceanic waters, the EMBA is unlikely to represent an important habitat for this species.

5.3.3.5.9 Australian Snubfin Dolphin

The Australian snubfin dolphin (*Orcaella heinsohni*, also known as the Irrawaddy dolphin, *O. brevirostris*) shares similar habitat preferences with the Indo-Pacific humpback dolphin, occurring in shallow coastal and estuarine waters (typically less than 20 m deep). However, as with the Indo-Pacific humpback dolphin, the species has also been recorded up to 23 km offshore. In Australia, the species distribution covers the coastal waters of Queensland, the NT and northern WA. The population in Australian waters is thought to be continuous with the Papua New Guinea species but separate from populations in Asia.

The Australian snubfin dolphin is known to occur within NT coastal waters. There are a number of BIAs listed for the species within the NWMR and NMR, including a foraging, feeding and breeding BIA that overlaps the EMBA in Darwin Harbour (**Figure 5-8**) where they are observed in small numbers year-round (Department of Sustainability, Environment, Water, Population and Communities 2012a). Given this species' preference for nearshore waters and apparent high site fidelity, individuals are likely to only rarely transit the offshore Commonwealth Waters section of the EMBA; however, they are expected to be residents of the NT coastal waters of the EMBA, particularly within Darwin Harbour.

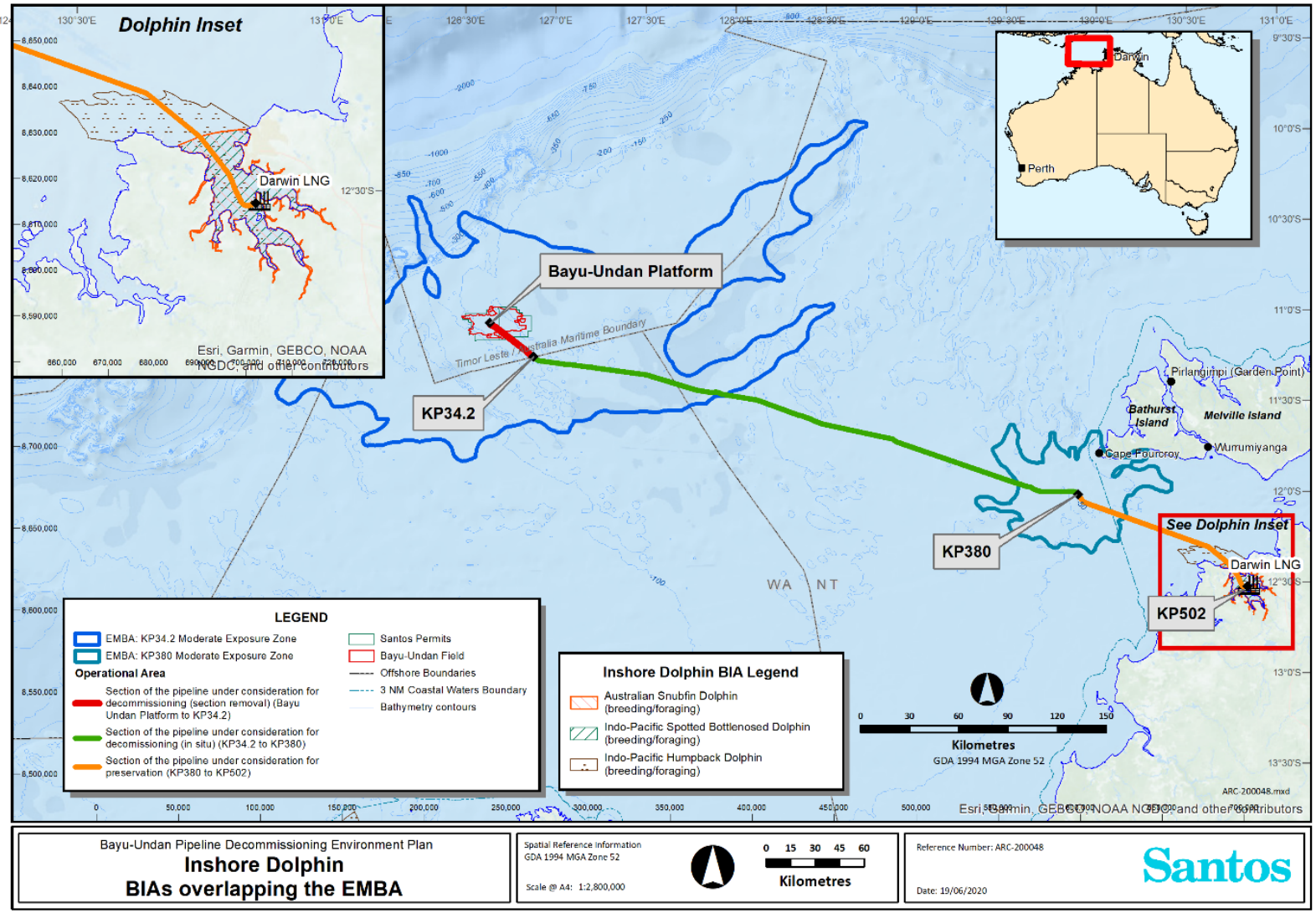


Figure 5-8: Inshore Dolphin BIAs overlapping the EMBA

5.3.3.5.10 Indo-Pacific Humpback Dolphin

The Indo-Pacific humpback dolphin has been recognised as two distinct species; the Indo-Pacific humpback dolphin (*Sousa chinensis*) and the Australian humpback dolphin (*S. sahulensis*) (Jefferson and Rosenbaum 2014). Only the Australian humpback dolphin is considered here. 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).

The Australian humpback dolphin occurs along the northern Australian coastline from Exmouth in WA to the Queensland/New South Wales border (Bannister et al. 1996). The species' preferred habitat is shallow (generally < 20 m in depth) coastal, estuarine and riverine (occasional) waters. However, individuals have been observed in shallow waters up to 55 km offshore (Bannister et al. 1996).

Given the species' preferred habitat is relatively shallow coastal waters, Australian humpback dolphins are very unlikely to occur in the offshore waters of the EMBA. Resident groups of this species are known to utilise NT coastal waters to forage, feed, breed and calve. There are several BIAs listed for Australian humpback dolphins within the NWMR and NMR, including a foraging, breeding and calving BIA that overlaps the EMBA in Darwin Harbour (**Figure 5-8**) where they are expected to be present in significant numbers year-round.

5.3.3.5.11 Spotted Bottlenose Dolphin (Arafura/Timor Sea Populations)

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

Given the species' utilisation of relatively deeper waters and the potential for long-range migratory movements, it is likely the species will occasionally transit the offshore Commonwealth waters of the EMBA. Year-round resident populations are expected to utilise NT coastal waters. There are several BIAs listed for spotted bottlenose dolphins within the NWMR and NMR, including a breeding and calving BIA during the dry season (approximately April to September) that overlaps the EMBA in Darwin Harbour (**Figure 5-8**).

5.3.3.6 Marine Reptiles

The EPBC Act PMST reports identified eight species of marine reptiles that may occur within the EMBA (**Table 5-3**). A number of BIAs and EPBC Act Critical Habitats occur within the EMBA for two species of marine turtles. These are discussed in **Sections 5.3.3.6.7** and **5.3.3.6.8**.

5.3.3.6.1 Short-nosed Sea Snake

The short-nosed sea snake (*Aipysurus apraefrontalis*) is a slender marine snake with a small head and pointed snout. This species has primarily been recorded at Ashmore Reef and Cartier Island on the Sahul Shelf, which lie over 400 km from the Operational Area and well beyond the EMBA. The species has also been recorded along the Pilbara coast between Exmouth Gulf and Broome (Threatened Species Scientific Committee 2010).

Like all sea snakes, the short-nosed sea snake must come to the surface to breathe at intervals anywhere between 30 minutes and two hours. The species has been recorded primarily in reef flats or in shallow waters (< 10 m). The short-nosed sea snake has apparently experienced a decline in numbers, with recent surveys of Ashmore Reef failing to observe the species (Threatened Species Scientific Committee 2010).

The short-nosed sea snake is unlikely to occur within the Operational Area but may occur within shallow reef habitat within the EMBA.

5.3.3.6.2 Loggerhead Turtle

The loggerhead turtle (*Caretta caretta*) is distributed throughout tropical, sub-tropical and temperate waters in all ocean basins. In Australia, the species ranges along most of the coastline, but is rare in temperate waters (Commonwealth of Australia 2017). Nesting in Australia is concentrated in southern Queensland and from Shark Bay to the North West Cape in WA. Foraging areas are more widely distributed with the WA stock foraging from Shark Bay through to Arnhem Land, Gove and into the Java Sea of Indonesia (Limpus 2008a). Loggerhead turtles are carnivorous and mainly feed on benthic invertebrates in a wide range of habitats ranging from nearshore to 55 m in depth (Commonwealth of Australia 2017).

Loggerhead turtles may occur within the EMBA, but there are no known nesting beaches in the vicinity of the EMBA. No BIAs or habitat critical for the survival of loggerhead turtles identified in the *Recovery plan for marine turtles in Australia 2017-2027* (Commonwealth of Australia 2017) occurs within the EMBA.

5.3.3.6.3 Green Turtle

The green turtle (*Chelonia mydas*) is distributed in tropical and sub-tropical waters in the Pacific, Atlantic and Indian oceans. Within Australian waters, the species is predominately found off the WA, NT and Queensland coastlines (Commonwealth of Australia 2017).

The species is primarily herbivorous and forages on algae, seagrass and mangroves, including where these habitats exist at offshore coral reef habitats (Commonwealth of Australia 2017). Tagging studies have shown that green turtles can move considerable distances between nesting, with movements of 100’s to 1,000’s of kilometres recorded (Limpus 2008b).

Green turtles may occur throughout the EMBA but would only be expected to occur in low numbers due to the absence of foraging or inter-nesting habitat. No significant green turtle nesting occurs around the Tiwi Islands. No BIAs or habitats critical for the survival of green turtles overlap the EMBA.

5.3.3.6.4 Salt-water Crocodile

The salt-water crocodile (*Crocodylus porosus*) occurs within the nearshore marine and estuarine waters throughout southern Asia and Northern Australia. Large populations inhabit the major river systems of the Kimberley and NT. Nesting occurs within freshwater swamps which experience little tidal movement, between December and March, with a peak period between January and February (Department of the Environment, Water, Heritage and the Arts 2008). There are no identified BIAs of EPBC Act listed critical habitat for the species within the EMBA. Given salt-water crocodiles preferred habitat, they are may be encountered within the EMBA within inshore/coastal areas in NT coastal waters.

5.3.3.6.5 Leatherback Turtle

The leatherback turtle (*Dermochelys coriacea*) is distributed in tropical and temperate oceans worldwide. The species is known to forage and migrate throughout the open offshore waters of Australia, with a distribution that extends further south into temperate waters than other marine turtle species (Limpus 2009a). Leatherback turtles eat almost exclusively jellyfish and are pelagic throughout their life in oceanic waters around Australia (Limpus 2009a). Records of leatherback turtle nesting in Australia are sparse and limited to the Cobourg Peninsula and Queensland coast (Limpus 2009a).

There are no BIAs or habitats critical for the survival of leatherback turtles within the EMBA. Leatherback turtles may occur within the EMBA in low numbers.

5.3.3.6.6 Hawksbill Turtle

The hawksbill turtle (*Eretmochelys imbricata*) has a worldwide distribution in tropical and sub-tropical waters. In Australia, hawksbill turtles predominately occur along the northern WA, NT and northern Queensland coastlines (Limpus 2009b). Hawksbill turtles are omnivorous and feed on algae, sponges, soft corals and soft bodied invertebrates. This species is typically associated with rocky and coral reef habitats.

There are no critical habitats or BIAs for hawksbill turtles within the EMBA. Hawksbill turtles may occur throughout the EMBA but would only be expected to occur in low numbers due to the

absence of nesting habitat and unsuitability of most benthic habitat in the EMBA for foraging.

5.3.3.6.7 Olive Ridley Turtle

The olive ridley turtle (*Lepidochelys olivacea*) has a global tropical distribution. In Australia, the species primarily occurs in the NT and Queensland (Limpus 2008c). The olive ridley turtle is primarily carnivorous and feeds predominantly on soft-bodied invertebrates (Commonwealth of Australia 2017). The species is known to feed in water depths between 15 m and 200 m, and may make movements > 1,000 km between their nesting and foraging grounds (Whiting et al. 2007).

Nesting is known to occur in the NT and on western Cape York (Queensland) (Commonwealth of Australia 2017, Limpus 2008c); low density nesting has also been described on the Kimberley coast (Limpus 2008c). Nesting around the Tiwi Islands is concentrated on the western and northern coastlines; nesting on the southern coast of Bathurst Island is relatively low (Chatto and Baker 2008). Nesting activity around the Tiwi Islands occurs year-round, with a peak from April to June (**Table 5-5**).

Two BIAs for olive ridley turtles occur within the EMBA, with one occurring within the Oceanic Shoals Marine Park (**Figure 5-9**). These include:

- A foraging BIA in the northern Bonaparte Gulf that overlaps the Operational Area approximately halfway between Bayu-Undan Platform and the tie-in point; and
- A foraging BIA in the Western Joseph Bonaparte Depression, which lies approximately 51 km from the Operational Area.

One habitat critical for the survival of olive ridley turtles occurs within the EMBA – this is the inter-nesting habitat around the northern and western coasts of Bathurst and Melville Islands. This critical habitat lies approximately 6 km from the Operational Area. Olive ridley turtles are expected to occur within the EMBA throughout the year.

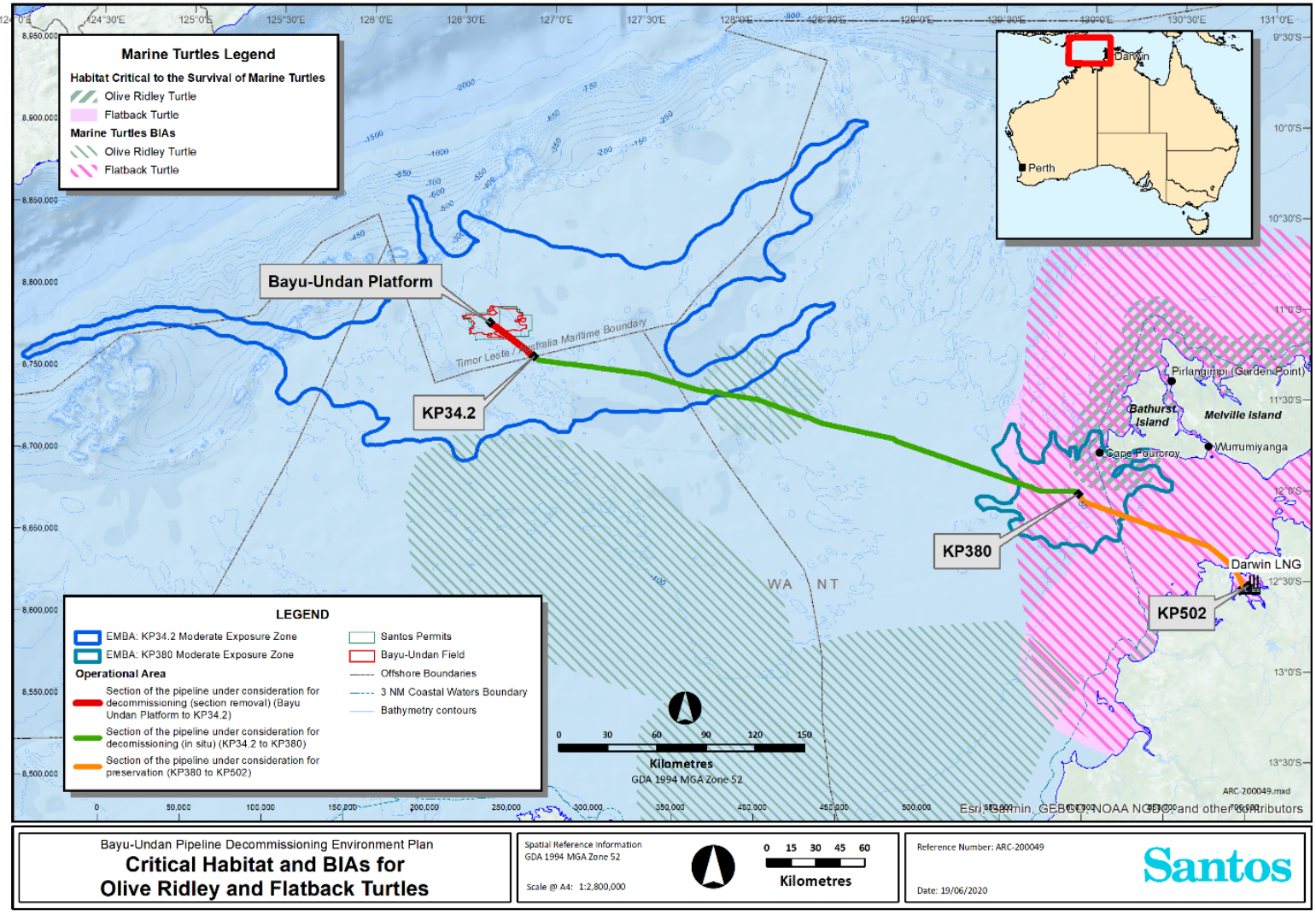


Figure 5-9: Critical habitat and BIAs for olive ridley and flatback turtles

5.3.3.6.8 Flatback Turtle

The flatback turtle (*Natator depressus*) is known to occur along the WA, NT and Queensland coastlines, and forages widely across the Australian continental shelf and into the continental waters off Indonesia and Papua New Guinea (Commonwealth of Australia 2017). Unlike other species of marine turtle, the flatback turtle does not have a global tropical distribution, with all recorded nesting beaches within Australian waters (Limpus 2007).

Flatback turtles nest throughout tropical Australia, although there are several distinct populations (Limpus 2007). The northerly populations in Queensland and the NT nest year-round with a peak during winter months. Populations at higher latitudes off central Queensland and WA's Pilbara coast tend to have a nesting peak in summer (Limpus 2007). Inter-nesting flatback turtles have been recorded travelling further from nesting beaches between laying clutches of eggs (Waayers et al. 2011, Whittock et al. 2014).

Flatback turtles are primarily carnivorous and feed predominantly on soft-bodied invertebrates in relatively shallow waters (Limpus 2007). Their distribution is largely restricted to continental shelf waters (< 200 m).

Studies have shown that pipelines can support diverse and abundant ecosystems and turtles have been noted in association with subsea pipelines (McLean et al. 2020). A flatback turtle was observed on a pipeline stereo-baited remote underwater video deployment on the outer shelf during the marine habitat survey (McLean et al. 2020). However, the significance of subsea pipelines as habitat is not well understood and there was no indication that the turtle favoured pipeline or off-pipeline habitats (McLean et al. 2020).

One BIA for flatback turtles occurs within the EMBA – an inter-nesting buffer around the islands and coastline of the NT. This BIA overlaps the Operational Area in both Commonwealth and NT coastal waters. This inter-nesting habitat is also recognised as habitat critical for the survival of flatback turtles (**Figure 5-9**).

5.3.3.7 Sharks and Rays

The EPBC Act PMST reports identified 12 species of sharks and rays that may occur within the EMBA (**Table 5-3**). No BIAs or EPBC Act Critical Habitats have been identified for these species within the EMBA.

5.3.3.7.1 Narrow Sawfish

The narrow sawfish is widely distributed throughout the Indo-Pacific region, with records spanning from the Arabian Gulf to Japan. In Australia, the species may have a broad tropical distribution from approximately the North West Cape in WA to southern Queensland. Like other sawfish species, the narrow sawfish has experienced considerable decline in numbers due to human activities, including fishing and habitat loss / damage (Cavanagh et al. 2003).

Like other sawfish in the family Pristidae, the narrow sawfish prefers shallow coastal, estuarine and riverine habitats, although may occur in waters up to 40 m deep (D'Anastasi et al. 2013). Given the water depth and distance from preferred habitats, narrow sawfish are not expected to occur in significant numbers in offshore areas of the EMBA. However, the species is likely to be found within the shallow NT coastal waters and estuaries within the EMBA.

5.3.3.7.2 White Shark

The white shark (*Carcharodon carcharias*) has a circum-global distribution primarily in temperate waters. In Australian waters, the species typically occurs in temperate and sub-tropical waters between the shore and the 100 m depth contour; however, adults and juveniles have been recorded diving to depths of 1,000 m (Bruce 2008, Bruce et al. 2006). Tagging studies indicate white sharks may move as far north as Rockhampton on the Queensland coast, however they are thought to be very uncommon in tropical waters (Bruce et al. 2006), such as the Timor Sea.

There are no BIAs for white sharks within the EMBA; given the anti-tropical distribution of this species, white sharks are unlikely to occur within the EMBA.

5.3.3.7.3 Northern River Shark

The northern river shark (*Glyphis garricki*) is a medium-sized shark which can tolerate both marine and freshwater. The species has a tropical distribution and is believed to be endemic to northern Australia and southern New Guinea (Stevens et al. 2005). The species is most commonly encountered in tidal creeks and estuaries (Morgan et al. 2010), hence it is unlikely to occur in significant numbers in offshore Commonwealth waters of the EMBA but may be present in NT coastal waters of the EMBA, including Darwin Harbour.

5.3.3.7.4 Speartooth Shark

The speartooth shark is thought to utilise riverine, estuarine and coastal habitats, with river systems being used as pupping and nursery habitats (Stevens et al. 2005). Only adults of speartooth sharks have been sighted in offshore waters (DEWHA 2008).

Based on the habitat preferences of the speartooth shark, the species is unlikely to occur in significant numbers in offshore Commonwealth waters of the EMBA but may be present in NT coastal waters of the EMBA, including Darwin Harbour.

5.3.3.7.5 Shortfin Mako

The shortfin mako shark is a pelagic species with a circum-global, wide-ranging oceanic distribution in tropical and temperate seas (Mollet et al. 2000). The shortfin mako is commonly found in water with temperatures greater than 16 °C. Tagging studies indicate shortfin makos spend most of their time in water less than 50 m deep but with occasional dives up to 880 m (Abascal et al. 2011, Stevens et al. 2010).

The species can grow to almost 4 m in length. Females mature later (19 to 21 years) than males (7 to 9 years) and adults have moderate longevity estimates of 28 to 29 years (Bishop et al. 2006).

The shortfin mako shark is an apex and generalist predator that feeds on a variety of prey, such as teleost fish, other sharks, marine mammals and marine turtles (Campana et al. 2005). Little is known about the population size and distribution of shortfin mako sharks in Australia. The species presence within the EMBA is likely to be infrequent and restricted to individuals transiting through mainly the offshore Commonwealth Waters section. Shortfin mako sharks are unlikely to be found within the NT coastal waters of the EMBA.

5.3.3.7.6 Longfin Mako

The longfin mako is a widely distributed, but rarely encountered, oceanic shark species. The species can grow to just over 4 m long and is found in northern Australian waters, from Geraldton in WA to at least Port Stephens in New South Wales and is uncommon in Australian waters relative to the shortfin mako (Bruce 2013, DEWHA 2010).

There is very little information about these sharks in Australia, with no available population estimates or distribution trends. 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).

Longfin mako may occur within the EMBA but given their widespread distribution and apparent low density they are likely to be uncommon.

5.3.3.7.7 Reef Manta Ray

The taxonomy of the reef manta ray (*Manta alfredi*) was revised relatively recently, with this species being recognised as distinct from the giant manta ray (*M. birostris*) (Marshall et al. 2009). The species occurs in inshore waters, but is also found around offshore coral reefs, rocky reefs and seamounts (Marshall et al. 2009). In contrast to the giant manta ray, long-term sighting records of the reef manta ray at established aggregation sites suggest that this species is more resident in tropical waters and may exhibit smaller home ranges, philopatric movement patterns and shorter seasonal migrations than the giant manta ray (Deakos et al. 2011, Marshall et al. 2009). A resident population of reef manta rays has been recorded at Ningaloo Reef, and the species has been shown to have both resident and migratory tendencies in eastern Australia (Couturier et al. 2011).

There are no known aggregation sites for reef manta rays within either the Commonwealth or NT

coastal waters sections of the EMBA. Reef manta rays may infrequently occur in the EMBA but only in low numbers.

5.3.3.7.8 Giant Manta Ray

The giant manta ray is broadly distributed in tropical waters of Australia. The species primarily inhabits near-shore environments along productive coastlines with regular upwelling, but they appear to be seasonal visitors to coastal or offshore sites including offshore island groups, offshore pinnacles and seamounts (Marshall et al. 2011).

The EMBA is not located in, or adjacent to, any known aggregation areas for the species (e.g. feeding or breeding). Occurrence of giant manta rays within the EMBA is likely to be infrequent and restricted to individuals transiting the area.

5.3.3.7.9 Dwarf Sawfish

The dwarf sawfish (*Pristis clavata*) is found in Australian coastal waters extending north from Cairns around the Cape York Peninsula in Queensland to the Pilbara coast (Kyne et al. 2013).

Dwarf sawfish typically inhabit shallow (2 to 3 m) silty coastal waters and estuarine habitats, occupying relatively restricted areas and moving only small distances (Stevens et al. 2008). Juvenile dwarf sawfish utilise estuarine habitats as nursery areas and migrate to deeper waters as adults (Thorburn et al. 2008, Threatened Species Scientific Committee 2009).

Dwarf sawfish are unlikely to occur in significant numbers within offshore areas of the EMBA. However, the species is likely to be present in NT coastal waters and estuaries within the EMBA.

5.3.3.7.10 Freshwater Sawfish

The freshwater sawfish (*Pristis pristis*) inhabits both riverine and marine environments in northern Australia. While primarily associated with rivers, tidal creeks and estuaries, the freshwater sawfish has been recorded up to 100 km offshore (Commonwealth of Australia 2015c). Riverine habitats are particularly important as pupping habitats.

The freshwater sawfish is unlikely to occur in significant numbers within offshore areas of the EMBA. However, the species is likely to occur in NT coastal waters and estuaries within the EMBA.

5.3.3.7.11 Green Sawfish

The green sawfish (*Pristis zijsron*) were once widely distributed in coastal waters along the northern Indian Ocean, although it is believed that northern Australia may be the last region where significant populations exist (Stevens et al. 2005). Within Australia, green sawfish are currently distributed from Cairns in Queensland across northern Australian waters to Broome in WA (Threatened Species Scientific Committee 2008b).

Despite records of the species in deeper offshore waters, green sawfish typically occur in the inshore fringe with a strong association with mangroves and adjacent mudflat habitats (Commonwealth of Australia 2015c, Stevens et al. 2005). Movements within these preferred habitats is correlated with tidal movements (Stevens et al. 2008).

Given the habitat preferences of the green sawfish, the species is unlikely to occur in significant numbers within offshore areas of the EMBA. However, the species is likely to occur in nearshore waters of the EMBA, particularly within Darwin Harbour. The Sawfish and River Sharks Multispecies Recovery Plan also notes that green sawfish pupping is likely to occur within Darwin Harbour (Commonwealth of Australia 2015c).

5.3.3.7.12 Whale Shark

The whale shark (*Rhincodon typus*) is globally distributed in tropical and warm temperate waters, and it is thought that individuals form a single genetic population (Castro et al. 2007). The species is an epipelagic filter feeder; their diet typically consists of planktonic and nektonic species, including small crustaceans and smaller schooling fish species.

Key areas of concentration within Australian waters include the Ningaloo coast (March – July), Christmas Island (December – January) and the Coral Sea (November – December), with the timing of the aggregations thought to be linked to seasonal fluctuations in prey abundance

(Threatened Species Scientific Committee 2015d). Tagging, aerial and vessel surveys of whale sharks aggregating off the Ningaloo Coast suggest that the group disperses widely. Satellite tracking has shown that the sharks may follow three migration routes from Ningaloo (Meekan and Radford 2010, Wilson et al. 2006):

- North-west, into the Indian Ocean,
- Directly north, towards Sumatra and Java, and
- North-east, passing through the NWS Province traveling along the shelf break and continental slope.

These large-scale movements are consistent with observations in other parts of the world. Tagging studies in other parts of the world have recorded whale shark movements > 13,000 km (Eckert and Stewart 2001). None of these migration routes overlap the EMBA and there are no BIAs or EPBC Act listed critical habitat for the species within the EMBA. Whale sharks may occur within the north-western offshore Commonwealth waters of the EMBA, but their presence is expected to be limited to individual animals moving through the area.

5.3.3.8 Birds

5.3.3.8.1 Oriental Reed-warbler

The oriental reed-warbler is a small passerine bird that undertakes migrations between northern hemisphere breeding grounds and feeding areas in the southern hemisphere, mainly south-east Asia. The species forages in marshes, grasslands and scrub and may occur within coastal areas of the EMBA, as identified in the PMST database search.

5.3.3.8.2 Common Sandpiper

The common sandpiper is a small, migratory sandpiper with a very large range through which is undertakes annual migrations between breeding grounds in the northern hemisphere (Europe and Asia) and non-breeding areas in the Asia-Pacific region (Bamford et al. 2008). The species congregates in large flocks and forages in shallow waters and tidal flats between spring and autumn. Specific critical habitat in Australia has not been identified due to the species' broad distribution (Bamford et al. 2008).

Given the species' preferred habitat, it may occur within coastal areas of the EMBA, however is likely to be restricted to birds flying passing through during their migration.

5.3.3.8.3 Common Noddy

The common noddy is the largest species of noddy found in Australian waters. The species is widespread in tropical and subtropical areas beyond Australia. This seabird typically forages in coastal waters around nesting sites, taking prey such as small fish, but may occur longer distances out to sea. Nesting occurs broadly across tropical and subtropical Australia in coastal areas, particularly on islands such as the Houtman Abrolhos island group (Burbidge and Fuller 1989).

The common noddy is thought to undertake seasonal movements, with some nesting sites abandoned during the non-breeding season (which is protracted between spring and autumn). The species may occur within coastal and offshore areas of the EMBA in low numbers.

5.3.3.8.4 Australian Lesser Noddy

The Australian lesser noddy (*Anous tenuirostris melanops*) is a tropical species of noddy endemic to Australia (Threatened Species Scientific Committee 2015e). Whilst the Australian lesser noddy has a large range, the species utilises primarily a small area in Houtman Abrolhos for breeding, well beyond the EMBA (Threatened Species Scientific Committee 2015e). The species is also thought to breed in small numbers at Ashmore Reef (Threatened Species Scientific Committee 2015e). Individuals generally remain in close proximity to the breeding islands throughout the year.

Given the distance from known nesting and roosting areas, the Australian lesser noddy is unlikely to occur within the Operational Area, but may occur around coastal islands within the EMBA.

5.3.3.8.5 Fork-tailed Swift

The fork-tailed swift has been observed in all states and territories of Australia. In WA, the species is widespread in coastal and subcoastal areas, as well as on nearshore and offshore islands. The species has also been recorded in the Timor Sea, at sea and near islands such as the Ashmore Reef. The preferred habitat for the species in Australia includes inland plains, as well as coastal areas and beaches, over islands and occasionally well out to sea.

Given the species preferred habitat, it may occur within the Operational Area and coastal areas of the EMBA.

5.3.3.8.6 Ruddy Turnstone

The ruddy turnstone is a migratory wading bird that is widespread within Australia during its non-breeding season, occurring from Tasmania to Darwin and a number of coastal areas in between. The species preferred habitat is coastal areas, particularly along shorelines.

Given the species preferred habitat, it may occur within the Operational Area and coastal areas of the EMBA.

5.3.3.8.7 Sharp-tailed Sandpiper

Like other species of sandpiper, the sharp-tailed sandpiper is a migratory wading shorebird and undertakes long distance seasonal migrations between breeding grounds in the northern hemisphere and over-wintering areas in the southern hemisphere (Bamford et al. 2008). The species may occur in Australian between spring and autumn. The species is unlikely to occur within the EMBA due to the lack of suitable habitat.

5.3.3.8.8 Sanderling

The sanderling (*Calidris alba*) is a migratory wading bird, typically observed in large flocks, and occurs in coastal areas around Australia. The species is known to frequent Darwin and other locations on the northwest coast, particularly Eighty Mile Beach, Roebuck Bay and Ashmore Reef, where significant numbers have been recorded (Bamford et al. 2008). The sanderling prefers open sandy beaches exposed to ocean swell, as well as exposed sandbars which provide foraging habitat. Due to the presence of suitable habitat near coastal areas of the EMBA, the species may occur within the EMBA.

5.3.3.8.9 Red Knot

The species 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. Both Australia and New Zealand host significant numbers of red knots during their non-breeding period (Bamford et al. 2008). As with other migratory shorebirds, the species is unlikely to occur in the EMBA due to the lack of suitable habitat.

5.3.3.8.10 Curlew Sandpiper

The curlew sandpiper breeds in northern Siberia but has a non-breeding range that extends from western Africa to Australia, with small numbers reaching New Zealand (Bamford et al. 2008). In Australia, curlew sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period and also during the breeding season when many non-breeding one-year old birds remain in Australia rather than migrating north. As with other migratory shorebirds, the species is unlikely to occur in the EMBA due to the lack of suitable habitat.

5.3.3.8.11 Pectoral Sandpiper

The pectoral sandpiper is a small-medium sandpiper that is seasonally widespread in Australia. As with other species of sandpiper, the pectoral sandpiper breeds in the northern hemisphere during the boreal summer, before undertaking long distance migrations to feeding grounds in the southern hemisphere. The species occurs throughout mainland Australia between spring and autumn. The pectoral sandpiper prefers coastal and near-coastal environments such as wetlands, estuaries and mudflats. Given the species' preferred habitat the pectoral sand piper may occur within coastal areas of the EMBA.

5.3.3.8.12 Great Knot

The great knot (*Calidris tenuirostris*) is a migratory shorebird that utilises the East Asian – Australasian Flyway. The species breeds in north-east Siberia and during the non-breeding season, most of the Great Knot populations occur in Australia. It has been recorded around the entire Australian coast, although there have been a few scattered records inland. In Australia, the species typically prefers sheltered coastal habitat, with large intertidal mudflats or sandflats.

The great knot may occur in coastal areas of the EMBA during their non-breeding season.

5.3.3.8.13 Streaked Shearwater

The streaked shearwater occurs frequently in northern Australia, with records from central WA, around the north coast, and south to central New South Wales (DSEWPaC 2012b).

In northern Australia, the streaked shearwater is usually found in offshore waters, where it forages mainly for fish and squid caught by surface-seizing or by shallow plunges. Off the NT coast, the species is common in the Arafura Sea during summer. Although the streaked shearwater does not breed in Australia, the species is recorded regularly in northern Australia from October to March, with some records as early as August and as late as May (DSEWPaC 2012b).

The species may occur within the EMBA in low numbers throughout the year.

5.3.3.8.14 Greater Sand Plover

The greater sand plover (*Charadrius leschenaultii*) occurs in all states of Australia with the greatest numbers occurring in Northern Australia. Like many migratory shorebirds, the species breeds in central Asia and migrates to Australia to feed during the non-breeding season.

The greater sand plover may occur throughout coastal and estuarine areas within the EMBA.

5.3.3.8.15 Lesser Sand Plover

The lesser sand plover (*Charadrius mongolus*) is widespread in coastal regions during the non-breeding season; although it has been known to occur inland and has been recorded in all states. The lesser sand plovers that occur in Australia migrate from two or possibly three distinct breeding areas in central and eastern Asia. The species does not breed in Australia.

The species feeds on freshly exposed areas of intertidal sandflats and mudflats in estuaries or beaches.

The lesser sand plover may occur throughout coastal and estuarine areas within the EMBA.

5.3.3.8.16 Oriental Plover

The oriental plover is a migratory shorebird that undertakes seasonal migrations between breeding grounds in the northern hemisphere and feeding areas in the southern hemisphere. It is seasonally present in coastal and inland areas throughout much of Australia. Significant foraging areas in Australia include large tidal flats, such as those found at Eighty Mile Beach and Roebuck Bay. The species may be present within coastal areas of the EMBA.

5.3.3.8.17 Lesser Frigatebird

The lesser frigatebird is the most widely distributed frigatebird in Australian tropical seas and is the smallest species of frigatebird. The species is well-adapted for an aerial existence and may range considerable distances from land. Food consists largely of fish taken at the sea surface or stolen from other birds. Beyond Australia, the lesser frigatebird occurs throughout the tropical Indian Ocean, the western tropical Pacific Ocean, and the south-western tropical Atlantic Ocean. The lesser frigate bird may occur within the EMBA.

5.3.3.8.18 Great Frigatebird

The great frigatebird is widespread and breeds on tropical islands in the Indo-Pacific region. The great frigatebird forages far from sea, although breeding birds probably forage within 100–200 km of the colony during the early stages of the breeding season. The diet consists mainly of flying fish with some cephalopods. The foraging great frigatebird may occur within the EMBA in

low numbers, however there are no known nesting colonies in the vicinity of the EMBA.

5.3.3.8.19 Oriental Pratincole

The oriental pratincole is a migratory bird that is seasonally present in warmer parts of Australia. The species is somewhat unusual in that is classed as a wading bird, but also hunts insects in the air. Important habitat within Australia includes Ramsar wetlands such as Eighty Mile Beach. This species may occur within coastal areas of the EMBA.

5.3.3.8.20 Bar-tailed Godwit (Including *Baueri* Subspecies)

The bar-tailed godwit (including the *baueri* subspecies) is a migratory wading shorebird. It undertakes the longest know migration flight of any bird species, moving from breeding grounds in the Arctic and tundra in the northern hemisphere to temperate and tropical feeding grounds in the southern hemisphere. It typically forages in mudflats and marshlands; as such, it may occur within the mudflat habitats of the EMBA.

5.3.3.8.21 Northern Siberian Bar-tailed Godwit

The northern Siberian bar-tailed godwit, (*Limosa lapponica menzbieri*) is a sub-species of the bar-tailed godwit (*Limosa lapponica*). Like the bar-tailed godwit (*baueri*), this species has been recorded in coastal areas of all Australian states including the offshore islands.

The species usually forages near the edge of water or in shallow water, mainly in tidal estuaries and harbours and roosts on sandy beaches, sandbars, spits and also in near coastal saltmarsh.

The northern Siberian bar-tailed godwit is very unlikely to occur within the Operational Area due to the absence of suitable habitat; the species may occur during summer months throughout coastal habitats in the EMBA.

5.3.3.8.22 Black-tailed Godwit

The Black-tailed Godwit is a migratory found in all states and territories of Australia during the non-breeding season. The species is not known to breed in Australia. It prefers coastal regions and the largest populations are found on the north coast between Darwin and Weipa. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets.

The black-tailed godwit may occur throughout coastal and estuarine areas within the EMBA.

5.3.3.8.23 Eastern Curlew

The eastern curlew takes an annual migratory flight to Russia and north-eastern China to breed, arriving back home to Australia in August to feed on crabs and molluscs in intertidal mud flats (Bamford et al. 2008). The species has a number of important sites in Australia, primarily along the eastern coastline (Bamford et al. 2008). No BIAs or critical habitats for the eastern curlew have been identified in the Operational Area.

5.3.3.8.24 Whimbrel

The whimbrel is a regular migrant to Australia and New Zealand, with a primarily coastal distribution. There are also scattered inland records of whimbrels in all regions. It is found in all states but is more common in the northern Australia.

The whimbrel may occur throughout coastal and estuarine areas within the EMBA.

5.3.3.8.25 Osprey

The osprey is a medium-sized raptor (length 50–65 cm; wingspan 145–170 cm) that is widely distributed around Australia in coastal and wetland habitats. The species also occurs throughout south-eastern Asia (Indonesia, Philippines, Palau Islands, New Guinea, Solomon Islands and New Caledonia). Ospreys feed almost exclusively on fish, typically capturing prey observed while flying by plunging feet first into the water (Clancy 2005). While listed as migratory, adults are generally restricted to a foraging area surrounding their nests.

Egg laying in Australia is protracted between April and February, which may be due to the

extended geographic range of the species within Australia and discrete genetic populations that may constitute subspecies (Olsen and Marples 1993, Wink et al. 2004).

Given the species' preference for coastal and wetland environments, it is unlikely to occur within the Operational Area, but may occur within coastal waters in the EMBA.

5.3.3.8.26 Grey Plover

The grey plover has been recorded in all states, where it is found along the coasts, and it especially abundant on the western and southern coastlines. In the Northern Territory, small numbers of grey plovers are regularly recorded in the Top End.

The grey plover may occur throughout coastal and estuarine areas within the EMBA.

5.3.3.8.27 Australian Painted Snipe

The Australian painted snipe (*Rostratula australis*) is a wading bird, generally seen singly or in pairs, or less often in small flocks. The species has been recorded in wetlands in all states of Australia but is most common in eastern Australia. The Australian painted snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent swamps, claypans and lakes. Little is known about the movement patterns of the species; however, dispersive movements have been attributed to local conditions (e.g. move to flooded areas; from drying to permanent wetlands; away from areas affected by drought).

The Australian painted snipe is very unlikely to occur within the Operational Area due to the absence of suitable habitat; the species may occur throughout coastal and estuarine areas within the EMBA.

5.3.3.8.28 Little Tern

The little tern is a small seabird. The species is widespread in Australia, with breeding sites widely distributed from north-western Western Australia, around the northern and eastern Australian coasts to south-eastern Australia. The species has both resident breeding populations within Australia, as well as non-breeding visiting migrant populations that are seasonally present. The species breeds throughout coastal areas and islands in northern Australia and forages at sea.

The little tern may occur throughout the EMBA.

5.3.3.8.29 Common Greenshank

The Common Greenshank is a heavily built, elegant wader. The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. It usually occurs in freshwater marshes but may occur in estuaries and protected coastlines.

The common greenshank may occur I coastal areas throughout the EMBA.

5.4 SOCIO-ECONOMIC AND CULTURAL ENVIRONMENT

5.4.1 Heritage

5.4.1.1 World Heritage Properties

There are no World Heritage Properties within the EMBA. The nearest World Heritage Property is the Kakadu National Park, over 150 km from the EMBA at the closest point.

5.4.1.2 National Heritage Properties

There are no National Heritage Properties within the EMBA. The nearest National Heritage Property is the Kakadu National Park, over 150 km from the EMBA at the closest point.

5.4.1.3 Commonwealth Heritage Properties

There are no European heritage values within the EMBA. The nearest Commonwealth Heritage

Properties are in the city of Darwin (i.e. the Larrakeyah Barracks Headquarters Building, Barracks Precinct and Sergeants Mess).

5.4.1.4 Indigenous Heritage

There are no recorded Indigenous heritage sites within the EMBA. The Tiwi Islands are a declared Aboriginal reserve and comprise a number of protected sacred sites under the NT *Aboriginal Sacred Sites Act*. Traditional practices, including fishing continue to take place on the islands.

5.4.1.5 Historic Shipwrecks

One historic shipwreck occurs within the EMBA – the wreck of the Japanese submarine I-124. The I-124 was sunk in 1942 during mine-laying operations off northern Australia with the loss of the entire crew. The wreck lies beyond the Operational Area (approximately 24 km from the tie-in point) but occurs within the EMBA.

5.4.2 Marine Protected Areas

Marine protected areas that lie within or overlap the EMBA are shown in **Figure 5-10** and described below.

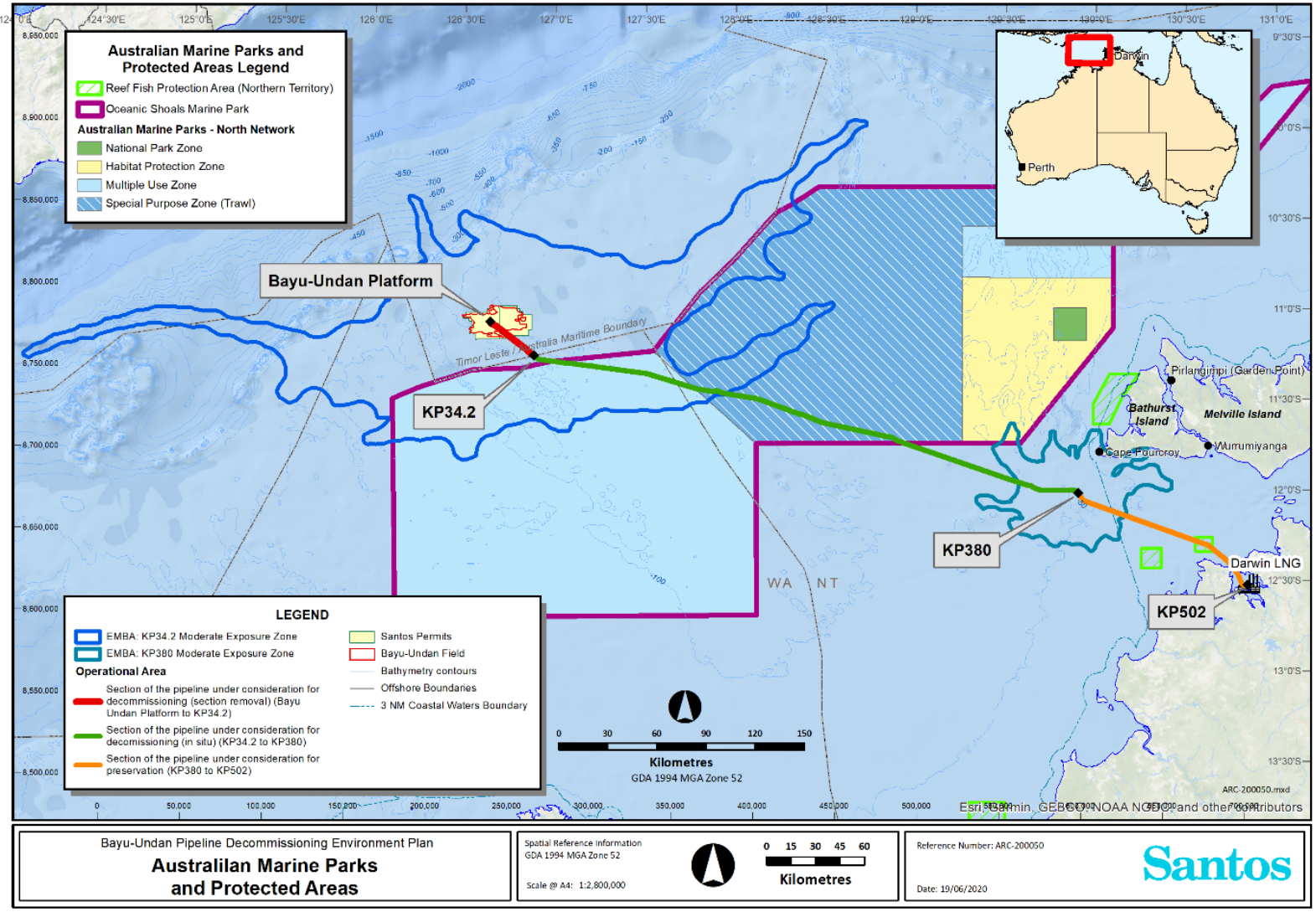


Figure 5-10: Marine Parks and Protected Areas

5.4.2.1 Marine Parks

One Marine Park, the Oceanic Shoals Marine Park, overlaps the Operational Area and MEZ within Commonwealth waters (**Figure 5-10**). The Oceanic Shoals Marine Park is a Commonwealth reserve proclaimed under the EPBC Act and is managed under the *Australian Marine Parks - North Marine Parks Network Management Plan 2018* (Director of National Parks 2018). The Oceanic Shoals Marine Park has several conservation values, including:

- An important inter-nesting area for the flatback and olive ridley turtles,
- An important foraging area for loggerhead and olive ridley turtles, and
- Examples of the ecosystems of both the Northwest Shelf Transition and Timor Transition provinces.

Three KEFs are also represented within the Marine Park, two of which overlap the EMBA (refer to **Section 5.3.2.4**).

The Operational Area overlaps a Multiple Use Zone and a Special Purpose Zone (trawl) within the Oceanic Shoals Marine Park, both of which are classified as IUCN Category VI. The managed area overlapped by the Operational Area is entirely Multiple Use Zone (IUCN Category VI). Stated reserve management principles for IUCN Category VI areas are:

- The reserve or zone should be managed mainly for the sustainable use of natural ecosystems.
- The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term.
- Management practices should be applied to ensure ecologically sustainable use of the reserve or zone.
- Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles.

A class approval covering the construction, operation and decommissioning of the Pipeline within the IUCN Category VI zones of the Oceanic Shoals Marine Park is in place; refer to **Section 2.1.2.1** for further information on the class approval and associated conditions.

5.4.2.2 Territory Reef Protection Areas

A number of Reef Protection Areas have been established in the NMR following stock analyses which identified the downward trend of golden snapper and jewfish. One Reef Protection Area overlaps the Operational Area in NT coastal waters - Charles Point Wide (**Figure 5-10**). This area protects key deep water sections of fish habitat within the nearshore habitat to reduce impacts of barotrauma, while allowing fishing to occur in shallower adjacent areas. The reef protection area does not have conservation objectives relevant to activities outlined in this EP.

5.4.3 Fishing

5.4.3.1 Commercial Fisheries

Commercial fisheries that were identified as potentially being active within the EMBA are described in **Table 5-6** and shown in **Figure 5-11**. A relatively small portion of the EMBA partially overlaps several WA managed fisheries on the outer continental shelf, none of which are active within the EMBA. These WA managed fisheries have not been considered further.

During the consultation period for this EP, there were no concerns raised specific to any of the fisheries outlined in Table 5- in relation to the proposed decommissioning activities. The common issues raised across all fisheries are discussed in the Stakeholder Consultation section (Section 9) of this document.

Table 5-6: Commercial fisheries overlapping the EMBA

Commercial Fishery	Description
Commonwealth Managed Fisheries	
Northern Prawn Fishery	The Northern Prawn Fishery management area extends over Australia's northern coast, between Cape York in Queensland and Cape Londonderry in WA, from the low water mark to the outer edge of the Australian Fishing Zone (AFZ). 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 (Larcombe et al. 2018), beyond the EMBA. The highest catches come from nearshore 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. Data from the most recent fishing season recorded a very low fishing effort within the EMBA (Larcombe et al. 2018).
Northern Territory Managed Fisheries	
Demersal Fishery	The Demersal Fishery boundary extends from 15 nautical miles (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 snappers, goldband snappers, saddletail, and crimson snapper. There are currently 18 licences issued for the fishery (NT Government 2017). The majority of the fishing effort occurs in relatively deep offshore water; most effort occurs east of the EMBA (NT Government 2017).
Coastal Line Fishery	The Coastal Line fishery extends 15 NM from the low water mark around the entire NT coastline. The fishery is divided into two zones, which divide the coastline at Vashon Head on the Cobourg Peninsula (NT Government 2017). 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 (NT Government 2017). 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 (NT Government 2017). Catch from droplines and traps account for less than 7% of the total reported catch (NT Government 2017). Given activity within the Coastal Line Fishery is concentrated in nearshore water, the potential for fishing activity in the EMBA is very low.
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 (NT Government 2017). The fishery permits both pelagic gillnets and longline gear and targets Australian and common blacktip sharks, spottail sharks and grey mackerel; however, longlines have not been used since 2013 due to a drop in shark fin price (NT Government 2017). 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 (NT Government 2017). Effort beyond 12 NM from shore is typically very low The number of licences for the fishery is restricted to 17 and generally 11 licences are active in any given year (NT Government 2017). 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. prior to the introduction of precautionary fishing measures) (NT Government 2017). Participants in the fishery may fish within the EMBA; however, as most effort is located within 12 NM of the shore, fishing within the EMBA will most likely only occur in NT coastal waters.
Spanish Mackerel Fishery	The fishery extends from the NT high water mark to the outer limit of the AFZ (NT Government 2017). 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 (NT Government 2017). The target species of the fishery is the narrow-barred Spanish mackerel, however a small number of other mackerels are also taken. 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 (NT Government

Commercial Fishery	Description
	2017), and boat-days and spatial fishing intensity data have not been reported for recent years. Given most of the fishing takes place to the east of the EMBA, there is low potential for fishing to occur within the EMBA and/or for interactions with fishery participants within NT coastal waters, which would likely be focused in the area closest to Bathurst Island.
Timor Reef Fishery	The Timor Reef Fishery operates offshore and targets tropical snappers (*Lutjanus* spp. and *Pristipomoides* spp.) using a variety of gear. The majority of the catch is taken using baited traps, but hand lines, droplines and demersal longlines may also be used. The harvest by this fishery is limited through a set of total allowable catches applied to goldband snappers (900 t), red snappers (1,300 t) and “group fish” (415 t). The composition of these groups is the same as those for the Demersal Fishery. A total of 806 t of fishes was harvested by licensees in 2015, with goldband snappers and red snappers constituting most of the harvest (38% and 31% of the total, respectively) and Mangrove Jack (*Lutjanus argentimaculatus*) being the primary byproduct species (6% of the total harvest). The total estimated value of the catch in this fishery is $3.6 million. The Timor Reef Fishery lies approximately 45 km from the Operational Area but occurs within the MEZ component of the EMBA.

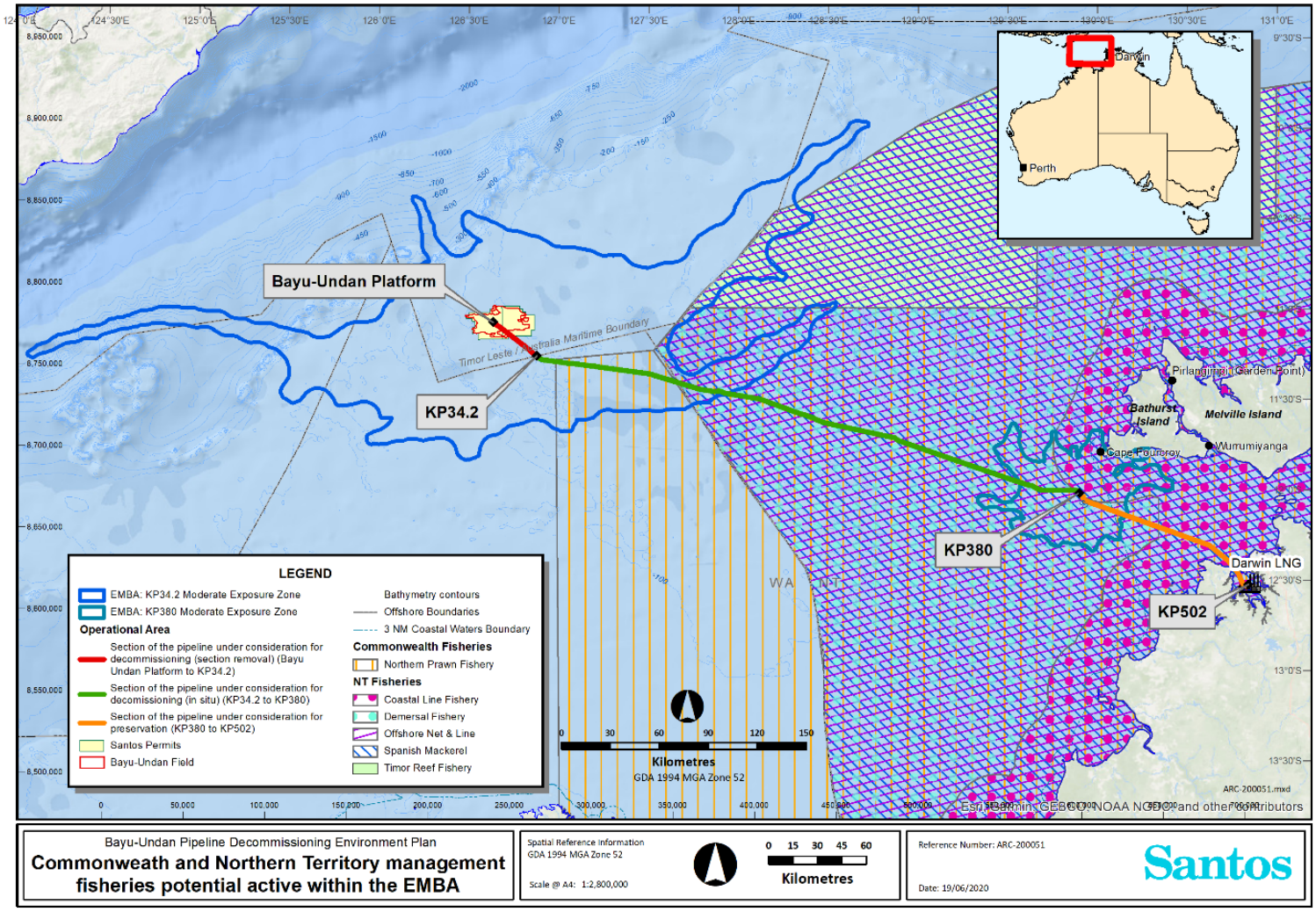


Figure 5-11: Commonwealth and Northern Territory managed fisheries potentially active within the EMBA

5.4.3.2 Traditional Fishing

Traditional fishing in the NT and WA waters predominately occurs within inshore tidal waters. Approximately 85% of the NT's inter-tidal zone is recognised as Aboriginal land under the *Aboriginal Land Rights (Northern Territory) Act*. Almost all Indigenous fishing effort is concentrated within the 3 NM NT coastal waters boundary, with fishing effort spanning the entire coastline (NT Government 2017) and is mostly focused around the Tiwi Islands. A number of areas within this coastal region have been declared Aboriginal sacred sites, which are restricted from other recreational and commercial fishing.

Within Darwin Harbour, fishing and foraging for food and other resources occurs within the intertidal regions, mainly around Nightcliff, Coconut Grove, Kululuk, Sadgroves Creek, and Lee Point (INPEX Browse 2010). As such, Indigenous fishing will be restricted mainly to NT coastal waters of the EMBA.

5.4.3.3 Recreational Fishing

Like traditional fishing, recreational fishing in NT waters is predominantly in coastal waters, either from shore or in recreational fishing boats. 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).

Recreational fishing activity is typically concentrated around access nodes, such as boat ramps in Darwin Harbour, and will primarily occur within the NT coastal waters areas of the EMBA. Given the distance from shore and absence of habitat supporting high value species (e.g. reefs, banks and shoals), recreational fishing activities will be limited and infrequent within Commonwealth waters in the EMBA.

5.4.3.4 Aquaculture

There are no known open-water aquaculture activities occurring within the EMBA in Commonwealth or NT Coastal Waters; however, there are government initiatives to encourage the development of aquaculture, particularly within Aboriginal communities. Should these be developed they are likely to be located within NT Coastal Waters.

5.4.4 Tourism

Tourism is unlikely to occur within the Commonwealth waters of the EMBA due to the absence of nature-based or cultural attractions. Some tourism activities, such as guided fishing tours, scuba diving (associated with shipwrecks, coral reefs and artificial reefs), boating, water-skiing and beach use, may occur within the coastal waters of the EMBA including Darwin Harbour (INPEX Browse 2010). The Tiwi Islands are also a popular tourist destination offering cruises, sailing and water tours among other cultural activities. Tourism and recreational activities are likely to be more concentrated within NT coastal waters sections of the EMBA.

5.4.5 Ports and Commercial Shipping

Darwin Port (beyond the EMBA) is the only major shipping port in the region. A range of materials are imported and exported from the port and surrounding industrial facilities, including general cargo, livestock and LNG. Cruise ships, naval vessels and vessels servicing operations offshore from north-west Australia also utilise the port and Darwin Harbour.

Shipping activity within the EMBA occurs between Darwin Harbour and the Bayu-Undan field, within both Commonwealth and NT coastal waters. However, shipping is concentrated around the south-western tip of Bathurst Island (Cape Fourcroy), in the vicinity of the Pipeline within the NT coastal waters region of the EMBA. The main preferred shipping routes that occur within the EMBA are:

- Between Darwin and ports in South-East Asia (mainly livestock carriers and general cargo vessels),

- Bulk carriers averaging 55,300 tonnes with speeds of 14 knots and typically pass no closer than about 50 km from the Bayu-Undan field. Livestock carriers and cargo ships, however, may pass anywhere between 8-30 km from Bayu-Undan, and
- Livestock carriers averaging 2,800 tonnes with speeds of 12 knots, whilst general cargo vessels have a similar average speed, but with an average displacement of 4,900 tonnes.

Shipping activity within the EMBA is shown in **Figure 5-12**.

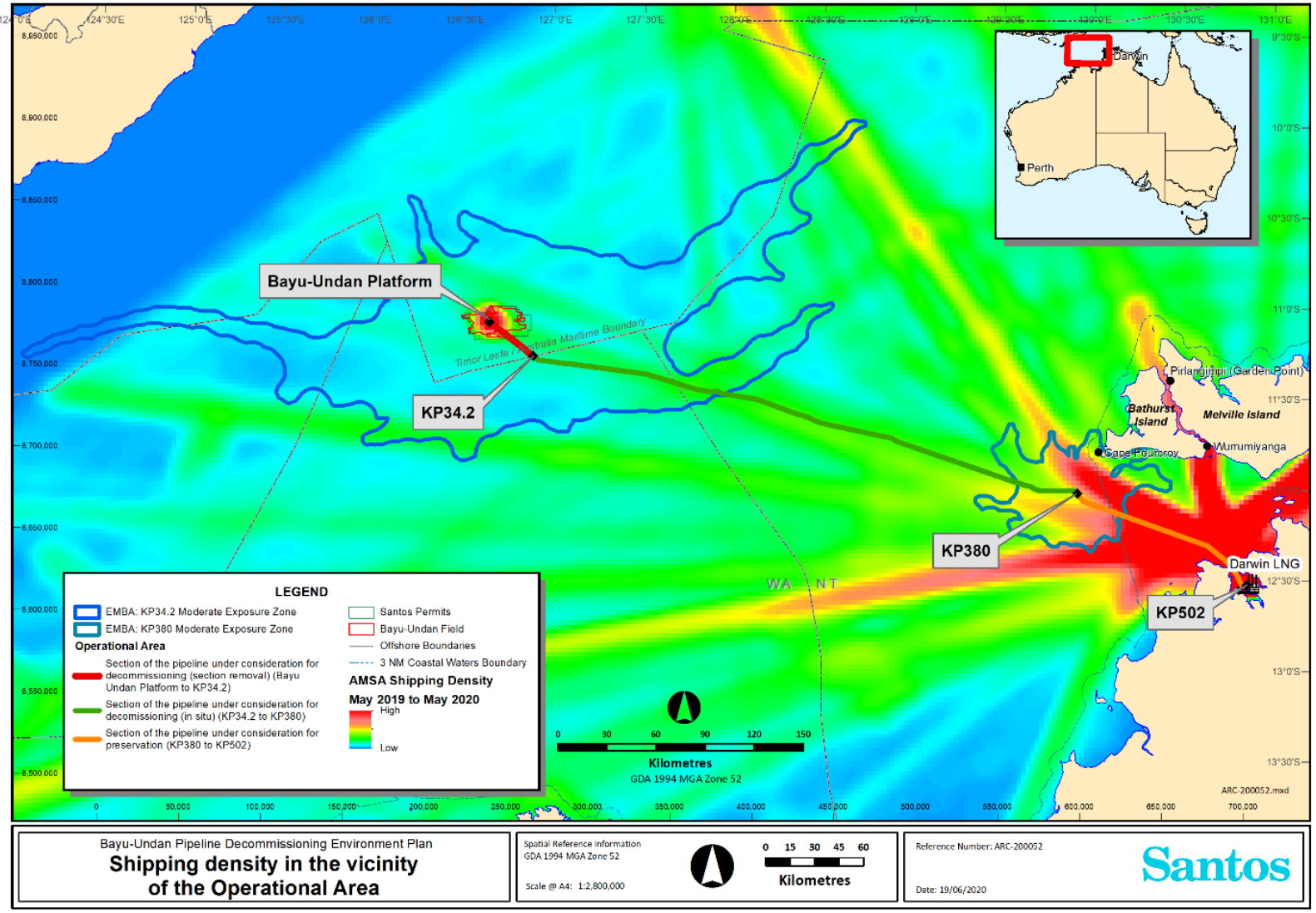


Figure 5-12: Shipping density in the vicinity of the Operational Area

5.4.6 Offshore Petroleum Exploration and Operations

The Bayu-Undan Field, operated by Santos, is the only active petroleum production facility within the EMBA. This facility will not be producing petroleum at the time of the Pipeline decommissioning activities. A tie-in by an upstream party is planned at the tie-in point; i.e. downstream of the Pipeline isolation and section removal included within the decommissioning activities described in this EP. The activities associated with the tie-in will be the subject of a separate EP.

Petroleum exploration, including seismic surveys and drilling activities, occur within the Timor Sea. Santos is not aware of any such planned activities within the EMBA.

5.4.7 Defence Activities

The EMBA intersects a practice and training areas of the North Australian Exercise Area (NAXA), a maritime military zone administered by the Department of Defence (**Figure 5-13**). The NAXA comprises practice and training areas and extends approximately 300 km north and west from just east of Darwin into the Arafura Sea in both Commonwealth and NT coastal waters. 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 EMBA within Commonwealth Waters.

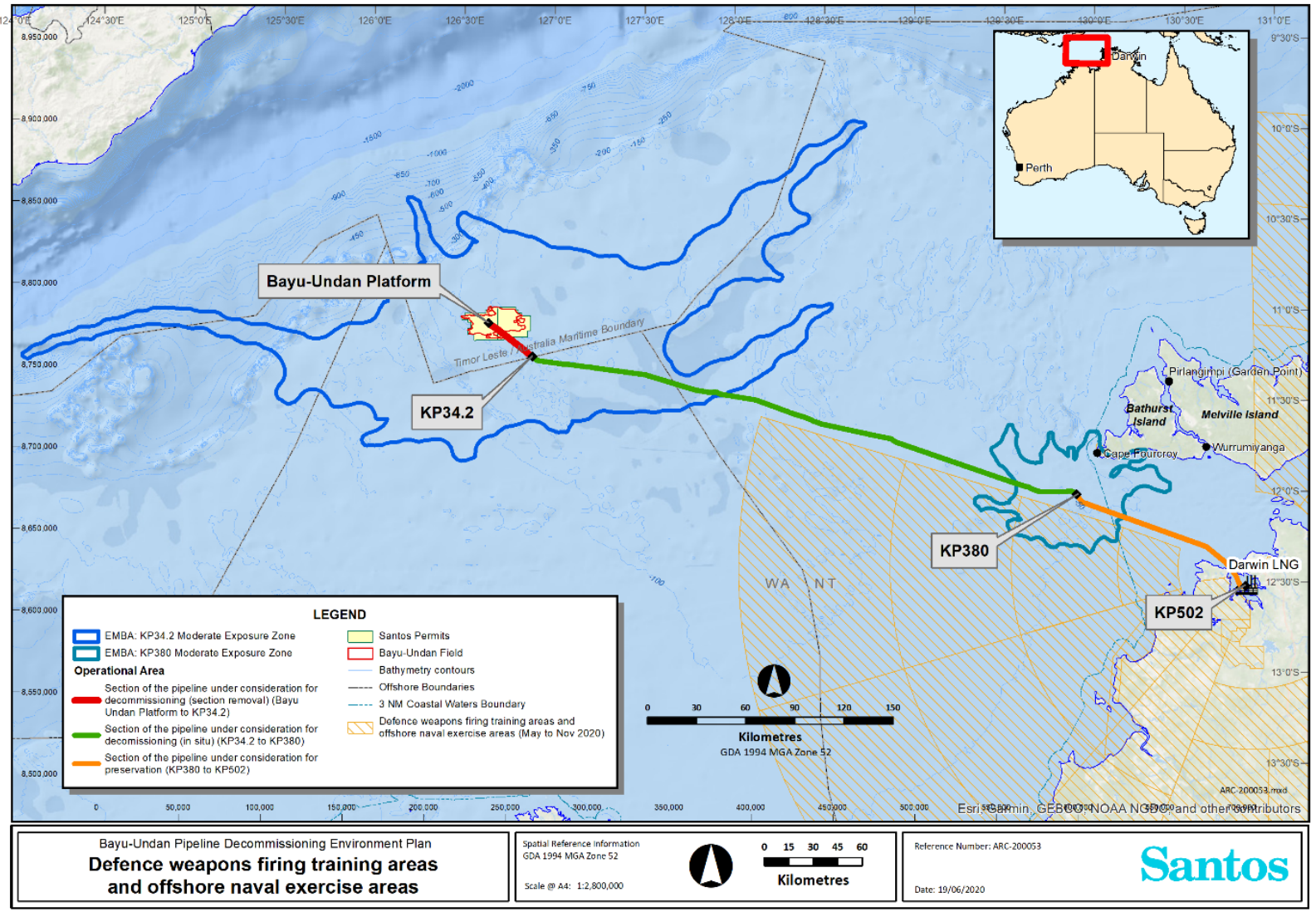


Figure 5-13: Defence weapons firing training areas and offshore naval exercise areas

6 DESCRIPTION OF ENVIRONMENTAL RISKS AND IMPACTS

In accordance with regulations 13(5) and 13(6) of the OPGGS(E) Regulations 2009, this section identifies and evaluates the risks and potential environmental impacts associated with the activity (including potential emergency situations), as appropriate to the nature and scale of each impact and risk. The risk assessment, evaluation and management process applied, as described below, provides a framework to demonstrate that environmental impacts and risks are reduced to ALARP and acceptable levels, as required by Regulation 10A(b) and 10A(c) of the OPGGS(E) Regulations 2009.

6.1 OVERVIEW

Santos seeks to minimise environmental impact through the active and progressive elimination of hazards and the reduction of risk. This objective is achieved through a systematic and integrated approach to risk management to reduce risks to a level that is ALARP.

Environmental management is implemented through a hierarchy of policies and procedures that cascade from the Santos corporate level through to individual operating assets and projects. These policies/procedures are framed and implemented within the Santos ABU-W HSEMS; refer to the Implementation Strategy in **Section 8** for additional information on the HSEMS.

The following steps outline the environmental and risk management framework for the Petroleum Activity, which are developed in accordance with the ABU-W HSEMS:

- Establish the context by considering:
    - The nature and scale of the Petroleum Activity and its associated environmental aspects and hazards,
    - Relevant legislation/guidance (**Section 2**),
    - The existing environment (**Section 5**), and
    - Relevant stakeholder values and feedback (**Section 9**).
- Identify hazards by:
    - Considering the aspects, hazards, impacts and risks associated with the activity, with regard to:
        - Santos' operational experience,
        - The potential planned and unplanned activities that may occur within the scope of the EP, and
        - Relevant stakeholder context.
    - Defining the credible impacts and risk scenarios and the existing control measures associated with each aspect.
- Inherent risk analysis by:
    - Assessing the impact or risk associated with each hazard and the existing control measures in place to determine the inherent risk.
- Residual risk analysis by:
    - Identifying and considering potential additional control measures to reduce the risk to a level that is ALARP and acceptable.
- Risk evaluation by:
    - Assess the risk with any additional control measures in place to determine the residual risk and evaluate if the risk has been reduced to ALARP and is acceptable, and

- If not ALARP, consider potential additional control measures until the risk has been reduced to ALARP and is acceptable.

- Risk treatment by:
  - Defining EPOs, EPSs and MCs for the risk sources,
  - Determining measurement, monitoring and reporting requirements, and
  - Defining roles and responsibilities for implementation of EPSs.

This EP demonstrates risk assessment and risk mitigation and provides discussion of various control measures and management systems that can be used to reduce the environmental impact and risk of the activity to ALARP and an acceptable level. The risk assessment process applied for this EP was based on the ABU-W corporate risk assessment process as outlined in the ABU-W Risk Management Procedure (ALL/HSE/PRO/040). This risk assessment process is consistent with the AS/NZS ISO 31000:2009: Risk Management – Principles and Guidelines and Handbook (HB) 203:2006 Environmental risk management – Principles and process (Guide) (AS/NZS 2006). The core steps of the ABU-W risk assessment process are summarised in **Figure 6-1**.

Table 6-1 provides definitions that are commonly used environmental risk assessment terminology.

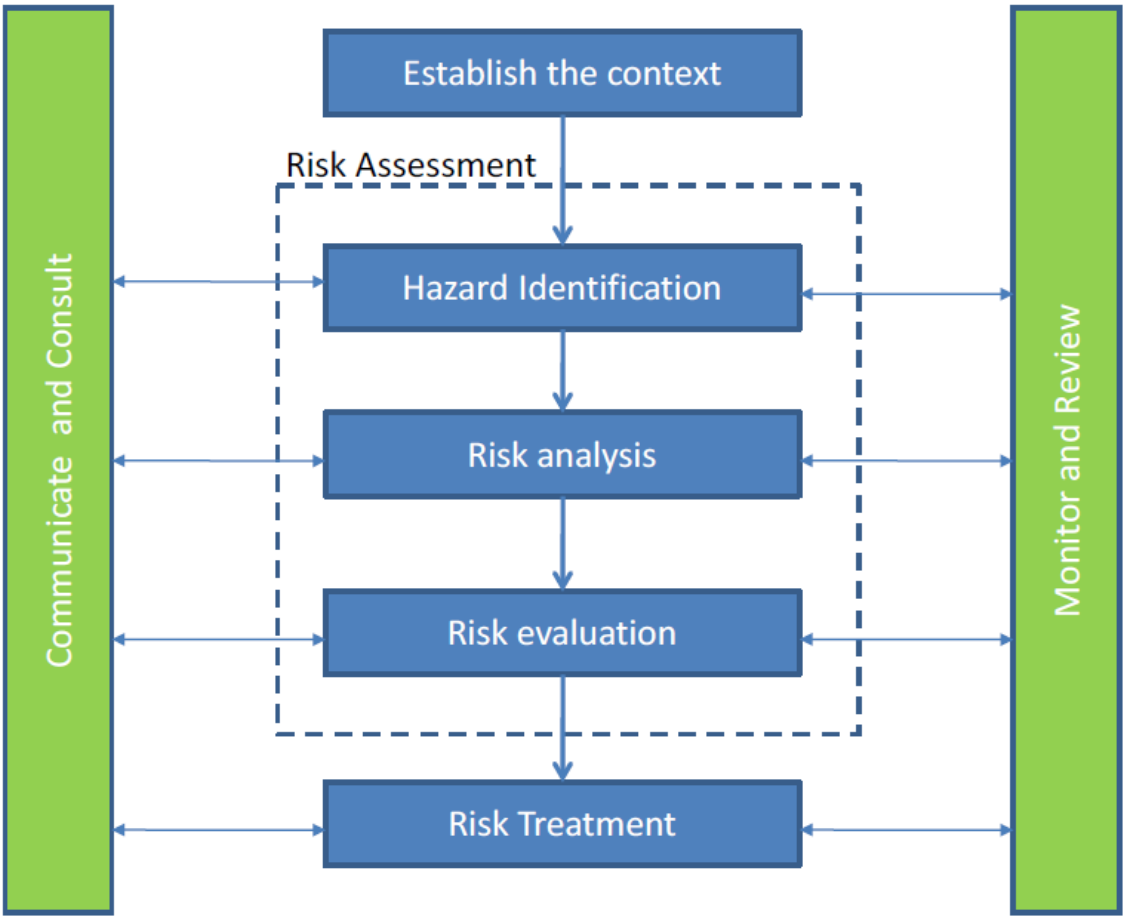


Figure 6-1: ABU-W environmental risk assessment process

Table 6-1: Risk assessment terminology and definitions

Term	Definition
Activity	Components or elements of work associated with the Petroleum Activity
ALARP	ALARP is defined in Santos' ABU-W Risk Management Procedure (ALL-HSE-PRO-040) as follows: "*ALARP is a level of risk that cannot be reduced further without the expenditure of effort or capital cost which is disproportionate to the benefit gained. In relation to HSE, determination of whether a risk reduction measure is practicable needs to consider the following key factors:* • *The severity of any injury, harm to health and/or impact to environmental/ecologically sustainable development that may occur from an event;* • *The likelihood of that injury, harm to health and/or impact to environmental/ecologically sustainable development occurring;* • *How much is known about the hazard and the ways of eliminating, reducing or controlling the hazard; and* • *The availability, suitability and cost of safeguards."*
Aspect	Elements of Santos' activities or products or services that can interact with the environment. These include routine/non-routine planned and unplanned (including those associated with emergency conditions) activities.
Receptor	Relevant natural, socio-economic and cultural features of the environment
Potential impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from a proponent's environmental aspects
Event	An event is an occurrence of a particular set of circumstances. An event can be one or more occurrences and can have several causes.
Hazard	A hazard is defined as the ability of a substance, situation, process or activity to cause harm to the environment
Control	A control is a measure which mitigates risk through the reduction of the likelihood for a consequence to occur. Controls include 'existing controls' (i.e. industry standards) or 'additional controls' (i.e. key Santos management controls or additional measures identified during the risk assessment processes)
Consequence	A consequence is the outcome of an event. An event can lead to a range of consequences. A consequence can be certain or uncertain and can have positive or negative effects. Consequences can be expressed qualitatively or quantitatively. For risk assessment purposes, the consequence typically remains unchanged since it is determined without controls in place.
Likelihood	Description of probability or frequency of a consequence occurring.
Inherent risk	The level of risk (with existing controls in place) before application of additional risk controls arising from risk assessment processes
Residual risk	The level of risk remaining after risk treatment (i.e. application of additional controls) inclusive of unidentified risk

6.2 RISK ASSESSMENT

6.2.1 Risk Identification

A review of the activity was completed to identify potential aspects of Pipeline decommissioning and preservation that may result in environmental impacts or risks. These aspects were then assessed to determine which constituted hazards (i.e. may credibly result in environmental impacts and / or risks). Each hazard was then assessed to identify the impact and risks to environmental receptors described in **Section 5**. Both planned and unplanned events that could occur during Pipeline decommissioning activities were considered.

Identification of the aspects, receptors, and the potential impacts and / or risks was conducted through:

- A review of the activities that may be undertaken during the Petroleum Activity (**Section 4**),
- Knowledge developed by Santos' operational experience,
- A review of the existing environment (physical, biological, socio-economic and cultural; **Section 5**), including information gained through stakeholder consultation (**Section 9**), and
- The environmental hazard identification and risk assessment (ENVID) workshops.

The ENVID workshop was undertaken in accordance with the Santos ABU-W Risk Management Procedure (ALL/HSE/PRO/040). This workshop aimed to identify and assess the impacts and risks associated with Pipeline decommissioning and preservation activities. The ENVID workshop was aligned with NOPSEMAs Hazard Identification and Risk Assessment Guidance Note[6] (N-04600-GN1613) The team of ENVID participants had sufficient knowledge, training and experience to reasonably assure that all credible impacts and risks were identified and assessed. The workshop was informed by:

- A detailed understanding of the environmental and socio-economic setting of the petroleum activity, as described in **Section 5**,
- A review of aspects and associated hazards from Pipeline decommissioning and preservation activities, and
- The knowledge, training and experiences of workshop participants.

The outputs of the ENVID are incorporated into **Sections 6.3** and **6.4**.

A separate oil spill response assessment, the outcomes of which are documented in the OPEP (DCOM-652-EN-OPE-00002), was undertaken to identify relevant spill response strategies and assess the potential impacts and ALARP considerations associated with the implementation of response strategies.

6.2.2 Risk Analysis

The environmental risk assessment process is a qualitative risk-screening tool for evaluating the environmental risk posed by Pipeline decommissioning and preservation. Santos assesses the risk in two key stages:

- Inherent risk analysis – assessment of the potential environment, socio-economic and cultural consequences and the likelihood of that consequence occurring with the application of existing control measures (e.g. relevant legislation, Santos and contractor procedures/standards etc.) for each credible risk source scenarios, and
- Residual risk analysis – reassessment of the inherent risk following the application of additional controls/mitigation measures. The residual risk is an indication of the significance of an environmental, socio-economic or cultural impact, considering the management approach expected to be applied throughout the activity to achieve acceptable outcomes.

[6] Santos acknowledges this Guidance Note is a component of the suite of material provided by NOPSEMA to assist in well integrity management. Risk management concepts described in the Guidance Note are applicable to the management of environmental impacts and risks.

Two key factors underpin the environmental risk assessment:

- The severity of the consequences if impact does occur, and
- The likelihood of receptors at risk being impacted.

Risk analysis frames the assessment of controls that could be applied during execution of activities that pose a potential hazard to receptors. It also provides a framework to identify the measures to mitigate the severity of the impact arising from either planned or unplanned events. The process provides essential input into the assessment of controls and mitigation measures that ensures that the level of risk posed by an activity to a sensitive receptor is reduced to ALARP and is acceptable.

Santos applies the hierarchy of controls as part of the risk assessment process to identify any additional/alternative measures to reduce the risk to ALARP. The general hierarchy of control applied, in the order of priority, is as follows:

- Elimination (of the hazard) - Note that elimination of a hazard precludes further risk analysis for the particular hazard; risks and impacts will no longer credibly occur once the hazard is eliminated. Where applicable, Santos has documented where hazards have been eliminated during the risk management process to demonstrate the risk management process,
- Substitution (e.g. using a less hazardous process),
- Engineering (e.g. screens on cooling water intake),
- Administrative (e.g. using procedures), and
- Personal protective equipment (PPE). Use of PPE is always viewed as the last line of defence or as a supplement to other controls.

The level of risk is determined by establishing the potential consequence of an impact on an environmental, socio-economic or cultural receptor resulting from an aspect of the activities associated with the Petroleum Activity. Following the determination of the level of risk, the likelihood of the consequence occurring is then assigned. The assigned consequence and likelihood are mapped on the risk matrix to determine the level of risk, as illustrated in **Table 6-2**.

Table 6-2: Santos ABU-W risk matrix

Risk Matrix					
Likelihood	***Consequence***				
	Level 1	***Level 2***	***Level 3***	***Level 4***	***Level 5***
Frequent (5)	RRII	RRII	RRIII	RRIV	RRIV
Probable (4)	RRI	RRII	RRIII	RRIII	RRIV
Rare (3)	RRI	RRII	RRII	RRIII	RRIII
Remote (2)	RRI	RRI	RRII	RRII	RRII
Improbable (1)	RRI	RRI	RRI	RRI	RRII

Risk Rating		
Risk score	***Risk rating***	***Description of risk level***
RRIV	High	Manage risk using additional or improved risk-reducing measures with priority. Inform appropriate management level with risk assessment detail and obtain appropriate approvals per the business unit's requirements.
RRIII	Significant	Manage risk using additional or improved risk-reducing measures with priority. Inform appropriate management level with risk assessment detail and obtain appropriate approvals per the business unit's requirements.
RRII	Medium	No additional risk-reducing measures required where controls can be verified as functional. Improvements based on lessons learned are encouraged.
RRI	Low	No additional risk-reducing measures required. Improvements based on lessons learned are encouraged.

6.2.2.1 Assessment of Consequence of Potential Impacts

In evaluating the level of consequence of a potential event, the following factors have been considered:

- Extent of impacts – whether the impact affects the local or wider regional environment,
- Duration of the impact – how long it will interact with the receiving environment, and
- Sensitivity of the receiving environment (including seasonal sensitivities) – nature, importance (local, national or international significance) and the sensitivity or resilience to change of the receptor that could be affected. This also considers any relevant laws, regulations or standards aimed at protecting the receiving environment.

The potential impacts which have been considered in relation to each of the aspects of the activity are shown in the aspect and receptor interaction matrix provided in **Table 6-6**. The interaction matrix was informed by detailed consideration of the nature and scale of the activity (**Section 4**) and comprehensive understanding of the existing environment (**Section 5**).

The consequence definitions in the ABU-W Risk Management Procedure (ALL/HSE/PRO/040) have been applied to this risk assessment, as shown in **Table 6-3**. While the risk assessment process was undertaken with a primarily environmental focus, other potential cultural, socio-economic and business impacts were also considered in determining the consequence rating. The consequence rating is based on a consequence when no safeguards are in place. As a conservative approach, the consequence that results in the highest risk consequence rating by these definitions is carried through for each potential impact.

Table 6-3: Risk assessment consequence definitions (from ABU-W Risk Management Procedure (ALL/HSE/PRO/040))

Consequence severity description			
Rating	***Biodiversity***	***Socio-cultural and economic***	***Business impact***
5	Catastrophic permanent loss/extinction (100%) of species, habitat or ecosystem. Irrevocable loss, no mitigation possible.	• Permanent lost access or use of area with permanent reduction in community or tribal quality of life; major economic impact to surrounding community; irrevocable loss of culture resources. and/or • The remediation associated with the environmental harm, asset damage and/or litigation/resolution costs will probably exceed $25 million.	• Complete area evacuation. and/or • National and global negative media exposure and/or • Business interruption costs likely to exceed $25 million.
4	Serious loss or migration (> 50%) of species population, habitat or ecosystem. Partial mitigation only possible through prolonged and resource intensive effort (greater than 50 years).	• Permanent partial restriction on access or use, or use, or total restriction > 10 years in duration; temporary reduction in quality of life > 10 years' duration; harm to cultural resources requiring major mitigation. and/or • The remediation associated with the environmental harm, asset damage and/or litigation/resolution costs are between $2.5 million and $25 million.	• Selected areas require evacuation. and/or • Regional Asia-pacific and national negative media exposure and/or • Business interruption costs likely to be between $2.5 million and $25 million.
3	Temporary, but reversible loss/migration of species population (< 25%), habitat or ecosystem. Moderate mitigation efforts required for total reversal.	• Temporary restriction < 10 years in duration with a moderate reduction in usage levels or quality of life; harm to cultural resources recoverable through moderate mitigation efforts. and/or • The remediation associated with the environmental harm, asset damage and/or litigation/resolution costs are between $250,000 and $2.5 million.	• Shelters in place but evacuation not mandatory. and/or • Regional negative media exposure and/or • Business interruption costs likely to be between $250,000 and $2.5 million.
2	Brief, but reversible loss/migration of species population (< 15%), habitat or ecosystem. Minor mitigation efforts required for total reversal.	• Brief restriction < 5 years in duration with a minor reduction in usage levels or quality of life; minor harm to cultural resources that are recoverable through minor mitigation efforts. and/or • The remediation associated with the environmental harm, asset damage and/or litigation/resolution costs are between $25,000 and $250,000.	• Local notification only (selected phone calls, letter notification). and/or • State and local negative media exposure and/or • Business interruption costs likely to be between $25,000 and $250,000.
1	Some minor loss/migration of species population (<10%) habitat or ecosystem that are short term and immediately and	• Restrictions on access without loss of resources; temporary but fully reversible impacts on quality of life; minor impact on cultural resources, landscapes, traditions that are fully reversible without lost value. and/or	• No communication to the public. and/or • No media exposure and/or • Business interruption costs likely to be

Consequence severity description			
Rating	***Biodiversity***	***Socio-cultural and economic***	***Business impact***
	completely reversible.	• The remediation associated with the environmental harm, asset damage and/or litigation/resolution costs are between $0 and $25,000.	between $0 and $25,000.

6.2.2.2 Likelihood of Impact Occurrence

The likelihood of an impact occurring considers the effective implementation of industry standard mitigation measures. The likelihood of the event occurring that could give rise to the impact is based on industry experience.

The likelihood selection is based on the likelihood of a consequence occurring with safeguards in place; it is not based on how often the cause occurs.

Table 6-4 provides the likelihood descriptions that have been used for the risk review, which are based on the Santos ABU-W Risk Management Procedure (ALL/HSE/PRO/040). As outlined above, this process reflects the risk management process detailed within AS/NZS ISO 31000:2009 (AS/NZS 2009) and HB 203:2006 (AS/NZS 2006).

Table 6-4: Risk assessment likelihood definitions

Level	Descriptor	Description	Enhanced description
1	Improbable	Virtually improbable and unrealistic	Unheard of in the industry
2	Remote	Not expected nor anticipated to occur	Has occurred once or twice in the industry
3	Rare	Occurrence considered rare	Has occurred many times in the industry but not in the company
4	Probable	Expected to occur at least once in 10 years	Has occurred once or twice in the company
5	Frequent	Likely to occur several times a year	Has occurred several times on the location

* The values in the quantitative range should be used as guidance in selecting the appropriate likelihood category. These values should not be used in the risk calculation.

6.2.3 Risk Evaluation

The evaluation of the environmental risks was undertaken in the context of ALARP and acceptability, which are described in detail below.

6.2.3.1 Demonstration of Risk Reduction to ALARP

Santos demonstrates risks are reduced to ALARP when the cost and effort required to further reduce risk is grossly disproportionate to the risk benefit gained. This demonstration shall include the following:

- Compliance with relevant legislation, accepted industry codes and standards, including standard industry practice and guidelines,
- Implementation of effective management system controls,
- Incorporation of barriers/control measures commensurate with the potential impact and risk from the activity, and
- Confirmation that the cost/benefit/sacrifice and effort of adding further barriers/control measures is grossly disproportionate to the potential reduction in risk. This is achieved through the identification and evaluation of further measures to determine those appropriate for implementation (i.e. practicable).

For inherently significant and high-risk activities, significant effort is made to assess and implement risk reduction opportunities such as quantitative studies and cost benefit analyses and undertaking detailed review of the risk in consultation with management. For inherently low or medium risk activities, further controls are assessed qualitatively/semi-quantitatively (as per Santos' ABU-W Risk Management Procedure (ALL/HSE/PRO/040)) based on the nature and scale of the risk and taking into consideration regulator expectations. All assessments are recorded for demonstration purposes.

6.2.3.2 Demonstration of Acceptability

OPGGS(E) Sub-regulation 10A(c) requires than an EP demonstrate that the environmental impacts and risks of the activity will be of an acceptable level. An "acceptable level" is the level of impact or risk to the environment that may be considered broadly acceptable with regard to all relevant considerations including, but not limited to (National Offshore Petroleum Safety and Environmental Management Authority, 2016):

- Relevant principles of ecologically sustainable development,
- Legislation and other requirements (including conservation advice and recovery plans for MNES, international agreements and conventions, guidelines and codes of practice),
- Internal context (alignment with Santos ABU-W HSEMS, ABU-W HSE and Sustainable Development (HSE&SD) Policy, culture and company standards and systems), and
- External context (the existing environment and stakeholder expectations (**Section 9**).

As part of the impact and risk analysis process, Santos set criteria for acceptable levels of each impact and risk identified. Following risk evaluation and treatment, the predicted impacts and risks were compared against the acceptable level criteria.

Defined significant impacts to various receptor groups are detailed in **Table 6-5**. Impacts associated with Bayu-Undan Pipeline decommissioning and preservation that fall below these are considered acceptable.

Table 6-5: Definition of acceptable levels impact

Receptor	Defined Acceptable Levels of Impacts	Source
Water and Air Quality	Substantial change in water or air quality which may adversely impact biodiversity, ecological integrity, social amenity or human health are unacceptable. Impacts to water and air quality below this level are acceptable.	MNES Significant Impact Guidelines *Australian and New Zealand guidelines for fresh and marine water quality* (Commonwealth of Australia and New Zealand Government 2018)
Sediment Quality	Substantial change in sediment quality which may adversely impact biodiversity, ecological integrity, social amenity or human health are unacceptable. Impacts to sediment quality below this level are acceptable.	ANZ Default Guideline Values for (non-radionuclide) toxicants in sediment National Assessment Guidelines for Dredging (2009) ARPANSA Exemption Levels in RPS6, Schedule 4
Habitat	Substantial change that may modify, destroy, fragment, isolate or disturb an area of habitat such that an adverse impact on marine ecosystem functioning or integrity are unacceptable. Impacts to habitats below this level are acceptable.	MNES Significant Impact Guidelines
Threatened and Migratory Marine Fauna	Substantial impacts to threatened and migratory marine fauna are unacceptable. Substantial impacts are changes that may: • Lead to a long-term decrease in the size of a population	MNES Significant Impact Guidelines Recovery Plan for Marine Turtles Blue whale Conservation Management Plan

Receptor	Defined Acceptable Levels of Impacts	Source
	• 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 • Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat • Introduce disease that may cause the species to decline • Interfere with the recovery of the species. Impacts to threatened and migratory marine fauna that are not substantial are acceptable.	Recovery Plan for the White Shark Sawfish and River Sharks Multispecies Recovery Plan Conservation advice for numerous species as outlined in **Section 5.3.3.1**
Oceanic Shoals Australian Marine Park	Substantial impacts to the Oceanic Shoals Marine Park are unacceptable. Substantial impacts are changes that may modify, destroy, fragment, isolate or disturb the following values of the Oceanic Shoals Marine Park: • KEFs within the marine park, • Threatened and migratory marine species, • BIA's for foraging and interesting marine turtles, and • Commercial fishing and mining. Impacts to the values of the Oceanic Shoals Marine Park that are not substantial are acceptable	North Marine Parks Network Management Plan MNES Significant Impact Guidelines
Key Ecological Features	Substantial impacts to KEFs are unacceptable. Substantial impacts are change that may modify, destroy, fragment, isolate or disturb values of the: • Carbonate bank and terrace system of the Sahul Shelf KEF: - relatively high benthic invertebrate biodiversity associated with hard substrates. • Carbonate bank and terrace system of the Van Diemen Rise KEF: - Sponges, soft corals and other sessile filter feeders associated with hard substrate sediments of the deep channels - Epifauna and infauna including polychaetes and ascidians - Olive ridley turtles, sea snakes and sharks. • Pinnacles of the Bonaparte Basin KEF:	Marine Bioregional Plan for the North Marine Region MNES Significant Impact Guidelines

Receptor	Defined Acceptable Levels of Impacts	Source
	- Unique seafloor feature (pinnacles) with ecological properties of regional significance.	
Socio-economic	Adverse interactions with other marine users are unacceptable.	Adapted from North Marine Parks Network Management Plan

6.2.4 Presentation in the EP

A summary of the risk identification and analysis process is provided in **Table 6-6**. 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, and
- The inherent and residual risk ranking for interaction between the activities and the receptors as determined through the risk assessment process.

The aspect-receptor cross references given in **Table 6-6** link to each of the hazards discussed in **Sections 6.3** and **6.4**.

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 6-7**. Further detailed impact assessment and risk evaluation discussion is provided below each of the summary tables.

Table 6-6: Activity aspect and receptor interaction matrix

Aspects and Sources of Risk		Physical Environment					Biological Environment										Socio-economic and Cultural Environment						
		Bathymetry and Seabed Features	Key Ecological Features	Water Quality	Sediment Quality	Air Quality	Threatened Ecological Communites	Ramsar Wetlands	Intertidal and Benthic Primary Producer Habitat	Other Benthic Communities	Plankton	Pelagic and Demersal Fish Communities	Marine Mammals	Marine Reptiles	Sharks and Rays	Birds	Heritage	Marine Protected Areas	Fishing	Tourism	Ports and Commercial Shipping	Offshore Petroleum Exploration and Operations	Defence Activities
Routine/Non-routine Planned Activities																							
6.3.1	Seabed Disturbance: Pipeline Removal and Installation and Removal of Upstream Skid / PLR	■		■	■					■		■											
6.3.2	Physical Presence: Decommissioned In-situ Pipeline and Preserved Pipeline		■							■								■	■				
6.3.3	Physical Presence: Vessels																		■		■		
6.3.4	Material Degradation: Pipeline Decommissioning In Situ		■	■	■					■		■		■		■		■	■				
6.3.5	Waste Management: Disposal of Waste Materials																■	■	■	■	■		
6.3.6	Light Emissions: Artificial Light on Vessels											■		■		■							
6.3.7	Discharges: Vessel Utility Discharges			■							■												
6.3.8	Pipeline Cleaning: Disposal of Cleaning Fluids and Seawater from within the Pipeline			■																			
6.3.9	Discharges: Treated Seawater Discharge			■	■					■	■	■											
6.3.10	Atmospheric Emissions: Combustion Engine Exhaust and Pipeline Gas Flaring					■																	
6.3.11	Acoustic Emissions: Underwater Noise from Vessels, Helicopters and Pipeline Cutting											■	■	■	■								
Unplanned Activities																							
6.4.1	Pipeline Cleaning: Stuck Pig Intervention			■						■		■											
6.4.2	Physical Presence: Dropped Objects									■													
6.4.3	Physical Presence: Collision with Marine Fauna												■	■	■								
6.4.4	Physical Presence: Introduction of Invasive Marine Species									■													
6.4.5	Physical Presence: Implementation of Spill Response												■	■		■							
	Discharges: MDO Release from Vessel Collision		■	■						■	■	■	■	■	■	■		■	■				
6.4.7	Discharges: MDO Release from Bunkering Incident			■							■	■	■	■	■	■			■				
6.4.8	Discharges: Incidental Spills of Hydrocarbons and Chemicals			■																			

6.4.9	Discharges: Loss of Wastes Overboard																					

Key	
	Interaction reasonably possible – low residual risk
	Interaction reasonably possible – medium residual risk
	Interaction reasonably possible – significant residual risk
	Interaction reasonably possible – high residual risk
	Interaction not reasonably expected

6.2.5 Impact Assessment and Risk Evaluation

A summary of the risk identification and analysis process is provided in **Table 6-**. This summary outlines the presentation 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, and
- The inherent and residual risk ranking for interaction between the activities and the receptors as determined through the risk assessment process.

The aspect-receptor cross references given in **Table 6-6** link to each of the hazards discussed in **Sections 6.3** and **6.4**.

The outputs of the risk identification, analysis and evaluation (including ALARP evaluation of controls, statements of ALARP and acceptability) process are presented in a summarised tabular form in the following sections.

Table 6-7: 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	*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 6-**.*		
Description of the Source of Risk			
Brief description on 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.			
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**).* *Note, a more detailed impact assessment and risk evaluation discussion is provided below each of the risk assessment summary tables.*			
Risk Assessment *Presents the consequence, likelihood and overall risk ratings determined from the Santos ABU-W risk assessment process and ENVID workshop. As noted in **Section 5.2.2**, 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***
Inherent risk			
Residual risk			
Controls and Demonstration of ALARP *Identifies and details the appropriate existing management controls that will be implemented to reduce potential impacts and risks to ALARP. Considers the effectiveness of the control in reducing the risk (i.e. by reducing likelihood and/or consequence). Provides an Environmental Performance Standard (EPS), which states the required level of performance of the control.*			
Existing Controls			
Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***

Assessment of additional controls

Identifies the additional management controls that were considered, indicates whether they will be implemented or no, 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***
Eliminate				
Substitute				
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 6.2.3.1****.*

Acceptability

Statement of the acceptability of the risk / impact following the application of selected criteria and definition of significant impacts outlined in ***Section 6.2.3.2***

EPOs

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 8.7****).*

6.3 ROUTINE/NON-ROUTINE PLANNED ACTIVITIES

6.3.1 Seabed Disturbance: Pipeline Removal and Installation and Removal of Upstream Skid / PLR

<table>
<tr><td>Risk</td><td colspan="2">Disturbance to seabed from:
• Cutting and removal of the Pipeline at the tie-in point,
• Installation and removal of upstream skid/PLR installations (if cleaning from the tie-in point), and
• Removal of the Pipeline and spools between the Bayu-Undan Platform and approximately KP34.2 by reverse S-lay or cut and lift methods.</td></tr>
<tr><td rowspan="3">Aspect-receptor Reference</td><td>Bathymetry and seabed features</td><td>Water quality</td></tr>
<tr><td>Sediment quality</td><td>Other benthic communities</td></tr>
<tr><td>Pelagic and demersal fish communities</td><td></td></tr>
<tr><td colspan="3">Description of the Source of Risk</td></tr>
<tr><td colspan="3">Pipeline Cutting and Removal at the Tie-in Point
In order to cut the Pipeline at the tie-in point, sediment will need to be moved from around the Pipeline to allow access to the Pipeline for the cutting tools. The area from which sediment will be moved will be approximately 200 m^2, with approximately 1,100 m^3 of material to be moved. The method that will be used to remove the sediment is yet to be confirmed but is likely to be subsea sediment relocation using ROVs. Other sediment relocation methods that may be used are likely to be similar in nature and scale to the subsea sediment relocation.
The CWC will be removed from the Pipeline by making a series of cuts in the concrete to weaken it. High pressure water jetting will then be used to remove the cut sections of the CWC and expose the steel Pipeline. The removed concrete will be left in situ on the seabed. The length of Pipeline from which the concrete weight coating will be removed is approximately 200 m. The resulting concrete rubble will be a relatively small volume (< 5 m^3).
The Pipeline will be cut once the concrete weight coating has been removed. The cutting tool will be secured to the Pipeline and the Pipeline will be cut. This will be repeated for each of the series of cuts required to section the Pipeline.
Caps will be installed on the ends of the Pipeline upstream and downstream of the removed section of the Pipeline at the tie-in point.
Installation and Removal of Upstream Skid / PLR
An upstream skid / PLR will be installed on the end of the Pipeline upstream of the removed section of the Pipeline at the tie-in point if cleaning of the Pipeline is undertaken from the tie-in point. The upstream skid/PLR will cover a footprint of approximately 1,000 m^2 overlapping the seabed previously covered by the Pipeline. Scour protection may be installed around the upstream skid / PLR to reduce the risk of scour resulting in subsidence of the upstream skid / PLR.
The upstream skid / PLR will be removed following completion of Pipeline cleaning activities. An end cap and snagging protection to reduce the risk of trawled fishing gear becoming snagged will be installed following removal of the upstream skid / PLR.
Pipeline Cutting and Removal between the Bayu-Undan Platform and approximately KP34.2
Two methods are being considered for the removal of the Pipeline between the Bayu-Undan Platform and approximately KP34.2 (Section 4.4.4):
• Reverse s-lay:
- A reverse of the method used to install the Pipeline. An initial cut of the Pipeline will be made between the Pipeline and the spools with a further cut at approximately KP34.2 to allow free draining of the Pipeline during removal. Pipeline recovery tooling will then be lowered to the seabed and secured to the Pipeline. The Pipeline will then be recovered to the pipelay vessel, where marine growth will be removed and released to the surrounding marine environment, to ensure a secure grip on the Pipeline through the tensioners. The Pipeline will be cut into manageable sections onboard the pipelay vessel for disposal onshore. A pipe transportation vessel or barge will be used to offload pipe sections from pipelay vessel. The Pipeline will be lowered to the seabed in a controlled manner when the Pipeline section within Timor-Leste offshore waters has been removed, unless a cut is made at KP34.2 prior to removal.
• Cut and lift:</td></tr>
</table>

- The cut and lift methodology will cut the Pipeline on the seabed into manageable sized sections, each of which will be recovered to the sea surface. The cutting tool proposed for use is a shear cutter. Small quantities of the inert CWC will be released to the seabed at each cutting location. Some minor sediment relocation may be required for sections of the Pipeline that are partially buried in order for the cutting tool to access the Pipeline. The recovered sections of Pipeline will be placed on a pipe transportation vessel or barge and disposed of onshore.

The rigid spools between the Pipeline and the Bayu-Undan Platform will be cut / disconnected and recovered to a vessel, regardless of which method is used to remove the Pipeline. The Pipeline will be cleaned and filled with treated or untreated seawater, depending on whether the Pipeline cleaning is executed from the DLNG Plant or the tie-in point, prior to commencing removal.

Either method may require the deployment of anchors for moorings for use by vessels and barges undertaking decommissioning activities. All anchoring will be restricted to within the Operational Area. For the S-lay methodology, it was estimated that approximately 12 anchor points will be required at each vessel anchoring location, with a total potential disturbance area of 77 ha (conservative estimate).

Potential Impacts

Bathymetry and Seabed Features

The seabed between the Bayu-Undan Platform and approximately KP34.2 is relatively flat and featureless. There are no seabed features, such as shoals or KEFs, within the footprint of the seabed that may be disturbed. Activities to remove the section of the Pipeline between the Bayu-Undan Platform and approximately KP34.2, including anchoring, will have a negligible impact on bathymetry and seabed features due to the low sensitivity of seabed features in the Operational Area in Timor-Leste waters. Any disturbance to the seabed is expected to recover over time through natural sedimentary processes.

The seabed in the vicinity of the tie-in point consists of relatively flat bare sediments. There are no seabed features, such as shoals or KEFs, within the footprint of the seabed disturbances associated with Pipeline cutting and upstream skid / PLR installation and removal. Given the relatively small volume of sediment that will be moved, along with the relatively flat and featureless bathymetry around the tie-in point, activities associated with cutting the Pipeline and installing the end cap or the upstream skid/PLR will have a negligible impact on bathymetry and seabed features.

Water Quality

Movement of sediment from around the Pipeline will result in a temporary increase in turbidity in the vicinity of the Pipeline. Sediments between the Bayu-Undan Platform and approximately KP34.2 and around the tie-in point are characterised by sand-sized particles (between 63 µm and 2 mm), which typically have high settling velocities and are expected to be deposited rapidly (i.e. within 10's of metres). Hence any potential decreases in water quality from these activities will be temporary and highly localised.

There will be a minor, temporary decrease in water quality from the removal of marine growth if the reverse S-lay method is used due to the discharge of marine growth to the environment. This decrease will be temporary and of negligible consequence.

Habitat modelling and mapping within the Operational Area has not indicated the presence of benthic communities (e.g. filter feeders) that may be impacted by the temporarily increased turbidity resulting from these activities. No benthic primary producer habitat (e.g. seagrasses, macroalgae and zooxanthellate corals) has been observed or predicted to occur. Resuspended sediments will not be advected to shallow or nearshore areas that may host benthic primary producer habitat at concentrations that will affect benthic primary producers.

Mobile marine fauna, such as turtles and fish, may temporarily move away from the area due to the temporary, localised increase in turbidity. However, similar habitat to the area potentially affected by any temporary turbidity plume is widespread throughout the region. Waters in the region are naturally turbid and frequently experience pulsed turbidity events (e.g. sediment resuspension due to cyclones and turbidity from discharges from tidal creeks). Observations by McLean et al (2020) indicated the outer continental shelf experienced high levels of turbidity, with natural turbidity levels insufficient to permit towed video surveys. This is consistent with other visual observations of the seabed made by ConocoPhillips and Santos. Hence, biological receptors are adapted to intermittently high turbidity. On this basis, the potential impacts to biological receptors from increased turbidity due to sediment removal are negligible.

Other Benthic Communities

Pipeline inspections, benthic habitat modelling and environmental surveys indicate benthic habitats adjacent to the Pipeline between the Bayu-Undan Platform and approximately KP34.2 and around the tie-in point are entirely unconsolidated sediments with very sparse epibenthic biota. No other benthic communities are expected to occur within the disturbance footprint between the Bayu-Undan Platform and KP43.2 or around the tie-in point. Bare sediment habitat is very widely represented in the region and is not considered to be sensitive benthic habitat. Fauna associated with bare sediment habitat are widely represented and many mobile fauna species in this habitat type, such as fish, are not site-attached. Impacts to this bare sediment habitat from Pipeline removal and equipment installation / removal will be negligible.

The Pipeline itself provides benthic habitat, which was investigated by AIMS (McLean et al. 2020). The marine habitat survey of the Pipeline found the benthic habitat composition to be < 3% of bare benthic habitat, < 20% of sand habitat, and > 75% coverage of biota. This includes sponges and soft corals, as well as an array of filter feeders. Benthic communities on the Pipeline reflected the morphological complexity of surrounding natural habitats and communities. Turfing communities were dominant in the sparse low relief areas of the outer shelf study locations of the Pipeline (e.g. between the Bayu-Undan Platform and approximately KP34.2), compared to more abundant morphologically complex communities in the shallower areas with raised shoal features (McLean et al. 2020).

Removal of the Pipeline between the Bayu-Undan Platform and approximately KP34.2, and around the tie-in point, will result in the loss of any sessile organisms attached to the cut sections of the Pipeline. It should be noted that the removal of the Pipeline between the Bayu-Undan Platform and approximately KP34.2 is a legislative requirement of the Treaty, and therefore retaining the Pipeline for the purposes of minimising seabed and Pipeline habitat disturbance is not an option. However, given the length of Pipeline sections that will be cut, the impact from the loss of habitat associated with the Pipeline will be negligible.

Based on the points above, impacts to other benthic habitats and communities from seabed disturbance will be negligible.

Pelagic and Demersal Fish Communities

The recent Pipeline habitat study undertaken by AIMS (McLean et al. 2020) found that the Pipeline supports a distinct fish assemblage characterised by commercially important fish species. This was indicated by the total abundance of fish and biomass of the top 10 commercially fished species (bioindicator species) decreasing with increased distance from the Pipeline. This could be attributed to the Pipeline providing shelter and a hard substrate supporting benthic habitats, as well as greater availability of prey (e.g. small fish and invertebrates) (McLean et al. 2020).

The removal of sections of the Pipeline will result in the loss of habitat for fish communities. It should be noted that the removal of the Pipeline between the Bayu-Undan Platform and approximately KP34.2 is a legislative requirement of the Treaty, and therefore retaining the Pipeline for the purposes of minimising disturbance to fish habitat is not an option. However, fish associated with the structure provided by and/or habitat growing on the Pipeline are expected to move into nearby suitable habitat, such as the remaining upstream and downstream sections of the Pipeline. Impacts to fish communities from seabed disturbance as a result of Pipeline cutting and removal and equipment installation and removal will be negligible.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	1 Negligible	2 Remote	RRI – Low
Residual risk	1 Negligible	2 Remote	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***
No existing controls identified			

Assessment of additional controls

Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
No additional controls identified				
Engineering				
No additional controls identified				
Administrative				
No additional controls identified				

ALARP Statement
No existing or additional controls were identified during the assessment of impacts and risks from seabed disturbance from Pipeline removal and installation and removal of the upstream skid / PLR. Santos has a good understanding of the receiving environment and the nature and scale of the activity. This provides a high degree of confidence in the predicted impacts. Given the nature and scale of the activity and the environmental receptors that will credibly be impacted, Santos considers that the impacts from seabed disturbance from Pipeline and equipment removal are inherently ALARP.
Acceptability
The potential impacts to the seabed from Pipeline cutting, Pipeline removal and equipment installation/removal activities are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. The impacts to environmental receptors are predicted to be within the defined acceptable levels of impacts provided in **Table 6-5**. Santos has undertaken environmental studies to inform the impact assessment in Commonwealth waters, which included habitat surveys and modelling adjacent to the Pipeline, as well as fish surveys. It is considered that these studies are broadly applicable to the section of the Pipeline in Timor-Leste waters. These studies reduce potential uncertainty in the assessment of environmental impacts. It should be noted that under the provisions in Part 18 of the *Timor Sea Maritime Boundaries Treaty Consequential Amendments Act 2019*, the Pipeline section within the BUPIOA in Timor-Leste offshore waters is required to be decommissioned by complete removal to the satisfaction of NOPSEMA in order to surrender the licence for the Pipeline in whole or in part. This requirement effectively redirects the acceptability discussion to the impacts associated with different methods of removal, as opposed to the whether Pipeline removal is an acceptable strategy. Relevant requirements have been met, including Santos' internal processes and standard industry practices during the design of the Pipeline removal and installation and removal of the upstream skid / PLR activities. No significant impacts to the Commonwealth marine environment or to threatened or migratory fauna will occur. The Pipeline removal and installation and removal of the upstream skid / PLR activities are not inconsistent with conservation advice and recovery plans published under the EPBC Act. In addition, the majority of the Pipeline to be removed occurs in Timor-Leste waters, outside of Commonwealth jurisdiction where the conservation advice and recovery plans apply. Based on the points outlined above, Santos considers the environmental impacts of seabed disturbance from Pipeline removal and equipment installation and removal are acceptable.
EPOs
EPO 1 No impacts to environmental receptors beyond the Operational Area in Timor-Leste waters (between the Bayu-Undan Platform and approximately KP34.2) or Australian Commonwealth waters (around the tie-in point) from seabed disturbance due to Pipeline removal and equipment installation/removal activities.

6.3.2 Physical Presence: Decommissioned In-situ Pipeline and Preserved Pipeline

Risk	Physical presence of the preserved Pipeline and upstream skid/PLR on the seabed.	
Aspect-receptor Reference (Table 6-)	KEFs	Other benthic communities
	Marine protected areas	Fishing

Description of Source of Risk

The Pipeline commenced operating in 2005 and was installed on the seabed but has become partially or completely buried for the vast majority of the Pipeline, and to a depth of 30% - 90% of the Pipeline diameter. The Pipeline will self-bury to varying extents based on flexibility, weight and bottom hardness. An investigation into burial rates showed that the Pipeline fully buried ratio increased from 1% in 2005 to 7.2% in 2014, indicating an overall trend towards a burial condition. This will reduce the effects of the physical presence of the Pipeline.

The Pipeline is inherently stable due to its concrete weight coating but has a design allowance for some lateral flexing. The Pipeline is marked on nautical charts provided by the Australian Hydrographic Service.

Decommissioned In-situ Pipeline

The Pipeline between approximately KP34.2 and the tie-in point will be decommissioned in situ. It will be left on the seabed filled with treated seawater (if cleaned from the DLNG Plant) or untreated seawater (if cleaned from the tie-in point) to degrade over time (impacts from Pipeline degradation are considered in **Section 6.3.4**). No intervention with the Pipeline is planned beyond snagging protection measures at the tie-in point end of the Pipeline. The CWC of the Pipeline provides inherent stability on the seabed, which is expected to increase associated with increased weight following Pipeline flooding. The Pipeline is partially or completely buried by sediments along most of the section from approximately KP34.2 to the tie-in point. The Pipeline will continue to self-bury over time, and self-burial is expected to accelerate with increased weight following Pipeline flooding.

The end of the Pipeline upstream of the removed section of Pipeline at the tie-in point will have anti-snagging protection installed following capping of the Pipeline and removal of the upstream skid / PLR (if cleaning from the tie-in point is required). The dimensions of the snagging protection (e.g., gravity anchor) will be approximately 25m^2.

Temporary equipment associated with the decommissioned Pipeline such as the upstream skid/PLR is considered negligible in terms of risk of physical presence to sensitive receptors. Therefore, the upstream skid/PLR was not included in this risk assessment.

Preserved Pipeline

The Pipeline between the tie-in point and DLNG will remain on the seabed filled with either production gas (if the HPIT or Local Line Stops isolation method is used) or treated seawater (if the flooding isolation approach is used) following completion of cutting and removal of the Pipeline at the tie-in point. This section of the Pipeline is intended to be re-used to transport gas from future upstream gas source. The tie-in of the future gas source and associated activities (e.g. dewatering, reconditioning and operation of the Pipeline) are beyond the scope of this EP.

Installation of anti-snagging protection downstream of the removed section of the Pipeline at the tie-in point, if required, does not form part of the scope of this EP.

Potential Impacts

The presence of the Pipeline on the seabed may result in changes to benthic communities and may also present an obstacle or snag risk to trawl fishers.

KEFs

As described in **Section 5.3.2.4**, the Pipeline EMBA overlaps three KEFs:

- Carbonate bank and terrace system of the Sahul Shelf,
- Carbonate bank and terrace system of the Van Diemen Rise, and
- Pinnacles of the Bonaparte Basin.

Given the small proportion of relevant KEFs overlapping the Pipeline (detailed in **Table 5-2**), the seabed footprint impact from the presence of and/or localised movement of the Pipeline (which has been in place since 2005) would only occur to a very small portion of these features and will not cause a significant impact to the ecological values associated with the KEFs.

Other Benthic Communities

As outlined in **Section 5.3.2.5.4**, benthic habitat modelling and mapping indicated the majority of the Operational Area is classified as bare sand (75%), with small areas of burrowers / crinoids (23%) and filter feeders (2%). In contrast to the benthic habitats surrounding the Pipeline, environmental surveys found the Pipeline itself to be <3% of bare benthic habitat, <20% of sand habitat, and >75% coverage of biota, which includes sponges and soft corals, as well as an array of filter feeders (McLean et al. 2020). Benthic communities on the Pipeline reflected the morphological complexity of surrounding natural habitats and communities, with turfing communities predominant in the sparse low relief areas of the outer shelf and more abundant morphologically complex communities in the shallower areas with raised shoal features (McLean et al. 2020). The proximity of raised geomorphic features to the Pipeline could potentially result in inter-habitat interactions such as larval exchange and colonisation, between benthic communities on the Pipeline and those in adjacent natural habitats at the local scale (McLean et al. 2020). The nearest notable seabed feature is Shepparton Shoal, which lies beyond the Operational Area; Shepparton Shoal will not credibly be impacted by the physical presence of the Pipeline and upstream skid/PLR.

Benthic communities in the area have been found to be correlated with geomorphology and substrate type, with relatively featureless areas restricted to infauna communities with almost no visible presence of epifauna (Nichol et al. 2013). Higher density benthic communities are expected to be restricted to isolated geomorphic features, particularly banks / shoals (Przeslawski et al. 2011), which do not overlap the Operational Area. The Pipeline has been shown to support higher diversity and abundance of marine biota as it functions as an artificial reef compared to the surrounding bare sand habitat (McLean et al. 2020). This will include increased fish community richness and abundance (Bond et al. 2018, McLean et al. 2017). The Pipeline was also observed to provide suitable habitat for the top 10 commercially important fishery species for the region (McLean et al. 2020).

Given most of the seabed within the Operational Area comprises bare sand and low diversity benthic communities, the potential impacts from the continued presence of the Pipeline are expected to be restricted to ongoing, localised increases in biodiversity and habitat complexity. Therefore, the consequence of potential impacts associated with seabed disturbance from the presence of the Pipeline are negligible.

Pelagic and Demersal Fish Communities

The recent Pipeline habitat study undertaken by AIMS (McLean et al. 2020) found that the Pipeline supports a distinct fish assemblage characterised by commercially important fish species. This was indicated by the total abundance of fish and biomass of the top 10 commercially fished species (bioindicator species) decreasing with increased distance from the Pipeline. This could be attributed to the Pipeline providing shelter and a hard substrate supporting benthic habitats, as well as greater availability of prey (e.g. small fish and invertebrates (McLean et al. 2020).

The presence of the in situ decommissioned Pipeline is expected to result in a localised increase in abundance of demersal fish species typically associated with seabed features such as reefs. This includes species that are targeted by commercial fishers, such as fishes in the family Lutjanidae (e.g. snappers and emperors). Species that prefer rugose structures and benthic communities that form on hard substrates would be less abundant if the Pipeline were not present.

Marine Protected Areas

Natural values of the Oceanic Shoals Marine Park include the KEFs (refer to discussion above) and examples of ecosystems representative of the Northwest Shelf Transition Provincial Bioregion. The Oceanic Shoals Marine Park also hosts threatened and migratory species, including BIAs and habitat critical for the survival of marine turtles. The Oceanic Shoals Marine Park is a biodiversity hotspot for sponges (Director of National Parks, 2018), and although the Pipeline is notably less diverse, the Pipeline also provides hard substrate for the establishment of sponges, as identified in the Pipeline habitat survey (AIMS, 2020). Given the Pipeline footprint is a narrow linear feature, and the Pipeline has become an artificial reef, decommissioning and preservation activities within the Marine Park (i.e. retention of the Pipeline on the seabed) are not expected to result in impacts to the values of the Oceanic Shoals Marine Park.

The North Marine Parks Network Management Plan 2018 includes prescriptions for mining operations, including offshore petroleum activities (Director of National Parks, 2018). Under this management plan, decommissioning and preservation activities associated with this EP are an authorised action.

The section of the Oceanic Shoals Marine Park within which the Pipeline exists is zoned IUCN VI (Multiple Use Zone and Special Purpose Zone (Trawl)). Management principles for this zoning include:

- The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term,
- Management practices should be applied to ensure the ecologically sustainable use of the reserve or zone,
- Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles, and
- Providing for ecologically sustainable use and the conservation of ecosystems, habitats and native species, while applying special purpose management arrangements for specific activities.

The increase in biodiversity and abundance of marine life from the physical presence of the in-situ decommissioned Pipeline is consistent with these principles. Based on the information outlined above, the potential impacts to the Oceanic Shoals Marine Park from the physical presence of the Pipeline are negligible.

Fishing

The presence of the Pipeline on the seabed may present a hazard to commercial trawl fishers. Considering the Pipeline has been in operation since 2005 with no incidents from interaction between trawl fishing gear/vessels to date, it is considered highly unlikely that incidents will arise in the future given the existing controls in place. The only trawl fishery currently active within the EMBA that utilises trawl gear is the Northern Prawn Fishery, which has historically had very low activity within the EMBA.

Santos has provided information and opportunities for consultation with all relevant commercial fishers which have potential to fish within the EMBA. Santos also completed an engineering assessment of the potential for snagging of the in-situ Pipeline between approximately KP34.2 to the tie-in point.

As part of this assessment, the Pipeline was separated into discrete regions which related to the relevant marine park or fishery for that section to identify the likelihood of occurrence of such activity.

- Pipeline cut end at approximately KP34.2: The cut end remains in Australian waters adjacent to the Oceanic Shoals Marine Park zoning for the multiple use zone, which prohibits commercial trawling. The KP34.2 end will be terminated within the boundaries of a pre-defined target zone located sufficiently inside Australian waters, to minimise risks associated with snagging risk from international fishing vessels.
- Pipeline approximately KP34.2 – KP135: This section is routed through the Oceanic Shoals Marine Park multi-use zone which prohibits commercial trawling.
- Pipeline KP135 – KP268: This section is routed through the Oceanic Shoals Marine Park special purpose trawl zone where trawling restrictions are in place and vessel tracking history suggests trawling has not occurred to date.
- Pipeline KP268 – KP306: This section is routed within the Northern Territory Fishery Joint Authority (NTFJA) Demersal Fishery where trawling is permitted. It was noted that some Pipeline freespan regions may pose a moderate safety risk to trawling vessels in event of an interaction. However, unsupported Pipeline freespans and associated risks to trawling vessels will be reduced over time as a result of increased self-burial of the Pipeline.
- Pipeline KP306 – Tie-in Point: This section is routed within the current Northern Prawn Fishery (NPF) where trawling is the main method of fishing. No fishing activity has been noted along this Pipeline section to date and any future activity would be subject to limitations on likelihood of activity due to increasing water depth and presence of prawns at these depths.
- Pipeline cut end at tie-in point: This cut end is located within the existing NPF where trawling is the main method of fishing. No trawling activity has been noted at this location to date. However, the likelihood of interaction at this cut end is higher due to shallower water depth and closer proximity to existing fished regions.

A snagging risk assessment indicated that engineering controls should be considered only at the tie-in point cut end to reduce the potential snagging risk to ALARP for the in-situ pipeline section from approximately KP34.2 to the tie-in point. Recommendations for the remainder of the Pipeline left in situ indicated that adopting administrative controls such as marking on charts, would be sufficient, subject to stakeholder consultations. It was also recommended that an additional Pipeline length should be removed at the KP34.2 end, so that the Pipeline will be sufficiently within Australian waters and the risk to minimise potential interaction with international fishing vessels.

The Pipeline has been present at its current location on the seabed since 2005 without incident or claim about interaction between trawl fishing gear and vessels to date. It is considered highly unlikely that snagging incidents will arise when this section is decommissioned and left in-situ given the proposed controls and the ongoing self-burial of the Pipeline outlined in **Section 6.3.4**.

As outlined above in **Pelagic and Demersal Fish Communities**, the fish assemblages associated with the Pipeline are more diverse and abundant than the surrounding predominantly bare habitats. This includes an increase in the abundance of commercially targeted fish species.

Risk Assessment

Physical Presence of Pipeline and Upstream skid/PLR

	Consequence	***Likelihood***	***Risk rating***

Inherent risk	1 Negligible	3 Rare	RRI – Low
Residual risk	1 Negligible	3 Rare	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	**Reference (*Table 7-1*)**	***Environmental Performance Standard***
Undertake consultation with relevant persons (including applicable notifications) to support decommissionin g and preservation of the Pipeline	This control is effective for avoiding unplanned interactions with other vessels, such as fishers. Consultation with relevant persons allows all parties to be aware of the Pipeline. This allows Santos and other users to undertake activities in such a way to minimise the potential for adverse interactions.	**C 2.1**	**EPS 2.1.1** Develop and implement consultation plan to support decommissioning and preservation of the Pipeline
Notify the Australian Hydrographic Office (AHO) prior to commencing activities	This control is effective in notifying the AHO of the location of the Pipeline. This allows the AHO to modify nautical charts and issue notices to mariners if required. This will assist other users in avoiding interactions with the Pipeline (e.g. trawl fishers may avoid dragging gear over the Pipeline to prevent snags)	**C 2.2**	**EPS 2.2.1** AHO notified prior to commencement of decommissioning and preservation activities.
The end of the Pipeline upstream of the tie-in point will have trawl protection installed following installation of the cap or removal of the upstream skid / PLR	This control is effective in preventing a trawl net from becoming snagged in the event fishing gear is dragged over the end of decommissioned in-situ Pipeline at the tie-in point. This control is consistent with the recommendation of the Santos anti-snagging study.	**C 2.3**	**EPS 2.3.1** Installation of snag protection on the upstream cut end of the Pipeline at the tie-in point.

Assessment of Additional Controls

Additional control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Elimination				
Remove the Pipeline section proposed to be decommissione d in-situ	Yes	No	Removal of the Pipeline transfers the environmental impacts and risks from the Operational Area to another location – either onshore or another dumping location at sea. Hence, the impacts and risks are not eliminated, but transferred to another location. Work to remove the Pipeline is a much longer process than leaving the Pipeline in-situ and exposes the	N/A

			workforce to a protracted offshore campaign, with associated safety risk exposure. The financial cost of this campaign and associated waste disposal is also forecast to be significantly higher than that of decommissioning in-situ. The energy use and associated emissions generated during a protracted offshore pipeline removal campaign would be significantly higher than that of decommissioning the pipeline in-situ. Removing the Pipeline would also result in significant seabed disturbance and potentially decrease fisheries resource and benthic habitat created by presence of the Pipeline, resulting in a net loss of environmental value. Hence the cost (safety, financial and environmental) of removal is considered to be grossly disproportionate to the environmental benefit of decommissioning the pipeline in-situ.	
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 to the KEFs, other benthic communities, marine protected areas and fishing from the physical presence of the Pipeline are reduced to ALARP. 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 to environmental receptors due to the physical presence of the Pipeline. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts. No credible additional controls were identified.				
Acceptability				
The potential impacts to the seabed and other marine users due to the physical presence of the Pipeline are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. The impacts to environmental receptors are predicted to be within the defined acceptable levels of impacts provided in **Table 6-5**. Santos has undertaken environmental studies to inform the impact assessment, including benthic habitat surveys, benthic habitat modelling and snagging assessments along the Pipeline. These studies reduce potential uncertainty in the assessment of environmental impacts. Relevant requirements have been met, including Santos' internal processes and industry good practice (consultation).				

The management of the risks and impacts are consistent with the objectives of the IUCN Category VI and the Multiple Use Zone and Special Purpose Zone (Trawl) of the Oceanic Shoals Marine Park within which the Pipeline lies. The advice of the Director of National Parks (a relevant person, **Section 8**) in relation to the management of the Oceanic Shoals Marine Park has been considered by Santos in the environmental assessment and discussed in **Section 5.4.2.1** of this document. Santos' view following the assessment of environmental impacts is that no unacceptable impacts to the environmental values of the Oceanic Shoals Marine Park will credibly occur. No significant impacts to the Commonwealth marine environment or to threatened or migratory fauna will occur. The Pipeline decommissioning and preservation activities with reference to physical presence are not inconsistent with conservation advice and recovery plans for threatened species published under the EPBC Act. Consultation in support of the EP has identified other users that may potentially be affected and provided sufficient opportunity to provide feedback. No claims or objections were raised in relation to the physical presence of the Pipeline.
EPOs
EPO 2 No adverse interactions[7] between other marine users and the decommissioned or preserved Pipeline or ancillary Pipeline infrastructure.

[7] Whether an interaction constitutes an adverse interaction is determined on a case by case basis. Examples of adverse interactions may include substantiated complaints by other marine users to Santos or NOPSEMA. Interactions where other users have not taken reasonable measures to avoid the interaction (e.g. third-party vessel failing to observe nautical charts) are not considered to be adverse for the purpose of this EP.

6.3.3 Physical Presence: Vessels

Risk	Physical presence of vessels undertaking Pipeline decommissioning and preservation activities.	
Aspect-receptor Reference	Fishing	Ports and Commercial Shipping

Description of the Source of Risk

Vessel-based activities are planned to occur during decommissioning between the Bayu-Undan Platform and approximately KP34.2 and around the tie-in point. Vessel activities are expected to occur over a period of 39 weeks; note these activities may not be consecutive. Vessels required to undertake the activity may include barges, support vessels, construction vessels/HLV, anchor handlers, pipelay vessel and a DSV.

Vessel-based activities are also planned to occur between the tie-in point and the DLNG Plant during external inspections conducted at the current established RBI maximum target interval of 5 years, or 2 years for the section in Darwin Harbour.

Vessel activities within the scope of this EP will all occur within the Operational Area.

All contracted vessels are subject to the requirements under Santos' Contractor HSE Management Process (ALL/HSE/PRO/016) and Santos' ABU-W Marine Vessels Vetting Process (**Section 8.2.2**). These outline the minimum requirements that must be met and confirm that the vessels meet or exceed the standards and criteria set by industry practice, international regulations, and relevant authorities such as AMSA.

Potential Impacts

During decommissioning and preservation activities there is potential for interference with commercial fishers, shipping vessels and other marine users. Given the spatially restricted, offshore locations and short duration of decommissioning and preservation activities, the likelihood of interactions with other marine users are considered remote.

Fishing

From review of available fishery data, it was determined that there is only a low potential for commercial, traditional and recreational fishing to be undertaken within the Operational Area, (**Section 5.4.3**). Any interactions with fishers are expected to be restricted to temporary avoidance and potential displacement of fishing effort, which will not significantly impact fishing activities.

Based on the considerations above, impacts to fishing activities will be negligible.

Ports and Commercial Shipping

The presence of vessels has the potential to cause temporary displacement of commercial shipping. However, as all shipping vessels are also required to comply with the COLREGS (and associated Marine Orders in Australian waters), it is expected navigational and communicative aids are sufficient to preventing any negative interactions beyond basic avoidance during Pipeline decommissioning and preservation activities. Most vessel traffic within 20 km of the Operational Area comprises ships displacing less than 10,000 tonnes which allows for greater manoeuvrability and, therefore, greater ease when shipping vessels are required to avoid vessels.

The potential impacts of interactions between vessels undertaking Pipeline decommissioning and preservation activities and other marine traffic are no more than a temporary displacement of other users, which are considered to be negligible.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	1	3	RRI – Low
Residual risk	1	3	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***
Vessel equipped and crewed in accordance with Australian maritime requirements	This control is effective in avoiding unplanned interactions with other	**C 3.1**	**EPS 3.1.1** Vessels will be equipped and crewed in accordance with the

	marine users. Crew qualifications and experience, along with communication and navigation equipment, allows decommissioning vessels to detect, communicate with, and avoid interaction with other marine users		*Navigation Act 2012* (as applicable for vessel size, type and class), including implementing: • Marine Order 21 (Safety of navigation and emergency procedures) 2012, which implements elements of Chapters III, V and VI of International Convention for the Safety of Life at Sea (SOLAS), including: - Design and maintenance of onboard safety critical equipment (e.g. navigation, bridge equipment etc.) and crew requirements as applicable to vessel class per the SOLAS convention. • Marine Order 27 (Radio Equipment) 2009, which implements Chapter IV of the SOLAS Convection, including: - Radio, vessel tracking and distress communications as applicable to vessel class per SOLAS requirements. • Marine Order 30 (Prevention of Collisions) 2009, which implements COLREGS, including: - Lights, shapes and sounds as applicable to vessel class per COLREGS requirements • Marine Order 71 (Masters and Deck Officers) 2014, which implements the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Convention), including: - 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 decommissioning and preservation of the Pipeline	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 decommissioning and preservation of the Pipeline. This allows Santos and other users to undertake activities in such a way to minimise the	**C 2.1**	**EPS 2.1.1** Develop and implement consultation plan to support decommissioning and preservation of the Pipeline **EPS 2.2.1** Notify AHO prior to commencement of Pipeline decommissioning and preservation activities.

	potential for adverse interactions.		

Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
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 other marine users due to the physical presence of vessels are reduced to ALARP.

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 vessels and other marine users. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts. No credible additional controls were identified.

Acceptability

The potential impacts from the physical present of vessels to other users are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been met, including Santos' internal processes, COLREGS, SOLAS, STCW Convention and relevant Marine Orders.

Adverse interactions between vessels undertaking the petroleum activities and other users are not expected to occur upon implementation of the selected controls.

Consultation in support of the EP has identified other users that may potentially be affected and provided sufficient opportunity to provide feedback. No claims or objections were raised in relation to the physical presence of vessels.

EPOs

EPO 3

No adverse interactions[8] between other marine users and vessels undertaking the petroleum activities within the scope of this EP.

[8] Whether an interaction constitutes an adverse interaction is determined on a case by case basis. Examples of adverse interactions may include substantiated complaints by other marine users to Santos or NOPSEMA. Interactions where other users have not taken reasonable measures to avoid the interaction (e.g. third-party vessel failing to observe nautical charts) are not considered to be adverse for the purpose of this EP.

6.3.4 Material Degradation: Pipeline Decommissioning In Situ

Risk	Decomposition of Pipeline structural components and potential release of any residual contaminants contained within the Pipeline over the degradation timeline.	
Aspect-receptor Reference	KEFs	Water quality
	Sediment quality	Other benthic communities
	Pelagic and demersal fish communities	Marine reptiles
	Birds	Marine protected areas
	Fishing	

Description of the Source of Risk

The section of the Pipeline between approximately KP34.2 and the tie-in point will be decommissioned in situ. This section of the Pipeline will progressively degrade over time due to a range of mechanisms. At some point, the Pipeline will lose structural integrity and break apart. The Pipeline will continue to degrade and break down in the environment to the point the Pipeline is no longer identifiable after it has dispersed and mixed with the seabed sediment (sands/muds).

The Pipeline is comprised of several different components, including (**Figure 6-2**):

- Steel pipeline wall,
- Internal epoxy flow coating,
- Asphalt enamel coating,
- Concrete weight coating,
- High density polyethylene heat shrink wraps at field joints, and
- Sacrificial bracelet anodes along the Pipeline.

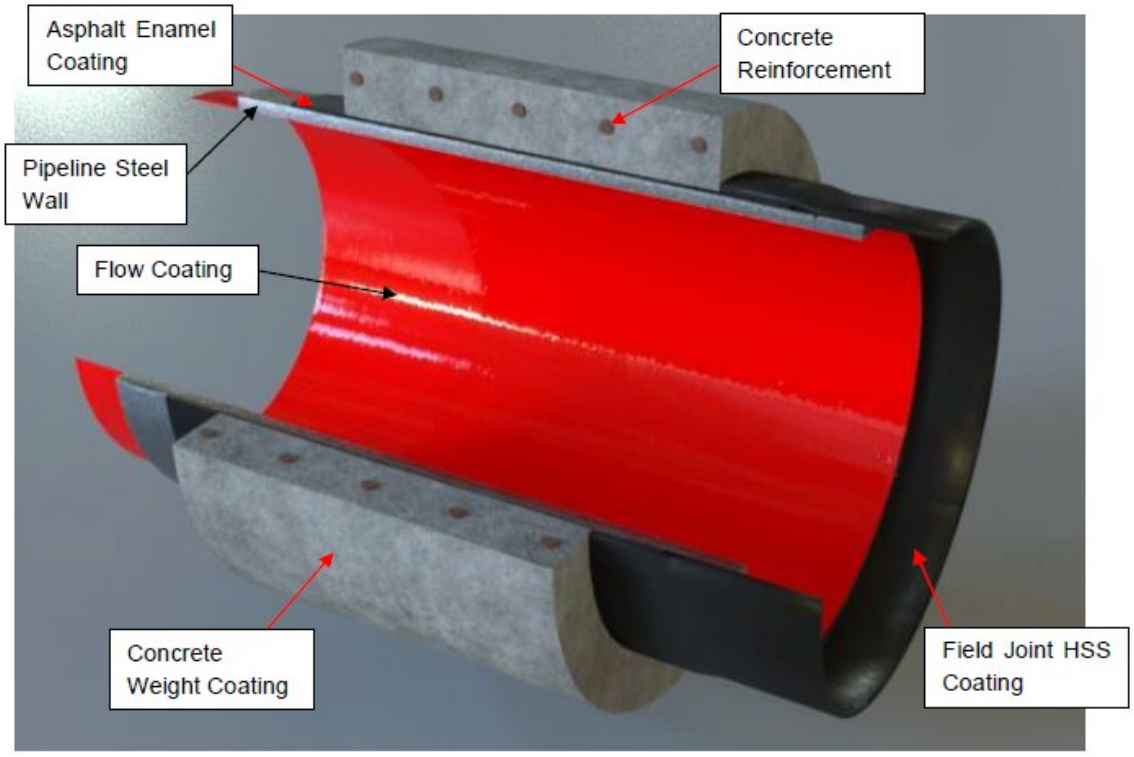


Figure 6-2: Conceptual diagram of Pipeline components (Atteris 2020)

Santos commissioned a degradation study to identify the breakdown processes and material fates for each of these components (Atteris 2020). The degradation study was conservative in that it assumed an open Pipeline (i.e. no capping), which is the fastest degradation timeline.

The pipeline material breakdown initiating events are predicted as follows:

- Concrete Weight Coating – the possible degradation events leading to material breakup include spalling, abrasion and substrate corrosion. Other potential events may include extreme environmental loading and external impact. The rate of spalling is likely to dictate the size of the CWC pieces, with rapid spalling likely to result in larger pieces. Additionally, the timing of an extreme loading event will impact the particle size with early events likely to result in larger pieces and late life events likely resulting in smaller pieces.
- Pipeline Steel – the Pipeline steel is predicted to corrode in a relatively uniform manner. Other potential events may include fatigue, on-bottom stability, irregular corrosion, extreme environmental loading and external impact. Irregular corrosion, on-bottom stability and fatigue may cause the separation of sections of steel. Any large separated sections of steel will continue to corrode in their new position.
- Corrosion and Flow Coatings – the possible degradation events leading to material breakdown include biotic degradation, abiotic degradation and substrate corrosion. Other potential events may include extreme environmental loading and external impact. The main factor in particles size formation is when the event occurs. This dictates the residual strength of the material during the loading. If it happens early in the timeline, larger pieces are likely as the material is strong enough to stay together. Late in the timeline, the material may be weak and small particles are more likely to form.

The predicted timeline and key event milestones for degradation of the pipeline is outlined in **Figure 6-3** below.

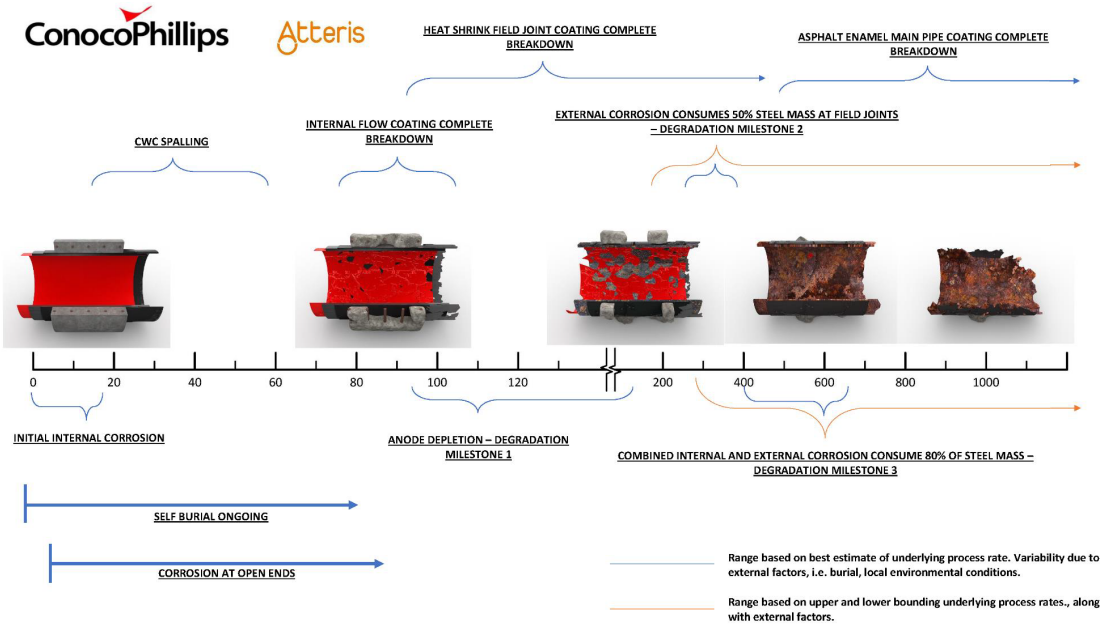


Figure 6-3: Pipeline degradation timeline

The degradation study estimated that it will take between 210 and 500 years for the carbon steel pipe material of the Pipeline to have corroded sufficiently (i.e. 80% mass loss) to start breaking apart and dispersing. However, based on the uncertainties around the degradation of the pipeline coating system, this estimate may be extended to more than 1,200 years when the lower bound (slower) corrosion rates are considered.

The following general behaviours and degradation processes are expected to occur:

- The pipeline will self-bury to varying extents based on flexibility, weight and bottom hardness. This will reduce the effects of a variety of degradation methods, along with stabilising the line and reducing degradation product dispersal. The potential for the burial state to change over time (both bury or un-bury) increases the uncertainty in the timeline of the pipeline degradation.
- **Degradation Milestone 1:** The anodes providing the cathodic protection will steadily deplete. The initial coating breakdown rate is assumed to be 0% and the annual coating breakdown rate is adjusted such that the anode depletion reaches 100% after 112 years of operations in 2117 (i.e. 100 years after the 2017 inspection). This is assuming that the Pipeline is fully exposed. The exact duration is dependent on the burial status and condition of the coatings at the time of decommissioning.
- The open ends of the pipe will begin to internally corrode due to oxygen and nutrient influx.
- The CWC will largely spall off due to the expansion of corrosion products from the internal steel reinforcement.
- External corrosion will begin at external coating discontinuities or pinholes (holidays), particularly the field joints.

- If the Pipeline is filled with treated seawater and capped, the initial corrosion will stall once the available oxygen and nutrients in the water have been totally consumed, which then limits the corrosion mass loss away from the open ends.
- **Degradation Milestone 2:** after 240 – 350 years the field joints will reach 50% mass loss, the likelihood of cracking due to fatigue or instability increases as does the density of wall perforations. This will increase the rate of internal corrosion.
- The external asphalt enamel coating will continue to degrade, increasing the area of steel exposed to corrosion.
- **Degradation Milestone 3:** after 400 – 650 years the combined effects of internal and external corrosion will consume 80% of the pipeline steel mass. This is the point where the likelihood of breakup of the pipe is considered to increase substantially.
- Following Degradation Milestone 3, the material release and 'breaking up' of the pipeline components is more likely to be triggered during extreme loading events, such as cyclones or external impacts.

Pipeline Material Breakdown Outcomes

Reporting from 2005, 2007 and 2014 show that the Pipeline fully buried ratio increased from 1% in 2005 to 7.2% in 2014, indicating an overall trend towards a burial condition. The Santos anti-snagging study determined that the vast majority of the remaining Pipeline section is currently under a partial burial condition to a depth between 30% and 90% of pipeline diameter.

Following cessation of production and flooding of the Pipeline section to be decommissioned, the change in content density between operation and decommissioning will result in an increase in Pipeline on-bottom self-weight of between 1.5 and 2.4 times depending on the remaining thickness of the concrete weight coating as it degrades over time. The Santos anti-snagging study has determined that the additional weight of the Pipeline will significantly increase the potential for the Pipeline to self-bury with the self-burial frequency with reference to Pipeline diameter predicted to be in the range of 80% – 99%. These sections of the Pipeline are likely to remain permanently buried and any material in these sections which lie below the regional scour depth will remain buried. The pipeline degradation study found that buried material is unlikely to disperse (Atteris 2020).

Based on an assumed 80% average self-burial during the initial phase of Pipeline degradation, the total mass of Pipeline components which could be available for dispersal during the degradation process would be as follows:

- Concrete Weight Coating – the total mass released over the ~345 km of Pipeline left in-situ would be approximately 80 to 220 kg/m or 27,600 to 76,000 tonnes. Any exposed pieces are likely to remain in the local area and be incorporated into the seabed due to the significantly higher density than seawater (specific gravity (SG) 3.04). Larger pieces are likely to erode in the seabed into small particles and aggregate.
- Pipeline Steel - The total mass released over the ~345 km of Pipeline left in-situ would be approximately 93 kg/m or 32,000 tonnes. Any exposed sections are likely to remain in the immediate area and be incorporated into the seabed due to the significantly higher density than seawater (SG ~5 varies based on chemical composition). A portion of the metals may remain dissolved. Any remaining CWC may contain any corrosion product dispersal while it holds its shape.
- Asphalt Enamel - The total mass released over the ~345 km of Pipeline left in-situ would be approximately 3.2 kg/m or 1,100 tonnes. Any exposed pieces are likely to remain in the immediate area and be incorporated into the seabed due to the higher density than seawater (SG 1.3). Larger pieces are likely to erode and biotically degrade into small particles and aggregate on the seabed.
- Heat Shrink Sleeve - The total mass released over the ~345 km of Pipeline left in-situ would be approximately 0.03 kg/m or 10 tonnes. Any exposed pieces are likely to float and be very widely dispersed due to lower density than seawater (SG 0.94). Floating heat shrink sleeve material will be exposed to ultraviolet radiation from sunlight, accelerating the degradation of the material. Larger pieces are likely to erode and fracture into microplastics.
- Internal Flowcoat - The total mass released over the ~345 km of Pipeline left in-situ would be approximately 0.06 kg/m or 20 tonnes. Any exposed pieces are likely to be very widely dispersed due to the very low mass of the broken-up coating. Mobile larger pieces are likely to erode and fracture quickly into microplastics.

As the in-situ Pipeline degrades over the extended time frames discussed earlier in this section, the associated Pipeline constituents will gradually mix and become part of seabed sediment with smaller, lighter particles being widely dispersed by seabed currents.

In addition, the current benthic habitat encrusted on portions of the Pipeline may act as an additional mitigating factor to reduce the release and impact of Pipeline constituents, specifically the heat shrink sleeves which have a low density. Examples of benthic habitat communities encrusted on the Pipeline are provided in **Figure 6-4**, as identified during the 2017 pipeline cathodic protection ROV survey.

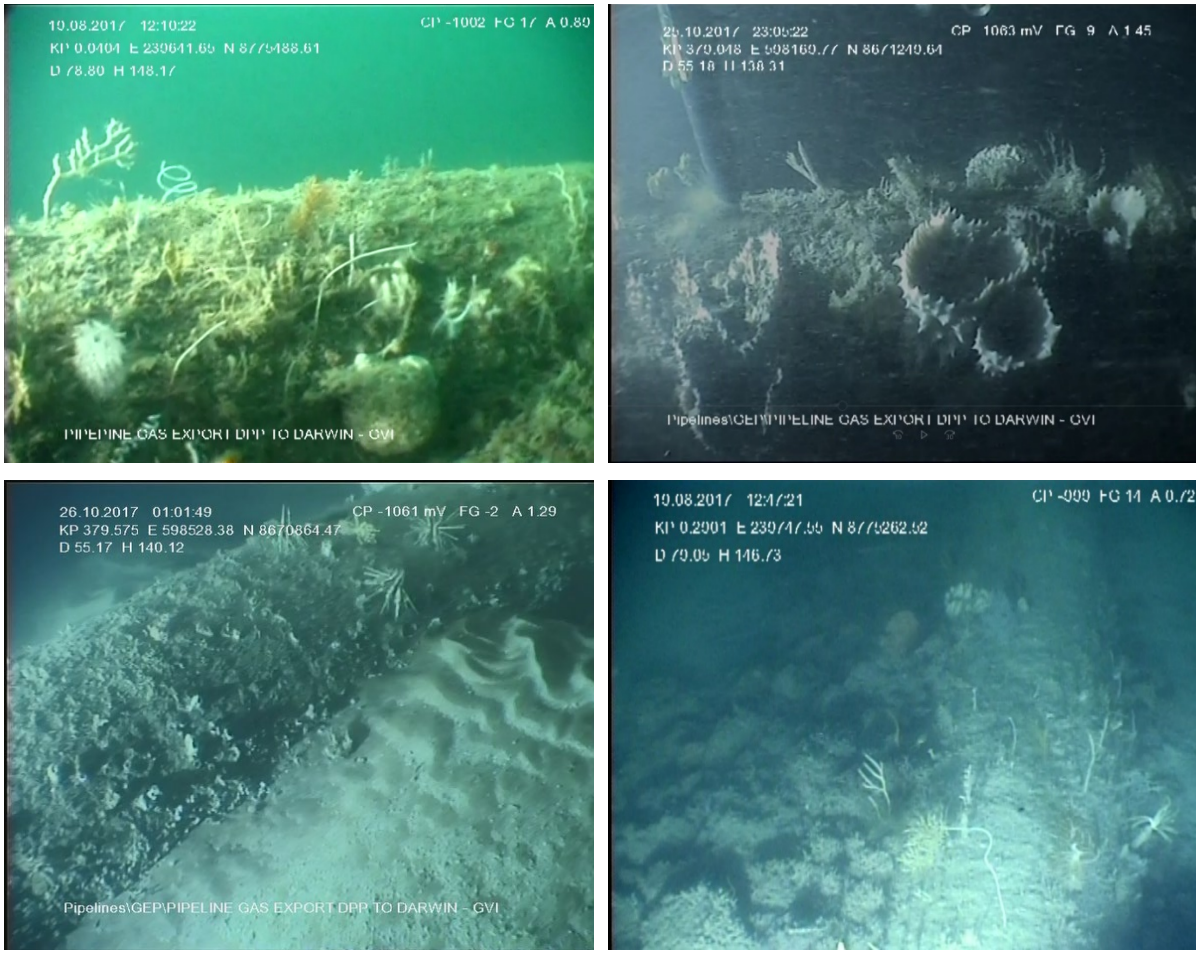


Figure 6-4: Examples of benthic habitat communities encrusted on the Pipeline

Naturally occurring radioactive material (NORM) is the term used to describe materials containing radionuclides that exist in the natural environment. The radionuclides of interest include long-lived radionuclides such as uranium-238 and their radioactive decay products (such as isotopes of radium, radon, polonium, bismuth and lead) (Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) 2008). NORM is widely distributed and gives rise to a natural radiation background that varies by approximately two orders of magnitude over the Earth, and even more if localised mineral deposits are taken into account. This means every living species is exposed to this radiation, and in most situations this exposure is not amenable to control. There appears to be no scientific evidence relating general variations in this natural background to health effects (ARPANSA 2008). For the purposes of Pipeline decommissioning, these radiation materials can either precipitate inside the Pipeline in the form of scale or create surface contamination on the inside of Pipelines during hydrocarbon production.

NORMS in the form of isotopes of lead (^{210}Pb) and polonium (^{210}Po) have been identified within pigging dust samples taken from the Pipeline. The measured activity levels are low, in the order of 28 Bq/g for each isotope or 56 Bq/g combined total activity, which is slightly higher than the *National Assessment Guidelines for Dredging* (Department of the Environment, Water, Heritage and the Arts 2009a) sediment disposal at sea threshold (35 Bq/g) and the ARPANSA exemption threshold for radioactivity for these two isotopes (10 Bq/g). If left in their current form and contained inside the Pipeline, the combined total activity for these two isotopes would fall below the exemption threshold for radioactivity due to radiological decay within approximately 33 years after cessation of production (Australian Nuclear Science and Technology Organisation (ANSTO) 2020). This is considerably earlier than the predicted corrosive breakthrough of the in-situ Pipeline in approximately 200 years.

Very low levels of ^{226}Ra were also identified in one of the two samples of pipeline pigging dust with an activity level of 0.022 Bq/g which is well below the ARPANSA exemption threshold for this isotope (10 Bq/g). The source of the ^{226}Ra has been identified as scale found in the Bayu-Undan platform production separator and second stage separator from hydrocarbons produced from Bayu-Undan Field (ANSTO 2018). The decay of this ^{226}Ra to radon decay products within the platform gas circuit and further decay to ^{210}Pb and ^{210}Po is identified as the likely origin of these latter two isotopes and their presence in dusts pigged out of the pipeline.

Dilution modelling for the egress of NORMS from a release point assumed to be located at the cut and open-ended Pipeline section at the tie-in point indicates the predicted no-effects concentration for marine organisms of 400 uGy/h (United Nations Scientific Committee on the Effects of Atomic Radiation 2011) would be reached

within 0.3 m from the release point and the ARPANSA exemption level for radioactivity would be reached at approximately 5m from the release point under medium ocean current strength conditions (RPS 2020a). This modelled scenario is conservative, based on the pre-cleaning pipeline status and without end caps installed.

Despite the low environmental risk posed by NORMs in the uncleaned, uncapped pipeline, the Pipeline will be chemically cleaned during the decommissioning process to remove scale and dust and associated NORMs contamination as part of a precautionary management approach. In addition, the open ends of the cut pipeline at the tie-in point will be capped within 7 days to minimise the risk of egress of any residual scale associated with NORMs contamination during the time period when the radiological activity level is predicted to be higher than the ARPANSA exemption threshold.

A highly insoluble inorganic compound of mercury (Hg), mercury sulphide (HgS) or metacinnabar, has been identified in a thin hard scale coating the internal surface of piping on the Bayu-Undan Platform immediately upstream of the start of the Pipeline at the Bayu-Undan platform and within pigging dust collected from the Pipeline. This scale is found on bare metal interior surfaces of the topsides piping and it is assumed that a similar situation exists on the Pipeline field joint locations (Wilhelm and Nelson 2010). Pipeline field joint locations make up less than 1% of the interior surface of the Pipeline, with the remainder of the interior Pipeline surface covered by epoxy flow coat. Laboratory analysis has established that the flowcoated sections of the Pipeline have no affinity to adsorb/adsorb mercury (Santos 2020).

Analysis of this inorganic mercury compound indicates the material poses low risk to the marine environment and biota (ANSTO 2020a). Following the tiered framework for the assessment of contaminated sediment for metals developed by Simpson and Batley (2015), the inorganic mercury compound analysis found:

- Based on acid-solubility testing, the soluble fraction of the inorganic mercury compound was below the *Australian and New Zealand guidelines for fresh and marine water quality* (Commonwealth of Australia and New Zealand Government 2018) sediment default guideline value - low trigger level for mercury of 0.15 mg/kg. The low trigger level for Hg of 0.15 mg/kg provides a threshold used for the protection of marine organisms from Hg in sediment below which toxic effects will not occur.
- Based on bioavailability testing with three representative species [sand sifting starfish (Archaster typicus), juvenile tiger prawn (Penaeus monodon) and Manybar goatfish (Parupeneus multifasciatus)], the inorganic mercury compound exhibited no bioavailability based on muscle tissue analysis and therefore poses a low environmental risk to marine life and potential human consumers.

As part of a precautionary management approach, the Pipeline will be chemically cleaned to reduce any potential long-term risk associated with methylation of any residual insoluble mercury to a soluble form above accepted limits during the pipeline degradation process to ALARP.

Potential Impacts

Sediment Quality

The degradation of the Pipeline will release material among seabed sediments over the course of several hundred years. This material will be concentrated around the Pipeline but may be dispersed by natural sedimentary processes.

The CWC, which represents approximately 69.5% of the mass of the Pipeline, consists of cement and aggregate material, which is inert. This material is expected to weather over long periods of time (hundreds to thousands of years) and break down into its component materials. This will result in changes to the particle size distribution and composition of the sediments along the Pipeline.

The asphalt enamel, which represents approximately 1.01% of the mass of the Pipeline, will be progressively released into the marine environment as various sized pieces. Asphalt is comprised of high molecular weight hydrocarbons. The high molecular weight hydrocarbons in asphalt are inert; they are very stable and insoluble in seawater. As such, asphalt is expected to persist within the sediment for a long period of time but will not result in acute or chronic toxic effects. The SG of asphalt is greater than seawater, but lower than sediments. As such, it is likely to be concentrated in surface sediments, where it may be moved by currents. This may result in the asphalt enamel being dispersed over a wide area over time. Asphalt enamel will be transported through being entrained in the water column, spending the majority of the time on the seabed (i.e. bedload). Asphalt enamel may be subject to friction with the natural sediments, which may accelerate the degradation of the asphalt.

Fibreglass, which represents approximately 0.095% of the mass of the Pipeline, is expected to break down over time as the asphalt enamel coating degrades. The glass fibre matrix within the asphalt enamel is expected to gradually dissolve in seawater as it progressively becomes exposed over time. The glass fibres consist primarily of silica, which will become incorporated into the sediments as the fibreglass degrades. The addition of silica to sediments around the Pipeline from the degradation of fibreglass is not expected to result in any measurable changes to sediment quality.

Steel material, which represents approximately 29.4% of the mass of the Pipeline, will rust as the Pipeline degrades, with rust flakes breaking away and being incorporated into the sediments. This dispersion is expected to result in the concentration of iron in the sediments decreasing as distance from the Pipeline increases, with highest iron concentrations in sediment surrounding the Pipeline. Iron is not recognised as a potential toxicant in sediments and the *Australian and New Zealand guidelines for fresh and marine water quality* (Commonwealth of

Australia and New Zealand Government 2018) do not provide trigger values for iron in sediments. The increased concentrations of iron in sediments are not expected to result in any biological impacts.

The epoxy flowcoat, which represents approximately 0.02% of the mass of the Pipeline, will progressively be released as the steel Pipeline degrades. The flowcoat material is expected to be denser than seawater but less dense than sediments. The flowcoat material is expected to persist for very long periods of time, as it will not be exposed to ultraviolet radiation, which is the most rapid degradation pathway for plastics in the sea (due to photo-oxidation). The flowcoat material will gradually be degraded through weathering, eventually forming microplastics that will be incorporated into the surface layers of the sediment. These microplastics are expected to be widely dispersed by strong currents and natural sediment transport processes. Microplastics and polymers in self-buried Pipeline sections will remain in the sediment. Microplastics in the sediment may be ingested by deposit-feeding organisms, which may result in impacts due to physical and toxic effects (Wright et al. 2013).

Heat shrink sleeve, which represents approximately 0.009% of the mass of the Pipeline, may be incorporated into the sediments of the buried sections of the Pipeline. Once buried, heat shrink sleeve material is expected to degrade slowly over time, as it will be less exposed to degradation processes, such as abrasion from sediment movement. Heat shrink sleeves that degrade above the pipeline (i.e. without becoming buried) are less likely to be incorporated into sediments, as the density of the sleeve material is lower than seawater.

It should be noted that any polymers (e.g. microplastics from the epoxy flowcoat) will remain in the Pipeline until corrosive breakthrough and degradation (210 – 500 years).

Potential contaminants may be released as the steel rusts and, like steel, become incorporated into the sediments around the Pipeline. This may result in a localised increase in the concentrations of potential contaminants in sediments. Potential contaminants within the Pipeline are planned to be removed to as low as practicable by chemical cleaning. Residual amounts of potential contaminants following cleaning, such as NORM and mercury, may be present within the Pipeline but at concentrations and in a form (insoluble mercury) below acceptable impact thresholds.

Methylation is a naturally occurring process that can convert a fraction of insoluble mercury compounds such as mercury sulphide into a soluble form. Therefore, there is a longer-term risk that as the pipeline corrodes and breaks apart over an extended time period, if environmental conditions are conducive, methylation of a fraction of residual mercury sulphide may occur. Although published literature estimated rates of methylation can be anywhere from 1% to 10% of total mercury, location specific rates of methylation cannot be predicted with certainty (ANSTO 2020b).

To mitigate risk associated with methylation of inorganic mercury in the long term, pipeline scale and dust will be chemically cleaned to reduce methylation risk to ALARP. Cleaning to reduce methylation risk to ALARP will be based on results of chemical cleaning trials to test cleaning efficacy relative to chemical volumes, contact time, etc. For example, laboratory tests of one propriety scale removal product on the scale from a spool piece immediately upstream of the pipeline demonstrated optimum cleaning efficiency at 4-hour chemical contact time before cleaning effectiveness diminished relative to increases in chemical volumes and contact times. At a 4-hour chemical contact time, 95% cleaning effectiveness was achieved with a subsequent verification chemical pill indirectly confirming the level of cleaning effectiveness achieved within an acceptable level of certainty.

Reduction of mercury methylation risk to ALARP will be based on cleaning to an optimal level of cleaning efficiency for the selected cleaning product as demonstrated by laboratory trials. Other chemical cleaning products are under review for this purpose.

Despite the low environmental risk posed by NORMs in the uncleaned, uncapped pipeline, the Pipeline will be chemically cleaned during the decommissioning process to remove scale and dust and associated NORMs contamination as part of a precautionary management approach. In addition, the open ends of the cut pipeline at the tie-in point will be capped within 7 days to minimise the risk of egress of any residual scale associated with NORMs contamination during the time period when the radiological activity level is predicted to be higher than the ARPANSA exemption threshold.

Water Quality

Most of the degraded material is insoluble and will remain on the seabed, or in the sediment (self-buried Pipeline sections) and hence has little potential to impact water quality. The heat shrink sleeve material is expected to be buoyant and float to the surface, however, the release of heat shrink sleeve material is expected to occur over a long duration (210 – 500 years) and only represents approximately 0.0009% of the mass of the Pipeline. The heat shrink sleeve material is expected to be widely dispersed by ocean currents, where the relatively high levels of ultraviolet radiation will accelerate the breakdown of the material relative to degradation at the seabed. As the material breaks down, it is expected to degrade into progressively smaller particles over time, until if forms relatively persistent microplastics. Degradation of microplastic materials is primarily by physical means, as very few naturally occurring biota (e.g. bacteria) can consume plastics (Andrady 2011). Microplastics have been shown to potentially be toxic through the concentration of persistent organic pollutants, such as through absorption of persistent organic pollutants present in seawater (Andrady 2011). The continental shelf waters throughout the Operational Area are expected to have very low levels of persistent organic pollutants as there are very few potential sources in the region. Many potential persistent organic pollutants, such as dieldrin, are highly regulated and not permitted for use in Australia. Plastic and microplastic material has the potential to impact upon marine organisms that may consume this material (discussed below).

Flooding and cleaning of the Pipeline from DLNG will leave the section of the Pipeline decommissioned in situ filled with treated seawater. This treated seawater will gradually be released to the environment over a long time frame due to the expected limited water exchange between the interior of the Pipeline and the sea. The Pipeline ends will be capped to prevent egress of the treated seawater before the treated seawater chemicals degrade, therefore, there is not expected to be any decrease in water quality due to treated seawater chemicals. Refer to **Section 6.3.9** for additional consideration of the release of treated seawater.

Other Benthic Communities

The Pipeline has developed a relatively diverse benthic habitat on the external surface of the Pipeline (see **Figure 6-4**). Decommissioning in situ will retain this community, which will enhance biodiversity and abundance of organisms, as discussed in **Section 6.3.2**. It is considered that the presence of the benthic habitat community on the Pipeline may slow the process of Pipeline degradation. However, as the Pipeline eventually buries and degrades over the course of hundreds of years, this benthic habitat will gradually be lost as the Pipeline substrate becomes less available. Following complete degradation of the Pipeline, the benthic communities along the Pipeline route are expected to be consistent with the surrounding natural areas.

The changes in sediment and water quality from the degradation of the Pipeline are not expected to result in any impacts to the development of benthic habitat on the Pipeline.

KEFs

The three KEFs through which the Pipeline extends have all been identified as KEFs based on the geomorphology. The degradation of the decommissioned in-situ Pipeline will not affect the geomorphology of the KEFs. Some minor impacts to the benthic communities associated with the Pipeline within the KEFs will occur (see discussion above in **Other Benthic Communities**), however this will only affect a very small portion of the KEFs (**Table 5-2**) and will not diminish the ecological role of these KEFs.

Pelagic and Demersal Fish Communities

Pelagic and demersal fish may ingest microplastics from the degradation of the heat shrink sleeves and flowcoat. The release of heat shrink sleeve and epoxy flowcoat material is expected to occur over a long duration (210 – 500 years) and only represents approximately 0.0009% and 0.02% of the mass of the Pipeline, respectively. The material is also expected to be widely dispersed by ocean currents,

Studies show ingestion of microplastics by fish is relatively common, with over a third of all fish examined in studies in European waters having microplastics within their gastrointestinal tract (Lusher et al. 2013, Murphy et al. 2017). Ingestion of fish with a microplastics load may result in bioaccumulation within higher trophic levels, although most microplastics in such situation may pass through an animal and be expelled with faeces (Gil-Delgado et al. 2017). The ubiquity of microplastics on the sea and the relatively high portion of fishes observed with microplastics in their gut with little apparent consequence suggests that significant effects of microplastics on fishes is small.

Marine Fauna

Marine debris has been identified as a threat for a number of threatened and migratory marine fauna, and is the subject of the *Threat Abatement Plan for the Impacts of Marine Debris on the Vertebrate Wildlife of Australia's Coasts and Oceans* (Commonwealth of Australia 2018). The components of the Pipeline that may pose a threat to marine fauna are plastics – the flowcoat and the heat shrink sleeves. The release of heat shrink sleeve and epoxy flowcoat material is expected to occur over a long duration (210 – 500 years) and only represents approximately 0.0009% and 0.02% of the mass of the Pipeline, respectively. The material is also expected to be widely dispersed by ocean currents,

Other components of the Pipeline are not expected to pose a risk to marine fauna as they are inert, deposited in sediments, or both. Marine debris poses a threat to marine fauna primarily due to impacts resulting from:

- Entanglement, resulting in fauna becoming trapped, and
- Ingestion, potentially resulting in blockage of the gastrointestinal tract.

Components of the Pipeline are not considered to pose a credible risk to marine fauna through entanglement, which is typically through ropes or ghost nets. Ingestion of plastics derived from the Pipeline by seabirds and marine turtles could credibly occur, as heat shrink sleeves may occur at or near the surface. Ingestion of plastics derived from the Pipeline may result in loss of fitness, or death (Wilcox et al. 2015). However, fragments of plastic will be released in small quantities over a long duration (210 – 500 years). In addition, seabirds and marine turtles are not expected to occur in the Operational Area in high densities and so any impacts are expected to be limited to low numbers of individual animals and not at a population-scale.

Given the very long timeframes over which the Pipeline will degrade and the relatively rapid degradation of the sleeves (if they reach the sea surface) due to ultraviolet radiation, the total amount of plastic from the Pipeline available to foraging seabirds and turtles at any given time is expected to be relatively small compared to the total heat shrink sleeve inventory. Any heat shrink sleeve fragments released from the Pipeline are expected to be highly degraded and substantially broken up in order for the sleeve to become detached from Pipeline. In the context of other polluting sources of plastic in the ocean, the contribution from the pipeline is considered to be insignificant.

Marine Protected Areas

The section of the Pipeline that will be decommissioned in situ overlaps two zones of the Oceanic Shoals Marine Park, which have the following management objectives (Director of National Parks 2018):

- Multiple Use Zone (IUCN Category VI) – the objective of this zone is to provide for the ecologically sustainable use and the conservation of ecosystems, habitats and native species.
- Special Purpose Zone (Trawl) (IUCN Category VI) - the objectives of this zone is to provide for the ecologically sustainable use and the conservation of ecosystems, habitat and native species, while applying special purpose management arrangements for specific activities (trawl fishing).

Environmental values of the Oceanic Shoals Marine Park include:

- Three KEFs,
- Marine species, including turtles, and
- Commercial fishing.

The decommissioning in situ of the Pipeline within these zones is consistent with these management objectives. As outlined above, impacts from the degradation of the Pipeline in situ are not expected to interfere with the ecologically sustainable use, or conservation of, ecosystems, habitats and native species. The degradation of the Pipeline will not result in unacceptable impacts to the environmental values of the Marine Park.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	1	4	RRI – Low
Residual risk	1	4	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***
Cleaning of the Pipeline prior to in situ decommissioning	Cleaning the Pipeline with scale removing chemicals will effectively remove the majority of any residual contaminants associated with scale presence (e.g. NORMs and inorganic mercury sulphide) in the Pipeline.	**C 4.1**	**EPS 4.1.1** Clean pipeline to an ALARP level where benefits outweigh the costs associated with additional cleaning.
Reduce the time between cutting the pipeline and installation of end caps at the tie-in point.	This control is effective because it reduces the time during which the pathway between the pipeline interior and the environment exists.	**C 4.2**	**EPS 4.2.1** The time period between pipeline cutting and end caps installation at the tie-in point must be within 7 days.
Santos meets the requirements of the *Environment Protection (Sea Dumping) Act 1981*.	Effective through compliance with legislative requirements associated with *Environment Protection (Sea Dumping) Act 1981*.	**C 4.3**	**EPS 4.3.1** Santos will continue to engage with DAWE regarding its obligations under the *Environment Protection (Sea Dumping) Act 1981*.

Assessment of additional controls

Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
Remove the Pipeline section proposed to be decommissioned in-situ	Yes	No	Removal of the Pipeline transfers the environmental impacts and risks from the Operational Area to another location – either onshore or another dumping location at	N/A

			sea. Hence, the impacts and risks are not eliminated, but transferred to another location. Work to remove the Pipeline is a much longer process than leaving the Pipeline in-situ and exposes the workforce to a protracted offshore campaign, with associated safety risk exposure. The financial cost of this campaign and associated waste disposal is also forecast to be significantly higher than that of decommissioning in-situ. The energy use and associated emissions generated during a protracted offshore pipeline removal campaign would be significantly higher than that of decommissioning the pipeline in-situ. Removing the Pipeline would also result in significant seabed disturbance and potentially decrease fisheries resource and benthic habitat created by presence of the Pipeline, resulting in a net loss of environmental value. Hence the cost (safety, financial and environmental) of removal is considered to be grossly disproportionate to the environmental benefit of decommissioning the pipeline in-situ.	
Substitute				
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 implementation of the controls throughout the activity, Santos considers that the impacts to the environment from the degradation of the section of the Pipeline decommissioned in situ are reduced to ALARP. Relevant legislative requirements and standard industry practices have been applied to control the impacts. An additional control (i.e. removal of the Pipeline) was evaluated and rejected as the reduction in risks was considered to be grossly disproportionate to the environmental impacts and cost of implementation. The control selected for implementation is effective in reducing the impacts to the environment from the degradation of the section of the Pipeline decommissioned in situ. Santos considers the control adopted is commensurate to the nature and scale of the potential impacts.				

Acceptability
The potential impacts to the environment from the degradation of the section of the Pipeline decommissioned in situ are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. The impacts to environmental receptors are predicted to be within the defined acceptable levels of impacts provided in **Table 6-5**. Santos has undertaken environmental studies to inform the impact assessment, including degradation studies, contaminant presence, characterisation bioavailability studies, NORM dilution modelling and pipeline burial studies. These studies, which have adopted intentionally conservative assumptions where relevant (e.g., assumptions that all bare metal sections for the full length of the decommissioned pipeline are equally contaminated), reduce potential uncertainty in the assessment of environmental impacts. Relevant requirements have been met, including Santos' internal processes and standard industry practices. No significant impacts to the Commonwealth marine environment or to threatened or migratory fauna will occur. The impacts to the environment from the degradation of the section of the Pipeline decommissioned in situ are consistent with conservation advice and recovery plans published under the EPBC Act or the management plan for the Oceanic Shoals Marine Park. Based on the points outlined above, Santos considers the environmental impacts of the material degradation of the pipeline section decommissioned in-situ are acceptable.
EPOs
EPO 4 Impacts from long-term degradation of the section of the Pipeline decommissioned in situ are acceptable.

6.3.5 Waste Management: Disposal of Waste Materials

<table>
<tr><td>Risk</td><td colspan="2">Generation of waste materials, including:
• Recovered Pipeline from the Bayu-Undan Platform to approximately KP34.2,
• Recovered sections of the Pipeline at the tie-in point and equipment (spools, upstream skid / PLR), and
• Vessel waste.</td></tr>
<tr><td rowspan="3">Aspect-receptor Reference</td><td>Heritage</td><td>Marine Protected Areas</td></tr>
<tr><td>Fishing</td><td>Tourism</td></tr>
<tr><td>Ports and commercial shipping</td><td></td></tr>
<tr><td colspan="3">Description of the Source of Risk</td></tr>
<tr><td colspan="3">Recovered Sections of Pipeline and Equipment
Removal of the Pipeline between the Bayu-Undan Platform and approximately KP34.2 and at the tie-in point will generate sections of pipe for onshore disposal. The Pipeline is constructed of:
• Steel linepipe,
• An internal epoxy flow coating,
• Asphalt enamel coating,
• Reinforced concrete weight coating, and
• High density polyethylene heat shrink sleeves at joint welds.
All of these materials are non-toxic and are not considered to be hazardous. The spools between the Bayu-Undan Platform and the Pipeline and the upstream skid / PLR are constructed primarily of steel. Opportunities to recycle the upstream skid / PLR will be reviewed as part of pipeline decommissioning waste management activities.
The Pipeline will be cleaned as part of the flooding activity (if the pig cleaning train is pushed from the DLNG Plant), or after the flooding activity (if the pig cleaning train is pushed from the tie-in point).
There is the potential for residual contaminants deposited during the operational phase of the Pipeline to be present within the Pipeline and spools. These may include NORMs and mercury, both of which may result in the Pipeline sections being classified as hazardous wastes under the Hazardous Waste (Regulation of Exports and Imports) Act 1989. The section of Pipeline from the Bayu-Undan Platform to approximately KP34.2 will have been cleaned under both cleaning scenarios prior to removal and as such, will be a non-hazardous waste. The section of Pipeline planned for removal at the tie-in point may or may not be hazardous waste, depending on whether cleaning occurs from DLNG or the tie-in point.
Santos is committed to the environmentally sound management of hazardous wastes. Santos will implement a process to analyse the Pipeline sections and spools to determine if they constitute a hazardous waste as defined by the Hazardous Waste (Regulation of Exports and Imports) Act 1989. If the disposal of Pipeline sections and spools outside of Australia is to occur, a hazardous waste export permit may apply to the section removed at the tie-in point (dependant on cleaning occurring prior to removal). The selected disposal location, within or outside of Australia, will be a suitably licenced waste management facility.
Vessel Waste
Vessels will also routinely generate wastes, such as domestic waste, packaging etc. that are stored onboard and disposed of onshore. Vessel utility discharges that are released to the marine environment (e.g. grey water, sewage, bilge water etc.) are considered in Section 6.3.7. Vessel wastes will be disposed of in port in accordance with port requirements, either within Australia or overseas.</td></tr>
<tr><td colspan="3">Potential Impacts</td></tr>
<tr><td colspan="3">Socio-economic and Cultural Environment
All waste material onboard vessels during decommissioning activities will be transported to shore and disposed of at an appropriately licenced waste management facility.</td></tr>
<tr><td colspan="3">Risk Assessment</td></tr>
</table>

	Consequence	***Likelihood***	***Risk rating***

Inherent risk	2 Minor	2 Remote	RRI – Low
Residual risk	2 Minor	2 Remote	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***
All recovered sections of the Pipeline and equipment will be disposed of at an appropriate waste management facility in accordance with the decommissioning waste management strategy.	Inappropriate disposal of waste material, particularly hazardous waste, may result in impacts to the environment at the location receiving the waste material. The classification and subsequent management of wastes is effective at reducing this risk.	**C 5.1**	**EPS 5.1.1** All recovered sections of the Pipeline and equipment will be managed according to relevant waste management legislation, regulations and standard industry practices.
All vessel wastes managed in accordance with vessel waste management plan meeting MARPOL Annex II, III & V requirements	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 5.2**	**EPS 5.2.1** Vessels will be suitably 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: • Marine Order 93 (Marine Pollution Prevention – Noxious Liquid Substances), which implements Annex II of the MARPOL Convention, including (as required by vessel class): - International Pollution Prevention (IPP) Certificate. • Marine Order 94 (Marine Pollution Prevention – Packaged Harmful Substances), which implements Annex III of the MARPOL Convention, including (as required by vessel class): - No disposal of harmful substances (identified as marine pollutants in the IMDG Code) overboard - Packaged harmful substances to be properly packed, marked, labelled, stowed and secured - Any loss or discharge to sea of harmful materials will be reported to the AMSA rescue coordination centre (RCC) via a marine pollution report (POLREP). • Marine Order 95 (Marine Pollution Prevention – Garbage), which implements Annex V of the MARPOL Convention, including: - Garbage management plan in place. - Types of wastes that will be generated onboard and will require

			containment, transport and disposal at a licensed facility onshore - Procedures for handling, storage segregation and disposal of wastes - Maintenance of Garbage Record Book, recording the types and volumes of waste incinerated or disposed onshore - Garbage record book maintained onboard.

Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
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 controls throughout the activity, Santos considers that the impacts and risks from the disposal of waste materials are reduced to ALARP.

Relevant legislative requirements and standard industry practices have been applied to control the risk. The controls selected for implementation are effective in managing the impacts and risks of waste disposal. Santos considers the control adopted is commensurate to the nature and scale of the impacts.

Acceptability

The risks and impacts from the disposal of waste materials are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been met, including Australian legislation. Santos considers the selected controls are effective in managing the risk to a level that is acceptable.

EPOs

EPO 5

Disposal of hazardous and non-hazardous waste materials at licenced waste disposal facilities.

6.3.6 Light Emissions: Artificial Light on Vessels

Risk	Light emissions from vessels	
Aspect-receptor Reference	Pelagic and demersal fish communities	Marine reptiles
	Birds	

Description of the Source of Risk

Lighting is required for the safe operation of vessels at sea, and vessel navigation lighting is mandated by the COLREGS and associated Australian Marine Orders. Lighting cannot be eliminated without incurring unacceptable safety risks. Lighting on vessels is predominately facing away from the marine environment, directed to deck working areas.

Pipeline decommissioning activities will be undertaken by vessels, which will be within the Operational Area between the SSIV and approximately KP34.2, and around the tie-in point, for a total campaign duration of up to 39 weeks. Note that activities within the campaign may not be contiguous. Vessels may also undertake IMR activities on the preserved section of the Pipeline between the tie-in point and DLNG. Vessels undertaking decommissioning and IMR activities will operate on a 24-hr basis and will require lighting at night.

Potential Impacts

Light emissions associated with activities involving vessels may present a potential risk to marine fauna causing a temporary change in movement patterns and/or behaviour, such as attraction, displacement or disorientation. Artificial lighting can affect seabirds and migratory shorebirds, marine turtles, as well as sharks/rays and other fish.

Pelagic and Demersal Fish Communities

Fish, including sharks and rays, may exhibit behavioural disturbance in response to artificial lighting. Behavioural effects may include avoidance of, or attraction to, the light source. Effects may vary for individual species-based timing of the activity (i.e. during feeding, breeding or resting periods). Impacts to fish from artificial lighting is expected to cause only brief behavioural changes within a localised area and will not have any lasting effects to individuals. These impacts are considered to be negligible.

Marine Reptiles

Marine turtle hatchlings and nesting adults can become disorientated by coastal artificial lighting when moving towards the sea from nesting beaches(Salmon et al. 1995, Salmon and Witherington 1995), however, once reaching the water are primarily directed by water movements (Lohmann et al. 1990, Lohmann and Lohmann 1992). No activities within direct line of sight of turtle nesting beaches will occur, with all vessel activities constrained to the Operational Area between the SSIV and approximately KP34.2, and around the tie-in point. The nearest potential turtle nesting beach is approximately 27 km from the tie-in point. Therefore, marine turtle hatchlings and nesting adults are not expected to be affected by artificial lighting associated with the activities.

Light is recognised as a threat to marine turtles in the *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia 2017), particularly for stocks off Queensland and WA where there is coastal development near nesting beaches. Light is not recognised as a threat for the olive ridley and flatback turtle stocks in the NT. Given the short duration of the activity and the distance from the nearest turtle nesting beach, the Pipeline decommissioning activities are considered to be consistent with the objectives of the *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia 2017).

Low numbers of marine turtles are likely to traverse through the area where artificial light associated with decommissioning activities will occur. The potential impact to marine turtles is expected to be limited to minor and temporary behavioural disturbance, which is considered to be negligible.

Birds

Artificial lighting may result in behavioural disturbance of birds, such as attraction or mis-orientation (Poot et al. 2008). There are isolated incidents of bird mortality influenced by artificial light, however such reports typically occur during unusual meteorological conditions (e.g. fog) when light sources are in close proximity to high density areas of birds (e.g. roosting areas). The Operational Area is not known to host significant seabird or migratory shorebird assemblages, and any behavioural disturbance to birds would only affect a small number of individuals. Impacts to these individuals are likely to be limited to short-term attraction. This impact will cease upon completion of the vessel-based decommissioning activities, and hence is considered to be negligible.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***

Inherent risk	1 Negligible	2 Remote	RRI – Low
Residual risk	1 Negligible	2 Remote	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***
No existing controls identified			

Assessment of additional controls

Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No existing controls identified				
Substitute				
No existing controls identified				
Engineering				
No existing controls identified				
Administrative				
No existing controls identified				

ALARP Statement

Based on the outcomes of the risk assessment, Santos considers that the impacts to marine fauna from artificial light on vessels are inherently ALARP. No existing or additional controls were identified that would reduce the environmental impacts or artificial lighting.

Acceptability

The potential impacts to marine fauna from artificial light on vessels are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been considered, including relevant conservation advice and recovery plans that identify light as a threat to fauna. The potential impacts to marine fauna from artificial light on vessels are consistent with the objectives and requirements of the conservation advice and recovery plans.

EPOs

EPO 6

Behavioural disturbance impacts from artificial light emissions will be temporary and localised.

6.3.7 Discharges: Vessel Utility Discharges

Risk	Routine discharge of sewage, grey water, putrescible waste, deck drainage, and bilge water from vessels.	
Aspect-receptor Reference	Water quality	Plankton

Description of the Source of Risk

Vessels will be required to undertake decommissioning activities between the Bayu-Undan Platform and approximately KP34.2, and around the tie-in point. Vessels may also undertake IMR activities on the preserved section of the Pipeline between the tie-in point and DLNG. Vessels will generate a range of utility waste streams that will be discharged to the marine environment, including:

- Sewage,
- Grey water,
- Putrescible waste,
- Deck drainage, and
- Bilge water.

These may be generated intermittently or continuously during the decommissioning campaign, which is expected to occur during a campaign of approximately 39 weeks, as well as during IMR activities. Note that activities within the campaign may not be contiguous.

Potential Impacts

Water Quality

Impacts to water quality from vessel utility discharges may include:

- Increases in nutrients,
- Increased biochemical oxygen demand,
- Increased turbidity,
- Reduced visual amenity, and
- Low concentrations of potential contaminants such as hydrocarbons and chemicals.

The open water environment receiving these utility discharges is expected to result in rapid mixing of utility discharges. As a result, the potential impacts to water quality will be highly localised and restricted to the immediate area (i.e. 10's to 100's of metres) around the discharge point. Given the length of vessel-based activities during Pipeline decommissioning is relatively short, the associated highly localised impacts will also be of relatively short duration. On this basis, impacts to water quality from vessel utility discharges will be negligible.

Plankton

The increase in nutrients from sewage and putrescible waste discharges may lead to a temporary, localised increase in phytoplankton productivity. This will be of negligible environmental consequence given the small amounts of nutrients that are expected to be released and the well mixed open water environment of the Operational Area.

As outlined above, some utility discharge streams may contain low concentrations of potential contaminants. These may result in highly localised, temporary impacts to phytoplankton and zooplankton; these impacts will be negligible.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	1 Negligible	2 Remote	RRI – Low
Residual risk	1 Negligible	2 Remote	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***
Routine discharges of	This control is consistent with standard maritime	**C 7.1**	**EPS 7.1.1**

treated sewage, grey-water, putrescible waste, deck drainage, and bilge water in accordance with standard maritime practice	practices which have been developed through international consensus. The control is consistent with relevant requirements, including the International Convention for the Prevention of Pollution from Ships 1973/1978 convention (MARPOL) and Australian Marine Orders.		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: • Marine Order 91 (Marine Pollution Prevention – Oil), which implements Annex I of the MARPOL Convention, including (as required by vessel class): - 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. - A deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. - Waste oil storage available - Valid International Oil Pollution Prevention (IOPP) Certificate. • Marine Order 95 (Marine Pollution Prevention – Garbage), which implements Annex V of the MARPOL Convention, including: - 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. - Garbage management plan in place. - Garbage record book maintained onboard. • Marine Order 96 (Marine Pollution Prevention – Sewage), which implements Annex IV of the MARPOL Convention, including (as required by vessel class): - A valid International Sewage Pollution Prevention (ISPP) Certificate. - An MARPOL approved sewage treatment plant. - A sewage comminuting and disinfecting system. - A sewage holding tank sized appropriately to contain all generated waste (black and grey water). - Discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land. - Discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land.

			- Discharge of sewage will occur at a moderate rate while support vessel is proceeding (> 4 knots).

Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
No additional controls identified				
Engineering				
No additional controls identified				
Administrative				
Storage and transfer of food wastes onshore for treatment and disposal	No	No	The storage of food wastes onboard may present a waste management hazard given the length of time the Pipeline decommissioning campaign is expected to cover (approximately 39 weeks). Given the negligible environmental impact that the discharge of putrescible waste presents, the cost of storing and transporting food wastes to shore is considered grossly disproportionate to the environmental benefit. Note that vessels may be required to store waste onboard if they do not meet MARPOL discharge requirements.	N/A

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 and plankton from vessel utility discharges are reduced to ALARP.

Relevant legislative requirements and standard industry practices have been applied to control the risk. An additional control was evaluated and rejected as the reduction in risks was considered to be grossly disproportionate to the cost of implementation. 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.

Acceptability

The potential impacts to water quality and plankton from vessel utility discharges are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been met, including Santos' internal processes, MARPOL, and related Marine Orders.

EPOs

EPO 7

Environmental impacts from vessel utility discharges will be within acceptable levels by maintaining discharge streams in accordance with standard maritime practices.

6.3.8 Pipeline Cleaning: Disposal of Cleaning Fluids and Seawater from within the Pipeline

Risk	Disposal of cleaning fluids during Pipeline cleaning
Aspect-receptor Reference	Water Quality

Description of the Source of Risk

Pipeline cleaning activities within the scope of this EP will consist of a pig train containing a cleaning chemical slugs pushed with treated seawater either from onshore at the DLNG Plant or with untreated seawater from the tie-in point. The slugs will be pushed along the entire length of the Pipeline that will be decommissioned, including the length of the Pipeline that will be preserved, if pushed from the DLNG Plant. Upon arrival at the Bayu-Undan Platform, the pigs will be recovered at the Bayu-Undan Platform pig receiver. The treated or untreated seawater that is pushed in front of the cleaning chemical pig train, the cleaning chemical slugs and any associated contaminants will be disposed via a disposal well(s) located in Bayu-Undan Field.

The chemicals that will be used in the slug are yet to be determined and will be selected based on the Pipeline cleaning needs identified by Santos. It is expected that the slugs may include chemicals to remove any material deposited on the interior of the Pipeline, such as scale. All chemicals used will be subject to Santos' ABU-W chemical selection process described in **Section 4.6**.

The chemical slugs and any associated treated seawater will be injected to a geological formation using the produced formation water (PFW) reinjection system at the Bayu-Undan Platform or a production well if the produced water reinjection well is unavailable. Temporary pumps will be used if the Bayu-Undan Platform PFW reinjection pumps are unavailable (e.g. due to platform decommissioning activities). As such, there are no planned releases of cleaning chemicals, associated contaminants or treated/untreated seawater from within the Pipeline to the marine environment during the pipeline cleaning activity. Obtaining regulatory authorisation for downhole disposal into the Bayu-Undan formation/reservoir of chemical slug and treated seawater will be the responsibility of Santos and will be managed as a component of an activity specific EMP submitted to the Timor Leste offshore regulator.

Potential Impacts

Water Quality

The cleaning pig train contains both treated seawater (containing biocides, corrosion inhibitors etc.) and cleaning chemical that contains target contaminants (e.g. mercury) and as such, poses an impact to water quality if released to the marine environment.

Risk Assessment

	Consequence	*Likelihood*	*Risk rating*
Inherent risk	2	2	RRI – Low
Residual risk	2	2	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	*Effectiveness*	*Reference (Table 7-1)*	*Environmental Performance Standard*
Implement chemical selection procedure for all chemicals	This control is effective in ensuring chemicals pose a acceptable environmental risk. The chemical selection process requires less environmentally harmful alternatives be used as substitutes for more harmful chemicals where practicable.	**C 8.1**	**EPS 8.1.1** All chemicals will be assessed through the chemical selection procedure.
Injection of chemical slug and untreated / treated	This control is effective in preventing chemicals that may be harmful to the	**C 8.2**	**EPS 8.2.1** All cleaning chemical slugs, associated contaminants and untreated / treated

seawater from within the Pipeline via a disposal well.	environment from being discharged.		seawater in front of the cleaning pig train will be injected via a disposal well(s) at the Bayu-Undan Field facility, for which authorisation will be obtained from the Timor-Leste offshore waters regulator.

Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
No additional controls identified				
Engineering				
Contingency wells to be used if PFW re-injection wells are not able to inject chemical slug.	Yes	Yes	A number of re-injection wells will be available for use during decommissioning of the Pipeline. In the event a well is not available, a contingency reinjection well can be used. In addition to reinjection wells, the series of production wells at the Bayu-Undan Field may also be repurposed for use as a re-injection well, if required.	**EPS 8.3.1** If the re-injection well becomes unavailable for use, injection of the cleaning chemical slugs, associated contaminants and untreated / treated seawater in front of the cleaning pig train to be done using a contingency well.
Administrative				
No additional controls identified				

ALARP Statement

Based on the outcomes of the risk assessment and the implementation of the selected controls, Santos considers that the impacts and risks from the disposal of cleaning fluids and seawater from within the Pipeline are reduced to ALARP.

Standard industry practices have been applied to control the risk. An additional control was evaluated and was adopted. The controls selected for implementation are effective in reducing the impacts and risks from the disposal of cleaning fluids and seawater from within the Pipeline. Santos considers the controls adopted are commensurate to the nature and scale of the impacts.

Acceptability

The potential impacts and risks from the disposal of cleaning fluids and seawater from within the Pipeline are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been met, including Santos' internal processes and standard industry practices. Recognised guidelines for water quality published by the Commonwealth of Australia have been applied in determining acceptable levels of impacts.

EPOs

EPO 8

All cleaning fluids and associated contaminants from within the Pipeline will be disposed via a disposal well into a geological formation at the Bayu-Undan field.

6.3.9 Discharges: Treated Seawater Discharge

Risk	Discharge of treated seawater from the removal of Pipeline sections that have been flooded with treated seawater.	
Aspect-receptor Reference (Table 6-)	Water Quality	Sediment Quality
	Other Benthic Communities	Plankton
	Pelagic and Demersal Fish Communities	

Description of Source of Risk

Under the flooding isolation approach the Pipeline will be initially flooded with treated seawater. Treated seawater from the Pipeline will be potentially exposed to the environment during the removal of Pipeline sections which will occur:

- at the tie-in point, regardless of whether the Pipeline is cleaned from DLNG or the tie-in point, and
- between the Bayu-Undan Platform and approximately KP34.2 if the Pipeline is cleaned from DLNG. If the Pipeline is cleaned from the tie-in point, the Pipeline between the Bayu-Undan Platform and the tie-in point will be filled with untreated seawater as the cleaning pig train is pushed to Bayu-Undan platform.

Under the HPIT or Local Line Stops isolation approach flooding of the pipeline section to be decommissioned will be with untreated seawater with the exception of a 2km section of treated seawater behind the HPIT (refer to the Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan Section 5.3.7 for more details on this risk).

Under the flooding isolation approach, the entire pipeline from DLNG to the Bayu-Undan platform will be filled with treated seawater. The treated seawater will contain biocide, corrosion inhibitor and oxygen scavenger, which are required to maintain the integrity of the section of Pipeline to be preserved (between the tie-in point and the DLNG Plant) and cannot reasonably be eliminated.

The specific chemical products that will be used to treat the seawater have not yet been determined, however all chemicals will be subject to the chemical selection and use process outlined in **Section 4.6**. This process preferences chemicals that have been shown to present an acceptable environmental risk under the OCNS, readily degrade in the environment, and have a low risk of bioaccumulation. The chemical dosages required will be sufficient to achieve the desired technical outcome (i.e. effective preservation of the Pipeline); over-dosage of chemicals beyond that required will be avoided.

Treated Seawater Release at the Tie-in Point

Treated seawater will be released when the pipeline is cut and a section removed at the tie-in point. The estimated amount of treated seawater released to the environment from the cut section at the tie-in point is estimated to be 30 m^3 - 60 m^3 depending on the length of section cut out (100 m – 200 m). Treated seawater in the sections of the Pipeline upstream and downstream of the cut section will also be exposed to the environment between cutting and installation of the end caps. The treated seawater in the pipeline will be at ambient pressure and of density to the surrounding seawater. There will not be a noticeable pressure gradient between the treated seawater and the water column outside the pipeline at the time of release. As a result, the majority of the treated seawater within the sections upstream and downstream of the cut sections of pipeline are expected to remain within the pipeline, with little egress of treated seawater from these sections of the pipeline.

End cap installation will occur on a priority basis (within 7 days) after completion of the cutting of the Pipeline at the tie-in location, limiting the period during which the treated seawater within the Pipeline upstream and downstream from the cut section at the tie-in point is exposed to the environment (assumed to be approximately 15m^3 from each cut end over the 7 days). *Treated Seawater Release during Pipeline Removal in Timor Leste Offshore Waters*

Any treated seawater within the pipeline section being removed within Timor Leste offshore waters will also be released to the environment if the pipeline is both flooded and cleaned from DLNG rather than from the tie-in point. In the latter case, the pipeline will have been cleaned and flooded with untreated seawater. In the former case, the volume of treated seawater between the Bayu-Undan Platform and approximately KP34.2 released to the environment under either removal method is estimated to be up to 10,500 m^3.

The environmental risk of this treated seawater release during the Bayu-Undan platform to KP34.2 pipeline section removal activity will be mitigated by three factors:

- the chemical dosing of treated seawater in the pipeline section to be decommissioned (tie-in point to BU platform) will be approximately one-third of the amount used for the preserved section (tie-in point to DLNG)

- the release of treated water during the pipeline section removal activity will be gradual and intermittent over an approximately 20-week removal period. (For the cut and lift method this would consist of an approximately 9m^3 release for each 30m section removed)
- the delay between the flooding and pipeline section removal, which is planned to be several years, will significantly degrade the initial toxicity and associated environmental risk of the lightly dosed treated water chemicals in this section.

Following removal of the pipeline section from the Bayu-Undan platform to KP34.2, and the installation of an end cap at KP34.2, the seawater contained within the pipeline section to be decommissioned in-situ (KP34.2 to KP380) will be contained.

Fate of Treated Seawater in the Environment

Once released into the environment, the plume of treated seawater is expected to mix in the surrounding water. As the treated seawater will have similar physical properties, there is not expected to be a density interface (e.g. halocline or thermocline) between the treated seawater and the surrounding water that would inhibit mixing. The treated seawater plume is not expected to be trapped in the water column by a thermocline or halocline, as the water column is expected to be well mixed throughout the entire depth range. Recent environmental monitoring at the Bayu-Undan field found dissolved oxygen was consistently at approximately 80% saturation between the shallow surface thermocline and the seabed (CDM Smith 2020). Temperature and conductivity profiles were similar, with all indicating the water column was well mixed throughout. Brownian motion will also result in mixing of the treated seawater at the molecular scale. These natural processes are expected to mix the treated seawater rapidly (within hours) following release. Chemicals in treated seawater released as the Pipeline degrades may largely be consumed prior to being released.

The biocide will be the most toxic component of the treated seawater. While the treated seawater will be anoxic upon release and have a chemical oxygen demand due to the residual oxygen scavenger, the surrounding seawater is expected to be well oxygenated as the water column at the release location is well mixed through the entire depth range. As the treated seawater plume mixes, the residual oxygen scavenger will be consumed and oxygen levels within the plume will increase. Dissolved oxygen levels are expected to be within approximately 95% of natural levels within 100 dilutions. The number of dilutions at which dissolved oxygen levels are expected to be tolerated by benthic organisms are considerably lower than the number of dilutions at which the biocide will no longer be acutely toxic. As a result, the presence of biocides within the treated seawater plume is expected to have the greatest potential for impacts to benthic biota.

The specific biocide(s) that will be used to treat the seawater have not been finalised. An indicative quaternary ammonium-based biocide has been used to inform impact assessment (Roemex RX-5722), which comprises >90% by mass the biocidal ingredient. This chemical is considered to be representative of the type of chemicals that may be used to treat the seawater that will be discharged. Ecotoxicity testing data for RX-5722 is provided in **Table 6-8**.

Table 6-8: Ecotoxicity testing summary for RX-5722 biocide

Test Biota	Test Type	Effect Concentration (mg/L)
Copepod (*Acartia tonsa*)	48 hr EC50*	0.032
Fish	96 hr LC50†	0.84
Microalgae (*Skeletonema costatum*)	72 hr EC50*	0.023

* Half maximal effective concentration – the continuous dose concentration point halfway between the baseline (i.e. no effect) and maximum effect of the chemical on test organisms within the test timeframe.

† Lethal concentration 50% – the continuous dose at which half of the test organisms die within the test timeframe.

Based on an initial dose of 500 ppm (i.e. 500 mg/L) of RX-5722 (which is considered conservative given the reduced dosing proposed for the pipeline section to be decommissioned), approximately 600 dilutions will be required to reduce the concentration of the biocide to the 96 hr LC50 concentration. This number of dilutions is considered to be an environmentally conservative estimate based on the following points:

- the number of dilutions assumes no consumption of the biocide prior to or following release, and
- 96 hr laboratory test exposure duration is likely to be much longer than the exposure that will occur in the environment due to water movement and dilution of the treated seawater plume.

Potential Impacts

Water Quality

The release of the treated seawater to the environment will result in an acute, temporary, localised decrease in water quality. The biocide and absence of oxygen within the treated seawater will result in mortality of marine biota exposed to high concentrations of the treated seawater plume. These effects are expected to be limited to

< 1 km from the discharge location along the prevailing current vector. As the plume undergoes mixing through the oceanographic processes, the potential impacts will reduce as the treated seawater plume becomes diluted.

Approximately 60m^3 to 600m^3 of treated seawater containing biocide, corrosion inhibitor and oxygen scavenger will be released to the marine environment at the tie-in point over a seven day period when the pipeline is cut and a section is removed prior to caps being installed on both cut ends. Modelling indicates that 1,000 dilutions (0.5 mg/L concentration) will be reached within approximately 250m of the release point for the larger 600m^3 volume.

The environmental risk of this treated seawater release during the Bayu-Undan platform to KP34.2 pipeline section removal activity will be mitigated by three factors:

- the chemical dosing of treated seawater in the pipeline section to be decommissioned (tie-in point to BU platform) will be approximately one-third of the amount used for the preserved section (tie-in point to DLNG)
- the release of treated water during the pipeline section removal activity will be gradual and intermittent over an approximately 20-week removal period. (For the cut and lift method this would consist of an approximately 9m^3 release for each 30m section removed)
- the delay between the flooding and pipeline section removal, which is planned to be several years, will significantly degrade the initial toxicity and associated environmental risk of the lightly dosed treated water chemicals in this section.

The potential for chronic impacts on water quality is not considered credible as the treated seawater discharge is a discrete, one-off release and the chemicals in the treated seawater are readily biodegradable and do not bioaccumulate.

Sediment Quality

The chemicals added to the treated seawater will not become bound to the sediments and will not bioaccumulate. As the discharge is not actively pumped into the environment, no scouring of sediments at the release location will occur. On this basis, no changes to sediment quality are expected to occur as a result of the discharge of treated seawater.

Other Benthic Communities

Habitat surveys indicate benthic habitats surrounding the Pipeline to be removed are largely bare sediments, with small areas of burrower / crinoid and filter feeder habitat. These habitats are widely represented in the region and are not considered to be of particularly high environmental value. Sessile epibenthic biota and infauna communities within the treated seawater plume near the release location are expected to experience mortality. These communities are expected to recover over time, with no persistent effects expected to occur.

The nearest potentially sensitive benthic habitat is within the Oceanic Shoals Marine Park. No Pipeline section removal will occur within the Oceanic Shoals Marine Park, with the nearest part of the Park located 5.6 km and 46 km from KP34.2 and the tie-in location, respectively. No impacts to the conservation values of the Oceanic Shoals Marine Park are expected to occur as the plume will not reach the boundary of the Park above concentrations that may result in impacts. The release of treated seawater

Plankton

Planktonic biota exposed to undiluted plume will experience mortality, with the potential for mortality decreasing as the plume becomes more diluted. Given the widespread nature and high turnover rates of planktonic communities, impacts from the discharge of treated seawater on planktonic communities are expected to be negligible. Recovery is expected to occur within days of the release.

Pelagic and Demersal Fish Communities

Fish are likely to be attracted to the Pipeline, as it provides habitat in an area that is largely devoid of rugose seabed features. Fish exposed to the undiluted plume released from the section of Pipeline that will be removed are expected to be deterred by the use of equipment, noise and presence of chemicals during Pipeline section removal and move away from the release location. As the plume dilutes and water quality returns to the baseline condition, the displaced fish are expected to return and utilise the habitat created by the Pipeline again.

The mortality of benthic biota may result in a temporary reduction in the availability of prey for fish in the vicinity of the release location. Given the expected localised nature of this impact to benthic communities, the impacts to fish are expected to be negligible.

No impacts to pelagic and demersal fish communities are expected to occur due to the release slow release rate and expected degradation of chemicals within the treated seawater prior to release (estimated between 210 and 500 years). Note this release will only occur if the cleaning pig train is launched from DLNG.

Risk Assessment

	Consequence	Likelihood	Risk rating
Inherent risk	1 Negligible	3 - Rare	RRI – Low
Residual risk	1 Negligible	3 - Rare	RRI – Low

Controls and Demonstration of ALARP				
Existing Controls				
Control	***Effectiveness***		***Reference (Table 7-1)***	***Environmental Performance Standard***
Implement chemical selection procedure for all chemicals planned to be released to the marine environment in treated seawater	This control is effective in reducing the consequence of chemical discharges, as the chemical selection procedure includes consideration of the environmental risks. The chemical selection process requires less environmentally harmful alternatives be used as substitutes for more harmful chemicals where practicable.		**C 9.1**	**EPS 9.1.1** All chemicals in treated seawater planned to be release to the marine environment will be assessed through the chemical selection procedure.
Monitor dosing of seawater treatment to prevent over-dosing	This control is effective in preventing high doses of chemicals (i.e. well above the dose required to achieve the intended effect) in the treated seawater.		**C 9.2**	**EPS 9.2.1** Dosing of chemicals to treat seawater will not exceed guidelines for use by manufacturers to achieve intended technical requirements.
Reduce the time between cutting the pipeline and installation of end caps at the tie-in point.	This control is effective because it reduces the time during which the pathway between the pipeline interior and the environment exists for treated seawater egress.		**C 9.3**	**EPS 9.3.1** The time period between pipeline cutting and end caps installation at the tie-in point must be within 7 days.
Assessment of Additional Controls				
Additional control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Elimination				
Do not use chemicals to treat seawater during flooding from DLNG	No	No	The use of chemically treated seawater to preserve the Pipeline between the tie-in point and the DLNG Plant is required to maintain the integrity of the Pipeline section which will be used for future operations.	N/A
Substitution				
No additional controls identified.				
Engineering				
Reduce treated water chemical dosing for the decommissioned pipeline section	Yes	Yes	Chemical dosing for the decommissioned section need only be sufficient to prevent damage as it passes through the preserved section during flooding, but not as high as the chemical dosing required for the preservation activity.	EPS 9.4.1 Chemical dosing for the pipeline section to be decommissioned will be minimised to the amount technically necessary to protect the preserved pipeline section during flooding.

Administrative				
Defer pipeline removal activity to reduce chemical toxicity through chemical degradation	Yes	Yes	Pipeline removal activities in Timor Leste offshore waters are scheduled to occur several years after pipeline flooding. Maintaining this activity schedule will reduce toxicity of any treated water in the removal section through chemical degradation.	EPS 9.5.1 Maintain scheduled pipeline removal activities in Timor Leste offshore waters occurring several years after flooding.

ALARP Statement

Based on the outcomes of the risk assessment and the implementation of the selected controls, Santos considers that the impacts and risks to water quality, other benthic communities, plankton and fish assemblages from the discharge of treated seawater are reduced to ALARP.

Relevant legislative requirements and standard industry practices have been applied to control the risk. An additional control was evaluated and was rejected as the control posed an unacceptable risk to the integrity of the Pipeline and hence was not feasible. The controls selected for implementation are effective in reducing the impacts to water quality, other benthic communities, plankton and fish assemblages from the discharge of treated seawater. Santos considers the controls adopted are commensurate to the nature and scale of the impacts.

Acceptability

The potential impacts to water quality, other benthic communities, plankton and fish assemblages from the discharge of treated seawater are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

The impacts are not inconsistent with the principles of ESD.

Relevant requirements have been met, including Santos' internal processes and standard industry practices.

EPOs

EPO 9

Impacts to water and sediment quality will be temporary and will recover completely within in a short time (several days) after cessation of the treated seawater discharge. Mortality of benthic biota from the treated seawater discharge will be limited to within 1 km of the release location.

6.3.10 Atmospheric Emissions: Combustion Engine Exhaust and Pipeline Gas Flaring

Risk	Atmospheric emissions from: • Vessel combustion engines and incinerators, and • Flaring of pipeline gas at Bayu-Undan platform.
Aspect-receptor Reference (Table 6-)	Air quality

Description of Source of Risk

Emissions to the atmosphere will occur from vessels, combustion of fossil fuels, incineration of waste, onboard vessels and flaring of gas at the Bayu-Undan Platform.

Flaring of Pipeline Gas

For the flooding isolation approach, the Pipeline will be depressurised through use as fuel gas for Bayu-Undan topsides decommissioning activities, prior to commencing flooding, with the excess gas flared at the Bayu-Undan field. Residual gas within the Pipeline will be pushed to the Bayu-Undan field as the Pipeline is flooded. This residual gas will be flared at the Bayu-Undan field. During depressurisation of the Pipeline prior to flooding, between 3471 to 7209 tonnes of CO_2-eq will be flared, depending on the volume of gas used at the Bayu-Undan Platform between the production cessation and Pipeline flooding. During Pipeline flooding, approximately 1435 tonnes of CO_2-eq will be flared. The total amount of gas that will be flared as CO_2-eq will be between 4906 to 8644 tonnes.

For the Local Line Stops isolation approach, as described in the Bayu-Undan to Darwin Gas Export Pipeline Production Cessation Environment Plan, flaring at Bayu-Undan platform from pipeline depressurisation after the line stops are set as well as during purging of any residual gas remaining in the pipeline during cleaning from the tie-in point will result in approximately 9,950 tonnes of CO_2-eq.

Vessels Combustion Engines and Incinerators

The main emissions identified from vessel combustion engines and incinerators include carbon dioxide, carbon monoxide, oxides of nitrogen, sulphur dioxide, particulate matter, non-methane volatile organic compounds and benzene, ethylbenzene, toluene and xylenes (collectively referred to as BTEX). Given the short duration of vessel activities during production cessation, atmospheric emissions will be limited. The actual expected volumes will be dependent on the size of vessel and the use of waste incinerators.

All vessels undertaking production cessation activities will run on MDO; no heavy or intermediate fuel oils will be used. This inherently reduces the potential pollutants such as particulates from exhaust emissions.

Atmospheric emissions from vessels will occur between the Bayu-Undan Platform and approximately KP34.2 and around the tie-in point section of the pipeline. Vessels undertaking IMR activities on the preserved section of the Pipeline will also produce atmospheric emissions.

Potential Impacts

Air Quality

The Bayu-Undan field is in a remote offshore environment and well away from population centres. The flared gas will disperse rapidly in this open offshore environment. The estimated annual steady-state emissions from flaring at the Bayu-Undan field are approximately 269,000 tonnes of CO_2e. Hence, the flaring of residual gas for Pipeline depressurisation prior to flooding and as part of the flooding process represents approximately 3% of the annual flaring CO_2e emissions from the Bayu-Undan field. The relative contribution of this flared gas to global greenhouse gas emissions will be negligible. The environmental impacts from these emissions will be subject to management under the applicable regulatory review process for Timor-Leste waters (i.e., annual flare allowance) and are deemed to be managed to a level that is ALARP and acceptable without further controls being adopted on this basis.

The location where vessels will be operating within the scope of this EP is a remote offshore environment where there are very few sources of air pollution and the air quality is expected to be nearly pristine. Atmospheric emissions from vessels can result in a deterioration in local air quality, while emissions of greenhouse gas (GHG) can cause an incremental increase in global GHG concentrations. Given the short duration of the activities, both risks are considered to have a negligible impact on air quality in the Operational Area. This impact will only persist while vessels are within the Operational Area and will be highly localised.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***

Inherent risk	1 Negligible	1 Improbable	RRI - Low
Residual risk	1 Negligible	1 Improbable	RRI - Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***
Atmospheric emissions from combustion engines and incinerators 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 10.1**	**EPS 10.1.1** Vessels will be suitably 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: • Marine Order 97 (Marine Pollution Prevention – Air Pollution), which implements Annex VI of the MARPOL Convention, including (as required by vessel class): - a valid International Air Pollution Prevention (IAPP) Certificate and / or Engine International Air Pollution Prevention (EIAPP) Certificate and / or International Energy Efficiency (IEE) Certificate - Use of low sulphur fuel (as per MARPOL requirements); - Use of incinerators in accordance with Annex VI of the MARPOL Convention.

Assessment of Additional Controls

Additional control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Elimination				
No additional controls identified				
Substitution				
Vessels use alternative fuels such as LNG	No	No	Santos is aware of the use of LNG-powered vessels in other parts of Australia. LNG fuel results in fewer potentially harmful gas and particulate emissions compared to MDO. There are currently very few LNG-powered vessels that can reasonably undertake decommissioning activities in the Asia-Pacific region, and there is currently no refuelling infrastructure at the port of Darwin to support LNG fuelled vessels. Given the lack of suitable vessel and supporting refuelling infrastructure, the use of an LNG-powered vessel to undertake production cessation activities is not	N/A

			considered practicable, particularly when considering the expected short duration of decommissioning activities under this EP.	
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 air quality from flaring, exhaust from combustion engines and incinerators are reduced to ALARP. Relevant legislative requirements and standard industry practices have been applied to control the risk. Additional controls were evaluated and rejected. The control selected for implementation is effective in reducing the impacts to air quality from exhaust from combustion engines and incinerators. Santos considers the control adopted is commensurate to the nature and scale of the impacts.				
Acceptability				
The potential impacts to air quality from flaring, combustion engine exhaust and incinerators are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 5.2.3.2**. Relevant requirements have been met, including Santos' internal processes, MARPOL, and Marine Order 97.				
EPOs				
EPO 10 Impacts from atmospheric emissions will be maintained within acceptable levels and limited to a temporary, localised decrease in air quality within the Operational Area and the Bayu-Undan field.				

6.3.11 Acoustic Emissions: Underwater Noise from Vessels and Pipeline Cutting

<table>
<tr><td>Risk</td><td colspan="2">Underwater noise associated with:
• Pipeline decommissioning vessels and helicopters, and
• Pipeline cutting.</td></tr>
<tr><td rowspan="2">Aspect-receptor Reference</td><td>Pelagic and demersal fish communities</td><td>Marine mammals</td></tr>
<tr><td>Marine reptiles</td><td>Sharks and rays</td></tr>
<tr><td colspan="3">Description of the Source of Risk</td></tr>
<tr><td colspan="3">Noise associated with decommissioning 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 noise which will be emitted from vessels during Pipeline decommissioning activities will be from dynamic positioning (DP) thrusters. Noise from DP systems is predominately generated from cavitation and typically ranges between 200 Hz and 1.2 kHz in frequency. Surveys measuring underwater noise from DP vessels holding station reported maximum source levels of approximately 182 dB re 1 µPa at 1 m (McCauley 1998). Levels emitted from vessels during Pipeline decommissioning activities are expected to be no higher than these reported levels.
Pipeline cutting may also generate underwater noise; however, this is expected to be much lower in intensity than DP thruster noise and of limited duration (e.g. several hours per cut using a diamond wire cutting tool, approximately 30 minutes per cut using the shear cutting tool) and hence has not been assessed.
Helicopters used for decommissioning vessel crew changes will also generate noise on an infrequent basis.
Note that no low frequency, high intensity underwater noise sources (e.g. sub-bottom profilers) will be used during Pipeline decommissioning activities.</td></tr>
<tr><td colspan="3">Potential Impacts</td></tr>
<tr><td colspan="3">Pelagic and Demersal Fish Communities, Marine Mammals, Marine Reptiles and Sharks and Rays
Marine fauna that may be impacted by underwater noise from decommissioning activities include marine mammals (cetaceans), reptiles, sharks/rays and other fish. Marine fauna use sound in a range of functions including 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, the animal's hearing sensitivity and audible frequency range, type and duration of sound exposure and the animal's activity at time of exposure. Broadly, the effects of sounds on marine fauna can be categorised as:
• Behavioural response – behavioural changes vary significantly and may include temporary avoidance, increased vigilance, reduction in foraging and reduced vocalisations.
• Acoustic masking – anthropogenic sounds may interfere, or mask, biological signals therefore reducing the communication and perceptual space of an individual.
• Auditory threshold shift (temporary and permanent hearing loss) – marine fauna exposed to intense sound may experience a loss of hearing sensitivity. 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.
• Non-auditory physiological effects – physiological injury or mortality.
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. Physiological impacts, including TTS and PTS, are associated mainly with the intensity level of the noise source; however, audible frequency can be taken into consideration for some marine species through using developed M-weighted sound exposure metrics (Southall et al. 2007).
Based on the potential frequency spectrum and intensity, DP thruster noise has the potential to cause behavioural impacts to fish (including sharks and rays), cetaceans and marine turtles in close proximity to the noise source. The type of behavioural impacts to marine fauna will depend on the intensity of sound. Table 5-10 summarises reported behavioural thresholds for potential physiological and behavioural impacts.</td></tr>
</table>

Table 6-9: Summary of marine fauna impact thresholds and predicted sound intensities from vessel and acoustic survey noise emissions, as derived in Southall et al. (2007), Popper et al. (2014) and (2019)

Potential Marine Fauna Receptor	Physiological Effects (Mortality and Injury)	Impairment			Behaviour
		PTS	TTS	Masking	
DP thrusters					
High frequency cetaceans	179 db re 1 μPa^2s weighted SEL	155 db re 1 μPa^2s weighted SEL	140 db re 1 μPa^2s weighted SEL	-	90-140 dB re 1 µPa rms SPL
Mid-frequency cetaceans*	198 db re 1 μPa^2s weighted SEL	185 db re 1 μPa^2s weighted SEL	170 db re 1 μPa^2s weighted SEL	-	90-170 dB re 1 µPa rms SPL
Low Frequency Cetaceans	192 db re 1 μPa^2s weighted SEL	183 db re 1 μPa^2s weighted SEL	168 db re 1 μPa^2s weighted SEL	-	120-160 dB re 1 µPa rms SPL
Marine Turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low
Fish: no swim bladder†	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder no involved in hearing†	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder involved in hearing†	(N) Low (I) Low (F) Low	170 dB rms SPL for 48 hrs	158 dB rms SPL for 12 hrs	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low

Note: a range of sound units are provided in the table above, reflecting the range of studies from which these data have been derived. The difference in units presents difficulty in reliably comparing threshold values. Where practicable, the threshold values have been compared with indicative sound sources levels of the same sound unit types to facilitate comparison. The sound units provided in the table above include:

- *Weighted sound exposure level (SEL): a weighted sound metric that emphasises the audible frequency bands for the receptor groups – low, mid- and high frequency cetaceans. SEL units are time integrated and best suited for continuous noise sources, such as vessels holding station or continuous machinery noise.*
- *Root mean square (rms) sound pressure level (SPL): root mean square of time-series pressure level, useful for quantifying continuous noise sources (as per SEL point above).*
- *Relative risk (high, medium and low) is given for fish (all types), turtles and eggs and larvae at three distances from the source defined in relative terms as near (N), intermediate (I) and far (F) (after Popper et al. 2014).*

Noise is identified as a potential threat to marine turtles in the *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia 2017), particularly high intensity, low frequency noise such as explosives and seismic survey air guns. Noise was not identified as a threat for the NT stocks, and the underwater noise that will credibly be generated during Pipeline decommissioning activities is not considered to be particularly harmful to marine turtles. On this basis, the Pipeline decommissioning activities are considered to be consistent with the objectives of the *Recovery Plan for Marine Turtles in Australia 2017-2027* (Commonwealth of Australia 2017).

Based on **Table 5-10**, vessel-related noises at the source are not expected to have the intensity and characteristics likely to cause physiological injury to most marine fauna, with the exception to some high frequency marine cetaceans. As DP thruster noise has a low frequency component, it propagates well through water and is not well absorbed, meaning marine fauna may be exposed to relatively high levels of this noise at greater distances from the source than high frequency noise. Surveys which reported maximum source levels for DP vessels holding station (182 dB re 1 µPa at 1 m), found reduced levels of 137 dB re 1 µPa at 405 m away from the source (measured in strong currents) (McCauley 1998). Given most marine fauna will only be affected behaviourally, impacts from DP thruster noise are not expected to cause more than minor and temporary changes in behaviour such as avoidance of Pipeline decommissioning vessels. The sections of the Pipeline between the Bayu-Undan Platform and approximately KP34.2 and around the tie-in point do not represent

important habitat for any noise-sensitive marine fauna, and any behavioural disturbance to marine fauna will not preclude biologically important activities such as migration or nesting.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	1 Negligible	2 Remote	RRI – Low
Residual risk	1 Negligible	2 Remote	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-1)***	***Environmental Performance Standard***
No existing controls identified. Note Santos implements EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles) to reduce the risk of a collision with marine fauna (**Section 5.4.3**). 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 risks and impacts of noise from decommissioning vessels and activities to marine fauna.			

Assessment of additional controls

Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
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. Additionally, noise sensitive fauna may be difficult to detect, which reduces the effectiveness of this control. Maintaining constant noise sources may act as a deterrent to sensitive fauna, encouraging them to move away from the noise source and hence reducing the potential for impact; ceasing noise generation may reduce or eliminate this effect. The source of risk in its inherent state is low, and the potential consequence is brief and reversible. The cost of implementing the control is considered to be grossly disproportionate to the reduction	N/A

			in risk. The control has not been adopted.	

ALARP Statement

Based on the outcomes of the risk assessment, Santos considers that the impacts and risks to marine fauna from noise from vessels, helicopters and decommissioning activities are inherently ALARP.

An additional control has been evaluated; however, it was not deemed to be practicable and was not selected for implementation. Given the nature and scale of the risk, Santos considers the risks and impacts from vessels, helicopters and decommissioning activities are inherently ALARP.

Acceptability

The potential impacts to marine fauna from noise from vessels, helicopters and decommissioning activities are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been considered, including relevant conservation advice and recovery plans that identify noise as a threat to fauna. The potential impacts to marine fauna from noise from vessels, helicopters and decommissioning activities are consistent with the objectives and requirements of the conservation advice and recovery plans.

EPOs

EPO 11

Impacts from underwater noise emissions will be maintained within acceptable levels and limited to a temporary, localised behavioural disturbance to fauna.

6.4 UNPLANNED ACTIVITIES

6.4.1 Pipeline Flooding and Cleaning: Stuck Pig Intervention

Risk	Stuck pig requiring Pipeline intervention to recover	
Aspect-receptor Reference	Water quality	Other benthic communities
	Pelagic and demersal fish communities	

Description of the Source of Risk

Pipeline chemical cleaning will be performed by a series of pigs in a train arrangement. The cleaning pig train will be pushed either from DLNG pushed in front of flooding treated seawater or from the tie-in point pushed by untreated seawater and recovered at the facilities in the Bayu-Undan field. There is the potential for the pig(s) to become stuck within the Pipeline during cleaning and flooding operations, although the likelihood of a stuck pig is considered to be very low. A stuck pig may occur within the Pipeline at the SSIV near the Bayu-Undan platform due to an increase in the internal diameter and orientation of the Pipeline.

The activities to recover a stuck pig at the SSIV would include adding more water pressure to dislodge the stuck pig and push it through, reversing pig direction for a short distance then pushing through with more water pressure, or bypassing the pig with seawater pushing the chemical slug to the Bayu-Undan Platform and then downhole. Any pig remaining stuck at the SSIV would be removed as part of the planned spool section removal. The design of the pig will allow seawater to bypass the pig should it become stuck. In the event of a stuck pig, seawater will continue to be pumped. This seawater will bypass the pig and continue to push the chemical slug to the facilities at the Bayu-Undan Field, where the slug will be injected using the PFW reinject system. Hence, Pipeline intervention to recover a stuck pig will not result in the release of the chemical slug to the marine environment.

Potential Impacts

Water Quality

Movement of sediment from around the Pipeline during stuck pig recovery will result in a temporary increase in turbidity in the vicinity of the stuck pig. These will be similar in nature to the temporary increase in turbidity during Pipeline cutting during removal (assessed in **Section 6.3**). The amounts of sediment resuspended, and the resulting impacts to water quality, from these activities is negligible.

Other Benthic Communities

Benthic habitat modelling and mapping indicates habitat adjacent to the Pipeline is predominantly bare sediment Bare sediment habitat is very widely represented in the region and is not of high environmental value. Fauna associated with bare sediment habitat are widely represented and many mobile fauna species in this habitat type, such as fish, are not site-attached.

The Pipeline itself provides benthic habitat, which was recently investigated by AIMS (McLean et al. 2020). The marine habitat survey of the Pipeline found the benthic habitat composition to be <3% of bare benthic habitat, <20% of sand habitat, and >75% coverage of biota. This includes sessile benthic organisms such as sponges and soft corals, as well as an array of filter feeders (McLean et al. 2020).

Cutting of the Pipeline to recover a stuck pig will result in the loss of any sessile organisms attached to the cut sections of the Pipeline. Given the length of Pipeline sections that will be cut, the impact from the loss of attached sessile fauna will be negligible.

Based on the points above, impacts to other benthic habitats and communities from seabed disturbance as a result of recovering a stuck pig will be negligible.

Pelagic and Demersal Fish Communities

Fish associated with the structure provided by and/or habitat growing on the Pipeline are expected to move into nearby suitable habitat, such as the remaining upstream and downstream sections of the Pipeline. Impacts to fish communities from seabed disturbance as a result of recovery of a stuck pig will be negligible.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***

Inherent risk	1 Negligible	2 Remote	RRI – Low
Residual risk	1 Negligible	2 Remote	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-2)***	***Environmental Performance Standard***
Pipeline cleaning activities designed and executed to have an inherently low risk of a stuck pig	The design of Pipeline cleaning activities, including pig characteristics, to have an inherently low risk of a stuck pig reduced the likelihood of a stuck pig intervention being required. This control is effective in reducing the need for a stuck pig intervention.	**C 12.1**	**EPS 12.1.1** Design and execution of Pipeline cleaning activities to consider measures to reduce the likelihood of a stuck pig occurring.
In the event of a stuck pig, untreated or treated seawater to be used to push cleaning chemical slug to the Bayu-Undan Field for injection into a disposal well.	The cleaning chemical slug may contain chemicals that are harmful if released into the marine environment. This control is effective in preventing the discharge of the cleaning chemical slug to the marine environment.	**C 12.2**	**EPS 12.2.1** No release of chemical slug to the marine environment in the event of a stuck pig.

Assessment of additional controls

Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
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 environment from a stuck pig intervention are reduced to ALARP.

Standard industry practices have been applied to control the risk. The controls selected for implementation are effective in reducing the risks to the environment from a stuck pig intervention. Santos considers the controls adopted are commensurate to the nature and scale of the risk. No credible additional controls were identified.

Acceptability

The potential impacts to the benthic habitats from dropped objects are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been met, including Santos' internal processes and standard maritime practices.

EPOs
EPO 12 No release of cleaning chemicals to the marine environment in the event of a stuck pig.

6.4.2 Physical Presence: Dropped Objects

Risk	Accidental dropping of objects from vessels resulting from: • Loss of control of suspended loads, and • Loss of equipment off vessel deck.
Aspect-receptor Reference	Other benthic communities

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 from vessels undertaking Pipeline decommissioning activities. Suspended loads (e.g. sections of the Pipeline) may also be accidentally dropped through operator error or mechanical failure. Given the expected short duration of vessel operations within the scope of this EP, the period of time during which an object may be dropped is short.

Dropped objects, particularly large objects, are an uncommon occurrence in Santos' operational experience. Dropped objects from lifting operations represent a significant safety risk and considerable effort is applied to prevent their occurrence.

A dropped object is not considered to be a credible event that may result in the loss of containment of hydrocarbons.

Potential Impacts

Other Benthic Communities

Given all vessel-based activities will be limited to the Operational Area from the Bayu-Undan platform to approximately KP34.2 and around the tie-in point, impacts from dropped objects within the scope of this EP cannot occur to distant receptors such as the Oceanic Shoals Marine Park, KEFs and benthic primary producer habitats.

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 habitat mapping and modelling shows that habitats within the vicinity of the tie-in point are generally bare sediments which are very widely represented throughout the region.

The consequences from disturbance from a dropped object to other benthic communities is negligible.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	1 Negligible	3 Rare	RRI – Low
Residual risk	1 Negligible	3 Rare	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-2)***	***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 13.1**	**EPS 13.1.1** Santos will confirm the vessel procedures for lifting include: • Lifting operations to be undertaken by competent personnel, • Use of appropriate and certified lifting equipment and accessories, • Preventative maintenance will be undertaken on the key lifting equipment as per manufacturer's specifications, and • 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 13.2**	**EPS 13.2.1** All dropped object incidents to be reviewed to assess the environmental risk and the potential to recover the object, and objects will be recovered where safe and practicable to do so.

Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
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 benthic habitats from dropped objects are reduced to ALARP.

Standard industry practices have been applied to control the risk. The controls selected for implementation are effective in reducing the risks to benthic habitats from dropped objects. Santos considers the controls adopted are commensurate to the nature and scale of the risk. No credible additional controls were identified.

Acceptability

The potential impacts to the benthic habitats from dropped objects are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been met, including Santos' internal processes and standard maritime practices.

EPOs

EPO 13

No loss of equipment/cargo overboard from decommissioning vessels with an environmental consequence greater than 1[9].

[9] Santos' HSEMS requires all environmental incidents to be assessed and recorded. The actual or potential environmental consequence is routinely determined during this process. This determination provides the means to demonstrate whether this EPO has not been met.

6.4.3 Physical Presence: Collision with Marine Fauna

Risk	Accidental collision between marine fauna (e.g. turtles and cetaceans) and vessels	
Aspect-receptor Reference	Marine mammals	Marine reptiles
	Sharks and rays	

Description of the Source of Risk

Vessel movements may result in collisions with marine fauna at or near the sea surface, such as marine mammals and turtles. Such collisions may result in injury to, or the death of, the fauna involved.

Vessels undertaking decommissioning activities may present a hazard to marine fauna that occur at or near the water surface. Vessel movements within the Operational Area typically do so at low speed during decommissioning activities (< 4 knots). With the exception of the pipeline removal vessel and pipe transportation vessels/barges and tugs, vessels will be stationary the majority of the time they are within the Operational Area.

Potential Impacts

Marine Mammals

The likelihood of vessel/whale collision being lethal is influenced by vessel speed; the greater the speed at impact, the greater the risk of mortality (Jensen and Silber 2004, Laist et al. 2001). Vanderlaan and Taggart (2007) found that the chance of lethal injury to a large whale as a result of a vessel strike increases from about 20% at 8.6 knots to 80% at 15 knots. Given the relatively low speed (typically < 4 knots) of vessels undertaking decommissioning activities within the Operational Area, the likelihood of a collision with a large whale resulting in injury is remote. Based on reported data contained in the US National Ocean and Atmospheric Administration database, there only two known instances of collisions when the vessel was travelling at less than 6 knots; both of these were from whale watching vessels that were deliberately placed amongst whales (Jensen and Silber 2004).

Whales are not expected to occur within the Operational Area in considerable numbers. There are no BIAs for whales within the Operational Area (although a blue whale migration BIA occurs within the EMBA). Given the low speeds of vessels undertaking decommissioning activities and the expected low numbers of whales, the probability of a collision is remote. In the event a collision did occur, whales are unlikely to be mortally injured due to the low speed of vessels.

Several BIAs have been identified for three species of inshore dolphins (Australian snubfin dolphin, Indo-Pacific humpback dolphin and spotted bottlenose dolphin (Arafura/Timor Sea Populations)) within the coastal waters surrounding Darwin Harbour. However, collisions with smaller cetaceans, such as dolphins and porpoises, are very infrequent due to the mobility of these smaller cetaceans, which allows them to avoid vessels. Collisions between vessels undertaking decommissioning activities and these dolphin species are considered improbable.

Marine Reptiles

Several species of marine turtle are known to occur in the vicinity of the Pipeline. The typical response from turtles on the surface to the presence of vessels is to dive (a potential “startle” response), which decreases the risk of collisions (Hazel et al. 2007). As with cetaceans, the risk of collisions between turtles and vessels increases with vessel speed (Hazel et al. 2007). Given the low speeds of vessels undertaking decommissioning activities and typical turtle response behaviour, collisions between vessels and turtles are considered to be improbable.

Sharks and Rays

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 EMBA, nor are there BIAs in the vicinity of the Pipeline. As such, collisions between vessels and whale sharks are considered improbable

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***

Inherent risk	2 Minor	2 Remote	RRI - Low
Residual risk	2 Minor	2 Remote	RRI - Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-2)***	***Environmental Performance Standard***
Apply operational controls, where practicable, to minimise the likelihood of interactions with cetaceans, turtles and whale sharks.	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 14.1**	**EPS 14.1.1** Vessels[10] will comply with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles), specifically: • Apply the following Caution Zones, as per the meaning of Division 8.1 of the EPBC Regulations 2000: - 300 m for whales, - 150 m for dolphins, and - 150 for turtles. • When operating a vessel or equipment within a Caution Zone: - Operate the vessel or equipment at a constant speed of < 6 knots and minimise noise, - Make sure the vessel or equipment does not drift or approach closer than: o 100 m for whales, o 50 m for dolphins, turtles or whale sharks, and - 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. • Post a lookout for cetaceans, turtles and whale sharks while within a Caution Zone. • Not approach, pursue or restrict the movement of cetaceans, turtles or whale sharks.

Assessment of additional controls

Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional; controls identified.				
Substitute				
Avoid decommissioning activities when cetaceans, turtles or whale sharks are seasonally abundant.	No	No	Unlike other parts of Australia (e.g. southern right whale calving off southern Australia, humpback whale migration off eastern and western Australia) there are no discrete seasonal peaks in	N/A

[10] 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.

			abundance of cetaceans in the vicinity of the Pipeline. Turtles are seasonally abundant around nesting beaches, typically over summer months. However, the combined nesting period for all marine turtles in the region is protracted. Seasonality of nesting / inter-nesting varies between species (**Table 5-5**), but all marine turtle species may be present in the Operational Area year-round. Following implementation of the selected existing controls, the risk reduction associated with avoiding seasonal peaks in fauna abundance 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.	
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 risks and impacts of collision with marine fauna are reduced to ALARP. Relevant legislative requirements and standard industry practices have been applied to control the risk. An additional control has been evaluated; the additional control was rejected as the reduction in risk was considered to be grossly disproportionate to the cost of implementation. The control selected for implementation is effective in reducing the risk of collision with marine fauna. Santos considers the control adopted is commensurate to the nature and scale of the potential impacts.				
Acceptability				
The risks and impacts of collisions with marine fauna are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. Relevant requirements have been met, including Australian legislation. Collisions between marine fauna and vessels is identified as a threat in conservation advice for several marine species that may occur in the Operational Area. Santos considers the selected control is effective in managing the risk to these species to a level that is acceptable. 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 collision with marine fauna.				
EPOs				
EPO 14 No collisions between vessels and marine fauna.				

6.4.4 Physical Presence: Introduction of Invasive Marine Species

Risk	Accidental introduction of invasive marine species (IMS) via: • Biofouling (e.g. on vessel hulls or submersible equipment), and • Ballast water.
Aspect-receptor Reference	Other benthic communities

Description of the Source of Risk

The establishment of IMS as a result of Pipeline decommissioning activities requires the following sequence of events:

- IMS to be present on a vector (vessel biofouling and ballast water identified as credible vectors),
- IMS to be transmitted from the vector to a new host, and
- IMS become established in the receiving environment.

Vessels moving between areas are the most common vector for the translocation of IMS. IMS may be present as biofouling on vessel hulls (e.g. adult sessile organisms) and in the ballast water (e.g. as larvae). Vessels contracted to undertake decommissioning activities may be sourced from Australia or overseas, depending on operational requirements. IMS may also be present on submersible equipment (e.g. mooring anchors). Such equipment is cleaned and dried between uses which will kill any potential IMS that may have become established. Santos' marine vessel vetting process requires vessel contractors to comply with IMO and Australian requirements to manage the risk of IMS. Hence, the likelihood of IMS being present on vessels and equipment is inherently low.

Vessel activities during decommissioning of the Pipeline will be concentrated between the Bayu-Undan Platform and approximately KP34.2, and around the tie-in point. The duration of these vessel activities is relatively short; all activities are expected to be completed within 39 weeks in total. Hence, the duration of IMS vectors in the Operational Area is relatively short compared to other activities, such as production and drilling. This relatively short duration constrains the opportunities for IMS to be introduced.

Pipe transportation vessels/barges and support vessels may also undertake multiple trips to and from the Operational Area. Pipe transportation barges may be required to undertake trips between on-shore South East Asia, and the Operational Area, which would increase the opportunities for IMS to be introduced.

IMS require suitable habitat to become established in an area. Many potential IMS are sessile benthic organisms (e.g. mussels and ascidians). The habitat between the Bayu-Undan Platform and approximately KP34.2 and around the tie-in point are bare sediment and unsuitable for settlement of many sessile organisms, although the section of the Pipeline decommissioned in situ provides hard substrate in areas where it is exposed. Many potential IMS are from coastal environment and hence may not survive in the relatively deep open water environment in the Operational Area.

Potential Impacts

Other Benthic Habitats

The benthic habitats between the Bayu-Undan Platform and approximately KP34.2, and around the tie-in point, generally consist of unconsolidated sediments. Biota in this habitat consist of infauna (e.g. polychaetes) and epibenthic biota (e.g. crinoids). The benthic communities are not considered to be particularly sensitive or unique, and which are widely represented in the region (**Figure 5-6**).

The introduction of IMS into the Operational Area may result in environmental impacts such as competition with native species and modification of existing habitats. Once established, IMS may be very difficult or impossible to eradicate. While the environment within which IMS may be introduced is not particularly sensitive, the potential for long-term impacts from an introduction of IMS result in the consequence of IMS introduction being Medium.

Risk Assessment

Introduction of IMS from Biofouling

	Consequence	***Likelihood***	***Risk rating***

Inherent risk	3 – Moderate	1 – Improbable	RRI - Low
Residual risk	3 – Moderate	1 – Improbable	RRI - Low
Introduction of IMS from Ballast Water			
Inherent risk	3 – Moderate	1 – Improbable	RRI - Low
Residual risk	3 – Moderate	1 – Improbable	RRI - Low

Controls and Demonstration of ALARP			
Existing Controls			
Control	***Effectiveness***	***Reference (Table 7-2)***	***Environmental Performance Standard***
Vessels equipped with effective anti-fouling coatings	This control is effective in reducing the potential for fouling organisms to become established on vessels. Fouling organisms are recognised as posing a biosecurity risk and is recognised by the IMO as a significant vector for the translocation of marine organisms.	**C 15.1**	**EPS 15.1.1** Vessels will have a suitable anti-fouling coating in accordance with the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (as applicable for vessel size, type and class), including: • Marine Order 98 (Marine Pollution – Anti-fouling Systems) 2013, which implements the International Convention on the Control of Harmful Anti-fouling Systems on Ships, including (as required by vessel class): - A valid International Anti-fouling System Certificate.
Vessels undertake ballast water management or treatment to achieve low-risk ballast water	This control is effective in reducing the likelihood of ballast water hosting potential IMS. Like biofouling, the IMO recognises ballast water as a significant vector for the translocation of marine species.	**C 15.2**	**EPS 15.2.1** Ballast water discharges will comply with the requirements of the Australian Ballast Water Management Requirements, which implement the requirements of the *Biosecurity Act 2015* and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for vessel class), including: • No discharge of high-risk ballast water within 12 nautical miles of coastlines, including any ports, • Maintaining a ballast water record system to record the management of all ballast water taken up and discharged, • Implementation of approved methods of ballast water management (as detailed in the Australian Ballast Water Management Requirements), • Vessel implementing with Ballast Water Management Plan, and • Vessels maintain a Ballast Water Recording System.
Apply risk-based IMS management for vessels	The translocation of IMS is best managed through the implementation of risk-based assessments which take into account the operational history of a vessel. The risk-based approach is effective in	**C 15.3**	**EPS 15.3.1** Vessels will comply with IMO Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (2011) (as appropriate to class), including: • Vessels equipped with a Biofouling Management Plan, and

	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.		• Vessels maintain a Biofouling Record Book. **EPS 15.3.2** Vessels mobilised from international waters will comply with the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Department of Agriculture, Fisheries and Forestry 2009), including: • Completion of IMS Risk Assessment, and • Implement mitigation measures commensurate with the level of risk.	
Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified.				
Substitute				
Use freshwater ballast	No	No	Substituting seawater ballast with freshwater reduces the risk of IMS being present in ballast water. The requirement for freshwater ballast may considerably constrain vessel selection, which may impose additional costs, schedule constraints and operational restrictions. Following implementation of the selected existing controls, the risk reduction associated with freshwater ballast 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
Source vessels from within Australia	No	No	Sourcing vessels from within Australia may result in a reduced likelihood of the vessel hosting IMS, as Australian ports are generally considered to be relatively low risk. Decommissioning activities may have specific vessel requirements, which may constrain the selection of vessels that can successfully undertake the required activity. Constraining vessel selection to Australian waters only may also result in increased costs and mobilisation times. Following implementation of the selected existing controls, the risk reduction associated with sourcing vessels from beyond Australian waters is considered to be negligible. The cost of implementing the control is considered to be grossly	N/A

			disproportionate to the reduction in risk. The control has not been adopted.	
Engineering				
No additional controls identified.				
Administrative				
No discharge of ballast water	No	No	Ballast water is required for the safe operation of vessels and cannot be eliminated. Vessels will not routinely discharge ballast water during decommissioning activities, and hence the risk of IMS introduction via ballast water is inherently low. While not expected to be required during decommissioning activities, operational requirements may require intake or discharge of ballast water to maintain vessel stability. Hence, the discharge of ballast water cannot be eliminated without posing an unacceptable risk to vessel safety.	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 of an introduction of invasive marine species are reduced to ALARP. Relevant legislative requirements and standard industry practices have been applied to control the risk. Additional controls have been evaluated. The controls selected for implementation are effective in reducing the risk of introduction of invasive marine species. Santos considers the controls adopted are commensurate to the nature and scale of the potential impacts.				
Acceptability				
The risks from the introduction of IMS are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. Relevant requirements have been met, including Santos' internal processes, legislation and guidelines, and international conventions. Consultation in support of the EP has identified government agencies that are relevant persons for the management of biosecurity risks and provided sufficient opportunity to provide feedback. No specific claims or objections were raised in relation to the risk of IMS introduction for activities conducted in Australian waters. Heightened risk was noted in the event of a vessel involved in activities in Timor-Leste Waters entering Australian Waters.				
EPOs				
EPO 15 No introduction of IMS to the marine environment in the Operational Area as a result of Pipeline decommissioning activities.				

6.4.5 Physical Presence: Implementation of Spill Response

Risk	Implementation of inappropriate response strategies in response to a hydrocarbon spill requiring response strategy implementation	
Aspect-receptor Reference	Marine mammals	Marine reptiles
	Birds	

Description of the Source of Risk

Hydrocarbon loss of containment during decommissioning cessation activities may warrant implementation of an emergency response. This response is detailed in the GEP Decommissioning and Preservation OPEP (DCOM-652-EN-OPE-00002). In the event of a hydrocarbon spill during Pipeline decommissioning activities, Santos will implement a spill response to maintain situational awareness and reduce the potential impacts. Credible worst-case spill scenarios identified for the decommissioning of the Pipeline comprise:

- an MDO release from vessel collision at approximately KP34.2, resulting in up to 1,125 m^2 released to the marine environment (**Section 6.4.6**),
- an MDO release from vessel collision at the tie-in point, resulting in up to 700 m^2 released to the marine environment (**Section 6.4.6**), and
- an MDO release from a bunkering incident, resulting in up to 10 m^2 released to the marine environment (**Section 6.4.7**).

Santos has undertaken a Spill Impact Mitigation Assessment (SIMA) 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, and
  - Pre-emptive capture/post-contact wildlife response.

All response options were assessed using a pre-operational SIMA. Given some response options have the potential to result in environmental damage, all secondary response options will be subject to an operational SIMA prior to implementation. Refer to the OPEP (DCOM-652-EN-OPE-00002) for additional information and **Table 8-5** for relevant EPOs, EPSs and MCs.

Potential Impacts

Monitor and Evaluate

The monitor and evaluate option for the credible spill scenarios during decommissioning of the Pipeline 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.

Wildlife Response – Hazing

Implementation of the wildlife hazing secondary response option relies on behavioural disturbance to encourage animals to avoid given 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.

Pre-emptive Capture/Post-contact Wildlife Response

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.

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***
Inherent risk	1 Negligible	1 Improbable	RRI - Low
Residual risk	1 Negligible	1 Improbable	RRI - Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-2)***	***Environmental Performance Standard***
Undertake operational SIMA 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 SIMA framework provides the Incident Management Team (IMT) implementing the OPEP with the means to undertake an assessment of the environmental benefit of the secondary response options	**C 16.1**	**EPS 16.1.1** IMT to undertake spill response (operational) SIMA to determine applicable response strategies, initiation and termination of response options in accordance with the requirements of the OPEP.

Assessment of additional controls

Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				

Substitute
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. 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 additional controls were identified.
Acceptability
The risks and impacts of implementation of spill response are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. Santos' management of the marine environment from emergency response is consistent with conservation advice and recovery plans for threatened fauna. 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 emergency response options to marine fauna.
EPOs
EPO 16 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.

6.4.6 Discharges: MDO Release from Vessel Collision

Risk	Loss of MDO containment resulting from vessel collision	
Aspect-receptor Reference	Key Ecological Features	Water quality
	Other benthic communities	Plankton
	Pelagic and demersal fish communities	Marine mammals
	Marine reptiles	Sharks and rays
	Birds	Marine protected areas
	Fishing	

Description of the Source of Risk

Vessels will be used to undertake decommissioning activities between the Bayu-Undan Platform and approximately KP34.2, and around the tie-in point. The specific vessels that will undertake the work are yet to be determined. A vessel collision with the potential to result in the release of MDO is considered credible within the Operational Area between the Bayu-Undan Platform and approximately KP34.2, and around the tie-in point. The vessel-based decommissioning activities are expected to be completed within 39 weeks in total. This duration may not be contiguous.

All vessels used to undertake activities within the scope of this EP will be fuelled using MDO. Heavier fuel types, such as intermediate fuel oil (IFO) or heavy fuel oil (HFO) will not be used.

MDO Release from Vessel Collision

A number of prerequisite conditions must exist for a vessel collision to result in the loss of fuel to the environment from a vessel undertaking decommissioning activities:

- The vessel must be involved in a collision: Collisions involving offshore support and pipelay vessels comparable to those that may undertake decommissioning activities are very uncommon. Statistics compiled by the Australian Transport Safety Bureau indicated that offshore support vessels were involved in only one collision-related incident between 2005 and 2012, and no pollution-related incidents from offshore support vessels were recorded in the same time period. The statistics from the Australian Transport Safety Bureau include Australian ships in international and Australian waters, and foreign trading ships within Australian waters.
- 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 into 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.

A range of controls, based on international and 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.

Credible Spill Scenario

Santos determined two worst-case credible spill scenarios to inform the impact assessment of an MDO release from a vessel collision. These scenarios are:

- Scenario 1 –release of 1,125 m^3 of MDO over six hours at approximately KP34.2, and
- Scenario 2 – release of 700 m^3 of MDO over a period of six hours at the tie-in point.

These release locations were considered representative as vessel-based decommissioning activities will be centred around these locations. The release characteristics of the worst-case credible spill scenarios are summarised in **Table 6-10**.

Table 6-10: Summary of characteristics of worst-case credible spill scenario from a vessel collision

Input Parameter	Scenario 1 – KP34.2	Scenario 2 – Tie-in Point
Hydrocarbon Type	MDO	MDO
Release Location (Decimal degrees)	11.2611 °S 126.8615 °E	12.0199 °S 129.9073 °E

Release Volume (m3)	1,125	700
Release Duration (hours)	6	6
Release Timing	All seasons	All seasons

Hydrocarbon Spill Modelling

Santos commissioned RPS to complete hydrocarbon spill modelling to determine the risk of exposure to the environment (RPS 2020b, 2019). The below sections summarise modelling methodology and results.

Modelled Hydrocarbon Types

The hydrocarbon type used in this assessment is limited to MDO as this is the only credible hydrocarbon that could be released from a vessel collision related to the decommissioning of the Pipeline. The MDO used in the modelling study was 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 spilled at sea and thin to low thickness levels, resulting in a high rate of evaporation. MDO has approximately 5% residual or persistent components when spilled into the marine environment. Characteristics of MDO used in the modelling studies are provided in **Table 6-11**. The wax content was 1% and the asphaltene content was negligible.

Table 6-11: Characteristics of MDO used in modelling study

Density at 25 °C (kg/3)	API	Viscosity at 25 °C (cP)	Component Boiling Point (°C) % of Total			
			Volative (%) <180	Semi-volatile (%) 180-265	Low Volatility (%) 265-380	Residual (%) >380
829	37.6	4.0	6	35	54	5

Hydrocarbon Fate and Weathering

MDO is a mixture of volatile, semi-volatile and low volatility hydrocarbons (**Table 6-11**), approximately 60% to 80% of the MDO is predicted to evaporate within 24-48 hours, depending upon the prevailing conditions (**Figure 5-2**). Once released into the environment, MDO spreads rapidly due to its low viscosity and low pour point. In open waters, this will result in rapid formation of very large, thin films which will enhance evaporation, particularly at high wind speeds.

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. Typically, approximately 20% to 30% of hydrocarbons become entrained through the action of wind and waves (**Figure 6-5**). Entrained MDO is largely concentrated in surface waters (< 10 m).

The soluble hydrocarbon fraction of MDO is very small relative to non-soluble fractions and hence, this fate does not account for a significant portion of hydrocarbons.

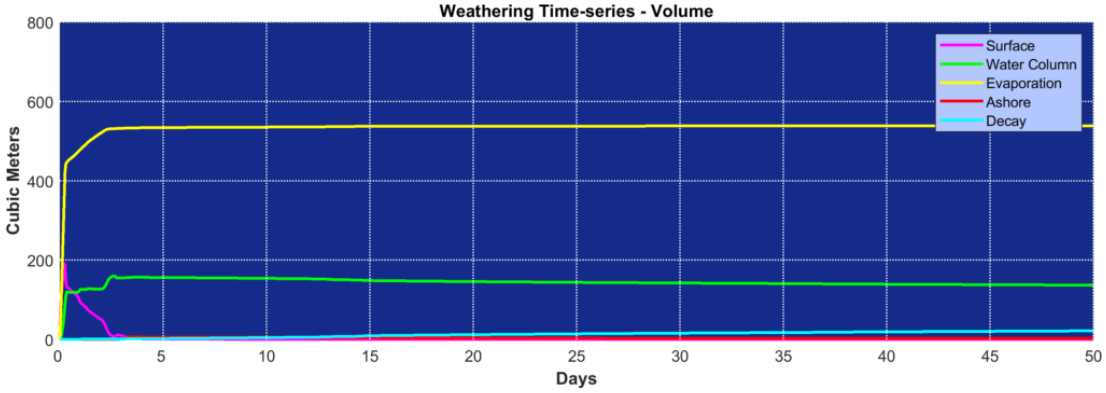


Figure 6-5: Weathering and fates graph, as a function of volume, for an instantaneous 700 m^3 surface release of MDO

Modelling Methods

The worst-case credible spill scenarios, including hydrocarbon type, volume, location and release duration, outlined in **Table 6-10** were used as the basis for the modelled releases.

The modelling studies were 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.

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. Each of the simulated spills was modelled for 50 days.

The model results at each release location were combined to provide a summary of each season and displayed as a graphical output. 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 above impact thresholds (defined below in ***Hydrocarbon Exposure Thresholds***).

Hydrocarbon Exposure Thresholds

Sea surface, sub-surface (entrained and dissolved hydrocarbon) and shoreline accumulation thresholds were defined based on the oil spill modelling bulletin published by NOPSEMA (2019). The thresholds for the surface and sub-surface hydrocarbons, and their correlation with the zones of exposure, are presented in **Table 6-12**.

Table 6-12: Sea surface and sub-surface thresholds and zones of exposure (NOPSEMA 2019)

Exposure Zone	Threshold	Justification
Floating Oil Threshold		
Low exposure	1 g/m^2	Approximates range of socio-economic effects and establishes planning area for scientific monitoring.
Moderate exposure	10 g/m^2	Approximates lower limit for harmful exposure to birds and marine mammals.
High exposure	25 g/m^2	Approximates surface oil slick and informs response planning.
Entrained Hydrocarbon Threshold*		
Low exposure	10 ppb	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers.
High exposure	100 ppb	As appropriate given oil characteristics for informing risk evaluation.
Dissolved Aromatic Hydrocarbon Threshold*		
Low exposure	10 ppb	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers.
Moderate exposure	50 ppb	Approximates potential toxic effects, particularly sublethal effects to sensitive species.
High exposure	400 ppb	Approximates toxic effects including lethal effects to sensitive species.
Shoreline Accumulation Threshold		
Low accumulation	10 g/m^2	Predicts potential for some socio-economic impact.
Moderate accumulation	100 g/m^2	Loading predicts area likely to require clean-up effort.
High accumulation	1,000 g/m^2	Loading predicts area likely to require intensive clean-up effort.

* These refer to instantaneous concentrations, where instantaneous was determined by the 1 hr. model timestep.

Modelling Results

The floating, dissolved and entrained MEZs for the annualised modelling results for the two worst case credible scenarios are shown in **Figure 6-6**.

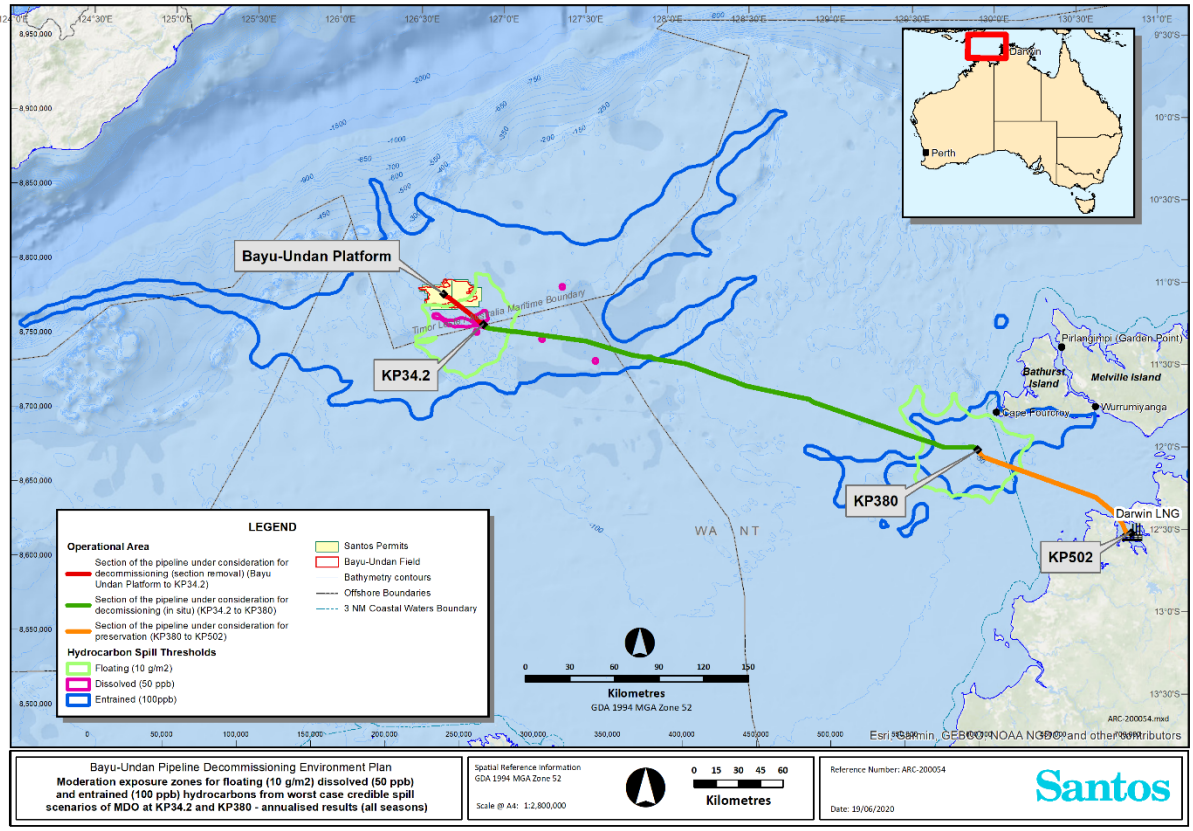


Figure 6-6: MEZs for floating (10 g/m^2), dissolved (50 ppb) and entrained (100 ppb) hydrocarbons from worst case credible spill scenarios of MDO at KP34.2 and Tie-in Point – annualised results (all seasons)

Table 6-13 and **Table 6-14** summarises the maximum distance and direction of sea surface hydrocarbon exposure at each surface threshold for low, moderate and high exposure thresholds.

Table 6-13: Summary of the maximum distance and direction of sea surface hydrocarbon exposure for Scenario 1 (KP34.2)

Season	Distance & Direction of MEZ relative to Release Location	Exposure to the Sea Surface		
		Low (1 g/m^2)	Moderate (10 g/m^2)	High (25 g/m^2)
Summer	Max. distance (km)	102	45	22
	Direction	WSW	W	WSW
Transitional	Max. distance (km)	109	46	17
	Direction	WNW	WSW	WSW
Winter	Max. distance (km)	48	25	14
	Direction	WNW	W	W

Table 6-14: Summary of the maximum distance and direction of sea surface hydrocarbon exposure for Scenario 2 (Tie-in Point)

Season	Distance & Direction of MEZ relative to Release Location	Exposure to the Sea Surface		
		Low (1 g/m^2)	Moderate (10 g/m^2)	High (25 g/m^2)
Summer	Max. distance (km)	128	24	-
	Direction	E	ENE	-
Transitional	Max. distance (km)	34	-	-
	Direction	E	-	-
Winter	Max. distance (km)	29.4	-	-
	Direction	WNW	-	-

No shoreline contact above impact thresholds was predicted to occur for Scenario 1. **Table 6-15** and **Table 6-16** summarise the predicted probability of hydrocarbon contact to shorelines and considers the time, volume and length for the three distinct seasons for Scenario 2. Modelling results indicated shoreline contact was very unlikely to occur, with only one of the 300 modelling runs resulting in shoreline contact above the moderate shoreline impact threshold (100 g/m^2). The contacted locations were on the southern coast of Bathurst Island, which are sandy beaches. The shortest time to shoreline contact was 2.9 days (allowing considerable weathering to take place) and the maximum volume ashore was 5.8 m^3.

Table 6-15: Summary of predicted hydrocarbon contact to shoreline receptors above moderate threshold (100 g/m^2)

Shoreline statistics	Summer	Transitional	Winter
Probability of contact to any shoreline (%)	1	-	-
Absolute minimum time to shore (days)	2.9	-	-
Maximum volume of hydrocarbon ashore (m^3)	5.8	-	-

Table 6-16: Predicted length of shoreline exposed by a single hydrocarbon spill trajectory (above 10 g/m^2) during summer, transitional and winter conditions for the spill modelling results for the vessel collision scenario

Shoreline statistics	Summer	Transitional	Winter
Maximum shoreline length (km) with stranded hydrocarbon concentration >10 g/m^2 accumulation threshold	8	-	-

Potential Impacts

Key Ecological Features

Three KEFs lie within the MEZ of the credible worst-case hydrocarbon spills:

- Carbonate bank and terrace system of the Sahul Shelf,
- Carbonate bank and terrace system of the Van Diemen Rise, and
- Pinnacles of the Bonaparte Basin.

Each of these KEFs is a geomorphic feature of the seabed.

While these KEFs lie within the MEZ, the ecological function of the KEF will not be impacted given hydrocarbons from a surface release of MDO will remain concentrated at the sea surface. Biological receptors associated with the KEF may be impacted; refer to the discussion below for an assessment of the potential impacts to biological receptors from a worst-case credible MDO release from a vessel collision.

Water Quality

Water quality will be reduced at the location of a spill due to hydrocarbon contamination. Modelling indicates this contamination will be temporary and highly localised in nature due to the rapid weathering of the released MDO. Impacts to water quality from hydrocarbon contamination may result in acute and chronic impacts to marine organisms; refer to the discussion below for an assessment of the potential impacts to biological receptors from worst-case credible MDO releases from vessel collisions.

Other Benthic Communities

There are several benthic communities identified by habitat modelling and mapping that occur within the MEZ, the majority of which are bare sediments (**Section 5.3.2.5**). Modelling by RPS (2020b, 2019) indicated that there are very few dissolved hydrocarbons and entrained hydrocarbons are likely to remain in surface waters (< 10 m water depth), which is shallower than the majority of the seabed in the MEZ. MDO is unlikely to persist and become deposited in sediments. As such, direct impacts to benthic habitats in much of the MEZ are not expected to occur.

An exception are the relatively shallow coastal habitats around the southern coast of Bathurst Island, where some shoreline contact was predicted by the model at very low likelihoods (i.e. 1 model run out of the 300 runs undertaken). The shoreline in this area is fine-grained sandy beach and the nearshore environment is expected to be bare sediments. No benthic primary producer habitat, such as mangroves, coral reefs or seagrasses occur off this coastline. Relatively low intensity flatback turtle nesting occurs along these beaches; refer to ***Marine Reptiles*** below for discussion.

Plankton

Plankton communities may be impacted in the event of a hydrocarbon spill, particularly dissolved and entrained fractions. Toxic effects from exposure to dissolved hydrocarbons may result in mortality of planktonic organisms, and entrained hydrocarbons may cause impacts such as blocked filter feeding organs and impacts resulting from ingestion of hydrocarbons. 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, 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 have occurred in sheltered bays and released relatively large volumes of hydrocarbons (i.e. tanker groundings). These volumes were significantly bigger than the worst-case credible spill scenario during decommissioning activities. Given the nature and scale of the two worst-case credible spill scenarios, impacts to pelagic and demersal fishes are expected to be highly localised and temporary.

Marine Mammals

Cetaceans are highly mobile and are known to occur within the MEZ. BIAs for the Australian snubfin dolphin, Indo-Pacific spotted bottlenose dolphin and Indo-Pacific humpback dolphin occur within the EMBA, within the coastal areas surrounding Darwin Harbour. Cetaceans are vulnerable to the effects of surface hydrocarbon 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. Studies and field observations suggest that cetaceans may be able to detect and avoid hydrocarbon slicks (Geraci and St Aubin 1990; Smith et al. 1983).

Potential impacts to dugongs are expected to be similar to cetaceans given their sensitivity to hydrocarbon exposure is likely to be similar. Dugongs may be present in the nearshore waters around Bathurst Island in low numbers. Any hydrocarbon spill reaching the nearshore waters is likely to have weathered and is expected to pose little risk to dugongs either through direct contact or through impacts to seagrass habitats. Given dugongs are typically occur in coastal waters, the worst-case credible spill at approximately KP34.2 is unlikely to impact upon dugongs.

Given spilled MDO is expected to disperse and weather rapidly, the potential for impacts to marine mammals will be concentrated around the release locations at KP34 2. and the tie-in point.

Marine Reptiles

Marine turtles are susceptible to the effects of hydrocarbon spills during all life stages (National Oceanic and Atmospheric Administration (NOAA) 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.

Inter-nesting BIAs and critical nesting habitat buffers for flatback and olive ridley turtles nesting in these areas overlap the MEZ (**Section 5.3.3.6**). 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. Marine turtles are more likely to be present in these BIAs and critical habitats during the nesting seasons shown in **Table 5-5**. Given the very low levels of hydrocarbons potentially stranding on shorelines, the potential for impacts to nesting turtles and egg clutches on beaches is considered to be very low.

Adult sea turtles exhibit no avoidance behaviour when they encounter hydrocarbon spills (NOAA 2010). Contact with surface slicks, or entrained hydrocarbon, can therefore, result in hydrocarbon adherence to body surfaces causing

irritation of mucous membranes in the nose, throat and eyes leading to inflammation and infection (Gagnon and Rawson 2010, NOAA 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 short. The spatial extent of the MEZs, 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 unlikely to be present in the MEZ in large numbers due to the relatively low abundance of their preferred habitat.

Birds

Seabirds and migratory shorebirds are particularly vulnerable to contact with floating hydrocarbons, which may mat feathers. 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. Such 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 (AMSA 2013, International Petroleum Industry Environmental Conservation Association 2004) and result in mortality due to oiling of feathers or the ingestion of hydrocarbons (Hassan and Javed 2011). 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 chick (AMSA 2013).

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 MEZ include Bathurst Island. Given the nature and scale of the credible hydrocarbon spill, the potential or impacts to birds is expected to be temporary (hours to days) and restricted to the area covered by sea surface hydrocarbons above impact thresholds. No impacts to wetlands supporting migratory shorebirds are expected to occur.

Marine Protected Areas

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. 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 due to the relatively small portion of the Oceanic Shoals Marine Park that overlaps the MEZ.

Fishing

A hydrocarbon spill may impact upon fish species exploited by fishers (refer to the discussion on pelagic and demersal fish communities above), potentially reducing fish numbers available for capture within the MEZ. A hydrocarbon spill may also temporarily displace traditional, commercial and recreational fishers from the MEZ. This displacement would be localised and short-term (hours to days). Additionally, spilled hydrocarbons may contaminate fishing gear, which may require cleaning.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	4	2	RRII – Medium
Residual risk	4	2	RRII – Medium

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-2)***	***Environmental Performance Standard***
Vessel 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 decommissioning vessels to detect, communicate with, and avoid other marine users	**C 3.1**	**EPS 3.1.1** Vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (as applicable for vessel size, type and class), including implementing: • Marine Order 21 (Safety of navigation and emergency procedures) 2012, which implements elements of Chapters III, V and VI of International Convention for the Safety of Life at Sea (SOLAS), including:

			- Design and maintenance of onboard safety critical equipment (e.g. navigation, bridge equipment etc.) and crew requirements as applicable to vessel class per the SOLAS convention. • Marine Order 27 (Radio Equipment) 2009, which implements Chapter IV of the SOLAS Convection, including: - Radio, vessel tracking and distress communications as applicable to vessel class per SOLAS requirements. • Marine Order 30 (Prevention of Collisions) 2009, which implements COLREGS, including: - Lights, shapes and sounds as applicable to vessel class per COLREGS requirements. • Marine Order 71 (Masters and Deck Officers) 2014, which implements the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Convention), including: - 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 decommissioning and preservation of the Pipeline	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 decommissioning and preservation of the Pipeline. This provides Santos and other users to undertake activities in such a way to minimise the potential for adverse interactions.	**C 2.1**	**EPS 2.1.1** Develop and implement consultation plan to support decommissioning and preservation of the Pipeline **EPS 2.2.1** Notify AHO prior to commencement of decommissioning and preservation activities.
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 (DCOM-652-EN-OPE-00002)) that is scalable to the needs of the spill.	**C 17.1**	**EPS 17.1.1** Implement tiered spill response in the event of an MDO spill

Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				

Substitute				
Vessels use alternative fuels such as LNG	No	N/A	Santos is aware of the use of LNG-powered vessels in parts of Australia. LNG fuel is less persistent in the environment than conventional fuels such as intermediate fuel oil and MDO. Note an unplanned release of LNG fuel poses a significantly higher safety risk than MDO due to the high potential for the formation of explosive vapour mixes. There are currently very few LNG-powered vessels that can reasonably undertake decommissioning activities in the Asia-Pacific region, and there is currently no refuelling infrastructure at the port of Darwin to support LNG fuelled vessels. Additionally, Santos vessels will use MDO, which are relatively non-persistent compared to heavier marine fuels such as IFO. Given the lack of suitable vessel and supporting refuelling infrastructure, the use of an LNG-powered vessel to undertake decommissioning activities is not considered practicable, particularly when considering the expected short duration of decommissioning activities under this EP.	N/A
Engineering				
Use double hulled vessels	No	No	The vessels that may credibly be used during decommissioning activities carry significantly smaller quantities of hydrocarbons than vessels that are typically double hulled (e.g. tankers). This is recognised in the suggested credible spill scenarios in AMSA guidance material (2013). The relatively short duration of decommissioning activities means the prerequisites for a vessel collision spill (i.e. a vessel in the field) are not present for the majority of the in-force period of the EP. The requirement for double hulled vessels may considerably constrain vessel selection, which may impose additional costs, schedule constraints and operational restrictions. Given the existing controls, the risk reduction associated with the use of double hulled vessels is considered to be grossly disproportionate to the costs of implementing this control. The control has not been adopted.	N/A

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. 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.
Acceptability
The potential impacts from an MDO release from a vessel collision are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. Relevant requirements have been met, including Santos' internal processes, COLREGS, SOLAS, STCW Convention and related Marine Orders. 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 EMBA 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. Consultation in support of the EP has identified other users that may potentially be affected and provided sufficient opportunity to provide feedback. No claims or objections were raised in relation to an MDO release from a vessel collision.
EPOs
EPO 17 No impacts to the marine environment from an MDO release as a result of a vessel collision.

6.4.7 Discharges: MDO Release from Bunkering Incident

Risk	Loss of MDO containment from a bunkering incident	
Aspect-receptor Reference	Water quality	Plankton
	Pelagic and demersal fish communities	Marine mammals
	Marine reptiles	Sharks and rays
	Birds	Fishing

Description of the Source of Risk

Bunkering of MDO at sea during decommissioning activities will not routinely occur; bunkering will typically be done while vessels are in port (and hence beyond the scope of this EP). However, operational circumstances may require that vessels undertake bunkering at sea. Bunkering of MDO is done via hose. Bunkering operations are typically undertaken during daylight hours and suitable sea states; bunkering may extend into night but are always commenced during daylight hours.

Credible Spill Scenario

A release of MDO could occur as a result of hose break or coupling failure during vessel refuelling. 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 m^3 considered to be the maximum volume that could escape from the hose (hose inventory) prior to shut down. This scenario was modelled by RPS using the methodology outlined below (RPS 2019).

Note this scenario was only modelled at the tie-in point. This was due to the proximity of this location to sensitive receptors (e.g. Bathurst Island). The spatial extent of the bunkering spill at the tie-in point is considered to be representative of the same volume spill at approximately KP34.2

Hydrocarbon Spill Modelling

As with the MDO release from a vessel collision scenario, Santos commissioned RPS to complete hydrocarbon spill modelling to determine the risk of exposure to environmental receptors from an MDO release from a bunkering incident. This modelling was undertaken in support of a different petroleum activity; however, the scenario characteristics are identical apart from the release location, which was approximately 18 km east-southeast of the tie-in point. Hence, the modelling results are considered suitable to inform the impact assessment of a bunkering incident. The below sections summarise the findings of the modelling.

Modelled Hydrocarbon Types

A description of MDO, including physical characteristics, is provided in **Section 6.4.5**.

Hydrocarbon Fate and Weathering

A description of MDO, including weathering, is provided in **Section 6.4.5**.

Modelling Methods

A description of modelling methods is provided in **Section 6.4.5**. **Table 6-17** provides a summary of the model settings and assumptions.

Table 6-17: 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
Oil Type	MDO
Spill Volume	10 m^3
Release duration	Instant
Simulation length	10 days

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 6.4.5** for information on the impact thresholds. No shoreline contact was predicted during any season for the bunkering incident scenario.

Modelling Results

The modelling results are summarised in **Table 6-18** and show:

- 0% probability of shoreline contact for any season.
- During the summer and transitional months, spill trajectories are predicted to travel to the east-south east and west – north west.
- During winter months spill trajectories are predicted to travel in a west – north west direction.
- When tracked to light exposure levels (1g/m^2), the maximum distance travelled was 21.2 km in summer and 15.2 km in winter.

Table 6-18: Maximum distances travelled by release of MDO from a bunkering incident

Season	Distance & Direction of MEZ relative to Release Location	Exposure to the Sea Surface		
		Low (1 g/m^2)	Moderate (10 g/m^2)	High (25 g/m^2)
Summer	Max. distance (km)	21.2	9.5	2.2
	Direction	E	WNW	ESE
Transitional	Max. distance (km)	16.8	8.7	3.6
	Direction	ESE	WNW	WNW
Winter	Max. distance (km)	15.2	7.5	2
	Direction	WNW	W	WNW

Potential Impacts

The potential impacts for an MDO release during a bunkering incident are similar to those described in **Section 6.4.5**, although the significantly smaller credible release volume constrains the receptors that may be impacted. Water quality in the area affected by the bunkering incident will decline due to the presence of floating, entrained and dissolved hydrocarbons. This may result in toxic effects to marine organisms such as phyto- and zooplankton. 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. 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.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	1 Negligible	2 Remote	RRI – Low
Residual risk	1 Negligible	2 Remote	RRI – Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-2)***	***Environmental Performance Standard***
Vessel equipped and crewed in accordance with MARPOL Annex I requirements	This control is effective in avoiding MDO releases from bunkering incidents. Crew qualifications and experience reduce the	**C 18.1**	**EPS 18.1.1** Vessels will be suitably 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

	likelihood of an incident occurring.		for vessel size, type and class), including implementing: • Marine Order 91 (Marine Pollution Prevention – Oil), which implements Annex I of the MARPOL Convention, including (as required by vessel class): - A deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. - Waste oil storage available. - Valid International Oil Pollution Prevention (IOPP) Certificate.
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 18.2**	**EPS 18.2.1** Santos will confirm vessel bunkering procedures include: • Defined roles and responsibilities – bunkering to be undertaken by trained staff. • Pre-bunker safety meeting to ensure all personnel involved are fully briefed and understand their roles and responsibilities. • Visual inspection of hose prior to bunkering to confirm they are in good condition. • Testing emergency shutdown mechanism on the transfer pumps. • Established communication protocols between vessel master and personnel responsible for monitoring tank levels, leaks and overflows during bunkering operations. • Continual visual monitoring during diesel transfers of hoses, connections and tank levels to detect leaks and prevent overflows during bunkering operations. • Assessment of weather/sea state.
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) that scales to the needs of the spill.	**C 17.1**	**EPS 17.1.1** Implement tiered spill response in the event of an MDO spill

Assessment of additional controls

Identifies the additional management controls that were considered, indicates whether they will be implemented or no, 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***
Eliminate				
No bunkering of fuel during the petroleum activity	No	No	Vessels will routinely bunker when in port, as this is the safest and most cost-effective means to refuel vessels. Under normal	N/A

			circumstances, no bunkering at sea is expected while undertaking the petroleum activity. However, there may be times when returning to port is not practicable and bunkering at sea will be required. Following implementation of the selected existing controls, the risk reduction associated with eliminating bunkering at sea is considered to be negligible. The cost of implementing the control is considered to be grossly disproportionate o the reduction in risk. The control has not been adopted.	
Substitute				
No additional controls identified.				
Engineering				
No additional controls identified.				
Administrative				
No bunkering during night hours during the petroleum activity	Yes	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). Santos commits to only commencing bunkering operations during daylight hours (although bunkering may continue beyond daylight hours). Operational experience indicates the commencement of bunkering is the most likely time for leaks to be occur (e.g. due to misaligned connections). 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 bunkering incident are reduced to ALARP. 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 an MDO release from a bunkering incident. Santos considers the controls adopted are commensurate to the nature and scale of the risks.
Acceptability
The risk of an MDO release from a bunkering incident is considered to be broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. Relevant requirements have been met, including Santos' internal processes, MARPOL, and related Marine Orders. Reasonable steps have been taken to avoid bunkering at sea where practicable (e.g. preference bunkering in port).
EPOs
EPO 18 No impacts to the marine environment from MDO releases during bunkering.

6.4.8 Discharges: Incidental Spills of Hydrocarbons and Chemicals

Risk	Chemical or hydrocarbon release from incidental spill (e.g. minor deck spill)
Aspect-receptor Reference	Water quality

Description of the Source of Risk

Vessels undertaking decommissioning activities will routinely have a range of chemicals and hydrocarbons onboard, including:

- Fuel for portable / deck equipment,
- Hydraulic fluid, and
- Miscellaneous chemicals (e.g. cleaning fluids).

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.

Hydraulic fluid is used in a range of equipment, such as A-frames, 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.

If cleaning of the Pipeline is undertaken from the tie-in point, chemicals will be pumped into the Pipeline via a downline from a vessel. Rupture of this downline will result in the loss of the chemical inventory of the downline to the environment (< 5 m^3). The chemical slug and pig will be pushed using untreated seawater pumped from a vessel at the tie-in point if cleaning from the tie-in point is selected.

Small quantities of liquids such as paint and lubricants may be used on Pipeline decommissioning vessels, which may be accidentally lost to the environment if spilled. Operational experience indicates typical volumes of such spills are < 10 L.

If cleaning of the Pipeline is undertaken from the tie-in point, a slug comprised of cleaning chemicals will be pushed from the tie-in point and recovered at the Bayu-Undan Platform. There are no planned discharges of cleaning chemicals and an unplanned discharge of the cleaning chemical slug to the marine environment is not considered credible.

Risks associated with onshore activities (e.g. chemical spills associated with Pipeline flooding and cleaning from the DLNG Plant) will be managed by the DLNG Environmental Management Plan and do not form part of the scope of this EP.

Potential Impacts

Water Quality

Accidental spills of hydrocarbons or chemicals from vessels undertaking decommissioning activities will decrease the water quality in the immediate area of the spill. Given the nature and 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.

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***
Inherent risk	2	2	RRI - Low
Residual risk	2	2	RRI - Low

Controls and Demonstration of ALARP			
Existing Controls			
Control	***Effectiveness***	***Reference (Table 7-2)***	***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 19.1**	**EPS 19.1.1** Selection of vessel contractor is subject to Santos local and global marine vessel vetting processes, specifically: • Appropriate procedures for storage (e.g. bunding), labelling (including Safety Data Sheet (SDS) available) and handling of chemicals and hydrocarbons. • Completion of vessel inspection and report. 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).
			EPS 19.1.2 Vessels will be suitably 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: • Marine Order 91 (Marine Pollution Prevention – Oil), which implements Annex I of the MARPOL Convention, including (as required by vessel class): - Vessel-specific SOPEP. - A deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. - Waste oil storage available. - Valid IOPP Certificate. Oil record book maintained.
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 19.2**	**EPS 19.2.1** Selection of vessel contractor is subject to Santos local and global marine vessel vetting processes, specifically: Spill kits stocked and ready for use by trained personnel.
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 19.3**	**EPS 19.3.1** Procedures for ROV operations meet requirements of IMCA guidelines or alternative equivalent guidelines for ROV operations including use of appropriate equipment, ROV operations undertaken by competent personnel, preventative maintenance and inspection of equipment.
Implement chemical selection	This control is effective in reducing the consequence of chemical discharges, as	**C 8.1**	**EPS 8.1.1**

procedure for all chemicals	the chemical selection procedure includes consideration of the environmental risks. The chemical selection process requires less environmentally harmful alternatives be used as substitutes for more harmful chemicals where practicable.		All chemicals will be assessed through the chemical selection procedure.
Leak, prevention detection and shutdown measures implemented during downline chemical transfers	Leak prevention measures (e.g. pressure rating of downlines) reduced the likelihood of a rupture occurring. Leak detection (e.g. downline pressure monitoring) can alert operators in the event of a loss of containment from a downline. Operators can then cease the chemical transfer, reducing the volume of chemicals spilled to the environment	**C 19.4**	**EPS 19.4.1** Procedures for downline chemical transfers to include: • Downlines suitably rated for operating pressures, • Leak detection measures (e.g. pressure monitoring), and • Emergency stop procedure in the event of a loss of containment.

Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
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 the risks from incidental spills of fluids, chemicals and lubricants to the environment are reduced to ALARP.

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.

Acceptability

The risk from incidental spills of fluids, chemicals and lubricants to the environment are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**.

Relevant requirements have been met, including Santos' internal processes, MARPOL, industry guidelines and Marine Orders. 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 EMBA. Santos considers the selected controls are effective in managing the risk to these species to a level that is acceptable.

Consultation in support of the EP has identified other users that may potentially be affected and provided sufficient opportunity to provide feedback. No claims or objections were raised in relation to the risk of incidental spills of fluids, chemicals and lubricants.

EPOs
EPO 19 No incidental spills of hydrocarbons or chemicals to the marine environment with an environmental consequence greater than 1[11].

[11] Santos' HSEMS requires all environmental incidents to be assessed and recorded. The actual or potential environmental consequence is routinely determined during this process. This determination provides the means to demonstrate whether this EPO has not been met.

6.4.9 Discharges: Loss of Wastes Overboard

Risk	Loss of waste material overboard	
Aspect-receptor Reference	Marine mammals	Marine reptiles
	Sharks and rays	Birds

Description of the Source of Risk

Vessels undertaking decommissioning 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 sections of the Pipeline, recovered subsea equipment, 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 Pipeline decommissioning 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 impacts to fauna from entanglement and / or ingestion. This has been recognised as a threat for many marine species, as outlined in the *Threat Abatement Plan for the Impacts of Marine Debris on Vertebrate Marine Life* (DEWHA 2009b).

Impacts to fauna may result in injury or mortality through entanglement and / or ingestion, however this would reasonably be expected to impact upon a small number of animals; no population-scale impacts would credibly occur.

Risk Assessment

	Consequence	***Likelihood***	***Risk rating***
Inherent risk	1 Negligible	2 Remote	RRI - Low
Residual risk	1 Negligible	2 Remote	RRI - Low

Controls and Demonstration of ALARP

Existing Controls

Control	***Effectiveness***	***Reference (Table 7-2)***	***Environmental Performance Standard***
All wastes managed in accordance with vessel waste management plan meeting MARPOL Annex II, III & V requirements	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 20.1**	**EPS 20.1.1** Vessels will be suitably 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: • Marine Order 93 (Marine Pollution Prevention – Noxious Liquid Substances), which implements Annex II of the MARPOL Convention, including (as required by vessel class): - International Pollution Prevention (IPP) Certificate.

			• Marine Order 94 (Marine Pollution Prevention – Packaged Harmful Substances), which implements Annex III of the MARPOL Convention, including (as required by vessel class): - No disposal of harmful substances (identified as marine pollutants in the IMDG Code) overboard. - Packaged harmful substances to be properly packed, marked, labelled, stowed and secured. - Any loss or discharge to sea of harmful materials will be reported to the AMSA rescue coordination centre (RCC) via a marine pollution report (POLREP). • Marine Order 95 (Marine Pollution Prevention – Garbage), which implements Annex V of the MARPOL Convention, including: - Garbage management plan in place. - Types of wastes that will be generated onboard and will require containment, transport and disposal at a licensed facility onshore. - Procedures for handling, storage segregation and disposal of wastes. - Maintenance of Garbage Record Book, recording the types and volumes of waste incinerated or disposed onshore. - Garbage record book maintained onboard.

Assessment of additional controls				
Additional Control	***Practicable?***	***Will it be applied?***	***Justification***	***Environmental Performance Standard***
Eliminate				
No additional controls identified				
Substitute				
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 the control throughout the activity, Santos considers the risks from loss of wastes overboard are reduced to ALARP.

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.

Acceptability
The risks and impacts from loss of wastes overboard are broadly acceptable based on the residual risk ranking and considerations outlined in **Section 6.2.3.2**. Relevant requirements have been met, including Santos' internal processes, legislation and guidelines, and international conventions. 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 EMBA. Santos considers the selected controls are effective in managing the risk to these species to a level that is acceptable.
EPOs
EPO 20 No loss of wastes overboard with a consequence greater than 1 [12].

[12] Santos' HSEMS requires all environmental incidents to be assessed and recorded. The actual or potential environmental consequence is routinely determined during this process. This determination provides the means to demonstrate whether this EPO has not been met.

7 ENVIRONMENTAL PERFORMANCE OUTCOMES, STANDARDS AND MEASUREMENT CRITERIA

Specific EPO(s), EPSs and MC have been developed for each environmental aspect and the associated impacts and risks assessed in **Section 6**. 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.

Table 7-1 and **Table 7-2** list the EPOs, EPSs, and MC that have been developed as part of a systematic approach to the management of the environmental risks (**Section 6**) 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 6**) 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.

EPOs, EPSs and MCs applicable to oil pollution response are detailed separately in **Table 8-5**.

Table 7-1: Routine / non-routine planned activity EPOs, controls, EPSs and MCs

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
Aspect						
Disturbance to seabed from: • Pipeline cutting, including local seabed excavation at Pipeline cut locations, Pipeline coating removal, cutting and cut section removal, end cap or upstream skid/PLR installations, and • Removal of the Pipeline and spools between the Bayu-Undan Platform and approximately KP34.2 by reverse S-lay or cut and lift methods, including removal of upstream skid/PLR installations.	**EPO 1** No impacts to environmental receptors beyond the Operational Area in Timor-Leste waters (between the Bayu-Undan Platform and approximately KP34.2) or Australian Commonwealth waters (around the tie-in point) from seabed disturbance due to Pipeline cutting, Pipeline removal or equipment installation/removal activities.	No controls applied – impacts are inherently acceptable and ALARP	N/A	N/A	N/A	N/A
Physical presence of the preserved Pipeline and upstream skid/PLR on the seabed	**EPO 2** No adverse interactions[13] between other marine users and the decommissioned or preserved Pipeline or ancillary Pipeline infrastructure.	**C 2.1** Undertake consultation with relevant persons (including applicable notifications) to support decommissioning and preservation of the Pipeline	**EPS 2.1.1** Develop and implement consultation plan to support decommissioning and preservation of the Pipeline.	**MC 2.1.1.1** Consultation records demonstrate implementation of consultation plan, including any claims or objections raised during production cessation of the Pipeline (**Section 8.10**).	External Relations Advisor	External Relations Lead
		C 2.2 Notify the Australian Hydrographic Office (AHO) prior to commencing activities	**EPS 2.2.1** Notify AHO prior to commencement of decommissioning and preservation activities.	**MC 2.2.1.1** Consultation records demonstrate AHO provided sufficient information to generate Temporary Notice to Mariners prior to commencing production cessation activities.	External Relations Advisor	External Relations Lead
		C 2.3 The end of the Pipeline upstream of the tie-in point will have trawl protection installed following installation of the cap or removal of the upstream skid / PLR	**EPS 2.3.1** Installation of snag protection on the upstream cut end of the Pipeline at the tie-in point.	**MC 2.3.1.1** Project documentation confirms installation of trawl protection prior to final decommissioning.	Decommissioning Subsea Engineer	Decommissioning Project Manager
Physical presence of vessels undertaking Pipeline decommissioning and preservation activities	**EPO 3** No adverse interactions[13] between other marine users and vessels undertaking the petroleum activities within the scope of this EP.	**C 3.1** Vessel equipped and crewed in accordance with Australian maritime requirements	**EPS 3.1.1** Vessels will be equipped and crewed in accordance with the *Navigation Act 2012* (as applicable for vessel size, type and class), including implementing: • Marine Order 21 (Safety of navigation and emergency procedures) 2012, which implements elements of Chapters III, V and VI of International Convention for the Safety of Life at Sea (SOLAS), including: - Design and maintenance of onboard safety critical equipment (e.g. navigation, bridge equipment etc.) and crew requirements as applicable to vessel class per the SOLAS convention.	**MC 3.1.1.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance with SOLAS, COLREGS and STCW Convention and applicable Marine Orders.	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director

[13] Whether an interaction constitutes an adverse interaction is determined on a case by case basis. Examples of adverse interactions may include substantiated complaints by other marine users to Santos or NOPSEMA. Interactions where other users have not taken reasonable measures to avoid the interaction (e.g. third-party vessel failing to observe nautical charts) are not considered to be adverse for the purpose of this EP.

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
			• Marine Order 27 (Radio Equipment) 2009, which implements Chapter IV of the SOLAS Convection, including: - Radio, vessel tracking and distress communications as applicable to vessel class per SOLAS requirements. • Marine Order 30 (Prevention of Collisions) 2009, which implements COLREGS, including: - Lights, shapes and sounds as applicable to vessel class per COLREGS requirements. • Marine Order 71 (Masters and Deck Officers) 2014, which implements the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW Convention), including: - All master, mate and watchkeeper officer duties undertaken by crew certified as applicable to vessel class per STCW requirements.			
		C 2.1 See above	**EPS 2.1.1** See above	**MC 2.1.1.1** See above	See above	See above
			EPS 2.2.1 See above	**MC 2.2.1.1** See above	See above	See above
Decomposition of Pipeline structural components and potential release of any residual contaminants contained within the Pipeline over the degradation timeline	**EPO 4** Impacts from long term degradation of the section of the Pipeline decommissioned in situ are acceptable.	**C 4.1** Cleaning of the Pipeline prior to in situ decommissioning	**EPS 4.1.1** Clean pipeline to an ALARP level where benefits outweigh the costs associated with additional cleaning.	**MC 4.1.1.1** Project documentation confirms completion of cleaning chemical trials to test effectiveness of the selected cleaning chemical product, and design of the pipeline cleaning program to optimize cleaning efficiency relative to chemical volumes and contact times.	Decommissioning Subsea Engineer	Decommissioning Project Manager
		C 4.2 Reduce the time between cutting the pipeline and installation of end caps at the tie-in point.	**EPS 4.2.1** The time period between pipeline cutting and end caps installation at the tie-in point must be within 7 days.	**MC 4.2.1.1** Records demonstrate that the period between pipeline cutting and end caps installation is within 7 days.	Decommissioning Subsea Engineer	Decommissioning Project Manager
		C 4.3 Santos meets the requirements of the *Environment Protection (Sea Dumping) Act 1981*	**EPS 4.3.1** Santos will continue to engage with DAWE regarding its obligations under the *Environment Protection (Sea Dumping) Act 1981.*	**MC 4.3.1.1** Records demonstrate compliance with requirements under the *Environment Protection (Sea Dumping) Act 1981* were undertaken.	Decommissioning Subsea Engineer	Decommissioning Project Manager
Generation of waste materials, including: • Recovered Pipeline from Bayu-Undan Platform to approximately KP34.2, • Recovered sections of the Pipeline at the tie-in point and equipment (spools, upstream skid / PLR), and • Vessel waste.	**EPO 5** Disposal of hazardous and non-hazardous waste materials at licenced waste disposal facilities.	**C 5.1** All recovered sections of the Pipeline and equipment (spools, upstream skid / PLR) will be disposed of at an appropriate waste management facility in accordance with the decommissioning waste management strategy.	**EPS 5.1.1** All recovered sections of the Pipeline and equipment will be managed according to relevant waste management legislation and regulations and standard industry practices.	**MC 5.1.1.1** Records demonstrate waste classification undertaken.	Decommissioning Delivery Manager	Decommissioning Project Manager
		C 5.2 All vessel wastes managed in accordance with vessel waste management plan meeting	**EPS 5.2.1** Vessels will be suitably equipped and crewed in accordance with the *Navigation Act 2012* and the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* (as	**MC 5.2.1.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance with MARPOL and Marine Orders 93, 94 and 95	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
		MARPOL Annex II, III & V requirements	applicable for vessel size, type and class), including implementing: • Marine Order 93 (Marine Pollution Prevention – Noxious Liquid Substances), which implements Annex II of the MARPOL Convention, including (as required by vessel class): - International Pollution Prevention (IPP) Certificate. • Marine Order 94 (Marine Pollution Prevention – Packaged Harmful Substances), which implements Annex III of the MARPOL Convention, including (as required by vessel class): - No disposal of harmful substances (identified as marine pollutants in the IMDG Code) overboard - Packaged harmful substances to be properly packed, marked, labelled, stowed and secured - Any loss or discharge to sea of harmful materials will be reported to the AMSA rescue coordination centre (RCC) via a marine pollution report (POLREP). • Marine Order 95 (Marine Pollution Prevention – Garbage), which implements Annex V of the MARPOL Convention, including: - Garbage management plan in place - Types of wastes that will be generated onboard and will require containment, transport and disposal at a licensed facility onshore - Procedures for handling, storage segregation and disposal of wastes - Maintenance of Garbage Record Book, recording the types and volumes of waste incinerated or disposed onshore - Garbage record book maintained onboard.			
Light emissions from vessels	**EPO 6** Behavioural disturbance impacts from artificial light emissions will be temporary and localised.	No controls applied – impacts are inherently acceptable and ALARP	N/A	N/A	N/A	N/A
Routine discharge of sewage, grey water, putrescible waste, deck drainage, and bilge water from vessels	**EPO 7** Environmental impacts from vessel utility discharges will be within acceptable levels by maintaining discharge streams in accordance with standard maritime practices.	**C 7.1** Routine discharges of treated sewage, grey-water, putrescible waste, deck drainage, and bilge water in accordance with standard maritime practice	**EPS 7.1.1** 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: • Marine Order 91 (Marine Pollution Prevention – Oil), which implements Annex I of the MARPOL Convention, including (as required by vessel class): - 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. - A deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. - Waste oil storage available. - Valid International Oil Pollution Prevention (IOPP) Certificate.	**MC 7.1.1.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance with MARPOL and Marine Orders 91, 95 and 96	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
			• Marine Order 95 (Marine Pollution Prevention – Garbage), which implements Annex V of the MARPOL Convention, including: - 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. - Garbage management plan in place. - Garbage record book maintained onboard. • Marine Order 96 (Marine Pollution Prevention – Sewage), which implements Annex IV of the MARPOL Convention, including (as required by vessel class): - A valid International Sewage Pollution Prevention (ISPP) Certificate. - An ASMA approved sewage treatment plant. - A sewage comminuting and disinfecting system. - A sewage holding tank sized appropriately to contain all generated waste (black and grey water). - Discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nm from the nearest land. - Discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land. - Discharge of sewage will occur at a moderate rate while support vessel is proceeding (> 4 knots).			
Disposal of flushing fluids during Pipeline cleaning	**EPO 8** All cleaning fluids and associated contaminants from within the Pipeline will be disposed via a disposal well into a geological formation at the Bayu-Undan field.	**C 8.1** Implement chemical selection procedure for all chemicals	**EPS 8.1.1** All chemicals will be assessed through the chemical selection procedure.	**MC 8.1.1.1** Records demonstrate that all cleaning chemicals were subject to chemical assessment process	Decommissioning Subsea Engineer	Decommissioning Project Manager
		C 8.2 Injection of chemical slug and untreated / treated seawater from within the Pipeline via a disposal well.	**EPS 8.2.1** The entire cleaning chemical slug will be injected via a disposal well at the Bayu-Undan Field facility, for which authorisation will be obtained from the Timor-Leste offshore waters regulator.	**MC 8.2.1.1** Records demonstrate that cleaning and verification slugs are injected into a geological formation via a disposal well.	Decommissioning Delivery Manager	Decommissioning Project Manager
		C 8.3 Contingency wells to be used if PFW re-injection wells are not able to inject chemical slug.	**EPS 8.3.1** If the re-injection well becomes unavailable for use, injection of the chemical slug and untreated / treated seawater from within the Pipeline to be done using a contingency well.	**MC 8.2.1.1** Records demonstrate that contingency disposal wells used if re-injection wells are unavailable.	Decommissioning Delivery Manager	Decommissioning Project Manager
Discharge of treated seawater from the removal of Pipeline sections that have been flushed with treated seawater.	**EPO 9** Impacts to water and sediment quality will be temporary and will recover completely within in a short time (several days) after cessation of the treated seawater discharge. Mortality of benthic biota from the treated seawater discharge will be limited to within 1 km of the release location.	**C 9.1** Implement chemical selection procedure for all chemicals planned to be released to the marine environment in treated seawater.	**EPS 9.1.1** All chemicals in treated seawater planned to be release to the marine environment will be assessed through the chemical selection procedure.	**MC 9.1.1.1** Records demonstrate that all chemical products used to treat seawater have been subject to chemical assessment process.	Decommissioning Subsea Engineer	Decommissioning Delivery Manager
		C 9.2 Monitor dosing of seawater treatment to prevent over-dosing.	**EPS 9.2.1** Dosing of chemicals to treat seawater will not exceed guidelines for use by manufacturers to achieve intended technical requirements.	**MC 9.2.1.1** Records demonstrate dosing of chemicals used for seawater treatment do not exceed planned target dosing concentration.	Decommissioning Subsea Engineer	Decommissioning Project Manager
		C 9.3 Reduce the time between cutting the pipeline and installation of end caps at the tie-in point.	**EPS 9.3.1** The time period between pipeline cutting and end caps installation at the tie-in point must be within 7 days.	**MC 9.3.1.1** Records demonstrate that the period between pipeline cutting and end caps installation is within 7 days.	Decommissioning Subsea Engineer	Decommissioning Project Manager

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
		C 9.4 Reduce treated water chemical dosing for the decommissioned pipeline section	**EPS 9.4.1** Chemical dosing for the pipeline section to be decommissioned will be minimized to the level technically necessary to protect the preserved pipeline section during flooding.	**MC 9.4.1.1** Records demonstrate chemical dosing for the decommissioned pipeline section have been minimized to the level technically necessary to protect the preserved pipeline section during flooding.	Decommissioning Subsea Engineer	Decommissioning Project Manager
		C 9.5 Defer pipeline removal activity to reduce treated water toxicity through chemical degradation	**EPS 9.5.1** Maintain scheduled pipeline removal activities in Timor Leste offshore waters occurring several years after flooding.	**MC 9.5.1.1** Project schedule maintains separation between pipeline flooding and pipeline removal in Timor Leste offshore waters.	Decommissioning Delivery Manager	Decommissioning Project Manager
Atmospheric emissions from: • vessel combustion engines and incinerators • flaring of pipeline gas at Bayu-Undan platform	**EPO 10** Impacts from atmospheric emissions will be maintained within acceptable levels and limited to a temporary, localised decrease in air quality within the Operational Area and the Bayu-Undan field.	**C 10.1** Atmospheric emissions from combustion engines and incinerators in accordance with standard maritime practice	**EPS 10.1.1** Vessels will be suitably 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: • Marine Order 97 (Marine Pollution Prevention – Air Pollution), which implements Annex VI of the MARPOL Convention, including (as required by vessel class): - a valid International Air Pollution Prevention (IAPP) Certificate and / or Engine International Air Pollution Prevention (EIAPP) Certificate and / or International Energy Efficiency (IEE) Certificate. - Use of low sulphur fuel (as per MARPOL requirements). - Use of incinerators in accordance with Annex VI of the MARPOL Convention.	**MC 10.1.1.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance MARPOL73/78 Annex VI and applicable Marine Orders	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director
Underwater noise associated with: • Pipeline decommissioning vessels • Pipeline cutting	**EPO 11** Impacts from underwater noise emissions will be maintained within acceptable levels and limited to a temporary, localised behavioural disturbance to fauna.	No controls applied – impacts are inherently acceptable and ALARP	N/A	N/A	N/A	N/A

Table 7-2: Unplanned activity EPOs, controls, EPSs and MCs

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
Aspect						
Stuck pig requiring Pipeline intervention to recover	**EPO 12** No release of cleaning chemicals to the marine environment in the event of a stuck pig.	**C 12.1** Pipeline cleaning activities designed and executed to have an inherently low risk of a stuck pig	**EPS 12.1.1** Design and execution of Pipeline cleaning activities to consider measures to reduce the likelihood of a stuck pig occurring.	**MC 12.1.1.1** Records demonstrate that stuck pig risks considered during planning and execution of Pipeline cleaning.	Decommissioning Subsea Engineer	Decommissioning Project Manager
		C 12.2 In the event of a stuck pig, untreated or treated seawater to be used to push cleaning chemical slug to the Bayu-Undan Field for injection into a disposal well.	**EPS 12.2.1** No release of chemical slug to the marine environment in the event of a stuck pig.	**MC 12.2.1.1** Records demonstrate that no cleaning chemicals are released to the environment as a result of stuck pig recovery.	Decommissioning Subsea Engineer	Decommissioning Project Manager
Accidental dropping of objects from vessels resulting from: • Loss of control of suspended loads, and • Loss of equipment off vessel deck.	**EPO 13** No loss of equipment/cargo overboard from decommissioning vessels with an environmental consequence greater than 1[14].	**C 13.1** Implement standards and procedures for lifting equipment	**EPS 13.1.1** Santos will confirm the vessel procedures for lifting include: • Lifting operations to be undertaken by competent personnel, • Use of appropriate and certified lifting equipment and accessories, • Preventative maintenance will be undertaken on the key lifting equipment as per manufacturer's specifications, and • Consideration of weather conditions (e.g. no heavy lifts undertaken in severe weather conditions.	**MC 13.1.1.1** Records demonstrate inspection and certification of lifting equipment and accessories	Vessel Master	Vessel Owner
		C 13.2 Dropped objects recovered where safe and practicable to do so	**EPS 13.2.1** All dropped object incidents to be reviewed 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 13.2.1.1** Incident documentation details considerations and outcomes of recovery of dropped objects.	Vessel Master	Vessel Owner
Accidental collision between marine fauna (e.g. turtles and cetaceans) and vessels	**EPO 14** No collisions between vessels and marine fauna.	**C 14.1** Apply operational controls, where practicable, to minimise the likelihood of interactions with cetaceans, turtles and whale sharks.	**EPS 14.1.1** Vessels[15] will comply with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans (and applied for marine turtles), specifically: • Apply the following Caution Zones, as per the meaning of Division 8.1 of the EPBC Regulations 2000: - 300 m for whales, - 150 m for dolphins, and - 150 for turtles. • When operating a vessel or equipment within a Caution Zone: - Operate the vessel or equipment at a constant speed of < 6 knots and minimise noise. - Make sure the vessel or equipment does not drift or approach closer than: o 100 m for whales, and o 50 m for dolphins, turtles or whale sharks. - 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.	**MC 14.1.1.1** Records demonstrate implementation of Part 8 Division 8.1 of the EPBC Regulations 2000 during decommissioning and preservation activities.	Vessel Master	Client Service Representative
				MC 14.1.1.2 Records demonstrate no breaches of EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.	Vessel Master	Client Service Representative
				MC 14.1.1.3 Collisions with marine fauna documented in daily reports as required. Where a collision with fauna that are MNES results in injury or death, Santos will notify the DAWE.	Santos HSE Representative or delegate	Client Service Representative

[14] Santos' HSEMS requires all environmental incidents to be assessed and recorded. The actual or potential environmental consequence is routinely determined during this process. This determination provides the means to demonstrate whether this EPO has not been met.
[15] 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.

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
			• Post a lookout for cetaceans, turtles and whale sharks while within a Caution Zone. • Not approach, pursue or restrict the movement of cetaceans, turtles or whale sharks.			
Accidental introduction of invasive marine species (IMS) via: • Biofouling (e.g. on vessel hulls or submersible equipment), and • Ballast water.	**EPO 15** No introduction of IMS to the marine environment in the Operational Area as a result of Pipeline decommissioning activities.	**C 15.1** Vessels equipped with effective anti-fouling coatings	**EPS 15.1.1** Vessels will have a suitable anti-fouling coating in accordance with the *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (as applicable for vessel size, type and class), including: • Marine Order 98 (Marine Pollution – Anti-fouling Systems) 2013, which implements the International Convention on the Control of Harmful Anti-fouling Systems on Ships, including (as required by vessel class): - A valid International Anti-fouling System Certificate.	**MC 15.1.1.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance with Marine Order 98	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director
		C 15.2 Vessels undertake ballast water management or treatment to achieve low-risk ballast water	**EPS 15.2.1** Ballast water discharges will comply with the requirements of the Australian Ballast Water Management Requirements, which implement the requirements of the *Biosecurity Act 2015* and the International Convention for the Control and Management of Ships' Ballast Water and Sediments (as appropriate for vessel class), including: • No discharge of high-risk ballast water within 12 nautical miles of coastlines, including any ports, • Maintaining a ballast water record system to record the management of all ballast water taken up and discharged, • Implementation of approved methods of ballast water management (as detailed in the Australian Ballast Water Management Requirements), • Vessel implementing with Ballast Water Management Plan, and • Vessels maintain a Ballast Water Recording System.	**MC 15.2.1.1** Records demonstrate compliance with 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 and *Biosecurity Act 2015*	Vessel Master	Vessel Owner
		C 15.3 Apply risk based IMS management for vessels	**EPS 15.3.1** Vessels will comply with IMO Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (2011) (as appropriate to class), including: • Vessels equipped with a Biofouling Management Plan, and • Vessels maintain a Biofouling Record Book.	**MC 15.3.1.1** Records demonstrate vessels have a Biofouling Management Plan	Vessel Master	Vessel Owner
				MC 15.3.1.2 Records show biofouling record book maintained and current	Vessel Master	Vessel Owner
			EPS 15.3.2 Vessels mobilised from international waters will comply with the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Department of Agriculture, Fisheries and Forestry 2009), including: • Completion of IMS Risk Assessment, and • Implement mitigation measures commensurate with the level of risk.	**MC 15.3.2.1** Records demonstrate compliance with the Australian National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia, 2008), including: • IMS Risk Assessment, and • Implementation of mitigation measures commensurate with level of risk.	Vessel Master	Vessel Owner
Implementation of inappropriate response strategies in response to a hydrocarbon spill requiring response	**EPO 16** In the event of a hydrocarbon spill, Santos will manage the risks of implementing appropriate response strategies to reduce the potential	**C 16.1** Undertake operational SIMA during implementation of OPEP	**EPS 16.1.1** IMT to undertake spill response (operational) SIMA to determine applicable response strategies, initiation and termination of response options in accordance with the requirements of the OPEP.	**MC 16.1.1.1** Records demonstrate operational SIMA undertaken during OPEP implementation in accordance with OPEP requirements	IMT Environment Unit Lead	IMT Incident Commander

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
strategy implementation	impacts to the environment.					
Loss of MDO containment resulting from vessel collision	**EPO 17** No impacts to the marine environment from an MDO release as a result of a vessel collision.	**C 3.1** See **Table 7-1**	**EPS 3.1.1** See **Table 7-1**	**MC 3.1.1.1** See **Table 7-1**	See **Table 7-1**	See **Table 7-1**
		C 2.1 See **Table 7-1**	**EPS 2.1.1** See **Table 7-1**	**MC 2.1.1.1** See **Table 7-1**	See **Table 7-1**	See **Table 7-1**
			EPS 2.2.1 See **Table 7-1**	**MC 2.2.1.1** See **Table 7-1**	See **Table 7-1**	See **Table 7-1**
		C 17.1 Implement tiered spill response in the event of an MDO spill	**EPS 17.1.1** Implement tiered spill response in the event of an MDO spill	**MC 17.1.1.1** Records demonstrate that spill response options are delivered in accordance with OPEP	IMT Environment Unit Lead	IMT Incident Commander
Loss of MDO containment from a bunkering incident	**EPO 18** No impacts to the marine environment from MDO releases during bunkering.	**C 18.1** Vessel equipped and crewed in accordance with MARPOL Annex I requirements	**EPS 18.1.1** Vessels will be suitably 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: • Marine Order 91 (Marine Pollution Prevention – Oil), which implements Annex I of the MARPOL Convention, including (as required by vessel class): - A deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. - Waste oil storage available. - Valid International Oil Pollution Prevention (IOPP) Certificate.	**MC 18.1.1.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance with MARPOL Annex I and applicable Marine Orders	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director
		C 18.2 Vessel-specific bunkering procedures and equipment consistent with Santos marine vessel vetting requirements	**EPS 18.2.1** Santos will confirm vessel bunkering procedures include: • Defined roles and responsibilities – bunkering to be undertaken by trained staff. • Pre-bunker safety meeting to ensure all personnel involved are fully briefed and understand their roles and responsibilities. • Visual inspection of hose prior to bunkering to confirm they are in good condition. • Testing emergency shutdown mechanism on the transfer pumps. • Established communication protocols between vessel master and personnel responsible for monitoring tank levels, leaks and overflows during bunkering operations. • Continual visual monitoring during diesel transfers of hoses, connections and tank levels to detect leaks and prevent overflows during bunkering operations. • Assessment of weather/sea state.	**MC 18.2.1.1** Records of demonstrate compliance with vessel bunkering requirements	Vessel Master	Vessel Owner
		C 17.1 See above	**EPS 17.1.1** See above	**MC 17.1.1.1** See above	See above	See above
Chemical or hydrocarbon release from incidental spill (e.g. minor deck spill)	**EPO 19** No incidental spills of hydrocarbons or chemicals to the marine environment with an environmental	**C 19.1** Chemical and hydrocarbon storage areas designed to contain leaks and spills	**EPS 19.1.1** Selection of vessel contractor is subject to Santos local and global marine vessel vetting processes, specifically: • Appropriate procedures for storage (e.g. bunding), labelling (including Safety Data Sheet (SDS) available) and handling of chemicals and hydrocarbons, and • Completion of vessel inspection and report.	**MC 19.1.1.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance with chemical and hydrocarbon storage and handling requirements	Vessel Master	Marine Director

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
	consequence greater than 1[16].		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).			
			EPS 19.1.2 Vessels will be suitably 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: • Marine Order 91 (Marine Pollution Prevention – Oil), which implements Annex I of the MARPOL Convention, including (as required by vessel class): - Vessel-specific SOPEP. - A deck drainage system capable of controlling the content of discharges for areas of high risk of fuel/oil/grease or hazardous chemical contamination. - Waste oil storage available. - Valid IOPP Certificate. Oil record book maintained.	**MC 19.1.2.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance with MARPOL Annex I and Marine Order 91	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director
		C 19.2 Spill clean-up kits available in high risk areas	**EPS 19.2.1** Selection of vessel contractor is subject to Santos local and global marine vessel vetting processes, specifically: • Spill kits stocked and ready for use by trained personnel.	**MC 19.2.1.1** Records of Santos Marine Vessel Vetting Process demonstrate availability of spill response kits by trained crew	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director
				MC 19.2.1.2 Use of spill kits documented in daily reports as required	Vessel Master	Marine Director
		C 19.3 ROV operations undertaken in accordance with good industry practice	**EPS 19.3.1** Procedures for ROV operations meet requirements of IMCA guidelines or alternative equivalent guidelines for ROV operations including use of appropriate equipment, ROV operations undertaken by competent personnel, preventative maintenance and inspection of equipment.	**MC 19.3.1.1** Records demonstrate ROV operations conform to IMCA guidelines (or equivalent alternative)	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director
		C 19.4 Leak, prevention detection and shutdown measures implemented during downline chemical transfers	**EPS 19.4.1** Procedures for downline chemical transfers to include: • Downlines suitably rated for operating pressures, • Leak detection measures (e.g. pressure monitoring), and • Emergency stop procedure in the event of a loss of containment.	**MC 19.4.1.1** Records demonstrate implementation of downline chemical transfer procedures	Vessel Owner	Marine Director
Loss of waste material overboard	**EPO 20** No loss of wastes overboard with a consequence greater than 1[17].	**C 20.1** All wastes managed in accordance with vessel waste management plan meeting MARPOL Annex II, III & V requirements	**EPS 20.1.1** Vessels will be suitably 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: • Marine Order 93 (Marine Pollution Prevention – Noxious Liquid Substances), which implements Annex II of the MARPOL Convention, including (as required by vessel class): - International Pollution Prevention (IPP) Certificate.	**MC 20.1.1.1** Records of Santos Marine Vessel Vetting Process demonstrate compliance with SOLAS, COLREGS and STCW Convention and Marine Order 95	Santos Marine Department Representative in liaison with Vessel Owner	Marine Director

[16] Santos' HSEMS requires all environmental incidents to be assessed and recorded. The actual or potential environmental consequence is routinely determined during this process. This determination provides the means to demonstrate whether this EPO has not been met.
[17] Santos' HSEMS requires all environmental incidents to be assessed and recorded. The actual or potential environmental consequence is routinely determined during this process. This determination provides the means to demonstrate whether this EPO has not been met.

Risk / Impact	EPO	Control	Environmental Performance Standards	Measurement Criteria	Responsible Person	Accountable Person
			• Marine Order 94 (Marine Pollution Prevention – Packaged Harmful Substances), which implements Annex III of the MARPOL Convention, including (as required by vessel class): - No disposal of harmful substances (identified as marine pollutants in the IMDG Code) overboard. - Packaged harmful substances to be properly packed, marked, labelled, stowed and secured. - Any loss or discharge to sea of harmful materials will be reported to the AMSA rescue coordination centre (RCC) via a marine pollution report (POLREP). • Marine Order 95 (Marine Pollution Prevention – Garbage), which implements Annex V of the MARPOL Convention, including: - Garbage management plan in place. - Types of wastes that will be generated onboard and will require containment, transport and disposal at a licensed facility onshore. - Procedures for handling, storage segregation and disposal of wastes. - Maintenance of Garbage Record Book, recording the types and volumes of waste incinerated or disposed onshore. - Garbage record book maintained onboard.			

8 IMPLEMENTATION STRATEGY

This section details the implementation strategy for this EP, 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 that 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, and
- Meeting monitoring, auditing, and reporting requirements.

Santos, as titleholder, is responsible for ensuring that decommissioning activities are undertaken in accordance with the implementation strategy and Santos' ABU-W HSEMS.

8.1 SANTOS' ABU-W HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEM

The Santos EH&S Policy (August 2019) establishes a commitment to be the safest gas company and preventing harm to people and the environment.

At Santos ABU-W, a HSEMS provides a systematic process to identify, assess, and manage the operational risks to the business, employees, contractors, stakeholders and the environment. The routine application of a HSEMS provides ongoing identification, prioritisation and control of these risks.

The HSEMS is implemented through a hierarchy of policies and procedures, which has four distinct phases and 15 interrelated elements, as shown in **Figure 8-1**, with each phase of the process building on the previous phases:

- PLAN: hazards, risks, and regulatory requirements are identified in these elements. These elements also identify the risk mitigation requirements that will be built-out in the DO phase and provide for the establishment of strategic plans, goals and objectives.
- DO: describes the specific implementation tools needed to manage the risks and requirements identified in the PLAN phase.
- ASSESS: describes detailed monitoring and auditing to ensure that risks and requirements are being identified, assessed, and managed.
- ADJUST: provides for modification of the HSEMS and its implementation to adjust for strengths, gaps and opportunities for improvement identified in the ASSESS phase.

Figure 8-1: Overview of Santos' ABU-W HSEMS

Further detail on the individual elements of the ABU-W HSEMS is provided below in **Section 8.1.1**.

In an ABU-W context, the policies and procedures are framed and implemented within the ABU-W HSEMS, which is aligned to the Australian Standards/New Zealand Standards (AS/NZS) ISO 14001:2004 Environmental Management Systems Standard. The ABU-W HSEMS outlines the key HSE processes and requirements for all HSE related activities for the ABU-W, including the broader aspects of plant equipment/infrastructure, programs and procedures, people, management of change and their interactions.

The core objectives of the ABU-W HSEMS are to support implementation of the Santos EH&S Policy and to provide a consistent framework and approach for effective management of HSE. The ABU-W HSEMS applies to all Santos ABU-W owned and/or operated facilities/locations and allows activities to be conducted in a safe, healthy, and environmentally conscious manner. The overarching intent of the HSEMS is to protect people, assets and the environment.

8.1.1 Santos ABU-W HSEMS Elements

8.1.1.1 Element 1: Policy and Leadership

This element defines expectations for the Santos EH&S policy and leadership requirements for

supporting a strong HSE culture, ensuring compliance with HSE requirements and driving HSE excellence.

The EH&S Policy (**Figure 8-2**) establishes the expectations, principles of operation and desired outcomes for the ABU-W.

8.1.1.2 Element 2: Risk Assessment (and Management)

This element defines the EH&S risk management requirements outlined in the ABU-W HSEMS.

The ABU-W seeks to maintain the health and safety of its employees and minimise environmental impact through the active and progressive elimination of hazards and the reduction of risk in the workplace. This objective is achieved at all ABU-W facilities and sites through a systematic and integrated approach to risk management to reduce risks to a level that is ALARP.

The ABU-W Risk Management Procedure (ALL/HSE/PRO/040), outlines the risk assessment process, including for environment and sustainable development assessments.

Section 6 provides a full summary of the risk approach undertaken for this EP.

8.1.1.3 Element 3: Legal Requirements and Standards of Operation

This element establishes requirements for maintaining a process to monitor changing laws/regulations and site activities, and assigning responsibilities to help assure compliance with legal requirements (e.g. laws, regulations, permits or project approvals and commitments made in permit applications) and standards of operation (e.g. relevant Santos and industry standards and/or design codes) applicable to the ABU-W.

All aspects of ABU-W operations (including project design, construction, commissioning, and operation and decommissioning) are compliant with relevant International, Commonwealth, State and Territory requirements, codes and standards of operation.

The ABU-W HSE Legal Requirements Identification and Monitoring Procedure (ALL/HSE/PRO/087) outlines the process for monitoring changing legal requirements and achieving legal compliance.

8.1.1.4 Element 4: Strategic Planning, Goals and Objectives

This element establishes the requirements associated with HSE planning and goal setting. Planning at Santos cascades from the Corporate level to the the ABU-W level.

The ABU-W HSEMS defines and implements a strategic EH&S planning, goals and objectives process. The ABU-W HSE planning process includes a strategic HSE Plan that is developed, resourced, communicated and measured to contribute to continuous HSE improvement and the reduction of HSE risk.

8.1.1.5 Element 5: Structure and Responsibility

This element establishes requirements to define and manage roles, responsibilities, accountabilities, employee engagement, and interrelationships.

The ABU-W maintains a structured organisation to manage all HSE issues that impact on, or have the potential to impact, Santos including:

- Maintaining a dedicated, specialist HSE team with specialists deployed to project and operations groups as required;
- Communicating organisation charts outlining the resourcing and management structure for ABU-W;
- HSE Committees that function at multiple levels to review and manage HSE related issues;
- Conducting management reviews of the ABU-W HSEMS to assess resource needs;

- Implementing specific processes which identify and effectively communicate roles, responsibilities and accountabilities associated with critical equipment and systems including via inductions, on-boarding processes and competency training programs; and
- Documenting roles, responsibilities and accountabilities, as they relate to the HSEMS and the EH&S Policy, in various HSEMS documents.

8.1.1.6 Element 6: Programs and Procedures

This element establishes requirements to develop and implement, within the ABU-W HSEMS, programs and documented procedures to ensure compliance with legal requirements and standards of operation and to manage HSE risk. All ABU-W HSE procedures are maintained on the ABU-W (HSE) intranet site and accessible to the business.

Documented ABU-W HSE programs and procedures, relevant to operational activities, are established and maintained to manage significant risks and comply with legal requirements and standards of operation. These programs, processes and procedures are made easily accessible to relevant employees and contractors and are reviewed in accordance with a defined review schedule. The ABU-W employs competent people capable of identifying and implementing programs and procedures to facilitate HSE compliance and continuous improvement.

8.1.1.7 Element 7: Asset and Operating Integrity

This element establishes standards for ABU-W development, implementation and maintenance of its Asset and Operating Integrity (A&OI) programs to:

- Properly managed risks associated with operations, equipment failure or uncontrolled loss of primary containment; and
- Establish within the ABU-W a clear understanding of its assets, failure mechanisms and their consequences/associated risks.

The ABU-W A&OI philosophy is communicated and fully integrated through the implementation of various A&OI programs, processes and procedures that define and manage the integrity of ABU-W assets and operations across the life cycle and comply with legal requirements (including statutory inspections, e.g. vessels) and standards of operation. These programs and procedures include:

- Procurement and pre-construction HSE assessment (e.g. design considerations);
- Identifying and documenting major accident hazards, safety critical elements and technical performance requirements;
- Process, mechanical instrumentation and electrical system documentation;
- Commissioning and pre-start up review;
- Structural integrity systems;
- Safe work practices;
- Hazard registers;
- SAP maintenance system;
- Operating and maintenance procedures and programs; and
- Management of change procedures.

The A&OI programs are reviewed and updated by technically competent personnel to manage the risks associated with the asset life cycle. This process involves application of appropriate controls and A&OI integrity management performance measures, and engagement of Santos personnel/contractors through communication of the aims and goals established for the management of technical integrity.

8.1.1.8 Element 8: Emergency Preparedness

This element defines the Crisis Management and Emergency Response (CM&ER) planning and preparedness requirements for Santos operated assets and the Crisis Management support functions provided and coordinated from Santos Corporate Headquarters.

All reasonably foreseeable crisis and emergency situations are identified via appropriate systematic review and analysis processes, with results documented in facility/project specific CM&ER processes and systems.

The ABU-W Crisis and Incident Management Plan (ALL/HSE/ER/001) and Incident and Crisis Management Bridging Procedure (ALL/HSE/BDG/016) defines the organisational responsibilities, actions, reporting requirements and management processes to be applied in the event of an emergency or crisis occurring. Crisis and emergency response is managed by a hierarchy of teams, e.g. a facilities-based Emergency Response Team (ERT), an IMT and Crisis Management Team (CMT) and supported by the international resources through the Crisis Management and Emergency Response group.

The corresponding Oil Pollution and Emergency Plan (DCOM-652-EN-OPE-00001) has been developed in accordance and to align with the ABU-W Incident Management Plan. EPOs, EPSs and MCs applicable to undertaking the oil spill response are detailed in **Table 8-5**.

8.1.1.9 Element 9: Awareness, Training and Competency

This element establishes the requirement that all employees, contractors, and visitors have the necessary awareness, training, and competency to perform their activities consistent with the Company EH&S Policy, standards, and procedures.

The ABU-W implements a documented training and competency system to confirm that employees/contractors have the required training and competency to fulfil their duties in a safe, environmentally and socially responsible manner. The system addresses:

- Employee selection and identification of training, competence and development needs;
- Contractor evaluation and management;
- Employee orientation;
- Operator or mechanical skills training and qualification;
- Development and maintenance of training resources and records; and
- Demonstration of competency.

The level of training and competency required at ABU-W facilities is based on the degree of risk and the complexities of the actions required to control or mitigate the risk. Measures are put in place to assess the competency of those trained and to determine the effectiveness of implemented training programs. Managers are personally responsible for ensuring that the ABU-W complies with Santos Corporate and Regulatory training and competency requirements. Further information of training and competency requirements is provided in HSE Training and Competency procedure ALL/HSE/PRO/089.

8.1.1.10 Element 10: Non-Conformance, Incident, and Near Miss Investigation and Corrective Action

Through this element, the ABU-W implements a systematic approach so that all incidents and near misses are consistently, methodically and effectively investigated, as appropriate to their risk or potential severity. All incidents including near misses are reported, investigated in a timely manner and analysed to identify corrective actions/preventive measures to prevent recurrence and continuously improve HSE performance. Incident investigations are documented using a database to track actions and enable sharing of learnings. The ABU-W Incident Reporting and Investigation Procedure (ALL/HSE/PRO/003) is the key document which outlines these requirements.

Non-conformances may be identified through audits, observations or incident reports. Actions to

address non-conformances are developed following the same process applied to address root causes of incidents.

Key performance indicators are in place to track and report the status of actions arising from incidents and audits.

8.1.1.11 Element 11: Communication

This element sets the requirements for the communication of information within the Company and engagement with external stakeholders.

The ABU-W actively seeks and obtains the co-operation and involvement of ABU-W personnel in promoting and improving HSE management and communication. Workers and technical experts are consulted when new HSE procedures or processes are developed or changes to the HSEMS occur (including risk management processes).

8.1.1.11.1 Internal Communication

The ABU-W has processes and procedures to facilitate effective internal communication of EH&S-related issues at Santos Corporate, ABU-W, project and operations levels. Examples include, but are not limited to, office and facility inductions, HSE Intranet websites with performance metrics, programs and procedures, ABU-W HSEMS Manual and HSE Procedures, HSE bulletins and safety moments, hazard reporting and issue resolution procedures and training programs and processes.

8.1.1.11.2 External Communication

The ABU-W is committed to ongoing, active, transparent and collaborative consultation with stakeholders throughout the lifecycle of its projects and operations. Accordingly, the ABU-W has developed processes and procedures to manage stakeholder relations, to understand and respond appropriately to their diverse and evolving expectations via free and open communication.

External communication processes define responsibility and chain of control for receiving and handling inquiries is defined in external communication processes and the ABU-W documents and tracks the receipt, response, and status of inquiries from external parties.

Refer to **Section 9** for an overview of the consultation program of relevance to this EP.

8.1.1.12 Element 12: Document Control and Records Management

This element establishes the requirements for management and control of HSEMS documents and records.

Santos HSE Documents and Records Management (ALL/HSE/PRO/004) is implemented to efficiently manage key documentation, including confirming that it remains accurate, current and available to required personnel. Documents and records, including procedures, work instructions and other information necessary to carry out work activities, are retained to corporate and legislative requirements. Documents are also periodically reviewed and revised as necessary, with current versions made available and obsolete documents removed or identified and retained (where necessary) for legal use.

Key ABU-W document control and records management processes include HSE procedure review and update schedules, document retention codes, management of change procedures, HSE Controlled Documents Registers and SAP Document Management System. Further detail is provided in HSE Documents and Records Management Procedure (ALL/HSE/PRO/004).

8.1.1.13 Element 13: Measuring and Monitoring

This element defines the requirements for measuring and monitoring ABU-W HSE performance, providing assurance of compliance, assessing the effectiveness in meeting the Santos' goals and legal obligations, and identifying opportunities for improvement.

The ABU-W has developed processes for 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, as per the ABU-W Projects HSE Management System Manual (ALL/HSE/MAN001).

Key ABU-W processes for measuring and monitoring HSE performance include development and implementation of HSE Strategic Plans, ABU-W competency assurance management, HSE committees and meetings, key performance indicators, environmental monitoring and reporting procedures, Asset Integrity and Process Safety Management System and contractor performance monitoring.

8.1.1.14 Element 14: Audits

This element establishes requirements for audit programs that assess the adequacy and effectiveness of HSE controls. The audit program also identifies any non-conformances within the HSEMS. The ABU-W implements and maintains a program for the planning, preparation, execution, reporting and close-out of HSE audits carried out across all areas of the ABU-W including Capital Projects.

The ABU-W HSE auditing process consists of a three-tier auditing hierarchy:

- Tier 3 – External to the BU (corporate, regulatory bodies and other external bodies);
- Tier 2 – Internal to the BU, independent to facility/project (HSEMS and A&OI MS policies and procedures); and
- Tier 1 – Workplace inspections (workplace hazard identification and control).

The ABU-W HSE Auditing and Inspection Procedure (ALL/HSE/PRO/031) provides methods and guidance for the implementation and execution of Tier 1, 2 and 3 auditing and inspection processes. An ABU-W Tier 1, 2 and 3 audit schedules are prepared on a three-year rolling plan basis and allows for an audit of all elements of the ABU-W HSE Management System over a three-year period. The schedule outlines which management system elements are to be audited in each year and refers to the applicable HSE Management System procedures. Once approved, the audit schedule is included in planning processes for the respective facilities and areas of operation for the coming year.

8.1.1.15 Element 15: Review

This element establishes requirements to review the content and functionality of the HSEMS to ensure there is a functioning and systematic process in place so that HSE&SD risks are identified and managed to achieve the Company and BU HSE&SD goals and objectives.

With participation from the most senior leadership positions, the ABU-W implements a documented annual HSE and A&OI Review Process for the review of the ABU-W HSEMS. The reviews are conducted by defined groups, teams, or committees (including HSE Steering Committees), with results reported to, and reviewed by, ABU-W management.

The review process considers applicable HSEMS data and outputs and includes a consideration of:

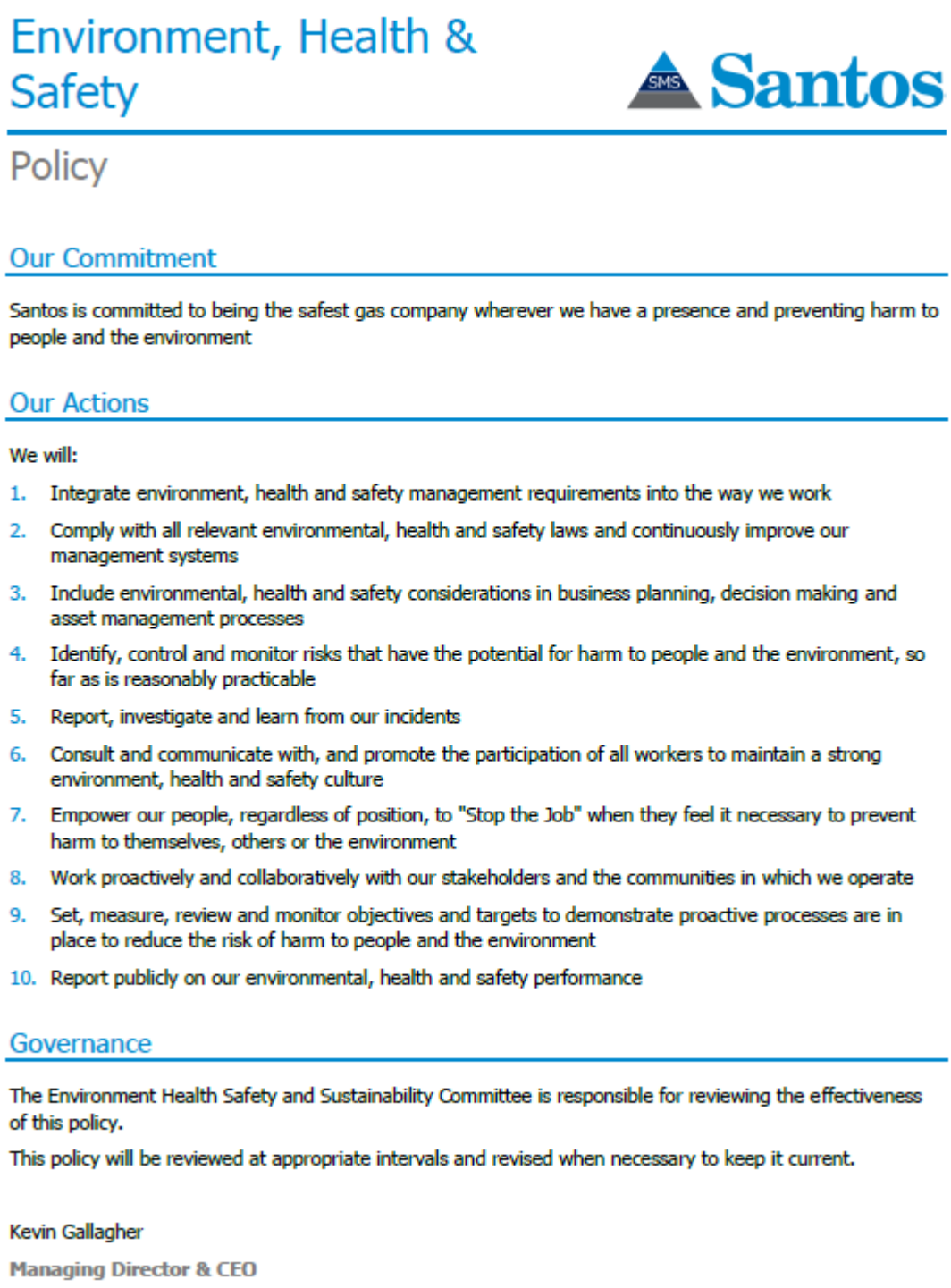
- Results of internal audits and evaluations of compliance with legal and other requirements;
- Communications from external interested parties, including complaints;
- The environmental performance of the organisation;
- The extent to which objectives and targets have been met considering changing circumstances and commitment to continuous improvement;
- Status of corrective and preventive actions from investigations and audits;
- Follow-up actions from previous management reviews;
- Significant issues from risk assessments;

- Resource allocation for system implementation and maintenance;
- Incidents; and
- Recommendations for improvement.

The outcomes and decisions made in these reviews are distributed to appropriate management and planning teams. This ensures that the 'adjust' phase of the HSEMS process may feed into the 'plan' phase, closing the loop on the plan, do, assess, and adjust cycle of continuous improvement (**Figure 8-1**).

8.1.2 Santos Environmental, Health and Safety Policy

The Santos EH&S Policy (HSEMS Element 1), as presented in **Figure 8-2**, establishes the expectations, principles of operation and desired outcomes for the operations. The Policy is distributed to all ABU-W facilities and contracted parties and is displayed prominently at work sites. Inductions to ABU-W facilities/projects include presentation and discussion of the EH&S Policy.



Environment, Health & Safety

Santos

Policy

Our Commitment

Santos is committed to being the safest gas company wherever we have a presence 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
2. Comply with all relevant environmental, health and safety laws and continuously improve our management systems
3. Include environmental, health and safety considerations in business planning, decision making and asset management processes
4. Identify, control and monitor risks that have the potential for harm to people and the environment, so far as is reasonably practicable
5. Report, investigate and learn from our incidents
6. Consult and communicate with, and promote the participation of all workers to maintain a strong environment, health and safety culture
7. Empower our people, regardless of position, to "Stop the Job" when they feel it necessary to prevent harm to themselves, others or the environment
8. Work proactively and collaboratively with our stakeholders and the communities in which we operate
9. Set, measure, review and monitor objectives and targets to demonstrate proactive processes are in place to reduce the risk of harm to people and the environment
10. 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

Figure 8-2: Santos EH&S Policy

8.2 OTHER SUPPORTING MANAGEMENT PROCESSES AND PROCEDURES

In addition to the HSEMS, Santos' ABU-W has several supporting management processes and procedures that outline how it undertakes its business.

8.2.1 Contractor HSE Requirements

In support of the ABU-W HSEMS Standard, the Corporate Contractor HSE Standard (Issue No. 3, May 2008) establishes the minimum requirements and expectations for HSE management of Contractors and subcontractors.

For ABU-W, the HSE requirements for contracts/contractor management during pre-contract planning, contracting, contract execution and contract completion and evaluation are outlined in the Contractor HSE Management Process document. It includes the following 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; and
- Provisions for Santos to conduct audits/inspections of the Contractor's operations, equipment and emergency procedures at any time.

8.2.2 Santos' ABU-W Marine Vessel Vetting Process

Santos' ABU-W 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.

8.2.2.1 Marine Vetting and Audit Process Manual for Offshore Vessels

Santos' ABU-W Marine Vetting and Audit Process Manual for Offshore Vessels (GM-PRO-MA-001) 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 from recognised industry organisations such as Oil Companies International Marine Forum (OCIMF) and International Maritime Contractors Association (IMCA), and international regulatory agencies like the International Maritime Organization (IMO) and vessel Classification Societies.

The Marine Vetting and Audit Process Manual for Offshore Vessels (GM-PRO-MA-001) 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.

8.2.2.2 Vetting Exception Request Process

The Vetting Exception Request Process (GM-PRO-MA-006) is a ABU-W process to be used only in exceptional circumstances when a justifiable case exists for contracting a vessel rejected through the Santos ABU-W vetting process and is only to be used when no other approved document or equipment is available in the time required and rejecting the vessel would have significantly impeded operations.

An exception request will at no time conflict with the Santos ABU-W HSEMS. An exception requires the development of a risk assessment and risk mitigation plan.

8.2.2.3 Integrated Operations Support Centre Marine Operations Manual

The Santos ABU-W Integrated Operations Support Centre Marine Operations Manual (IOSC/OPS/HBK/0003) and supporting Integrated Operations Centre Support Vessel Requirements (IOSC/OPS/GLN/0001) details:

- Standard operating procedures for all vessels under contract with Santos ABU-W;
- Compliance requirements for relevant maritime legislation and relevant guidelines, standards and codes;
- Compliance requirements for international conventions and agreements, including, but not limited to:
    - SOLAS;
    - MARPOL;

  - COLREGS; and
  - STCW Convention.

- Compliance requirements for industry standards as set up by:
  - OCIMF;
  - IMCA;
  - Guidelines for Offshore Marine Operations; and
  - Nautical Institute;

- Santos and contractor standards, procedures and best practice management, including, but not limited to:
  - Vessels' safety of navigation; vessels' using dynamic positioning systems (DP vessels);
  - Vessels' bunkering procedures;
  - Crew competency and training records;
  - Chemical storage and handling procedures;
  - Discharge management procedures;
  - Waste management procedures;
  - Anchoring procedures; and
  - Vessel and equipment maintenance procedures as per the vessel specific safety management system.

Santos carries out a risk assessment or HSE Qualification Evaluation process for each vessel to identify any HSE issues or specific management requirements prior to commencing activities.

8.2.3 Santos' ABU-W Waste Management Process

The Santos ABU-W HSE Waste Management Standard 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.

ABU-W is responsible for evaluating the suitability of the waste facilities and the ABU-W Waste Management Plan outlines the requirements for the management of wastes produced by Santos operated facilities, including compliance assurance processes (monitoring, auditing and reporting).

An overarching Bayu-Undan Decommissioning Waste Management Strategy and activity-specific Bayu-Undan Waste Management Plans will be developed and implemented by Santos to guide waste management activities.

8.3 SYSTEMS, PRACTICES AND PROCEDURES

All activities associated with Pipeline decommissioning and preservation 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 these controls and requirements are being implemented to manage environmental impacts and risks associated with the maintenance activities to ALARP.

The key operational controls related to Pipeline decommissioning and preservation activities

include:

- Management of all activities under Santos ABU-WHSEMS, described further in **Section 8**.
- Defined procedures for vetting of maintenance vessels prior to their contractual engagement to make sure that the marine vessels are fit for their intended purpose. These procedures include: “Support Vessel Requirements” (DOC/OPS/GLN/0001); ‘Support Vessel Tender Evaluation Requirements’ (DOC/OPS/GLN/0002); and Marine Vessel Management (DOC/OPS/GLN/0003).
- Preparation of project-specific documentation to bridge between Santos ABU-W HSEMS documentation and contractor HSE management systems.
- Documented procedures covering all operations, with all work executed under a PTW.

8.4 TRAINING AND COMPETENCIES

8.4.1 Santos Employees

All Santos personnel are vetted prior to their employment to ensure they have the suitable experience and qualifications for the roles they will be performing.

The ABU-W Vice-President Operations, Drilling and Supply Chain is ultimately accountable to ensure that the operating facilities are manned by adequate numbers of competent personnel and that trainees are properly managed.

8.4.2 Pre-activity Vessel Engagement

All contractors are managed through Santos’ Contractor HSE Management Process (ALL/HSE/PRO/016).

As part of this process all contractors undergo a prequalification screening of HSE Management systems. This includes a review of training and competency processes.

8.4.3 Pre-activity Activities

All personnel, including third party contractors, involved with Pipeline decommissioning and preservation activities 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.

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; and
    - Complaint/issue handling from fisheries.
- Waste segregation, containment and disposal:
    - Requirements for waste, segregation, labelling, handling and storage; and
    - 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; and

- 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.

8.4.4 During Pipeline Decommissioning and Preservation Activities

HSE management system audits of third-party contractors are completed according to the ABU-W audit procedure, 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 ABU-W HSE Audit schedule. Environmental risks will be discussed through job safety analyses, pre-tour and safety meetings conducted on board vessels undertaking Pipeline decommissioning and preservation activities.

Additional communications, including the findings of any incident investigations, will continue through daily meetings on board the vessels and via daily progress reporting.

8.4.5 IMT Roles, Responsibilities and Training

Spill response training is provided to key roles within the Santos IMT. Santos maintains competent and trained response capability to ensure an emergency management and response capacity can be maintained. Training requirements and core competencies for Santos key IMT response staff are outlined in **Table 8-1**. Additional detail on the listed training packages and drills is provided below:

- IMT Induction Computer Based Training (CBT) Module includes, but is not limited to the following content:
  - Santos emergency response standards, philosophies and principles
  - Emergency Response and Management Groups
  - Overview of IMT structure within Santos
  - Overview of IMT checklists
  - Corporate resources
  - Initial response and assessment and planning
  - Communications
- ISC 100 and 200 training (Online CBT or face-to-face)
- Santos induction package (face-to-face) includes, but is not limited to the following content:
  - IMT roles and responsibilities
  - Emergency Operations Centre (EOC) operation
  - Incident Action Plan software
  - IMT Tier 1-2 desktop drill or exercise
- Oil spill management computer-based training module includes, but is not limited to the following content:
  - Santos Emergency Management Framework, including plans and processes
  - Context – hydrocarbon spills (international and Australia)

- Australian response arrangements
- Government, industry and Australian Marine Oil Spill Centre (AMOSC) response
- Response planning
- Hydrocarbon spills and the environment
- Response issues
- Response options and implementation

- IMT Tier 1-2 desktop drill
  - Undertake an incident and hydrocarbon spill assessment process
  - Develop an IAP that includes hydrocarbon spill response options
  - Undertake preliminary planning for the implementation of those options
- IMT Tier 2 exercise (hydrocarbon spill scenario on a rotational basis)
  - Undertake an incident assessment process
  - Develop an IAP
  - Undertake preliminary planning for the implementation of those options
  - Interface with CMT

Role and responsibilities for the IMT are outlined in **Section 8.10**.

Table 8-1: IMT training summary

Role	Induction CBT Module	ICS 100 and 200	Santos Induction Package (Face-to-Face)	Oil Spill Management CBT Module	IMT Tier 1-2 Desktop Drill or Exercise
Incident Commander	Initial	Initial	Initial	Initial	Annual
Operations Section Chief	Initial	Initial	Initial	Initial	Annual
Planning Section Chief	Initial	Initial	Initial	Initial	Annual
Logistics Section Chief	Initial	Initial	Initial	Not required	Annual
Safety Officer	Initial	Initial	Initial	Not required	Annual*
Liaison Officer	Initial	Initial	Initial	Not required	Annual*
Environmental Unit Leader	Initial	Initial	Initial	Initial	Annual
Historian	Initial	Initial	Initial	Not required	Annual*
Situation Unit Lead	Initial	Initial	Initial	Not required	Annual*
Human Resource Officer	Initial	Initial	Initial	Not required	Annual*
Public Information Officer	Initial	Initial	Initial	Not required	Annual*

Initial: required when personnel commence IMT position.
Annual: personnel holding this IMT position will need to undertake this training/drill annually.

* This position is required to participate in an annual exercise or drill, but this may not always be a hydrocarbon spill scenario.

8.5 MONITORING, AUDITING, MANAGEMENT OF NON-CONFORMANCE AND REVIEW

8.5.1 Environmental Monitoring

In accordance with Santos' ABU-W HSEMS (Element 9), the ABU-W has developed processes for 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, as per the Santos ABU-W HSE Management System Standard.

Santos and its contractors will monitor and review HSE performance during Pipeline decommissioning and preservation activities. Specific monitoring activities related to the management of environmental risks identified within **Section 6** will collect, as a minimum, the information referred to in the MC listed in **Section 7** and **Table 8-5**. This information will be collected through set internal reporting processes, as detailed in this section.

As discussed in Section 4.5, no corrosive breakthrough of the Pipeline is expected for over 200 years. Therefore, post-decommissioning environmental monitoring is not proposed following decommissioning of the Pipeline.

8.5.2 Environmental Audits and Review

The objectives of the environmental auditing and review programs are to:

- Verify impacts and risks are being effectively managed;
- Confirm relevant standards and procedures are being followed;
- Demonstrate compliance with regulatory requirement, approval commitments and conditions within the EP;
- Monitor, review and evaluate the effectiveness of Santos ABU-W HSE-MS;
- Ensure a senior management review of performance via consideration of the audit reports; and
- Ensure effective implementation of the implementation strategy.

HSE audits and follow-up actions are conducted in accordance with Santos ABU-W HSE Audit Standard, Santos ABU-W Audit Guidelines and Santos ABU-W Auditing and Inspection Procedure (ALL/HSE/PRO/031). The audits will be documented, and corrective actions will be tracked to completion in accordance with these procedures.

The ABU-W HSE auditing process consists of a three-tier auditing hierarchy. In the last quarter of each year an annual integrated Tier 1, 2 & 3 audit schedule is developed and once approved the audit schedule is included in the planning processes for the respective facilities and areas of operation for the coming year. The audit schedule applicable to the Petroleum Activity consists of the following:

An audit review committee has been established which meets to track the status of audit findings and to improve the audit process, significant audit findings are shared across the business.

Corporate HSE, 3rd Party Audit and Regulator Audit findings and actions are tracked to completion in IMPACT. The audit process evaluates the effectiveness of the Santos ABU-W HSE Management System audit findings are risk ranked using the corporate risk matrix.

Santos will undertake internal audits of compliance against this EP. The risk assessment process detailed in this EP (**Section 6**) demonstrates that the highest risks to the environment from Pipeline decommissioning and preservation activities are associated with vessel activity; hence Santos' ABU-W audit process will focus on vessel-based activities. Additionally, Santos will submit annual environmental reports to NOPSEMA (**Section 8.6.2**) allowing the assessment

of performance against the EPOs, EPSs and MCs for this EP. Santos will feedback information from the annual reporting process into the EP, where appropriate. The key elements of the auditing and review program, and default frequencies, are specified in **Table 8-2**.

Table 8-2: EP Auditing and Review Program

Audit Type	Description	Scope	Frequency
Tier 1	Routine activities	Compliance with EP	During routine activities within the scope of this EP
Tier 2	Audit Internal ABU-W	Compliance with EP	3 –yearly
Tier 3	Audit External to ABU-W	Compliance with EP	5-yearly
Management Review	HSE Steering Committee HSE performance review	Management Team Monthly Review of HSE Performance.	Monthly
Management Review	ABU HSE Steering Committee Performance Reviews	Annual Review to assess the performance and effectiveness of existing programs and initiatives and to identify and initiate any process changes and improvements.	Annually
Incident Investigation Review	Review in line with Santos ABU-W - Health, Safety & Environmental Procedures Incident Reporting and Investigation procedure ALL/HSE/PRO/003.	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

8.5.3 Vessel Contractor Management

Santos, as titleholder, is responsible for the planning of the Pipeline decommissioning and preservation activities, including selection and management contractors conducting the work.

HSE assurance of all contracted vessels will be performed in accordance with Santos' Contractor HSE Management Process (ALL/HSE/PRO/016). The Santos ABU-W Marine Vessel Vetting Process (**Section 8.2.2**) 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.

8.5.4 Management of Non-conformance, Investigation and Corrective Action

Non-conformances may be identified through audits, observations or incident reports. Actions required to address non-conforming incidents (including those associated with spill response drills, tests and exercises) and to prevent the escalation of pollution or environmental damage will be appropriate to the nature and scale of the event. All HSE hazards and incidents are reported in accordance with the Santos ABU-W Incident Reporting and Investigation Procedure (ALL/HSE/PRO/003). Root cause analysis of incidents is performed to determine the cause and aid identification of appropriate corrective actions.

A corrective action plan is developed in consultation with senior management and other relevant action owners to address non-conformances. Audit findings and agreed audit follow-up actions are entered into a dedicated incident and assessment action tracking system and tracked through to closure by the Santos ABU-W HSE Department. Key performance indicators are in place to track and report the status of actions arising from incidents and audits.

8.5.5 Management of Change

Santos has a Management of Change (MOC) procedure (ALL/HSE/PRO/090) 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 'materiality test', i.e. 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; or
- 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 2009. 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 2009.

Santos will undertake an annual review of the description of the existing environment, including:

- Revised database searches for threatened fauna (e.g. PMST report) to identify species that may occur within the Operational Area and EMBA;
- Review of conservation advice, recovery plans and scientific literature for threatened fauna to identify threats; and
- Review sources of risk considered in the EP and update as required where the source of risk is identified as a threat.

8.6 ROUTINE REPORTING

8.6.1 Internal Routine Reporting

Table 8- contains a summary of internal reporting that will be completed for the duration of the Pipeline decommissioning and preservation activities.

Table 8-3: Summary of Internal Reporting

Report	Frequency	Contents
Daily Operations Report	Daily	Details of field activities, operations etc.
Vessel Report	Daily (during maintenance campaign)	Update on day's activities, including any identified non-conformance against this EP, and any issues that may need addressing.
First Incident Report	As per incident	Provides framework for Internal notification of incidents including spills. The first report contains tools for assessing the severity of the incident and

Report	Frequency	Contents
		escalating as per the ABU-W incident notification procedure.
EP Annual Report	Annual	Provides a summary of compliance performance, specifically in relation to the environmental performance objectives, standards and measurement criteria within this EP.
Incident Action Plan	As per incident	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	As per incident	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.
After Action Report	As per incident/drill	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	As per spill	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.

8.6.2 External Routine Reporting

8.6.2.1 Annual Environmental Report

Santos will submit annual environmental reports to NOPSEMA in accordance with Regulation 15 of the OPGGS(E) Regulations. The annual report will include all the information necessary to enable NOPSEMA to determine whether the environmental performance objectives and standards detailed within this EP have been met.

8.6.2.2 External Reporting Summary

Table 8- provides further information on the frequency, timeframe and contents of external reporting. 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 Pipeline decommissioning and preservation activities.

Table 8-4 Summary of Routine and Incident Agency Reporting Requirements

Report	Designated Authority	Frequency / Timeframe	Contents
Routine Reporting (Planned Impacts)			
Annual Report	NOPSEMA	Annually	In accordance with the OPGGS (E) Regulations 2009 (Regulation 14(2a, b; 26C)), the report will address compliance with EPOs and EPSs outlined in **Section 7** of this EP.
Reportable Incident Notification			
Reportable Incident Notification	NOPSEMA	Verbally, as soon as practicable, but within two (2) hours	Santos must notify the Regulator of any unplanned event identified as having the potential to cause moderate to significant environmental damage. In most circumstances reportable incident parameters will be detailed specifically within an EP for an activity; however, should an unforeseen event

Report	Designated Authority	Frequency / Timeframe	Contents
			occur that has caused or has the potential to cause moderate to significant environmental damage this must also be reported to NOPSEMA. **Section 8.7** details what constitutes a reportable incident.
Written report of reportable incident	NOPSEMA NOPTA	As soon as practicable but no later than three (3) 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. If NOPSEMA is not satisfied that the initial written report satisfies the requirements of the OPGGS (E) Regulations 2009, further information may be requested from the operator, which may include but is not limited to: • Immediate cause analysis; • Root cause analysis and a full report; • Actions taken to prevent recurrence of the incident with the responsible party; and • Completion date. Santos will provide NOPTA with a copy of the written report within 7 days after giving NOPSEMA the written report.
Recordable Incident Reporting			
Monthly Recordable Incident Reports	NOPSEMA	Monthly, on or prior to the 15th day of each month	Details of recordable incidents that have occurred in relation to Pipeline decommissioning and preservation activities for previous month (if applicable)
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 24hrs 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.
All actual or impending spills which occur within a marine park or are likely to impact on a Marine Park	Director of National Parks	As soon as practicable	The report will contain: • The location of the spill • The Marine Park at risk • A summary of the response being undertaken by Santos • Details of the relevant contact person in the IMT
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	AMSA Response Centre (ARC)	Within 1 hour of the incident occurring	Verbal reporting will consist of transfer of information in order 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	Frequency / Timeframe	Contents
probable discharge of harmful substances in packaged form			
Any spills within, or likely to enter, NT Waters	NT Department of Primary Industry and Resources (NT DPIR)	As soon as practicable. Written report as soon as practicable after request by DPIR	Verbal reporting will consist of transfer of information in order to conduct a coordinated emergency response. All reporting will be carried out by the vessel master as per the vessel specific SOPEP. 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.

8.6.2.3 Start and End of Activities

Regulation 29 of the OPGGS(E) Regulations 2009 requires Santos to notify NOPSEMA that a petroleum activity is commencing at least 10 days prior to the activity commencing. Regulation 29 also requires Santos to notify NOPSEMA within 10 days of completion of a petroleum activity. Santos will make these notifications.

8.6.2.4 End of the EP

As per Regulation 25A of the OPGGS(E) Regulations 2009, this Environment Plan will end when:

- Santos notifies NOPSEMA that:
    - The activity has ended, and
    - All obligations under the EP have been completed.
- NOPSEMA accepts the notification.

Following the end of the EP, Santos will fulfil their obligations under the OPGGS Act, for the removal and surrender of obligations by NOPTA when ultimately assessing relinquishment of a title.

8.7 INCIDENT REPORTING

8.7.1 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’, as categorised by the risk assessment process undertaken as part of the preparation of the EP.

The environmental risk assessment conducted for the following risks have a residual risk greater than Low and hence may constitute reportable incidents (**Section 6**):

- MDO release from a vessel collision, and
- Collision with marine fauna.

The notification and reporting requirements for incidents in Commonwealth waters are outlined in **Table 8-**. NOPSEMA reporting forms are provided in **Appendix D**.

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 DAWE within seven days.

8.7.2 Recordable Incidents

A recordable incident as defined as an incident arising from the Petroleum Activity that breaches an EPO or EPS in the EP that applies to the activity and is not a reportable incident. NOPSEMA will be notified of all recordable incidents as soon as practicable 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, and
- The action that has been taken, or is proposed to be taken, to prevent a similar incident occurring in the future.

8.7.3 Other Incident Reporting Requirements

8.7.3.1 Reporting Under MARPOL

In addition to the notification and reporting of environmental incidents defined in this EP and Santos requirements, the following incident reporting requirements also apply:

- 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, and
- 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; and
- Any loss of hazardous materials.

For oil spill incidents other agencies and organisations will be notified as appropriate to the nature and scale of the incident as per procedures and contact lists in the OPEP (DCOM-652-EN-OPE-00002).

8.8 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 in relation to this EP:

- Environmental training and induction records,
- Details of non-conformance inducing environmental incidents, complaints and follow up actions, and
- 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.

For vessels conducting Pipeline decommissioning and preservation activities, the vessel operator is responsible for retaining the following records as a minimum:

- Vessel log and manifests,
- Completed PTW forms,
- Completed specific risk assessments,
- Equipment and activity inspection records,
- Garbage record book (as per MARPOL 73/78, Annex V, Regulation 9),
- Vessel oil book records (MARPOL 73/78, Annex 1),
- Fuel usage and emission calculations, and
- GHG emissions.

8.9 EMERGENCY PREPAREDNESS AND RESPONSE

8.9.1 Overview

The Santos ABU-W HSEMS (Element 8) defines the Crisis Management and Emergency Response planning and preparedness requirements for ABU-W operated assets.

Under Regulations 14(8) of the OPGGS (E) Regulations 2009, 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 ABU-W Crisis and Incident Management Plan to direct the response.

8.9.2 Contractor Emergency Response Plan

The Pipeline decommissioning and preservation vessel contractor/s will develop an Emergency Response Plan (ERP) that addresses emergency response actions associated with all credible incidents for the activity. It will describe the interface arrangements between the ABU-W 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.

8.9.3 Oil Pollution Emergency Plan

The OPEP (DCOM-652-EN-OPE-00002) outlines the emergency management arrangements 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 IMT in response to the incident (consistent with the ABU-W 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 MDO with little risk of significant liquid hydrocarbon release; and
- NOPSEMA's acceptance criteria, including the requirement for updating of the OPEP (Regulation 14(8) of the OPGGS(E) Regulations).

The EPOs, EPSs and associated measurement criteria for the implementation of the response options in the OPEP are provided in **Table 8-5**.

8.9.4 ABU-W Crisis and Incident Management Plan

The ABU-W Crisis and Incident Management Plan (CIMP) (ALL/HSE/ER/001) and Incident and Crisis Bridging Procedure (ICBP) (ALL/HSE/BDG/016) define the organisational responsibilities, actions, reporting requirements and management processes to be applied in the event of an emergency or crisis occurring. It also provides detailed guidance and checklists for key roles in the IMT and CMT, consistent with the activity specific OPEPs.

The CIMP provides a graduated tiered response framework which classifies incidents based on the significance of the consequences, the risks involved and potential for escalation.

Individual operational facilities have detailed emergency response and oil pollution emergency plans developed that are aligned to this framework.

The CIMP also provides detail on Incident Action Plans (IAPs), which are developed by the IMT and communicated to the ERT and CMT (where applicable). IAPs are developed using current situational awareness and provide direction to response operations.

The CIMP is reviewed on an annual basis or if a significant change has occurred to the incident management or emergency response arrangements. Exercises and drills are performed to test the emergency response arrangements and updates are made to improve the CIMP, if required.

Table 8-5: Oil pollution response EPOs, EPSs and MCs

EPO	Performance Standard	Measurement Criteria
Incident Management		
EPO IS 1 Manage incident via a systematic planning process	**EPS IS 1.1** IMT to complete ICS Briefing Forms (ICS-201) during the initial phase of the incident, followed by an Incident Action Plan for each operational period	**MC IS 1.1.1** IMT to complete ICS Briefing Forms (ICS-201) during the initial phase of the incident, followed by an Incident Action Plan for each operational period
	EPS IS 1.2 IMT to monitor effectiveness of tactics being implemented and use information in the development of IAPs	**MC IS 1.2.1** Records demonstrate IMT used information on effectiveness of tactics in the development of IAPs
EPO IS 2 Maintain contracts with support agencies to obtain additional support or technical expertise to monitor and/or respond to a spill	**EPS 2.1** Service Level Agreement maintained with OSRL, Master Services Contract maintained with AMOSC and agreement maintained with RPS Asia Pacific Applied Science Associates (APASA) for the duration of the activity	**MC 2.1.1** Records demonstrate that Service Level Agreement maintained with OSRL, Master Services Contract maintained with AMOSC and agreement maintained with RPS APASA for the duration of the activity
SIMA		
EPO IS 3 Implement emergency response options that result in net environmental benefit	**EPS IS 3.1** IMT to undertake spill response (operational) SIMA to determine initiation and termination of response options	**MC IS 3.1.1** Records demonstrate spill response (operational) SIMA undertaken during OPEP implementation
	EPS IS 3.2 IMT to undertake an operational SIMA during the preparation and review of IAPs	**MC IS 3.2.1** Records demonstrate IMT completed an operational SIMA during the preparation and review of IAPs
Monitor and Evaluate		
EPO IS 4 Maintain situational awareness and inform IMT decision making using monitor and evaluate tactics	**EPS IS 4.1** IMT to undertake fate and weathering modelling to estimate the current and projected weathering of the spill	**MC IS 4.1.1** Records demonstrate fate and weathering modelling undertaken within 3 hours of IMT activation
	EPS IS 4.2 IMT to initiate trajectory modelling to estimate trajectory of the spill	**MC IS 4.2.1** Records demonstrate trajectory modelling requested, received and incorporated into IMT situational awareness
	EPS IS 4.3 Use monitor and evaluate data to periodically reassess the spill and modify the response, using the Incident Action Plan	**MC IS 4.3.1** Records demonstrate monitor and evaluate data incorporated into the Incident Action Plan

EPO	Performance Standard	Measurement Criteria
	EPS IS 4.4 Santos to maintain contracts with third-party providers to provide access to suitably qualified and competent personnel and equipment to assist in the implementation of monitor and evaluate tactics	**MC IS 4.4.1** Records demonstrate that Santos maintains contracts with third-party providers to provide access to suitably qualified and competent personnel and equipment to assist in the implementation of monitor and evaluate tactics
Wildlife Response		
EPO IS 5 Locate, identify and apply suitable response tactics to wildlife to prevent them from being contacted by oil or treat them if already contacted by oil	**EPS IS 5.1** Establish Wildlife Branch if monitor and evaluate activities have confirmed that wildlife is at risk of being contacted or have already been contacted by the spill	**MC IS 5.1.1** Records demonstrate that Wildlife Branch established if wildlife impacts confirmed via monitor and evaluate activities
	EPS IS 5.2 Conduct oiled wildlife operations in accordance with Santos' Oiled Wildlife Response – Implementation Plan (ALL/HSE/PLN/025)	**EPS IS 5.2.1** Records demonstrate that oiled wildlife operations were conducted in accordance with Santos' Oiled Wildlife Response – Implementation Plan (ALL/HSE/PLN/025)
Waste Management		
EPO IS 6 Collect, manage, transport and dispose of waste produced from response options to minimise secondary contamination of sensitive receptors	**EPS IS 6.1** Use the Bayu-Undan Decommissioning Waste Management Strategy and relevant decommissioning activity Waste Management Plan as guidance to collect, manage, transport and dispose of waste produced from response options	**MC IS 6.1.1** Records demonstrate that the Bayu-Undan Decommissioning Waste Management Strategy and relevant decommissioning activity Waste Management Plan was used as guidance to collect, manage, transport and dispose of waste produced from response options
	EPS IS 6.2 Waste management, storage, transport and disposal will comply with relevant legislation, conventions and standards, including: • MARPOL 73/78 (as appropriate to vessel class), including: - MARPOL 73/78, Annex I (Prevention of pollution by oil) - MARPOL 73/78 Annex II (Control of pollution by noxious liquid substances in bulk) • Relevant NT and Commonwealth Regulations, including: - Marine Order 91 (Marine pollution prevention – oil) (as appropriate for vessel class)	**MC IS 6.2.1** Records demonstrate waste generated during a hydrocarbon spill response is managed, stored, transported and disposed of in accordance with relevant legislations, conventions and legislation, including: • MARPOL 73/78 Annex I and Annex II • Marine Order 91 • Waste Management and Pollution Control Act 2015

EPO	Performance Standard	Measurement Criteria
	- Waste Management and Pollution Control Act 2015 (NT)	
	EPS IS 6.3 Santos to maintain contracts with third-party providers to provide access to suitably qualified and competent personnel and equipment to assist in the implementation of waste management activities.	**MC IS 6.3.1** Records demonstrate that Santos maintains contracts with third-party providers to provide access to suitably qualified and competent personnel and equipment to assist in the implementation of shoreline clean-up tactics
EPO IS 7 Implement relevant Operational and Scientific Monitoring Plans	**EPS IS 7.1** IMT will ensure operational and scientific monitoring initiation criteria are reviewed during the initial Incident Action Plan (IAP) and subsequent IAPs, and if any criteria are met, the relevant Operational Monitoring Plans (OMPs) and/or Scientific Monitoring Plans (SMPs) will be activated	**MC IS 7.1.1** Records demonstrate that the IMT reviewed operational and scientific monitoring initiation criteria during the initial and subsequent IAPs, and when criteria were met, the relevant OMP and/or SMP was activated
	EPS IS 7.2 Santos maintains the capability and capacity to deliver the Operational and Scientific Monitoring Program (OSMP) through: • OSMP Implementation Plan describes the process for implementing the operational and scientific monitoring programs • Individual OMP and SMP methodology describe data acquisition techniques, personnel and equipment required to conduct OMPs and SMPs Santos maintains access to OSMP resources through contracts with service and equipment providers listed in Attachment C of the OPEP	**MC IS 7.2.1** Records demonstrate OSMP carried out in accordance with the following: OSMP Implementation Plan Individual OMP and MSP methodologies Service provider and equipment provider contracts in place and maintained in accordance with Attachment C of the OPEP

8.9.5 Operational and Scientific Monitoring Plan

Santos' ABU-W OSMP (ALL/HSE/PLN/032) describes a program of monitoring oil pollution that will be adopted in the event of a hydrocarbon spill incident (tier 2 or 3) to marine or coastal waters. The OSMP is the principal tool for determining the extent, severity, and persistence of environmental impacts from a marine hydrocarbon spill and informing remediation activities.

The OSMP is structured so that it can provide a flexible framework that can be adapted to individual spill incidents. The OSMP provides an overarching framework, applicable to all assets where Santos is the Titleholder.

8.9.5.1 Operational Monitoring Focus Areas

Operational monitoring is undertaken during the course of a spill and comprises physical, chemical and environmental assessments. Operational monitoring collects information about the spill and associated response activities to aid situational awareness, planning and decision making for executing spill response or clean-up activities. Information collected from operational monitoring provides details about the extent and quantity of contamination and the effectiveness of response activities. This information includes monitoring the properties of the hydrocarbons released, including the state of weathering, bioavailability and spatial extent of the spill. Continued operational monitoring is used to determine the point at which no further environmental improvement outcomes can be achieved through continued response implementation. This monitoring will then finish when the spill response is terminated, usually because response objectives were met, and/or scientific monitoring was initiated.

8.9.5.2 Scientific Monitoring Focus Areas

Scientific monitoring focuses on the short- and long-term environmental impact assessment. It may occur in parallel to operational monitoring and can continue for some time after the spill event. Scientific monitoring addresses defined objectives and collects information to determine the potential short- and long-term and/or ongoing environmental impact attributable to the spill or the associated response activities and informs the requirements for scientific research and any potential remediation activity.

8.9.5.3 Reporting

Operational monitoring reporting will be provided on a daily basis to the IMT to maintain situational awareness and inform response option planning. Scientific monitoring reporting requirements will be specific to the individual monitoring plans initiated and are likely to include interim reports. The terms of responsibilities, report templates, schedule, quality assurance/quality control and peer review (if required) will be agreed with the nominated Environmental Service Provider(s) engaged to implement the individual monitoring plans.

Operational and scientific monitoring results will be discussed with relevant stakeholders as identified at the time. Monitoring reports will be shared with regulatory agencies/authorities if requested and inputs received from stakeholders will be evaluated and where practicable, will be used to refine the ongoing spill response and/or ongoing operational and/or scientific monitoring. The form, frequency, and content of discussions and reporting will be appropriate to the nature and scale of the incident.

8.9.5.4 Personnel and Response Readiness

Santos has a number of existing contracts, master service agreements, and business support relationships and alliances with service providers in place to provide support in the event of a spill, as outlined in the OPEP, and additional contracts will be in place with Environmental Service Providers prior to the commencement of the activity, to deliver the OMPs and SMPs as required. The OSMP includes an implementation strategy together with individual operational and scientific monitoring plans.

Indicative OSMP mobilisation time frames for personnel and resources are included in the OPEP.

8.9.5.5 Initiation and Termination of the OSMP

Criteria for initiating and terminating individual monitoring plans are provided in OPEP. The final decision on activation and termination of the monitoring plans will be signed off by the Santos ABU-W IC, in consultation with the Santos ABU-W Environment Unit Lead. Additional stakeholders that may be consulted on initiation and termination include the following:

- AMSA if the spill is from a vessel,
- AMOSC and Environmental Service Providers,
- Director of National Parks if the spill has entered, or has the potential to enter the Oceanic Shoals Marine Park,
- NT DoT personnel if the spill has entered, or has the potential to enter Territory waters,
- DAWE, if MNES are predicted to be affected, and
- NT Fisheries Department's and Australian Fisheries Management Authority (AFMA).

8.9.6 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 the Petroleum Activity 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 the Petroleum Activity, the Cyclone Response Plan will be actioned. If required, vessels can transit away from the proposed track of the cyclone (or severe weather event).

8.9.7 Emergency and Spill Response Drills, Exercises and Audits

Exercises and drills are conducted annually to test the arrangements of the OPEP. The exercises are scheduled in the Crisis and Emergency Management Training Schedule which is located in the ABU-W Annual Exercise Plan folder, and include a number of exercise types, as outlined in **Table 8-6**.

Table 8-6: Exercise Types

Exercise Type	Description
Notification drill	Test procedures to notify and activate the IMT, oil spill response organisations, third party providers and regulators
Desktop drill	Normally involves interactive discussions of a simulated scenario amongst IMT members, but does not involve the mobilisation of personnel or equipment
Incident Management Exercise	Involves IMT activation to establish command, control, and coordination of a Tier 2 or 3 incident. Can simulate several different aspects of an oil spill incident and may involve third parties

The purpose of this testing is to confirm that the response arrangements and capability in place is available when needed and function as intended. As part of the exercise process, Santos prepares a number of documents to ensure drills and exercises are well planned, conducted and evaluated. To support this, the following documents are used:

- ABU-W Exercise Scope Document – provides background context to the exercise, outlines the exercise need, aim, objectives, details of the scenario, participating groups and agencies, exercise deliverables and management structure. This document can be used to engage a third-party contractor to assist in conducting the exercise.

- Exercise plan and instructions – provide instructions and 'play' (including any injects) for conducting the exercise.
- Post exercise report – includes an after-action review of the exercise, evaluating how the exercise performed against meeting its aim and objectives.

Santos ABU-W routinely undertakes post-exercise debriefings following Tier 2-3 OPEP exercises and drills to identify opportunities for improvement and communicate lessons learned. All actions that are derived from drills and exercises including debriefs are documented in the HSE Action Tracking System (HATS).

The following exercises and drills will be conducted to specifically test response preparedness outlined within the scope of the OPEP (DCOM-652-EN-OPE-00002):

- Test of arrangements when they are introduced or significantly amended;
- Test of arrangements if a new location or activity is added to the EP after response arrangements have been tested, and before the next test is conducted; and
- IMT desktop exercise conducted at least annually. This desktop exercise will test the arrangements in place for a Tier 2 or Tier 3 level spill as defined in the OPEP (DCOM-652-EN-OPE-00002)). Where response arrangements are the same for a number of activity specific OPEPs, one exercise may be used to test these response arrangements for these OPEPs at the same time.

8.10 ROLES AND RESPONSIBILITIES OF PERSONNEL

In general, it is the responsibility of all personnel to act in an environmentally sustainable manner and to follow the environmental procedures detailed within this EP. The Pipeline decommissioning and preservation contractor's HSEMS will ensure that responsibilities for environmental performance are clearly delegated, all personnel are aware of their roles/responsibilities and personnel achieve adequate training on environmental issues. The suitability of the any contractors used to undertake the proposed work, including their HSEMS and past HSE performance, will be evaluated during the contractor evaluation phase of the project planning.

The roles and responsibilities for the Petroleum Activity for Santos' ABU-W and contractor personnel are outlined in **Table 8-7** and **Table 8-8** respectively. In the event of any emergency, response teams based on Santos ABU-W Crisis and Emergency Management structure will be formed, as outlined in **Section 8.10.1**.

Table 8-7: Santos ABU-W roles and responsibilities

Role	Responsibilities
VP Offshore Production Operations	The VP Offshore Production Operations has overall accountability for Bayu-Undan decommissioning and the contribution toward activities that are managed as part of the Bayu-Undan decommissioning scope.
Bayu-Undan Decommissioning Project Manager	The Bayu-Undan Decommissioning Project Manager has overall responsibility for the decommissioning of the Pipeline and: • Provides sufficient resources to implement the management controls in this EP; • Confirms Pipeline decommissioning and preservation activities are undertaken in accordance with this EP; • Actions the management controls, as detailed in the EPSs in this EP (**Section 7**), as required, during operations and prior to the commencement of the Pipeline decommissioning and preservation activities; and • Confirm Pipeline decommissioning activities meets the requirements of the Santos ABU-W HSEMS and relevant standards/procedures.
Bayu-Undan Decommissioning Delivery Manager	The Bayu-Undan Decommissioning Delivery Manager has overall responsibility for the decommissioning of the Pipeline and is responsible to ensure the effective implementation and compliance with this EP, including • Providing resources required to enable the commitments in this EP to be maintained;

Role	Responsibilities
	• Tracking and close out of any corrective actions raised from environmental audits as required by this EP; and • Confirming the reporting of environmental incidents meets both external and Santos ABU-W incident reporting requirements.
Marine Director	Confirm vessel vetting as per ABU-W Support Vessel Requirements Document No: IOSC/OPS/GLN/001 and obtain approvals from Corporate Marine Assurance for all vessels undertaking Pipeline decommissioning and preservation activities on the Pipeline
Bayu-Undan Decommissioning HSE Lead	Conduct relevant inspections to confirm vessels are in compliance with relevant Marine Orders and Santos ABU-W marine standards/procedures and on boarding requirements to meet pollution prevention safety, navigation and emergency response requirements
Bayu-Undan Decommissioning Subsea Project Engineer	The Bayu-Undan Decommissioning Subsea Engineer reports to the Bayu-Undan Decommissioning Delivery Manager and is responsible for: • Providing engineering assistance in the planning and scheduling of Pipeline decommissioning and preservation activities; • Communicating activity-specific EP requirements to the Pipeline decommissioning and preservation vessel crew; and • Confirming the reporting of environmental incidents meets both external and Santos ABU-W incident reporting requirements.
Crisis and Emergency Management Specialist	Crisis and Emergency Management Specialist is responsible for: • Assuring emergency response drills are undertaken as per the schedule outlined in this EP & OPEP; • Developing Santos ABU-W Crisis Management and Emergency Response Plans and Procedures; and • Providing input into SIMA for response strategies.
Bayu-Undan Decommissioning Environment Lead	• Confirm environmental audits are undertaken as outlined in this EP; • Develop Pipeline EP documents, including EPs and OPEPs, for submission and acceptance by NOPSEMA; • Provide environmental induction to production cessation vessel staff; • Ensuring Pipeline decommissioning and preservation Contractors attend an environmental induction upon commencing work on the Pipeline decommissioning and preservation activities; • Tracking and close out of any corrective actions raised from environmental audits as required by this EP; and • Communicating any changes to the Pipeline activity that may affect the EPOs, EPSs and MC detailed in this EP to the Santos ABU-W HSE team.
Senior External Relations Advisor	• Prepare and implement the stakeholder consultation program supporting all production cessation activities; • Report on any stakeholder consultation received in relation to the production cessation activities; and • Undertake ongoing engagement with relevant stakeholders for the duration of production cessation activities, as required.
Santos Client Site Representative (CSR)	The CSR will liaise with the Survey Contractor Party Chief, ensuring operations are completed to standard and that Santos' requirements are adhered to. The CSR will represent the client on-site for any decisions that need to be made and will be in direct regular contact (at least daily) with the Santos Engineering Project Manager. The CSR is responsible for conducting and lodging daily vessel reports, identifying and investigating any non-conformances with this EP and initiating incident reports.

Table 8-8: Contractor roles and responsibilities

Role	Responsibilities
Contractor Operations Manager	The Contractor Operations Manager is responsible for ensuring that vessel-based decommissioning and preservation activities are carried out in accordance with this EP.
Vessel Owner	Provide the Vessel Master with the resources to safely and efficiently fulfil the vessel requirements detailed in this EP
Vessel Master	• Confirm vessel management system and procedures are implemented and comply with the requirements detailed in this EP; • Confirm personnel receive an environmental induction that meets the requirements outlined in this EP on commencing work on the vessel; • Confirm crew personnel are competent to undertake the assigned work tasks; • Confirm SOPEP drills are undertaken in accordance with the vessel's schedule; • Confirm vessel crew are provided with sufficient training to implement the SOPEP/SMPEP (as appropriate to vessel class); and • Report any environmental incidents or non-conformances with the EPOs, EPSs or MC in this EP, as soon as practicable to the Santos Client Service Representative.
Contractor Party Chief (Pipeline Inspection & Maintenance Contractor)	The Contractor Party Chief will be responsible for the Pipeline decommissioning and preservation operations.
All Offshore Staff	• Act in an environmentally responsible manner; • Comply with this EP and all regulatory requirements as applicable to assigned role; • Report any unsafe conditions, near misses or environmental incidents immediately to supervisors; and • Attend environmental inductions and HSE meetings, and complete training as required.
Dive Superintendent	Accountability for diving activities including leading dive operations and ensuring activities are compliant with legislative and adopted company policies.

8.10.1 Incident Management

Santos is currently integrating the former ConocoPhillips' Australian Business Unit-West (ABU-W) assets, including the Bayu-Undan Facility and associated infrastructure. During this transitional period, ABU-W will remain in operational control of this Facility until it is fully transitioned to Santos. Therefore, the ABU-W Crisis and Incident Management Plan (CIMP) (ALL/HSE/ER/001) will continue to guide the ABU-W IMT when responding to emergency incidents. This document is supported by the Santos-ABU-W Incident and Crisis Management Bridging Plan (ALL/HSE/BDG/016), which outlines the interface between the ABU-W IMT and Santos Crisis Management Team (CMT). The ABU-W IMT and Santos CMT activation flow and communication interface are shown in **Figure 8-3** and **Figure 8-4** respectively.

The crisis and emergency response is managed by a hierarchy of teams within Santos, supported by international resources through the Crisis Management and Emergency Response group located at the Santos' Corporate office in Adelaide. Santos maintains a comprehensive Crisis Management and Emergency Response structure including:

- Santos CMT – Based in Adelaide under the leadership of a Crisis Manager. The CMT is responsible for coordinating and managing threats to the company's reputation and handling Santos' corporate requirements as an operator. In the event of a crisis or incident management engagement, after notification to the Santos CMT Duty Manager all initial and on-going status communications between Santos CMT and the ABU-W IMT shall be via the ABU-W IMT Incident Commander (or Deputy) to the Santos CMT Leader (or delegate).
- ABU-W IMT – Based in the Perth Emergency Operations Centre (EOC) under the leadership of an Incident Commander (IC). The ABU-W IMT supports on-site operations, or

in case of larger responses, assumes control of the response. For an ongoing response, the ABU-W IMT may decide to establish a forward operations base (FOB) in Darwin. The FOB would provide the IMT with a local presence to perform tasks such as local vessel contractor vetting, and equipment and personnel mobilisation.

- Emergency Response Teams (ERT) – On-site response teams under the control of the Emergency Commander (EC). The ERT is responsible for physically responding to and controlling emergency situations. For tier 1 spills, the response will be managed by the EC (i.e. Facility Emergency Controller for Bayu-Undan Field Facilities spills and Vessel Master for vessel-based spills) and ERT.

The ABU-W IMT is trained in emergency management in line with the ABU-W Incident Command System (ICS) procedures. The roles and responsibilities of the ABU-W IMT and emergency response checklists are presented in detail in the ABU-W CIMP (ALL/HSE/ER/001).

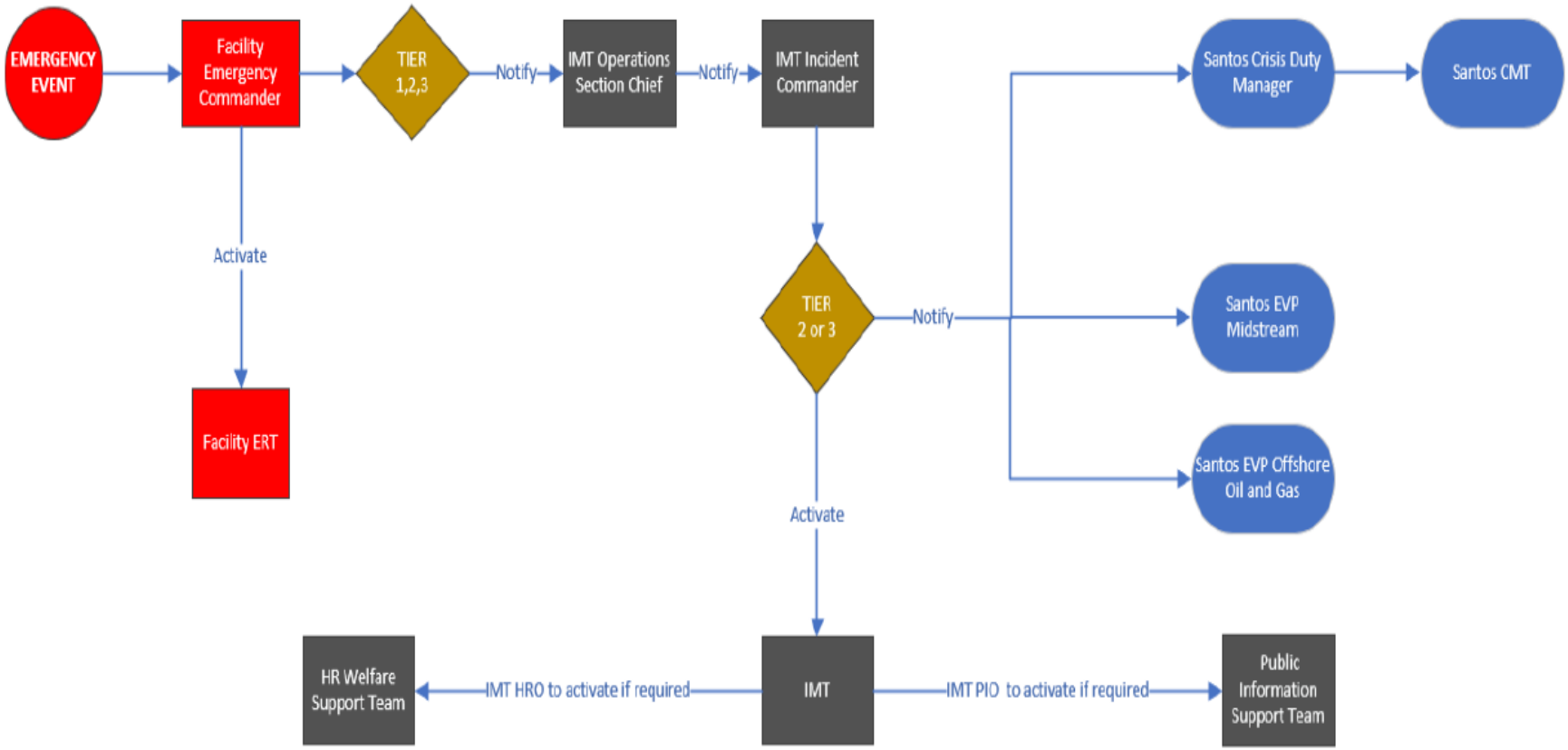


Figure 8-3: Santos Incident and Crisis Management Activation Flow

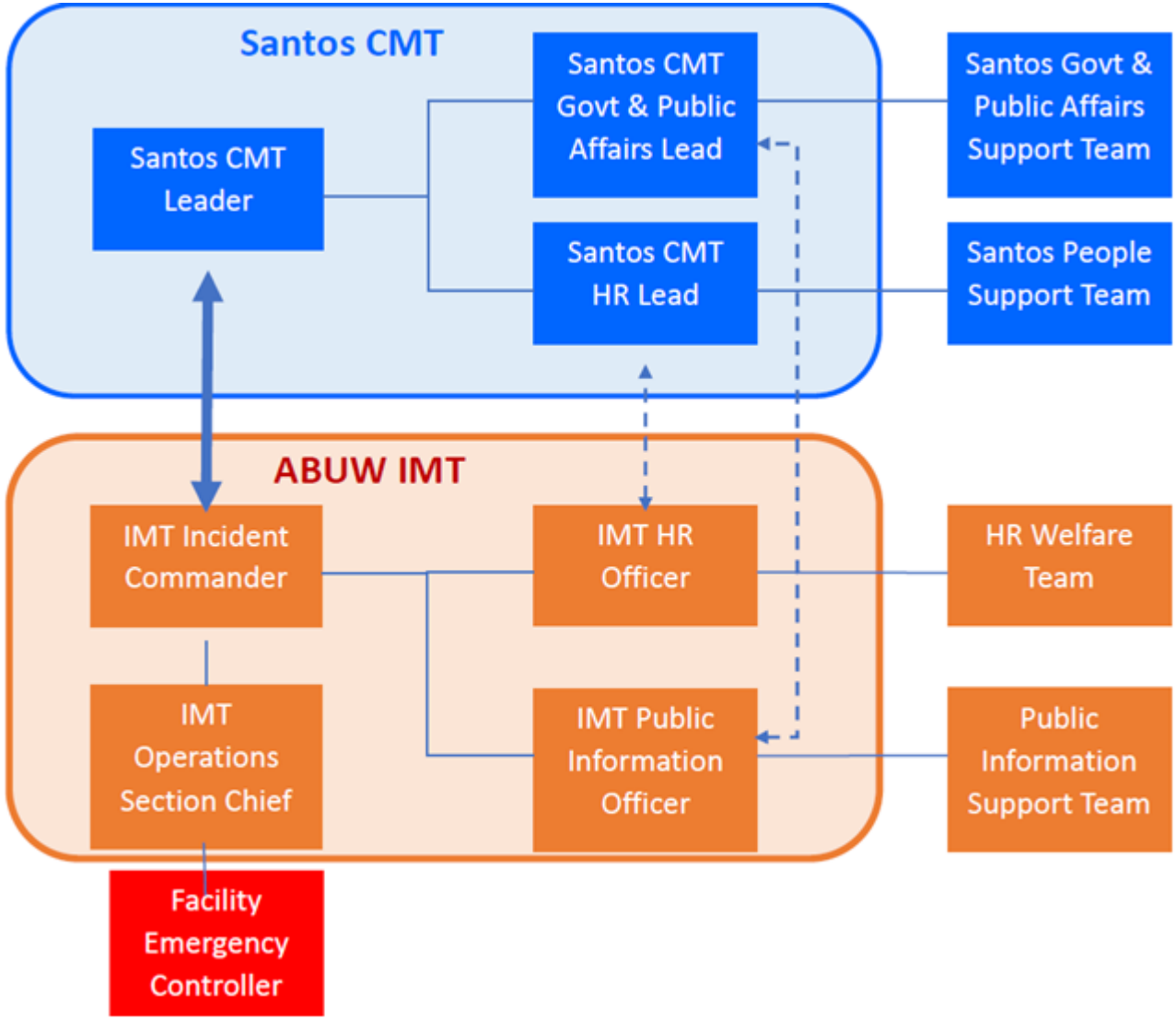


Figure 8-4: Ongoing Incident and Crisis Management Interface Communications After Activation of Santos CMT

8.10.1.1 Incident Management Team (IMT)

In the event of an emergency, the Santos ABU-W IMT will be mobilised. The IMT consists of Tactical Command, Operational, Planning, Logistics, and Support personnel. It is responsible for providing advice, logistical support and managing the operational and technical aspects of an incident response in support of the Emergency Response Team (ERT). In the case of a hydrocarbon spill from a vessel, the Vessel Master is the key member of the ERT and manages the shipboard response via the vessel Shipboard Oil Pollution Emergency Plan (SOPEP).

The IMT objectives are to:

- Provide timely operational support to the ERT,
- Protect employees, contractors and members of the public from injury or illness because of an incident,
- Minimise injury to people and damage to assets and the environment,
- Liaise with appropriate support agencies to assist ERT members in emergency situations,
- Develop an Incident Action Plan (IAP),
- Complete incident related communication and notifications to external parties, and
- Provide regular information updates to the CMT.

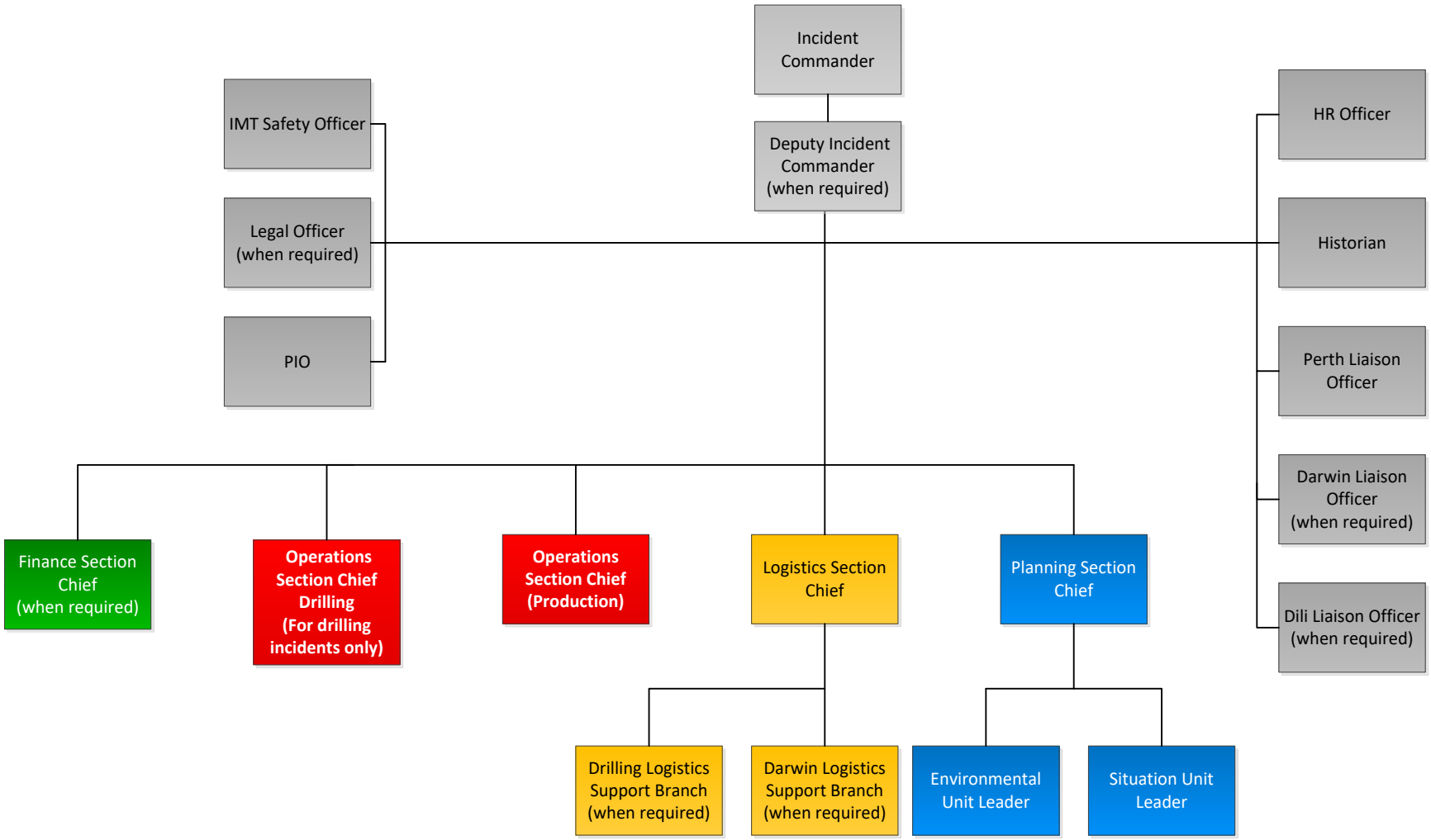


Figure 8-5: IMT structure

8.10.1.1.1 IMT Composition

To provide effective support and advice to the ERT at the site or facility, the IMT for Tier 2 and 3 incidents will be made up of the following roles and can be scaled up or down as required:

- Incident Commander (Deputy Incident Commander when required);
- Operations Section Chief;
- Planning Section Chief;
- Logistics Section Chief (Supplemented by Logistics Support as required);
- Liaison Officer (Darwin Liaison Officer when required);
- Safety Officer;
- Situation Unit Leader;
- Environmental Unit Lead;
- Public Information Officer;
- HR Officer;
- Legal Officer (As required);
- Finance Section Chief (As required); and
- Historian.

Key roles and responsibilities for Santos ABU-W personnel for incident response are outlined in **Table 8-9**.

Table 8-9: Roles and responsibilities of key IMT personnel

Role	Responsibilities
Incident Commander	• Overall management of incident response operations • Assess the situation and confirm or adjust the classification (tier) level in consultation with the Operations Section Chief and Emergency Commander • Notify the Crisis Manager of event and initial response tier • Set objectives for IMT • Confirm Incident Action Plan (IAP) is being developed and approve IAP • Validate that relevant regulators and other authorities have been notified • Consider and request Crisis Management Team support • Approve Incident Demobilisation Plan
Operations Section Chief	• Assist in classifying the emergency (Tier 1,2,3) in consultation with the site Emergency Commander and maintain open line of communication • Inform Incident Commander of emergency notification and tier level and maintain an open line of communication • Provide overview of response operations at initial IMT brief • Communicate incident updates provided by the Emergency Commander to IMT through meetings and team briefs • Provide incident details to the Planning Section Chief and Situation Unit Lead for development of Initial IAP and help develop incident objectives and strategies • Determine operational areas e.g. staging areas, forward command, incident area, oiled wildlife receiving and demobilisation areas • Contribute to the preparation and implementation of the Incident Demobilisation Plan
Planning Section Chief	• Consider incident escalation potential and predication for incident

Role	Responsibilities
	• Develop Initial IAP in conjunction with Operations Section Chief and Situation Unit Lead • Liaise with Logistics, Safety Officer and Environment Unit Leads as to requirements to complete response strategies • Facilitate/Chair IMT meetings • Monitor situation reports and update Emergency Operations Centre (EOC) status displays with additional information and adjust IAP as necessary • Prepare the Incident Demobilisation Plan
Logistics Section Chief	• Source all logistical requirements to complete response operations, including personnel, equipment and supplies for ongoing incidents. • Upon approval from IC, source third party resources (e.g. vessels, helicopters) to assist in response operations • Liaise with Planning Section Chief on specialist resource requirements being considered in response strategies. Verify availability as this may affect strategy selection
Environment Unit Lead	• Activate oil spill response organisations upon approval of the IC • Notify external agencies and regulators of spill (as detailed in activity specific OPEPs) • Undertake operational SIMA

8.10.1.2 Crisis Management Team

The CMT, under the leadership of the Crisis Manager, is responsible for the overall management of the incident from a strategic, legal, ethical and public image perspective.

The primary objectives are to:

- Provide strategic guidance and support to the IMT as required,
- Consider the strategic, legal and public image aspects of the incident,
- Attend to all public media issues,
- Develop a Crisis Management Plan to coordinate all actions,
- Communicate with internal and external stakeholders, and
- Comply with applicable regulatory requirements in an emergency situation.

9 STAKEHOLDER CONSULTATION

OPGGS(E)R 2009 Requirements
Regulation 9AB
If the Regulator's provisional decision under regulation 9AA is that the environment plan includes material apparently addressing all the provisions of Division 2.3 (Contents of an environment plan), the Regulator must publish on the Regulator's website as soon as practicable: (a) the plan with the sensitive information part removed; and (b) the name of the titleholder who submitted the plan; and (c) a description of the activity or stage of the activity to which the plan relates; and (d) the location of the activity; and (e) a link or other reference to the place where the accepted offshore project proposal (if any) is published; and (f) details of the titleholder's nominated liaison person for the activity. Note: If the plan is a seismic or exploratory drilling environment plan, the Regulator must also publish an invitation for public comment on the plan: see regulation 11B.
Regulation 16
16 The environment plan must contain the following: (b) a report on all consultations under regulation 11 A of any relevant person by the titleholder, that contains: (i) a summary of each response made by a relevant person; and (ii) an assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates; and (iii) a statement of the titleholder's response, or proposed response, if any, to each objection or claim; and (iv) a copy of the full text of any response by a relevant person.

9.1 INTRODUCTION

In accordance with the requirements of Regulations 11A and 14(9) of the OPGGS(E) Regulations, Santos has engaged with interested and relevant stakeholders while preparing this EP. This section outlines Santos' 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. Santos has considered and addressed all relevant feedback as appropriate and provided a detailed summary table at the end of this section and a separate Appendix comprising all relevant correspondence records.

9.2 APPROACH AND OBJECTIVES

Santos understands retaining a broad licence to operate depends on the development and maintenance of positive and constructive relationships with a comprehensive group of stakeholders in the community, government, non-government, other business sectors and other users of the marine environment. Fostering effective consultation between Santos and relevant stakeholders is an important part of this process.

This approach is reflective of approaches commonly adopted by the oil and gas industry, within Australia and internationally. More specifically, it aligns with NOPSEMA consultation guidelines under the OPGGS(E) Regulations. In addition, sources of external stakeholder engagement guidance used in preparing this EP were:

- Australian regulatory agencies (legislation and guidelines) – NOPSEMA, DPIR, AFMA,
- Australian industry organisations (principles and methodology) – Australian Petroleum Production and Exploration Association (APPEA), and

- International organisations (guidelines) – International Petroleum Industry Environmental Conservation Association (IPIECA), American Petroleum Institute (API), International Finance Corporation (IFC), International Association for Public Participation.

Santos is committed to ensuring that all stakeholders are kept informed of its activities and that clear response mechanisms are in place to receive feedback on relevant issues to inform development of each EP.

For stakeholder engagement conducted in preparing EPs, the Health, Safety and Environment (HS&E) and External Relations functions work in collaboration to ensure the relevant regulations and associated consultation and content guidance provided by NOPSEMA and other relevant organisations are understood and followed.

The consultation program for the Bayu-Undan to Darwin Gas Export Pipeline Decommissioning and Preservation EP was designed to meet the following objectives:

- Inform stakeholders of the rationale for decommissioning and preservation of the Pipeline and the provisions of the EP,
- Explain how Santos will identify and mitigate against potential risks that may impact stakeholders,
- Understand any concerns, objections or claims that stakeholders may have in relation to the EP,
- Address these concerns and requirements for ongoing consultation, and
- Inform stakeholders about how their concerns have been addressed and how they will be represented to NOPSEMA in the EP.

Santos ABU-W has operated the Pipeline since 2005 and during this time has developed a strong understanding of the environmental values that exist in the area and the activities of the other marine environment users. This understanding has been deepened by the interactions undertaken and relationships formed with a range of relevant stakeholders including Commonwealth and NT government departments, commercial fishing associations and licence holders, spill response agencies, contractors and non-government organisations.

The period that should be afforded stakeholders for consultation on proposed activities prior to an EP's submittal to NOPSEMA is not mandated in the governing regulations. As per NOPSEMA's guidelines, Santos determined an appropriate timeframe based on the nature of the proposed activity and our understanding of the likely issues and concerns that may be raised by stakeholders.

In the case of this EP, a formal consultation period of six months (24 weeks) was undertaken and is considered to have been appropriate considering the nature and scale of the activity and the following specific factors:

- The need to consult on different activities with different jurisdictions across three locations - in Timor-Leste Waters, Australian Commonwealth Waters and NT Waters,
- The sea-bed location (+100m water depths) of the Pipeline, predominantly in Australian Commonwealth Waters, minimises the opportunity for relevant stakeholders, such as other marine users at sea surface level, to interact directly with the Pipeline,
- In-situ decommissioning of the largest section of the Pipeline would require minimal offshore activities in Australian Waters while Preservation of the Pipeline would not involve any offshore activities in Australian and NT Waters,
- Decommissioning of the Pipeline would involve significant offshore activities in Timor-Leste Waters, where removal of an approximately 34km section is required, but the remote location also minimises opportunity for interaction with other marine users,
- Pipeline operations over a 15-year period have not resulted in any significant incidents that have impacted relevant stakeholders, particularly other users of the marine environment such as commercial fishers,

- Consultation with relevant stakeholders has been ongoing throughout the Pipeline's operation, most recently in 2019 for the last Operations EP Revision, during which no major concerns were identified by stakeholders, and
- Consultation with external stakeholders conducted in 2019 for the accepted Production Cessation EP, the first stage of planned decommissioning, did not raise any major concerns from stakeholders.

The first stage of Pipeline Decommissioning consultation involved the Cessation of Production activities. Consultation with stakeholders on the Production Cessation EP, including discussions on the future decommissioning process and timeframe and requirement for a separate decommissioning EP, was undertaken from March to June in 2019 with the EP submitted to NOPSEMA for assessment in July and accepted in September 2019.

In December 2019 Santos held initial discussions with key Australian Government departments on the intent to prepare and submit a Decommissioning EP in mid-2020. Initial discussions also commenced with the Timor-Leste Government's regulatory body for offshore oil and gas projects, the Autoridade Nacional do Petroleo no Mineral (ANPM).

In December 2019 Santos also commenced discussions with key commercial fishing and government stakeholders who were invited to planned workshops at which the Decommissioning Options Evaluation being undertaken to inform the EP preparation would be presented and discussed.

The workshops occurred in Darwin, NT in February 2020 and in Dili, Timor-Leste in March 2020. Feedback from these workshops and subsequent consultation with the attendees was used to inform preparation of the EP.

Following the workshops, Santos commenced wider consultation with the distribution of information to all relevant and interested stakeholders. Feedback received was also used to inform preparation of the EP.

In June 2020, Santos distributed updated information to all relevant and interested stakeholders and the feedback received was also used to inform ongoing preparation of the EP. In July, further attempts were made to seek feedback from key relevant stakeholders prior to submittal of the EP in August.

The section of Pipeline located in Timor-Leste Waters is regulated by NOPSEMA and the key stakeholder is the Timor-Leste Government's offshore oil and gas regulatory body, the ANPM. Following the Decommissioning Options Evaluation workshop, Santos worked with the ANPM to meet its external stakeholder consultation requirements.

The section of the Pipeline within NT Waters is regulated by the NT Government under the *Energy Pipeline Act*. Under the Act, Santos holds an accepted Pipeline Management Plan, including an EP consistent with the OPGGS(E) Regulations and NT Onshore Pipeline EP Guidance. This regulatory function is managed by the NT Department of Primary Industry and Resources (NT-DPIR). Santos included relevant stakeholders for NT Waters in the EP consultation process and, by agreement with the NT-DPIR, will submit the updated PMP following NOPSEMA's assessment of the EP.

9.3 IDENTIFICATION AND CLASSIFICATION

Santos began the stakeholder identification process for this EP with a review of its stakeholder database, including stakeholders consulted for the GEP Production Cessation EP and other recent activities in the area. The list of stakeholders was then reviewed and refined based on the defined Operational Area, the EMBA and relevance of the stakeholder according to Regulation 11A of the OPGGS (E) Regulations and NOPSEMA Bulletin #2 Clarifying statutory requirements and good practice consultation (November 2019).

An internal exercise then identified potential stakeholder-specific issues that needed to be addressed and cross-referenced these with the outcomes from ENVID workshops and risk assessments conducted by HS&E as part of the EP preparation process.

Stakeholder groups identified included Commonwealth and NT Government Departments and Agencies, fishing industry councils and commercial fishing licence-holders and recreational

fishing bodies operating close to the Pipeline jurisdiction within Commonwealth Waters and NT Coastal Waters. Spill response agencies with a role to play should an incident occur to the Pipeline were also consulted during preparation of the OPEP.

Issues, risks and opportunities associated with the project were mapped to stakeholders' interests. To ensure consistency with regulatory requirements, Santos adapted its categorisation and definition of stakeholder groups to broadly align with those used by NOPSEMA, as outlined below.

Table 9-1: Stakeholder groups

Stakeholder group	Description
Timor-Leste Government	ANPM/ Other external stakeholders identified by T-L Gov't/ANPM
Australian Government	Commonwealth Government regulatory agencies, organisations and political representatives
State and Territory Governments	NT and WA Government regulatory agencies, organisations and political representatives
Associations	Petroleum and professional and recreational fisherman industry associations
Industry	Petroleum titleholders (current and future applicants)
Other marine users	Commercial and recreational fishermen, shipping companies
Environmental interest groups	Environmental non-government organisations
Darwin Harbour users	Darwin Ports, Darwin Harbour commercial and recreational users
Indigenous groups	Traditional Owners and other local Indigenous groups
Business community	Companies with relevance to/interest in decommissioning of the Pipeline
Research/education groups	Interested research, education and training organisations

Within the broad stakeholder groupings, the following list of stakeholders was identified as being interested or relevant for Commonwealth waters and NT Coastal Waters. As stated above, all relevant stakeholders were afforded the same engagement process. During the consultation process, some stakeholders that Santos had designated as 'relevant' advised they did not consider this was the case and did not require further information.

In addition, new stakeholders who visit Santos' external facing website may contact the company via contact details provided online, and information about Santos' activities s published on the website for new stakeholders to review.

Table 9-2: BUPIOA, Commonwealth Waters and NT Waters stakeholders

Relevant	Commonwealth Waters	NT waters
A. Raptis & Sons Pty Ltd	x	
Aboriginal Areas Protection Authority, Northern Territory		x
Amateur Fishermen's Association of the Northern Territory	x	x
Aquarium Fishery NT Commercial Licence Holders		x
Arafura Bluewater Charters	x	x

Austfish Pty Ltd	x	
Austral Fisheries Pty Ltd	x	
Australia Bay Seafoods	x	
Australian Fisheries Management Authority	x	
Australian Marine Oil Spill Centre	x	x
Australian Maritime Safety Authority	x	x
Australian Radiation Protection and Nuclear Safety Agency	x	x
Australian Southern Bluefin Tuna Industry Association	x	
Autoridade Nacional do Petroleo no Mineral (ANPM)		
Commonwealth Fisheries Association	x	
Darwin Port Corporation*	x	x
Demersal Fishery NT Commercial Licence Holders	x	x
Department of Agriculture, Water and the Environment, Commonwealth	x	
Department of Defence, Commonwealth (including Australian Hydrographic Service and Maritime Border Command)	x	x
Department of Environment & Energy, Commonwealth (including Parks Australia)	x	
Department of Environment & Natural Resources (Environment division), NT		x
Department of Foreign Affairs & Trade, Commonwealth	x	
Department of Industry, Science, Energy and Resources, Commonwealth	x	
Department of Infrastructure, Planning & Logistics (Transport), NT*	x	x
Department of Primary Industries & Regional Development (Fisheries), WA	x	
Department of Primary Industry & Resources (Fisheries), NT	x	x
Department of Primary Industry & Resources (Mines & Energy), NT	x	x
Department of the Chief Minister, NT		x
ENI Australia	x	x
INPEX	x	x
JERA	x	x
Lattice Energy	x	
Monsoon Aquatics	x	x
Northern Prawn Fishery (NPF)	x	
Northern Territory Guided Fishing Industry Association	x	x
Northern Territory Seafood Council	x	x
Northern Trawl Owners Association	x	
Northern Wildcatch Seafood Australia	x	

Office of Minister for Environment & Energy, Commonwealth	x	
Office of Minister for Environment & Natural Resources, NT		x
Office of Minister for Infrastructure, Planning & Logistics, NT (Transport)*	x	x
Office of Minister for Primary Industry & Resources, NT (Fisheries; Mines & Energy)	x	x
Office of Minister for Resources, Energy & Northern Australia, Commonwealth	x	
Offshore Net and Line Fishery Commercial Licence Holders		
Oil Spill Response Ltd*	x	x
Origin Energy	x	
Paspaley Pearling Company		x
Pearl Oyster Fishery Commercial Licence Holders		x
Pearl Producers Association		x
Shell	x	
SK E&S	x	x
Spanish Mackerel Fishery (NT) Licence Holders	x	x
Timor Reef Fishery Licence Holders	x	
Tiwi Land Council	x	x
Tokyo Gas	x	x
Total	x	x
WA Fishing Industry Council, representing Western Tuna and Billfish Fishery license holders	x	
WA Seafoods	x	
WorkSafe NT		x
Interested		
Australian Institute of Marine Science	x	x
Australian Marine Conservation Society	x	x
Australian Petroleum Production & Exploration Association	x	x
Centre for Whale Research	x	x
Chamber of Commerce and Industry, Northern Territory	x	x
Charles Darwin University (CDU)	x	x
Commonwealth Scientific & Industrial Research Organisation	x	x
Department of Trade & Business Innovation, NT		x
Environment Centre Northern Territory	x	x
Environmental Defenders Office Northern Territory	x	x
Environment Protection Authority, NT		x
Federal Member for Solomon, Northern Territory	x	x

Geoscience Australia	x	
Kimberley Land Council	x	
Monash University	x	x
National Offshore Petroleum Titles Authority	x	
Office of Minister for Indigenous Affairs, Commonwealth	x	
Office of Minister for Industry, Innovation and Science, Commonwealth	x	
Office of Senator for the Northern Territory	x	x
Office of Shadow Parliamentary Secretary for Northern Australia	x	x
Office of the Chief Minister, NT	x	x
Office of the Leader of the Opposition NT	x	x
Pendoley Environmental*	x	x
Power and Water Corporation, NT		x
Sea Turtle Foundation	x	x
Whale and Dolphin Conservation Society	x	x
Wilderness Society	x	x

* Relevant to preparation of Oil Pollution Emergency Plan (OPEP)

9.4 METHODS AND TOOLS

Santos adopted the following process to address objections and claims received during the consultation process:

- Santos acknowledged receipt of all comments made by stakeholders,
- Santos assessed the merits of all objections and claims made by stakeholders. This included assessing all reasonably available options for resolving or mitigating the degree to which a stakeholder's functions, interests or activities may be affected, with control measures proposed where reasonably practicable,
- Santos responded to all stakeholder objections and claims, and advised the stakeholder how each of their issues would be addressed in the EP,
- Santos invited the stakeholder to provide additional feedback and comment, and
- As soon as possible, or on publication of the EP on the NOPSEMA website, Santos advised all stakeholders who had made an objection or claim, where their specific objection or claim was represented in the EP.

A similar process to the above was applied to information provided and requests made by stakeholders not deemed to be an objection or claim.

Santos is mindful of NOPSEMA guidance 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. During the consultation period, Santos sought to provide all stakeholders with appropriate time to assess the information provided and consider Santos' responses.

Santos recognises the importance of ensuring a high degree of transparency in how a titleholder manages ongoing stakeholder consultation during the life of an activity. As such, should additional stakeholder comments be received to those described in **Table 9-3** then Santos will assess the comments using the above process, ensuring the EP is updated to

document the assessment of any additional objections or claims.

During consultation, most stakeholders did not provide any written feedback. Where stakeholders did provide written feedback, the consultation is summarised in the table at the end of this section and full records provided in Appendix E. If a comment was provided by a stakeholder during a phone discussion but not followed-up by the stakeholder with an email, Santos initiated its own summary of the issues raised and its assessment back in writing to the stakeholder.

Santos sought to provide fully considered and appropriate written responses to issues as soon as possible, dependent 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, Santos advised stakeholders as such and provided an update to the stakeholder as to when a written response would be provided. All stakeholder feedback received over the duration of the stakeholder engagement program is summarised in **Table 9-3** and full records provided to NOPSEMA in the confidential **Appendix E: Stakeholder Consultation**.

9.5 OUTCOMES

Based on the feedback provided during the consultation period the common issues of concern raised by stakeholders were:

- The impacts and/or risks to the environment from the process of chemical cleaning and flooding of the pipeline with treated seawater
- The impacts and/or risks to the environment from degradation of the pipeline section to be decommissioned in-situ in Australian Commonwealth Waters.
- The nature of long-term environmental monitoring and question of liability for the pipeline section left in-situ in Australian Commonwealth waters, and
- Whether leaving the pipeline in-situ in Australian Commonwealth Waters would provide an equal or better environmental outcome, as defined in current legislation.

Santos has considered these and all other stakeholder responses, assessed the merits of all objections, claims, additional information and requests related to the risks and impacts of the proposed activities and provided detailed responses, either individually or collectively, to the stakeholders concerned. These are summarised in **Table 9-3.**

9.6 ONGOING CONSULTATION

Santos is committed to ongoing consultation in relation to the progress of this EP and as part of a broader commitment to thorough stakeholder engagement around the Decommissioning and Preservation of this asset.

In addition to the formal communication to all stakeholders on the submittal and assessment of the EP, during this period Santos will continue to consult with the ANPM, in relation to consultation required for the proposed activities within Timor-Leste Waters, and the NT DPIR for submission of the updated PMP.

Santos provides relevant stakeholders with ongoing consultation for regulatory purposes and to ensure community stakeholders are engaged and informed of Santos's activities in the region. Santos will work with stakeholders to address any future concerns if they arise throughout the duration of this EP. Should new stakeholders be identified they are added to the stakeholder database and included in all future correspondence as required, including activity-specific notifications and updates.

Activities covered under this EP will be included in Santos' Quarterly Consultation Update circulated to a broad group of Santos stakeholders, including many of the stakeholders identified for this activity. If stakeholders request additional information or raise concerns on any activity listed in a Quarterly Consultation Update, a dialogue with these stakeholders can continue during or post the preparation of an EP and will be recorded for future reference.

Santos commits to respond and address any comments to the satisfaction of both parties and

keep any consultation on file during and post acceptance of an EP.

Santos is further committed to ensuring stakeholders are kept informed with regards to the nature and timeframe for the required future works. Prior to the commencement of any activity Santos makes direct contact with its relevant stakeholders to inform them that the activity will be occurring. This is followed up by an email advice to all potential users of the area including commercial fishers.

This notification advises the names of vessels that will be undertaking the work on Santos' behalf and all notifications are also provided to the Australian Hydrological Service and the AMSA for Commonwealth waters and the Darwin Harbour Master for Northern Territory Waters prior to and during the duration of the activities in compliance with all maritime safety and navigation procedures.

A dedicated email address is available on an ongoing basis for any queries regarding the EP and associated activities. Santos manages external enquiries and concerns on an ongoing basis through active and transparent engagement to ensure issues are identified and resolved in a mutually satisfactory manner. Stakeholders are encouraged to make contact with Santos directly and immediately if a concern is identified.

9.7 CONCLUSION

Santos' view is that all stakeholders have been provided sufficient information and opportunity in a fair and reasonable timeframe to enable the discussion and assessment of all issues raised during the consultation period.

The consultation records demonstrate the lengths to which Santos has undertaken its regulatory responsibilities and applied its corporate principles to ensure stakeholders, in particular co-users with access rights to conduct activities in the marine environment, are fully informed and aware of how the issues they have raised have been addressed by Santos in the EP that will be presented to the regulator.

Table 9-3: Consultation summary for activity

<table>
<tr><th>Stakeholder</th><th colspan="2">Stakeholder Consultation Summary (OPGGS(E) Regulation 16 (b)(i))</th></tr>
<tr><td colspan="3">Timor-Leste Government</td></tr>
<tr><td rowspan="3">Autoridade Nacional do Petroleo no Mineral (ANPM) - relevant</td><td colspan="2">• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
• ANPM participated in Decommissioning Workshops with Santos on 5 May. Key questions raised by ANPM at the workshops related to:
o EP consultation process to be followed by Santos
o Onshore disposal options and potential locations
o Environment criteria used for the Decommissioning Options Evaluation (DOE)
o Long-term environmental impacts following pipeline removal
o Safety risks from contaminants associated with removal
o Risk and impact assessments and scoring methodology used for DOE
o Additional details of removal method
• Santos provided minutes of the workshops, including responses to all questions raised, and a copy of the PPT presentation, via email on 15 May; Santos provided follow-up emails on 26 May and 9 June
• ANPM requested additional information, via email on 17 June; no specific issues/concerns were raised; further information was requested on:
o Decommissioning Options Evaluation (DOE) criteria and process
o Legal framework applicable to project
o Description of proposed activity
o Environmental risk assessment for project
o Environmental performance objectives, performance standard and measurement criteria for project
o Proposed post-decommissioning environmental monitoring survey
• Santos provided the requested information to the ANPM, via email on 24 July 2020</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>The ANPM has asked a series of questions, the majority of which have related to either the CA process, including the criteria employed, or the proposed methodology for pipeline removal in Timor-Leste Waters.
Santos has answered all questions and responded to all requests for information.
No objections or claims have been raised by ANPM during the workshops held or the requests for additional information submitted.</td><td>Santos will continue to consult directly with the ANPM which has stated communication is also required with the Secretary of State of the Environment and the General Directorate of Fisheries, Ministry of Agriculture and Fisheries
The ANPM has advised that it (the ANPM) will be responsible for the communications with other stakeholders and will organise required briefings.
At the time of EP submittal, no further briefings had been requested.</td></tr>
<tr><td colspan="3">Australian (Commonwealth) Government</td></tr>
<tr><td></td><td colspan="2">• Santos provided Notice of Consultation Fact Sheet via email on 29 March
• ACMA suggested Santos check with AHO re presence of submarine cables, via email on 1 April</td></tr>
</table>

<table>
<tr><td rowspan="4">Australian Communications and Media Authority (ACMA) - relevant</td><td colspan="2">• Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet and additional information on 3 June
• Santos provided advice to ACMA re submarine cables following liaison with AHO, via emails on 18 and 19 June</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>As requested by ACMA, Santos liaised specifically with the Australian Hydrographic Office (AHO) on the presence of submarine cables and was advised by the AHO that there were no issues or concerns.
No objections, claims or other requests have been raised.</td><td>One query has been answered.
No further response is required.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">Australian Fisheries Management Authority (AFMA) - relevant</td><td colspan="2">• Santos provided initial information via email on 16 December 2019 and invited AFMA to participate in a pipeline decommissioning workshop
• Santos reissued the workshop invitation via email on 7 January 2020; AFMA declined the invitation on 20 January.
• Santos provided Notice of Consultation Fact Sheet via email on 29 March
• Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet and additional information on 3 June.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>AFMA declined to participate in a pipeline decommissioning workshop, stating it was aware that fishing industry bodies were attending and AFMA would liaise with them post the workshop.
Santos also provided AFMA with the tailored information provided to commercial fishing stakeholders.
No objections, claims, information or requests have been raised.</td><td>AFMA has been provided with base and additional information and opportunity to comment.
No further response is required.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">Australian Maritime Safety Authority (AMSA) - relevant</td><td colspan="2">• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
• Santos provided Updated Notice of Consultation Fact Sheet on 3 June
• AMSA provided acknowledgement and advice re process/notifications required in advance of and during execution of activities via email on 10 June
• Santos provided response confirming the submitted EP will include commitments to the required process and notifications via email on 9 July</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>AMSA has provided information on the process/notifications required of the Operator prior to operations commencing.</td><td>Santos has confirmed to AMSA that all the stated requirements will be met, including prior notifications to the AHO and AMSA’s Joint Rescue Co-ordination Centre.</td></tr>
<tr><td colspan="2"></td></tr>
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<tr><td></td><td colspan="2">No objections or claims have been raised.</td></tr>
<tr><td rowspan="4">Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) - relevant</td><td colspan="2">• Santos met with ARPANSA on 11 February 2020 and provided initial information on the technical assessments/studies to be undertaken as part of EP preparation for submittal to NOPSEMA
• Santos provided Notice of Consultation Fact Sheet via email on 29 March
• Santos provided Updated Notice of Consultation Fact Sheet on 3 June
• Santos held a further meeting with ARPANSA on 2 July to present outcomes of assessments/studies; ARPANSA asked questions related to the following:
o Management of waste from activities in Timor-Leste Waters
o Measurement of radioactivity levels in Pigging Dust Samples
o Threshold levels used for NORM dilution modelling analysis and modelling findings
o Potential for accumulation of waste material on seabed
o Presence of Radium
o Regulatory Process
• Santos provided record of meeting and copy of presentation to ARPANSA via email on 9 July; Santos provided responses to questions raised at meeting, via email on 13 July.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>Questions raised by ARPANSA were primarily seeking additional information/clarity or confirmation that specific information would be included in the EP and the risk assessment and mitigation processes being followed by Santos
Santos has answered all questions and responded to all requests for information.
Santos has undertaken two specific actions requested by ARPANSA (see column at right) relevant to analysis presented in the EP.
No objections or claims have been raised.</td><td>In response to a request from ARPANSA, Santos confirmed that, in addition to analysis of contaminant dilution in the water column, the potential for any NORM particle accumulation on the seabed would also be considered, specifically with regard to the risk/impact on biodiversity.
In response to a request from ARPANSA, Santos confirmed that analysis would consider and address Radium-226 exposure pathways, given the decay relationship between Ra-226 and Po-210 and the much longer half-life of Ra-226 (compared with Po-210), addressing where else Ra-226 is found in the extraction and production process, to explain the relatively low activity levels in the Pipeline.</td></tr>
<tr><td rowspan="3">CSIRO - interested</td><td colspan="2">• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
• Santos provided Updated Notice of Consultation Fact Sheet on 3 June.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td></tr>
<tr><td>No objections, claims, information or requests have been raised.</td><td>CSIRO has been provided with base information and opportunity to comment.
No further response is required.</td></tr>
<tr><td>Department of Agriculture, Water & the Environment (DAWE) - relevant</td><td colspan="2">• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
• DAWE’s SeaPorts Program provided acknowledgement and advice re biosecurity protection requirements pertaining to EP content and activities via email on 31 March</td></tr>
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Santos provided Updated Notice of Consultation Fact Sheet on 3 June
DAWE's SeaPorts Program provided acknowledgement and advice re biosecurity protection requirements pertaining to EP content and activities via email on 18 June. Key issue raised was the need to mitigate against risk of potential non-indigenous and invasive marine species (IMS) for activities occurring in Timor-Leste Waters
Santos provided response confirming the submitted EP will include commitments to the required process and notifications via email on 19 June

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<tr><td></td><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td></td><td>DAWE (SeaPorts Program) provided information on the regulatory requirements on an Operator to mitigate against biosecurity risks and impacts prior to and during activities.
Specifically, DAWE advised that any domestic conveyances that could potentially be exposed through interactions with persons, goods or conveyances outside Australian territory must be risk-assessed by the Dep't to determine whether they become subject to biosecurity control upon their return. DAWE also requested that the EP to be submitted considers these requirements.
No objections or claims have been raised.</td><td>As per DWE's request, with respect to the ~35km portion of pipeline in Timor-Leste Offshore Waters that is required to be fully removed, the EP has considered the potential for non-indigenous and invasive marine species (IMS) and planned mitigation measures prior to, during and upon disposal of the portion of pipeline.
The EP also includes the commitment to provide notification to the Dep't prior to project commencement in order for a risk assessment to be conducted as well as all other requirements referenced by the Dep't.</td></tr>
<tr><td>Department of Defence, including Australian Hydrographic Office (AHO) - relevant</td><td colspan="2">

Santos provided initial information re to prepare pipeline decommissioning EP, via phone and email in October/November 2019
Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020; AHO provided acknowledgement, via email on 31 March
Dep't provided acknowledgement and advice re presence of Darwin Air Weapons Range and notifications required prior to activities, via email on 24 April
Santos provided Updated Notice of Consultation Fact Sheet on 3 June
Santos provided formal response to the Dep't, via email on 18 June
AHO provided acknowledgement, via email on 19 June
Santos requested advice from AHO re presence of sub-marine cables via email on June 19; AHO advised there were no concerns via email on 22 June

</td></tr>
<tr><td></td><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td></td><td>The Dep't and the AHO have provided information on the notification requirements on an Operator prior to undertaking and during activities.
No objections or claims have been raised.</td><td>As requested, in order to ensure activities do not conflict with Defence training, Santos will provide the Dep't with a minimum of five weeks notification prior to the commencement of activities.</td></tr>
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		Santos will also continue to liaise with the AHO and ensure it is notified three weeks prior to the commencement of activities.
Department of Environment & Energy, including Parks Australia (PA) - relevant	• Santos held an initial meeting with PA on 26 November 2019 to discuss future pipeline decommissioning plans and EP requirements. Santos provided a record of the meeting via email on 29 November. Key issues discussed were: o Understanding potential residual mercury contamination risks o Beneficial outcomes to the Oceanic Shoals Marine Park o Need for consultation with indigenous stakeholders o Post-decommissioning inspection/monitoring obligations • Santos provided further information and invited PA to a decommissioning workshop, via email on 16 December; PA accepted via email on 7 January 2020 • Santos provided the workshop agenda and background information, via email on 14 February • PA participated in the decommissioning workshop held in Darwin on 27 February. Key issues raised by PA at the workshop were: o Post-decommissioning risk liability o Consideration of broader ecosystem impacts in CA o Technical feasibility of removal option o Visibility impact on AIMS study o Consideration of impact on habitat types in CA o Research into invasive species growing on infrastructure o Contamination risks from pipeline degradation and testing of assumptions o Assumptions in AIMS study on fishing habitat, species and activity o Assumptions surrounding creation of habitat and benefits in marine park o Assessment of cumulative impacts o Ability to seek in-situ decommissioning in Timor-Leste Waters • Santos provided copies of workshop presentations and draft record of proceedings, including responses to questions raised, for participant review on 6 March and final record on 22 March • Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • PA provided formal response to 29 March Notice of Consultation Fact Sheet, via email on 23 April. Key issues raised were: o Titleholder obligations under Class Approvals within the Oceanic Shoals Marine Park (OSMP) o Ecosystem impacts of leaving the pipeline in-situ and representativeness of habitat types in the OSMP o Environmental impacts/risks of breakdown and decomposition of the pipeline o Potential impacts on fishing industry o Consideration of cumulative impacts o Long term monitoring/management of the pipeline o Emergency response requirements • Santos provided Updated Notice of Consultation Fact Sheet and tailored commercial fishing issues and concerns fact sheet on 3 June. • PA attended meeting with Santos on 9 June; key issues raised by PA at the meeting were: o Long-term environmental monitoring o Potential impact of micro-plastics on marine environment	

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Santos provided record of 9 June meeting outcomes and PPT presentation along with formal responses to PA's email of 23 April, via email on 19 June.
PA requested clarification on the type and approximate volumes of micro-plastic material that would remain in-situ under the proposed decommissioning option, via email on 23 June; Santos provided the requested information, via email on 24 June
PA provided formal response to Santos' 3 June Updated Notice of Consultation Fact Sheet, via email on 29 June; key issues raised were:

Ecosystem impacts of leaving the pipeline in-situ and on representativeness of habitat types in the OSMP
Environmental impacts/risks of breakdown and decomposition of the pipeline
Long term monitoring and management of the pipeline
Potential impacts of base case decommissioning full removal option

Santos provided formal response to the issues raised, via email on 16 July 2020; PA acknowledged responses and advised it had no further issues at that time, via email on 20 July 2020.

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<tr><td></td><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td></td><td>Santos has responded to all claims, information and requests raised. PA's views are as follows (with santos' responses in column right):

1. The habitat created by the pipeline is an artificial construct and any flow on biomass changes are not equal or better than what was in those locations before the pipeline was laid, but different, with uncertain flow-on ecosystem impacts

2 The AIMS research cannot be used to argue an economic benefit case for commercial fishing by leaving the pipeline in-situ

3 As the pipeline is predicted to be buried over time (partially or wholly), this also means the argument for economic and biodiversity/biomass benefits of leaving the pipeline in-situ are diminished over time

4 Indirect impacts of leaving the pipeline in-situ should be considered and assessed in the EP, including flow on impacts to the rest of the ecosystem and the conflicting implication of partial/whole pipeline burial over time.
In order to verify whether the 'leave in situ' decommissioning option is expected to have equal or better environmental outcomes when compared</td><td>Santos' responses to the issues/concerns raised have been communicated to PA as follows:

1. Santos' overall position is that AIMS' work validates the CA assumption that the pipeline provides a complex habitat with higher biodiversity compared to surrounding nearby environment.

2. Santos will focus in the EP on AIMS' findings across-the-board. The study contributes to a growing body of research suggesting many important fishery species appear to benefit from the presence of subsea pipelines.

3. Burial processes will take place over decades/centuries so there will be a significant period of time over which the pipeline habitat will not be fully buried. Longer term the pipeline is still expected to bury which will constrain dispersal of pipeline components.

4. The submitted EP includes consideration of PA's comments in relation to the potential impacts on the ecosystem within the OSMR, including both pipeline removal and the preferred in-situ decommissioning options under the CA process.</td></tr>
</table>

	to removal of the pipeline, the impacts and environmental outcomes of full removal need to be equally considered and assessed and this comparative information presented in the EP. 5. Up to 30 tonnes of microplastics would be dispersed into the ocean and an unquantified amount of plastic remain within the sediment. The impact on marine infauna and other benthic communities that would seek to settle on the sediment needs to be considered adequately and presented as an environmental impact in the EP and a scored consideration in the CA. 6. The potential impacts from heavy metals and NORM should be presented in the EP with explanation provided on how mitigation measures make the potential impacts acceptable and reduced to ALARP. 7. Arrangements for a long-term monitoring and management program should be described in the EP to ensure that environmental performance outcomes are met over the longer term and to validate modelled predictions of pipeline decomposition. 8. In the short to medium term, the EP should describe arrangements for monitoring, reviewing and reporting on environmental performance, associated with all aspects of the decommissioning activity itself (flooding and chemical treating of pipeline, unplanned discharges from the pipeline or vessels, securing cut ends of the pipeline securely etc.). In addition to the points above, Santos understands the obligations under class approval authorisation advised by PA and sought to consult with indigenous organisations.	Assessment of the impacts of full removal compared with in-situ is largely contained in the work completed for the CA. Where relevant, the benefits/impacts of full removal in further reducing risk has been assessed for specific planned activities e.g. pipeline degradation, physical presence of the pipeline. 5 and 6. The submitted EP covers the following matters: • The toxicity and potential impacts to the environment of chemicals proposed to be used to clean and decontaminate the pipeline • The potential impacts to the environment of micro-plastic materials, dispersed in water or contained within sediment • Quantification and assessment of the potential impacts from mercury deposits and naturally occurring radioactive material (NORM), and the actions that will be taken to reduce these impacts to acceptable and ALARP levels Santos' overall view is that the in-situ pipeline residual contaminant and decontamination assessments and pipeline degradation studies have demonstrated the following: • The estimated degradation process for the pipeline would result in an initial corrosive breakthrough after approximately 200 years and then a slow loss of structural integrity and breakup between 200 and 600 years • The pipeline is predominantly comprised of carbon steel and concrete weight coating, with much smaller masses of pipeline coating systems (asphalt enamel, heat shrink sleeve and internal flow coating) • The degradation of coating systems will largely occur through material embrittlement over a long period eventually leading to release of small fragments dispersed in the marine environment • Environmental risk associated with dispersal of coating systems mitigated by gradual breakdown over several hundred years, combined with progressive self-burial over the corresponding period. 7 and 8. The submitted EP describes arrangements for monitoring, reviewing and reporting on environmental

		performance associated with all aspects of the decommissioning activity (flooding and chemical treating of pipeline, unplanned discharges from the pipeline or vessels, securing cut ends of the pipeline securely etc.). The EP includes commitment to meet all obligations under current regulations, but long-term environmental monitoring is not proposed because the assessment demonstrates that the in-situ pipeline poses low environmental risk. Following surrender of title and having satisfactorily met all decommissioning obligations, under the current regime residual liability for the Pipeline left in-situ is assumed to transfer to the Commonwealth. Several of PA's opinions are linked to the nature and scale of potential environmental monitoring and/or further studies that could be initiated by the Commonwealth Government, as future, long- term titleholder over the decommissioned infrastructure. Santos is happy to be involved in these discussions, as they relate to its eventual surrender of title.
Department of Foreign Affairs & Trade - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))**
	No objections, claims, information or requests have been raised.	DFAT has been provided with base information and opportunity to comment. No further response is required.
Department of Industry, Science Energy & Resources (DISER) - relevant	• Meeting held on 26 November 2019 to discuss future pipeline decommissioning plans and EP requirements. • Santos provided record of meeting via email on 29 November; Dept confirmed accuracy via email on 5 December. Key issues discussed were: o Consultation process with ANPM and key Australian Gov't departments o Current Australian Gov't review of decommissioning policy o Process for post-decommissioning inspection/monitoring and title surrender • Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	The Dep't provided advice and guidance to Santos on the process to be followed for EP preparation, in	The Dep't has been provided with base and additional information and opportunity to comment. No further response is required.

	particular for the section to be decommissioned in Timor-Leste Waters. No objections, claims or additional requests have been raised.	
Geoscience Australia - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))**
	No objections, claims, information or requests have been raised.	Geoscience Australia has been provided with base information and opportunity to comment. No further response is required.

NOPTA - relevant	• Santos provided initial information at meeting held with NOPTA on 5 December 2019; Follow-up email and PPT provided to NOPTA on 19 December. Key issues discussed:
	  ○ Decommissioning scope and timeframe for activities
	  ○ Process for future surrender of titles and liability framework
	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
	• Santos provided Updated Notice of Consultation Fact Sheet on 3 June
	• NOPTA met with Santos on 11 June and was provided with update of EP preparation.
	• Santos provided copy of meeting presentation and NOPTA advised a meeting record was not required, via email on 19 June	

	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	NOPTA provided advice and guidance to Santos on the process to be followed for EP preparation. No objections, claims or additional requests have been raised.	NOPTA has been provided with base and additional information and opportunity to comment. No further response is required.
Offices of a) Minister for Environment & Energy; b) Minister for Energy & Northern Australia; c) Minister for Indigenous Affairs; d) Minister for DIIS; e) Shadow Parliamentary Secretary for Northern Australia; f) Federal Member for Solomon (NT); g) Senators for the NT - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))**
	No objections, claims, information or requests have been raised.	Stakeholders have been provided with base information and opportunity to comment. No further response is required.
Northern Territory Government		
	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020	

Aboriginal Areas Protection Authority (AAPA) - relevant	• Santos provided Updated Notice of Consultation Fact Sheet on 3 June. • AAPA responded to 29 March Notice of Consultation, via email on 26 June. Key issues raised were: - Clarification sought on relationship of decommissioning project to DLNG Operations, as related to previous issue of a Certificate of Authority - Use of Certificates of Authority as part of development process for major projects • Santos provide a response to the questions raised, via email on 17 July 2020; AAPA acknowledged response, via email on 27 July 2020.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	AAPA sought clarification on the relationship between Santos as proponent for the pipeline decommissioning project and Santos as Operator of the Darwin LNG facility. AAPA advised that Santos would need to apply for a specific Certificate of Authority for the decommissioning project if the need for a Certificate was identified by the company. No objections, claims, other information or requests have been raised.	Santos advised AAPA that the need for a Certificate of Authority had not been identified due to there being no intent to conduct any decommissioning activities that would impact the surrounding environment, including any known or unknown sacred sites. No further response is required.
Darwin Port Corporation - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	Darwin Port has been provided with base information and opportunity to comment. No further response is required for this EP.
Department of Environment & Natural Resources - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Dep't requested removal from mailing list, via email on 29 March. No objections, claims, information or other requests have been raised.	The Dep't has been provided with base information and opportunity to comment. No further response is required
Department of Infrastructure, Planning & Logistics - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**

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<tr><td></td><td>No objections, claims, information or requests have been raised.</td><td>The Dep’t has been provided with base information and opportunity to comment.
No further response is required.</td></tr>
<tr><td>Department of Primary Industry & Resources (Fisheries) - relevant</td><td colspan="2">• Santos provided initial information and invited Dep’t to decommissioning workshop, via phone and email on 16 December 2019; Department accepted on 17 December
• Dep’t participated in Decommissioning Workshop held in Darwin on 27 February. Key issues raised by DPIR were:
o Potential for snagging protection measures to impact trawl ability
o Use of fish beach v market price data for economic modelling
o Assumptions on habitat and fish species for AIMS study
o Potential risks to fish from cleaning/flushing of pipeline
o EP consultation process
• Santos provided copies of workshop presentations and draft record of proceedings, including responses to questions raised, for participant review on 6 March and final record on 22 March
• Santos provided workshop agenda and background information via email on 14 February
• Santos provided Notice of Consultation Fact Sheet via email on 29 March
• Dep’t provided formal response to 29 March Notice of Consultation Fact Sheet, via email on 23 April. Key issues raised were:
o Assumptions in the AIMS study around commercial fish species
o Impacts of the cleaning of the pipeline
o Nature and scale of a long-term environmental monitoring program
o Liability for infrastructure left in the marine environment
o Extent of information provided to stakeholders
• Santos provided Updated Notice of Consultation Fact Sheet and tailored commercial fishing issues and concerns fact sheet on 3 June.
• Dep’t attended meeting with Santos on 4 June. Key issues raised were:
o Description of AIMS report outcomes in EP
o Long-term environmental monitoring
o Additional information re micro-plastics and contamination risk
o Need to anti-snagging protection measures
• Santos provided a record of meeting outcomes and copy of the meeting presentation and formal response to issues raised in the Dep’t, via email on 19 June</td></tr>
<tr><td></td><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td></td><td>Santos has responded to all claims, information and requests raised by the Dep’t. The Dep’t has advised that it is tentatively supportive of Santos’ intention to maintain the pipeline in situ, noting that the environmental impact of removal would be higher from a disturbance perspective. Support is contingent on the premise that decommissioning reflects “best possible use of the enhanced</td><td>1.The AIMS survey, commissioned and cited by Santos, was conducted over a typical time period for a defined area and purpose study. There have been few studies of this type on pipeline infrastructure in Australian waters and the findings are therefore important in extending knowledge and understanding of the issues involved.
The comment on aggregation was based on a perception of comments made by AIMS at the CA workshop held on 28</td></tr>
</table>

	site…and having access to a potentially improved and safe marine environment and marine resource." The Dep't has made the following key comments (Santos' responses are in the column at right): 1. Leaving the pipeline infrastructure in place has been promoted to increase fish production based on a short AIMS survey. The pipeline is more likely to be aggregating fish by providing food/shelter which can create the effect of fishers being able to more effectively target species, behavior that can lead to declines in fish stocks. 2.Santos needs to demonstrate how flooding and release of the cleaning agents will occur and be monitored and that any discharge into the environment will have no negative consequences 3 In relation to a long-term monitoring program: a) A much larger program than what has been conducted so far will need to be implemented to disentangle whether the pipe infrastructure is aggregating or increasing fish productivity. b) The data presented on the monitoring program raises concerns about the length and frequency of the monitoring program c) The program is not clearly articulated and its brevity (two monitoring events over five years) is inadequate to detect environmental changes (corrosion and potential contamination of water/ environment around the pipeline and to monitor the breakdown of the pipe) d) The monitoring program needs to have clear objectives, an appropriate and comprehensive timeframe and publishable outcomes e) Without a clear, long term articulated monitoring program there is no way to confirm the expected environment benefits of the in-situ decommissioning or potential negative impacts on both fishing and the environment. 4.The Dep't noted that the issue of liability for infrastructure left in the marine environment is of	February 2020, prior to the study being finalised. The study has now been completed and AIMS has presented the following findings: • The Bayu-Undan pipeline provides a corridor of low to moderate complexity habitat across a soft sediment region supporting what appears to be a novel benthic community (qualitative assessments) and distinct fish assemblage characterised by a high abundance of commercially important fish species • These target fish species, typically large predators, exhibit an affinity with the pipeline and decline in abundance and biomass with increasing distance from the pipeline • The total beach value ($ sum of all stereo-BRUV deployments) of the top 10 commercially fished species was twice as high on the pipeline ($2987) compared to high complexity habitats off the pipeline ($1408) • A high abundance of larval fish on the pipeline compared to other habitats suggests the pipeline is habitat for a variety of life-history stages of fish • The study contributes to a growing body of research suggesting many important fishery species appear to benefit from the presence of subsea pipelines The final outcomes of the study are more complex than those suggested in the Department's submission which was provided prior. In presenting the study findings Santos' overall position will be that the results validate the CA assumption that the pipeline provides a complex habitat with higher biodiversity compared to surrounding nearby environment. At the 4 June meeting, the Dep't stressed it was important not to "oversell" the findings of the AIMS' study and Santos believes its approach is appropriate and addresses the concerns. 2.Subsequent to the 28 February workshop and receipt of the Department's submission, Santos completed several of the technical studies referenced in the workshop, specifically the in-situ pipeline residual contaminant and decontamination assessments and pipeline degradation studies. Completion of these studies led to several scope changes relevant to the Department's concerns that were subsequently communicated to all external stakeholders via an updated fact sheet as well as a tailored and more detailed issues and concerns paper to commercial fishing stakeholders and

	particular interest and concern for the commercial fishing sector. If a monitoring program or other assessment should detect a negative environmental occurrence as a result of decommissioning, then it is unclear who has the short and long-term responsibility to mitigate any potential negative environmental impacts. The Dep't strongly recommended that a comprehensive and long-term monitoring program be developed in relation to the impacts (positive or negative) of the in-situ decommissioning. 5.There is a need to provide stakeholders with the information that supports the decision making on decommissioning, as outlined in the 28 February workshop, specifically relating to concerns of fisheries stakeholder groups.	discussed with DPIR in the meeting on 4 June. The relevant scope changes are: • Flooding of the Pipeline with treated seawater from DLNG to Bayu-Undan, as opposed to previous advice to flood the pipeline with untreated seawater from an offshore location in Commonwealth Waters back to Bayu-Undan • Execution of flooding from DLNG • Pipeline cleaning to be executed either from DLNG as part of flooding, or KP 380 by subsea launch of a cleaning pig train from a vessel. • Preservation of the Pipeline from KP 380 to DLNG (in Commonwealth and NT Waters), due to the above change • Cutting and removal of a 100m section at KP380 and capping of cut ends, due to the above change. The presentation and discussion at the 4 June meeting, along with the commercial fishing issues and concerns paper, included detail of the flooding and cleaning process which Santos believes will ensure contamination risk is at acceptable and ALARP levels. In summary: • Chemical cleaning will occur by use of a decontamination pipeline inspection gauge (PIG) chemical train pushed with treated seawater from onshore at DLNG or from a support vessel at KP380 • Chemical used for cleaning will be subject to Company chemical selection process to evaluate chemicals and preferentially use the least hazardous products that meet technical requirements • There are no planned releases of chemicals to the marine environment with flushing chemicals and fluids to be disposed at the Bayu-Undan platform via disposal well(s) There is potential for unplanned releases in Australian Waters if the KP380 support vessel option is used, when loading and launching the cleaning pig train. However, given the minimal volumes in an unplanned release and the low toxicity of chemicals proposed to be used, impacts are expected to be limited to localised temporary reductions in water quality with no significant impacts to protected or commercially important marine fauna 3.Comment a) relates to the AIMS survey which was not commissioned, designed or executed as a long-term monitoring program and was presented at the 28 February workshop as a work in progress. The study has now been completed and

		provided to the Department. AIMS intends to publish the study. Santos' interpretation of the findings has been discussed above. Comments b) to e) relate to Santos' initial advice at the 28 February workshop that it had assumed two monitoring events over a nominal five- year period to define in-situ monitoring scope for the purpose of the Decommissioning Options Evaluation of the in-situ alternative against full removal. Santos advised at the workshop that its view on post decommissioning environmental monitoring would be informed by the completion of the technical studies and environmental risk/impact assessments of leaving the pipeline in-situ. In summary, these studies have demonstrated the following: • The estimated degradation process for the pipeline would result in an initial corrosive breakthrough after approximately 200 years and then a slow loss of structural integrity and breakup between 200 and 600 years • The pipeline is predominantly comprised of carbon steel and concrete weight coating, with much smaller masses of pipeline coating systems (asphalt enamel, heat shrink sleeve and internal flow coating) • The degradation of coating systems will largely occur through material embrittlement over a long period eventually leading to release of small fragments dispersed in the marine environment • Environmental risk associated with dispersal of coating systems mitigated by gradual breakdown over several hundred years, combined with progressive self-burial over the corresponding period. As communicated to the department at the 4 June meeting, in Santos' view, the residual contamination risk has been demonstrated to be acceptable and ALARP based on contaminant characterisation, precautionary scale cleaning and burial/sediment dilution processes With low environmental risk, the burden and value of a long-term environmental monitoring program cannot be justified and will not be proposed by Santos in the EP to be submitted. Notwithstanding this position, Santos recognises the responsible government agencies may give further consideration to the need for a future monitoring program. Santos is happy to be involved in these discussions, as they relate to its eventual surrender of title, and to provide the benefit of its operatorship and understanding of the environmental impacts since 2005.

		4.Santos' EP includes commitment to meet all obligations under current regulations. Following surrender of title and having satisfactorily met all decommissioning obligations, under the current regime residual liability for the Pipeline left in-situ is assumed to transfer to the Commonwealth. Santos is aware of discussions related to potential future legislative change in relation to liability arrangements for decommissioning, but no specific details or timeframes are available. Santos will continue to act as per our understanding of the current regime but is unable to comment further on the plans of government or policy makers. 5.Following the 28 February workshop Santos provided all attendees, including commercial fishing representatives from the NT and WA, with the full presentation and report on the proceedings and outcomes and invited further discussion with individual organisations. The report on the workshop included issues and concerns raised by each attendee, initial response to the concerns and proposed actions as a result. The workshop attendees, as well as the full list of interested and relevant stakeholders, were also provided with a fact sheet and opportunity to comment. Following completion of the relevant technical assessments and studies referenced at the workshop, Santos provided commercial fishing interests, including the Department, with a tailored issues and concerns paper that included updated detail on the outcomes/findings and resulting scope changes, as explained above. Commercial fishing stakeholders, as well as the full list of interested and relevant stakeholders, were also provided with an updated fact sheet and further opportunity to comment.
Department of Primary Industry & Resources (Mines and Energy) - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June. • Santos provided additional information via phone and follow-up email inviting Dep't to a meeting at which an updated presentation would be provided. • Dep't attended meeting with Santos on 17 June. Key issues raised were: o Provisions in NT legislation for continuous operations, validation and transferability o Legislation enabling transport of NORMS into NT • Santos provided record of meeting outcomes, copy of presentation and responses to issues raised, via email on 30 June	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**

	While the Dep't does not have a decision-making role for this EP, preservation of the pipeline section in NT waters and the pipeline flooding/cleaning process commencing at the Darwin LNG facility triggers the requirement for an update to Santos' Pipeline Management Plan under the NT Energy Pipelines Act. Key points raised by the Dep't were as follows (Santos' responses are in the column right): 1 Section 37 of the Act requires continuous operation of the pipeline except with written consent of the Minister. 2.NOPSEMA assessment of the EP can be finalised prior to submittal of the updated NT Pipeline Management Plan. 3.The required update can be prepared/provided as an addendum to the current PMP 4.Santos to check whether a pipeline validation requirement would be required under the updated PMP. 5.Santos to confirm that 2018 legislation prohibiting transport of radioactive materials (NORMS) into the Northern Territory provided necessary exclusion for the decommissioning project. 6 What are the potential hazards for commercial fishing vessels associated with any pipeline free spans?	1.Santos will ensure this requirement is met 2 and 3. Santos will ensure the required processes are followed 4.The preservation scope does not meet the definition triggering the validation requirement ie. although the pipeline would be flooded with a preservation fluid there are no planned modifications to the pipeline itself or a plan to decommission the section in NT Waters 5.The exclusion in the legislation does apply to the Bayu-Undan pipeline. 6.Santos advised that DPIR Fisheries Division had no concerns with risk of fishing gear snagging on the pipeline due to the lack of relevant current/future commercial fishing activity and the equipment/processes involved. At pipeline free spans, the risk is further reduced by the increased weight and accelerated burial of the pipeline over time caused by flooding with treated seawater No further response is required. Santos will continue to consult with the Dep't for the PMP update process.
Department of the Chief Minister - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**

	No objections, claims, information or requests have been raised.	The Dep't has been provided with base information and opportunity to comment. No further response is required.
Department of Trade & Business Development - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The Dep't has been provided with base information and opportunity to comment. No further response is required.
Environment Protection Authority NT - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The EPA has been provided with base information and opportunity to comment. No further response is required.
Offices of a) Chief Minister; b) Minister for Environment & Natural Resources; c) Minister for Infrastructure, Planning & Logistics; d) Minister for Primary Industry & Resources; e) Leader of the Opposition - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The Offices have been provided with base information and opportunity to comment. No further response is required.
Power and Water Corporation - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The Dep't has been provided with base information and opportunity to comment. No further response is required.
WorkSafe NT - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**

	No objections, claims, information or requests have been raised.	WorkSafe NT has been provided with base information and opportunity to comment. No further response is required.
Western Australian Government		
Department of Primary Industries & Regional Development (Fisheries) - relevant	• Santos provided initial information and invited Department to decommissioning workshop, via phone and email on 16 December 2019 • Santos provided further information via phone call and follow-up email with Department on 8 January 2020; Dep't declined invitation on 8 January • Santos provided workshop agenda and background information via email on 18 February • Santos provided copies of workshop presentations and final record of proceedings on 22 March • Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and tailored commercial fishing issues and concerns fact sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	A short section of the pipeline located in Commonwealth Waters is available to some WA-based commercial fishers, however there is little or no activity in the area, according to the Dep't and WAFIC. The Dep't advised Santos via phone discussion that it was supportive in-principle of in-situ decommissioning of pipelines where environmental benefit, including to commercial fish species and habitat, can be shown. However, due to the lack of fishing activity in the area and other priorities, the Dep't declined Santos' invitation to be involved in the decommissioning workshop held in February 2020. The Dep't was provided with the workshop agenda and background information, presentation and record of proceedings, in addition to Notice of Consultation fact sheets. No objections, claims, information or requests have been raised.	The Dep't has been provided with base and additional information and opportunity to comment. No further response is required.
Associations		
Amateur Fisherman's Association of the Northern Territory (AFANT) - relevant	• Santos provided initial notice of decommissioning activities and EP consultation process via phone and email in February 2020; Santos offered to meet with AFANT that month • Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	

	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised. AFANT advised Santos via phone discussion that it was supportive in-principle of in-situ decommissioning of pipelines where environmental benefit, including to fish species and habitat, can be shown and that the majority of the pipeline is located in remote areas not frequented by recreational fishers.	AFANT has been provided with base information and opportunity to comment. No further response is required.
APPEA	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	APPEA has been provided with base information and opportunity to comment. No further response is required.
Australian Southern Bluefin Tuna Industry Association (ASBTIA) - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	ASBTIA has been provided with base and additional information and opportunity to comment. No further response is required.
Chamber of Commerce & Industry NT - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The Chamber has been provided with base information and opportunity to comment. No further response is required.
Commonwealth Fisheries Association (CFA) - relevant	• Santos provided initial information and invited CFA to decommissioning workshop, via email on 16 December 2019; CFA declined offer, via email on 8 January 2020 • Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and tailored commercial fishing issues and concerns fact sheet on 3 June.	

	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	CFA declined to participate in a pipeline decommissioning workshop, stating consultation should occur directly with commercial fishers. Santos also provided CFA with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	CFA has been provided with base and additional information and opportunity to comment. No further response is required.
Northern Fishing Companies Association - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided the Association with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The Association has been provided with base and additional information and opportunity to comment. No further response is required.
Northern Territory Guided Fishing Industry Association (NTGFIA) - relevant	• Santos provided initial notice of decommissioning activities and EP consultation process via phone and email in February 2020; NTGFIA accepted invitation to meet with Santos later that month • Santos provided additional information in advance of meeting, via email on 18 February; meeting held on 27 February with no issues/concerns raised • Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised. NTGFIA advised Santos via phone and meeting discussions that it was supportive in-principle of in-situ decommissioning of pipelines where environmental benefit, including to fish species and habitat, can be shown, however the majority of the pipeline is located in remote areas that are not frequented by guided fishing operators.	NTGFIA has been provided with base information and opportunity to comment. No further response is required.
	• Santos provided initial information and invited NTSC to decommissioning workshop, via email on 16 December 2019; NTSC accepted on 20 December	

<table>
<tr><td rowspan="3">Northern Territory Seafood Council (NTSC) - relevant</td><td colspan="2">• Santos provided workshop agenda and background information via email on 14 February
• NTSC participated in Decommissioning Workshop held in Darwin on 27 February. Key issues raised by NTSC were:
o Consultation process for Decommissioning Options Evaluation and EP preparation
o Stabilisation of pipeline
o Use of fish beach v market price data for economic modelling
o Criteria for Decommissioning Options Evaluation such as biosecurity, waste management and community perception
o Ability to re-use pipelines
o Additional information on pipeline design and layout
o Additional information required for commercial fishers
o Post-decommissioning risk liability
o Treatment of ‘perceived risk’ by community
o Cost of full removal versus in-situ
o Potential for Good Standing Arrangement
o Contamination risks from pipeline degradation
o Timeframe for EP submission
• Santos provided copies of workshop presentations and draft record of proceedings, including responses to questions raised, for participant review on 6 March and final record on 22 March
• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
• Santos provided Updated Notice of Consultation Fact Sheet and tailored commercial fishing issues and concerns fact sheet on 3 June.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>The NTSC raised the following issues through its participation in the February decommissioning workshop. (Santos responses in the column at right):

1 The selection process for workshop participants and the timeframe/nature of information that will be shared with commercial fishers, further consultation opportunities and the timeframe for EP submittal

2 If the pipeline is left in-situ, will this affect future decommissioning of other pipelines i.e. Barossa?

3 Are earthquakes factored into stabilisation and why is stabilisation required?

4. In relation to the study being undertaken by AIMS, fish price beach data is not an accurate</td><td>1 Stakeholders most relevant to the activity, being commercial fishers whose activities may be impacted, as well as the government regulatory bodies directly relevant, were invited to participate. The workshop was the start of a process and all relevant stakeholders were provided information and opportunity to comment prior to the EP being submitted.
The workshop presentation slides and summary was provided to participants and Santos approved NTSC’s request to be allowed to distribute the background information sheet to its members. Further information was provided during consultation activities prior to EP submission including a tailored commercial fishing issues and concerns fact sheet which included more detailed information. Further opportunity to meet and discuss issues in detail was also offered during the consultation period.
The pipeline decommissioning timeline depends on the timing of the Bayu-Undan end of field life (EOFL) which depends on reservoir performance and asset economics. As per current projections, EOFL could occur between 2021 and 2022.</td></tr>
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	method to determine the market value of fish catch provided by the pipeline 5. Some other CA criteria which may also considered in depth are biosecurity, waste management, general community's perspective about leaving behind "mess" after making money and altering the environment. 6. How long does a pipeline last for in operation? Can existing pipelines be used for new upcoming Oil and Gas projects, reducing the number of pipelines required to be laid for future projects? It is disappointing that consideration for reuse of existing infrastructure hasn't been done 7. Additional details to be provided on the project: pipeline design and layout (e.g. is the pipeline raised or laid on the seabed). More information is needed to be provided to the stakeholders so that they, as non-industry-experts, can have a better holistic idea of the infrastructure and decommissioning risks 8. Questioned the assumption of the biodiversity sub-criteria i.e. that more fish and more complex habitat is a good thing, as it isn't necessarily a reflection of the habitat before the pipeline was laid. Environment criteria needs to consider broader ecosystem impacts, beyond just increasing/decreasing biodiversity 9. Stakeholder engagement should have occurred earlier. The proposed four-month timeframe is a concern for any meaningful input to be provided. Recommended to perform a follow-up workshop to provide further detail on Decommissioning Options Evaluation studies to build transparency and greater level of trust 10. Recommended to engage WWF local representative	The EP needs to be prepared for the earliest EOFL scenario (Q1 2021) so needs to be ready for submission by the middle of 2020. During the consultation period Santos further advised stakeholders the submission period would be delayed to early August. 2. No. Future decommissioning of other pipelines, such as the Barossa pipeline, will be subject to its own Decommissioning Options Evaluation and regulatory assessment both as part of Barossa development and eventual Barossa field decommissioning. 3 Earthquake risk is more relevant to operational pipelines and the associated risk of hydrocarbon release. For the decommissioned pipeline, export gas will have been removed and flooded with seawater, therefore risk from earthquakes is considered negligible. Stabilisation may be required to avoid pipeline movement on the seabed potentially caused by major storm events. Typically, stabilisation measures are placed at pipeline ends since these are more susceptible to movement 4. AIMS used market price, not beach price for the marine survey assessment of commercial value. Santos subsequently provided the full version of the AIMS report to NTSC and no comments were received. 5. Biosecurity (IMS) and waste management were considered as part of CA criteria. The CA / EP development process is specifically designed to address the environmental management issues and includes stakeholder input, government review and authorisation of decommissioning activities. Santos' evaluation of decommissioning alternatives focused on assessing if alternatives provided an equal or better environmental or safety outcome to full removal 6. Pipeline design is specific to the resource. Typically, pipelines have a 20 to 25-year design life, supported by scheduled inspections and required maintenance/repairs. Further life extension measures can be taken if required. The Barossa Project is an example of partial re-purposing of existing infrastructure, i.e. tie-back onto the existing Bayu-Undan to DLNG pipeline from KP380 to Darwin

	Santos sought to re-engage with NTSC on two occasions after additional information had been distributed and offered to conduct additional engagement.	7. At the February workshop Santos acknowledged that further description and condition details would be helpful to stakeholders in their assessment of pipeline decommissioning alternatives and committed to offer further opportunities for stakeholder review and input once further information becomes available. The efforts made by Santos have been discussed above. 8. The biodiversity sub-criteria looked at biodiversity on a broad, whole-of-ecosystem scale. The purpose of the AIMS research was to assess the validity of the assumption that the pipeline habitat provides a positive net benefit. 9 and 10. Santos commenced stakeholder consultation on decommissioning related activities in early 2019 for the Pipeline Cessation of Production EP, accepted by NOPSEMA in mid-2019. This included providing a bespoke commercial fishing issues and concerns fact sheet to fishing associations and licence holders. Consultation with relevant and interested stakeholders will be ongoing up to and following submission of the GEP Decommissioning Environment Plan to NOPSEMA. The efforts made by Santos have been discussed above. During the consultation period Santos advised stakeholders that the EP submission would be delayed until August, providing additional time to provide comment on the information provided. Santos was prepared to conduct a second workshop however key participants instead met with Santos individually to discuss issues in more detail. 10. The suggested stakeholder was added to the distribution list for materials provided during the EP consultation period.
Northern Trawl Owners Association (NTOA) - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided the Association with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The Association has been provided with base and additional information and opportunity to comment. No further response is required.

<table>
<tr><td rowspan="3">Pearl Producers Association (PPA) – relevant for NT Waters</td><td colspan="2">Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>Santos also provided the Association with the tailored information provided to commercial fishing stakeholders.
No objections, claims, information or requests have been raised.</td><td>The Association has been provided with base and additional information and opportunity to comment.
No further response is required.</td></tr>
<tr><td rowspan="3">Western Australian Fishing Industry Council (WAFIC) - relevant</td><td colspan="2">Santos provided initial information and invited WAFIC to decommissioning workshop, via email on 16 December 2019; WAFIC accepted on 20 December
Santos provided workshop agenda and background information via email on 14 February
WAFIC participated in Decommissioning Workshop held in Darwin on 27 February; Key issues raised by WAFIC were:
Additional information required for commercial fishers
Post-decommissioning risk liability
Consideration of part-removal option
Engagement of jurisdictions in North Sea
Pipeline cleaning verification methods
Treatment of ‘perceived risk’ by community
Cost of full removal versus in-situ
Potential for Good Standing Arrangement
Contamination risks from pipeline degradation
Timeframe for EP submission
Community perception of disposal location
Santos provided copies of workshop presentations and draft record of proceedings, including responses to questions raised, for participant review on 6 March and final record on 22 March
WAFIC provided additional information on decommissioning experience in the North Sea, via email on 28 February
Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
Santos provided Updated Notice of Consultation Fact Sheet and tailored commercial fishing issues and concerns fact sheet on 3 June.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>The WAFIC raised the following issues through its participation in the February decommissioning workshop. (Santos responses in the column at right):</td><td>1.The workshop was the start of a process and all relevant stakeholders were provided information and opportunity to comment prior to the EP being submitted.
The workshop presentation slides and summary was provided to participants and Santos approved NTSC’s request to be allowed to distribute the background information sheet to its members.</td></tr>
</table>

	1 All information must be provided to appropriate fishing bodies when allowed to be publicly available 2 Who owns the risk if something goes wrong? 3.Was there ever consideration of a hybrid of half leave in-situ and half full removal of the pipeline option which could provide the most positive environmental outcome? 4 Have you engaged with other jurisdictions such as the North Sea to see what their standards are for snagging protection and how they have made the pipelines trawling/fishing safe? 5 What are the methods planned to verify that the pipeline cleaning process has been performed to an ALARP level? 6 Perceived risk by the wider community of contamination needs to be assessed 7 Is there an estimated cost for full removal vs. leave in-situ? Some of the savings of selecting the in-situ over full removal strategy should be considered to be paid back into the broader fishing community as part of a “make good” agreement. 8 The different strategy recommendations for the pipeline section in Timor-Leste waters (removal) vs. Commonwealth waters (in-situ), may be hard for the communities to justify and raises concerns over their respective grounds, i.e. why is it a viable solution for Timor but not for Commonwealth? This could pose a public perception issue as the legislation is to remove the whole pipeline in Commonwealth waters, however this is only upheld for the Timor-Leste section of the pipeline 9 What comes out of the pipeline over the degradation of the pipeline over the 100s of years, what particles will be emitted and how does that affect the food chain. What does the pipeline degrade to?	Further information was provided during consultation activities prior to EP submission including a tailored commercial fishing issues and concerns fact sheet which included more detailed information. Further opportunity to meet and discuss issues in detail was also offered during the consultation period. 2.Risk associated with in-situ decommissioning will be managed according to the residual liability framework. There is limited precedent for residual liability arrangements for in-situ decommissioning in Australia. Accountability for residual liability for Decommissioning of the GEP will be subject to requirements of NOPTA as part of surrender of title. 3. At the February workshop Santos advised that it had not formally assessed that scenario, but it could be looked at after the workshop if data collection, analysis and stakeholder feedback mad a compelling case for a hybrid approach. Santos’ view is that such a case did not subsequently emerge. 4 Engagement did occur with North Sea counterparts on lessons learned from North Sea decommissioning. Snag protection requirements are widely understood for operational pipeline in the region. However, further insight into the requirements for decommissioned pipelines in Commonwealth waters will be investigated where necessary. 5. At the February workshop Santos responded that there were several different approaches under consideration, such as: • sampling of the flushing discharge stream to verify contaminants concentration • testing of pipeline sections/samples to confirm cleanliness • onshore pre-execution trials to determine the level of cleanliness which could be achieved Further detailed information was provided in the tailored commercial fishing issues and concerns fact sheet and the updated Notice of Consultation fact sheet. 6. Actual contamination risk was considered as part of the CA. Scoring of the in-situ alternative to full removal was based on the key assumption that the pipeline will be cleaned to an ALARP and acceptable level. Perceived risk is difficult to quantify and as such was not a sub-criteria for the DOE. Assessment of contaminant risk and impact to the environment, and any required mitigations, is considered in the submitted EP

	10 Should the pipeline be fully removed as per the legislation, how can damage to the commercial fishers be quantified? How will the losses be addressed and what are the repercussions? 11 End of June submission seems very optimistic, considering decommissioning topic is new to stakeholders 12 The disposal assumption is based on a South East Asia location. Will it have an impact to your social licence? Concerns may be raised by the community over the integrity of SE Asian yard disposal operations.	7. High level estimates have been developed but will be subject to refinement following completion of supporting engineering studies and will remain commercial in confidence. On a relative basis, initial estimates indicate a difference in the order of several hundreds of millions of dollars between full removal and onshore disposal compared to decommissioning in-situ with minimal intervention. Good Standing Arrangements currently only apply to situations where titleholders have an opportunity to invest in programs to compensate for obligations not met under petroleum licence obligations. Santos is not aware that such obligations apply to titleholders contemplating decommissioning alternatives. Santos' evaluation of decommissioning alternatives remains focused on assessing if alternatives provide an equal or better environmental or safety outcome to full removal 8. While Santos acknowledges the apparent discrepancy between Australian and Timor-Leste waters, full removal in Timor-Leste offshore waters is a requirement of the Timor Sea Maritime Boundaries Consequential Amendments Bill 2019. As a result, only the Australian Waters section of the pipeline is subject to a DOE in order to evaluate alternatives to the base case of full removal 9. At the February workshop Santos advised that studies referenced were underway to characterise any residual composition or process contaminants found in the pipeline and assess the hazards they may pose to the marine ecosystem, including the human food chain, if released during in-situ degradation of the pipeline. Further information was provided in the tailored commercial fishing issues and concerns fact sheet. 10. The current recommendation is to decommission in-situ. Impacts to commercial fishers will be further assessed if full removal is the authorised decommissioning outcome. 11. During the consultation period Santos advised stakeholders that the EP submission would be delayed until August, providing additional time to provide comment on the information provided. The efforts made by Santos have been discussed above.

		12. Santos will ensure any disposal yard undergoes a thorough prequalification process prior to accepting decommissioning wastes, regardless of yard location.
Industry		
Australian Marine Oil Spill Centre (AMOSC) - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	AMOSC has been provided with base information and opportunity to comment. No further response is required.
ENI - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	ENI has been provided with base information and opportunity to comment. No further response is required.
Inpex- relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	Inpex has been provided with base information and opportunity to comment. No further response is required.
JERA - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Lattice - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**

	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Oil Spill Response Limited (OSRL) - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Origin - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Shell - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
SK E&S- relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Tokyo Gas - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**

	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Total - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Other marine users		
A Raptis & Sons Pty Ltd - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided A. Raptis & Sons with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
Aquarium Fishery NT Licence Holders - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised. Issues and concerns raised by the representative fishing association have been discussed above.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Arafura Bluewater Charters - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020	

Austfish Pty Ltd - relevant	• Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided Austfish with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
Austral Fisheries - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided Austral with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
Australia Bay Seafoods - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided Australia Bay with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
Demersal Fishery NT Licence Holders - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised. Issues and concerns raised by the representative fishing association have been discussed above.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.

<table>
<tr><td rowspan="4">Fischer, Horst (Timor Reef Fishery Licence Holder) - relevant</td><td colspan="2">Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>Santos also provided Mr Fischer with the tailored information provided to commercial fishing stakeholders.
No objections, claims, information or requests have been raised.</td><td>The stakeholder has been provided with base and additional information and opportunity to comment.
No further response is required.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">Monsoon Aquatics - relevant</td><td colspan="2">Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>Santos also provided Monsoon with the tailored information provided to commercial fishing stakeholders.
No objections, claims, information or requests have been raised.</td><td>The stakeholder has been provided with base and additional information and opportunity to comment.
No further response is required.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="4">Northern Prawn Fishery (NPF) Ltd - relevant</td><td colspan="2">Santos provided initial information and invited NPF to decommissioning workshop, via email on 16 December 2019; NPF accepted on 17 December
Santos provided workshop agenda and background information via email on 14 February
NPF representative was unable to attend Decommissioning Workshop held in Darwin on 27 February
Santos provided copies of workshop presentations and final record of proceedings, including responses to questions raised, on 22 March
Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020
Santos provided Updated Notice of Consultation Fact Sheet and tailored commercial fishing issues and concerns fact sheet on 3 June.</td></tr>
<tr><td>Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))</td><td>Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))</td></tr>
<tr><td>Santos also provided NPF with the agenda, background information and meeting record from the decommissioning workshop that NPF was unable to attend.
NPF was also provided with the tailored information provided to commercial fishing stakeholders.
No objections, claims, information or requests have been raised.</td><td>The stakeholder has been provided with base and additional information and opportunity to comment.
No further response is required.</td></tr>
</table>

Northern Wildcatch Seafood Australia - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided this stakeholder with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
Paspaley Pearling Company - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided this stakeholder with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
Pearl Oyster Fishery NT Licence Holders - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised. Issues and concerns raised by the representative fishing association have been discussed above.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
Spanish Mackerel Fishery NT Licence Holders - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided this stakeholder with the tailored information provided to commercial fishing stakeholders.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.

	No objections, claims, information or requests have been raised.	
Timor Reef Fishery Licence Holders - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided this stakeholder with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
WA Seafoods - relevant	• Santos provided workshop agenda and background information via email on 14 February • NPF representative (from WA Seafoods) was unable to attend Decommissioning Workshop held in Darwin on 27 February • Santos provided copies of workshop presentations and final record of proceedings, including responses to questions raised, on 22 March • Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet and Commercial Fishing Issues and Concerns Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos also provided a representative of this stakeholder with the agenda, background information and meeting record from the decommissioning workshop that they were unable to attend. The stakeholder was also provided with the tailored information provided to commercial fishing stakeholders. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base and additional information and opportunity to comment. No further response is required.
Environmental interest groups		
AMCS	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment.

		No further response is required.
ECNT - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
EDONT - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Sea Turtle Foundation - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Whale and Dolphin Conservation Society - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Wilderness Society - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020	

World Wildlife Fund - interested	Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))**
	No objections, claims, information or requests have been raised.	No objections, claims, information or requests have been raised.
Indigenous groups		
Kimberley Land Council - interested	• Santos provided information from Notice of Consultation Fact Sheet, via on-line submittal on 21 April 2020 • Santos provided updated information, via on-line submittal on 11 June	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	Santos has made several attempts to contact the stakeholder via phone as well as providing information via an on-line portal. No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Northern Land Council - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised. NLC has previously advised Santos that the Tiwi Land Council, as the nearest land manager to the pipeline, is the appropriate stakeholder to continue consultation and NLC input on marine parks management is provided directly to PA.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Tiwi Land Council - relevant	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	Santos maintains ongoing dialogue with the TLC. For this EP, the Council has been provided with base information and opportunity to comment. No further response is required.
Research/education groups		
	• Santos provided workshop agenda and background information via email on 14 February	

Australian Institute of Marine Science (AIMS) - interested	• AIMS representative attended Decommissioning Workshop held in Darwin on 27 February to present interim findings of Bayu-Undan Pipeline Study • Santos provided copies of workshop presentations and final record of proceedings, including responses to questions raised, on 22 March • Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Centre for Whale Research - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Charles Darwin University - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Monash University - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**
	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.
Pendoley Environmental - interested	• Santos provided Notice of Consultation Fact Sheet via email on 29 March 2020 • Santos provided Updated Notice of Consultation Fact Sheet on 3 June.	
	Assessment of the merits of objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(ii))	**Statement of response, or proposed response, to the objections, claims, information and requests (OPGGS(E) Regulation 16 (b)(iii))**

	No objections, claims, information or requests have been raised.	The stakeholder has been provided with base information and opportunity to comment. No further response is required.

10 REFERENCES

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11 ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ABU	Australian Business Unit
ACN	Australian Company Number
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHO	Australian Hydrographic Office
AIMS	Australian Institute of Marine Science
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
ANPM	Autoridade Nacional do Petróleo e Minerais
ANZG	Australia and New Zealand Guidelines for Fresh and Marine Water Quality
API	American Petroleum Institute
APPEA	Australian Petroleum Production and Exploration Association
ARC	AMSA Response Centre
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BIAs	Biologically Important Areas
BoM	Bureau of Meteorology
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
BUPIOA	Bayu-Undan Pipeline International Offshore Area
CAMBA	China-Australia Migratory Bird Agreement
CBT	Computer Based Training
CHARM	Chemical Hazard Assessment and Risk Management
CIMP	Crisis Incident Management Plan
CMT	Crisis Management Team
COLREGS	International Regulations for Preventing Collisions at Sea 1972
CP	Corrosion Prevention
CPP	Central Production and Processing
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSR	Client Site Representative
CSV	Construction Support Vessel
CWC	Concrete Weight Coating
DAWE	Department of Agriculture, Water and the Environment

DEWHA	Department of the Environment, Water, Heritage and the Arts
DLNG	Darwin Liquefied Natural Gas
DOE	Decommissioning Options Evaluation
DP	Dynamic Positioning
DPIR	Department of Primary Industry and Resources
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
DSV	Dive Support Vessel
EH&S	Environment, Health & Safety
EMBA	Environment that may be affected
EMP	Environmental Management Plan
ENVID	Environmental Risk Identification
EOC	Emergency Operations Centre
EP	Environment Plan
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPO	Environmental Performance Outcomes
EPS	Environmental Performance Standard
ERP	Emergency Response Plan
ERT	Emergency Response Team
ESD	Ecologically Sustainable Development
GEP	Gas Export Pipeline
GDA94	Geodetic Datum of Australia 1994
GHG	Greenhouse Gas
HATS	HSE Action Tracking System
HFO	Heavy Fuel Oil
HPIT	High Pressure Isolation Tool
HLV	Heavy Lift Vessel
HQ	Hazard Quotient
HSE	Health, Safety and Environment
HSEMS	Health, Safety and Environment Management System
IAP	Incident Action Plan
IAPP	International Air Pollution Prevention
IC	Incident Controller
ICS	Incident Command System
ID	Inner Diameter

IEE	International Energy Efficiency
IFO	Intermediate Fuel Oil
IMCA	International Maritime Contractors Association
IMDG	International Maritime Dangerous Goods
IMO	International Maritime Organization
IMR	Inspection, Maintenance and Repair
IMS	Invasive Marine Species
IMT	Incident Management Team
IOPP	International Oil Pollution Prevention
IPIECA	International Petroleum Industry Environmental Conservation Association
IPP	International Pollution Prevention
IS	Implementation Strategy
ISO	International Organization for Standardization
ISPP	International Sewage Pollution Prevention
ITF	Indonesian Throughflow
IUCN	International Union for the Conservation of Nature
JPDA	Joint Petroleum Development Area
JSA	Job Safety Assessment
KEF	Key Ecological Feature
KP	Kilometre Point
LC50	Median Lethal Dose
LNG	Liquefied Natural Gas
MARPOL	International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978
MC	Measurement Criterion
MDO	Marine Diesel Oil
MEZ	Moderate Exposure Zone
MNES	Matters of National Environmental Significance
NMR	Northern Marine Region
NOAA	National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NORM	Naturally Occurring Radioactive Material

NPF	Northern Prawn Fishery
NPI	National Pollutant Inventory
NT	Northern Territory
NWMR	North West Marine Region
NZS	New Zealand Standards
OCIMF	Oil Companies International Marine Forum
OCNS	Offshore Chemical Notification Scheme
OIW	Oil in Water
OMP	Operational Monitoring Plan
OPEP	Oil Pollution Emergency Plan
OPGGS (E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
OPGGS Act	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OSMP	Operational and Scientific Monitoring Program
OSRL	Oil Spill Response Limited
OVID	Offshore Vessel Inspection Database
PA	Parks Australia
PEC	Potential Effect Concentration
PFW	Produced Formation Water
PLR	Pig Launcher / Receiver
PMP	Pipeline Management Plan
PMST	Protected Matters Search Tool
PNEC	Potential No Effect Concentration
POLREP	Pollution Report
PPE	Personal Protective Equipment
PSV	Platform Supply Vessel
PTS	Permanent Threshold Shift
PTW	Permit to Work
RBI	Risk Based Inspection
RCC	Rescue Coordination Centre
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
ROV	Remotely Operated Vehicle
SD	Sustainable Development
SDS	Safety Data Sheet
SEL	Sound Energy Level

SG	Specific Gravity
SIMA	Spill Impact Mitigation Assessment
SMP	Scientific Monitoring Plan
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Plan
SPL	Sound Pressure Level
SSIV	Subsea Isolation Valve
STCW	International Convention on Standards of Training, Certification and Watchkeeping for Seafarers
TDM	Touch Down Monitoring
TTS	Temporary Threshold Shift
UTM	Universal Transverse Mercator
WA	Western Australia

12 APPENDICES

12.1 APPENDIX A: BAYU-UNDAN DECOMMISSIONING OPTIONS EVALUATION – GAS EXPORT PIPELINE (ADVISIAN 2020)

ConocoPhillips

Australia Business Unit - West

Capital Projects

Bayu-Undan Decommissioning

SUPPLIER COVER SHEET

DOE GEP Final Report

Company Document ID	Rev
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Supplier	Contract / Purchase Order No.
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Bayu-Undan Decommissioning Options Evaluation

Gas Export Pipeline

ConocoPhillips

24 February 2020

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401012-02723

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ACRONYMS

ALARP	As Low as Reasonably Practicable
ANPM	Autoridade Nacional do Petróleo e Minerais
APPEA	Australian Petroleum Production & Exploration Association
COP	ConocoPhillips Australia Pty Ltd
CUQ	Bayu-Undan Compression, Utilities and Living Quarters Platform
DOE	Decommissioning Options Evaluation
DPP	Bayu-Undan Drilling Production Platform
DWM	Manifold
FSO	Floating Storage and Offloading unit
FT	Flare Tower
GEP	Gas Export Pipeline
KEF	Key Ecological Feature
KP	Kilometre Point
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NORMS	Naturally Occurring Radioactive Material
NT	Northern Territory
SSIV	Subsea Isolation Valve
SUDU	Subsea Umbilical Distribution Unit
WA	Western Australia

1 Introduction

1.1 Project Background

Bayu-Undan is a gas-condensate field located in the Timor Sea within Timor-Leste offshore waters. The infield facilities transport dry gas to the Darwin LNG Plant (DLNG) by a subsea gas export pipeline (GEP). Bayu-Undan is forecast to cease gas production in 2021/2022. Backfill options to supply the Darwin LNG plant (DLNG) are currently being evaluated and it is anticipated that the selected backfill option will tie into the existing pipeline via a new export pipeline emanating from new offshore processing and production facilities. The components of the Bayu-Undan facilities, associated wells, interconnected subsea infrastructure and the section of the subsea GEP between the tie-in location and the Bayu-Undan field will require decommissioning.

The Decommissioning Options Evaluation (DOE) scope of work is to evaluate options for decommissioning the Bayu-Undan GEP, with respect to removal or alternative strategies and methods for recommended strategies. The DOE is an integrated, high level comparative assessment of the risks, benefits and feasibility across environmental, safety, societal, technical feasibility and economic primary criteria to determine the recommended option(s) for decommissioning offshore oil and gas facilities. The process will form part of demonstrating the risk to be As Low As Reasonably Practicable (ALARP) and acceptability of impacts of the final recommended decommissioning option(s) selected. The results of the DOE will be subject to stakeholder review and input, and only options that have the support of all internal and external stakeholders will be progressed for further detailed assessment and/or engineering. The DOE outputs will also be used for regulatory purposes, where relevant.

1.2 Scope and Objectives of this Report

The objectives of this report are to document the DOE process in a transparent manner and present the results for the recommended decommissioning option for the GEP. The DOE process for the remaining Bayu-Undan facilities is presented in a separate report.

To meet these objectives, this report includes the following:

- Information on the infrastructure being considered for decommissioning.
- The DOE methodology used to the assess various decommissioning options (primary criteria used, assumptions made, limitations).
- The results of the DOE process.

2 The Bayu-Undan Facilities

2.1 Location

The Bayu-Undan Field covers an area of approximately 25 km by 15 km (an estimated 375 km^2) and is located approximately 250 km south-east of Suai, Timor-Leste and 480 km north-west of Darwin, Australia. It is located in Timor-Leste offshore waters and water depth is approximately 80 m. The Bayu-Undan facilities have been operational since 2004 (Figure 2-1 and Figure 2-2).

The Bayu-Undan facilities exports dry gas to the Darwin LNG plant via a 502 km subsea GEP which crosses the Timor-Leste offshore waters, Australian Commonwealth waters and Northern Territory (NT) waters (Figure 2-1).

Australia and Timor-Leste signed the *Treaty Between Australia and the Democratic Republic Timor-Leste Establishing Their Maritime Boundaries in the Timor Sea* (the Treaty) in March 2018 to establish maritime boundaries between the two signatory countries. This Treaty replaced the *2003 Timor Sea Treaty* and the *2003 International Unitisation Agreement* for Greater Sunrise and establishes permanent maritime boundaries between Australia and Timor-Leste.

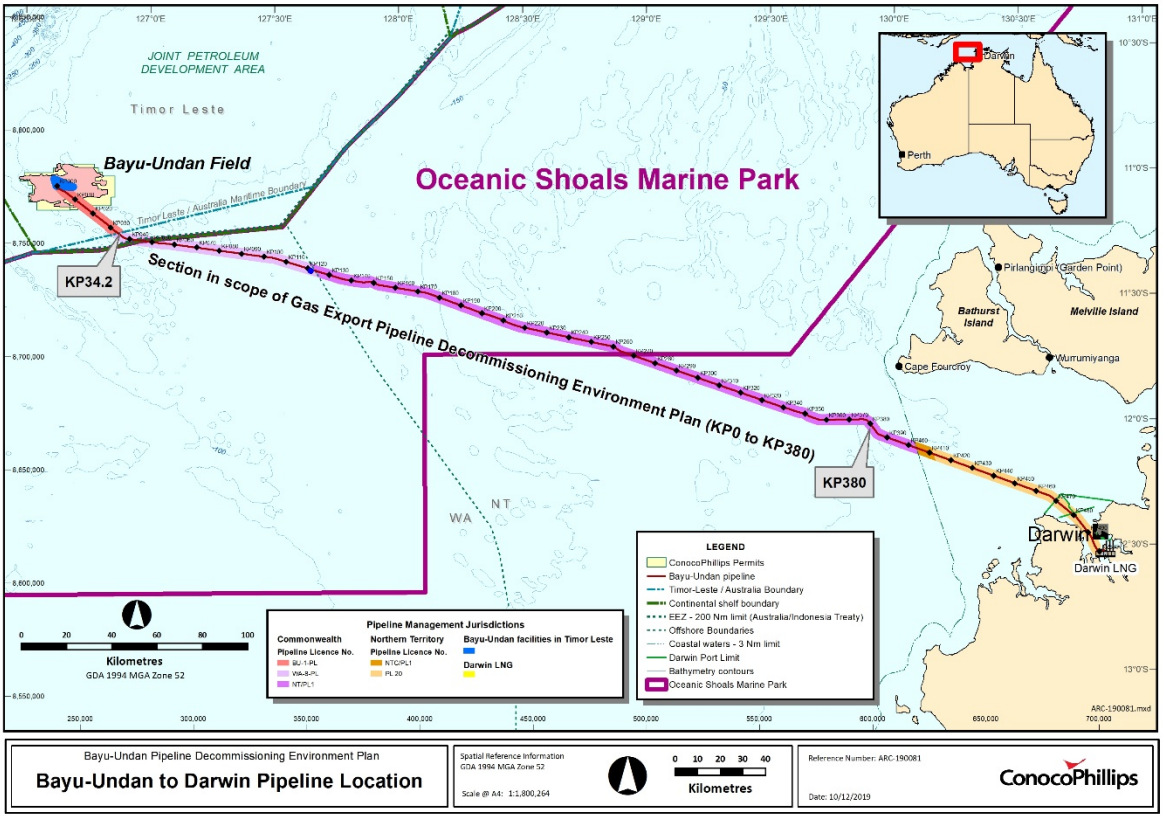

Figure 2-1: Location of Bayu-Undan facilities and GEP

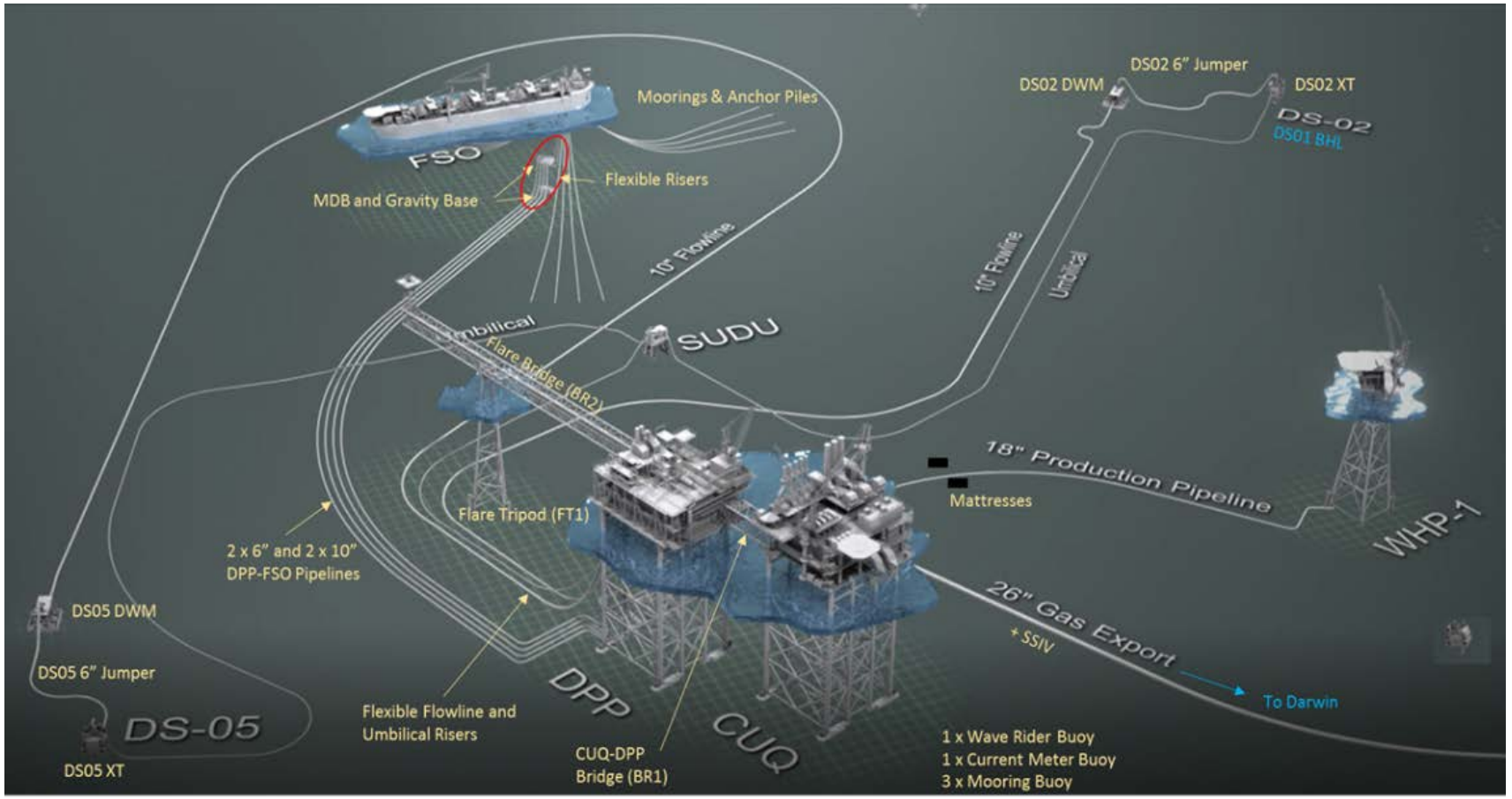

Figure 2-2: Bayu-Undan facilities

2.2 The Gas Export Pipeline

Of the 502km long GEP, a 380km section starting from the Bayu-Undan Field will need to be decommissioned. The section of the GEP downstream of KP380 will be left in-situ with KP380 the tie in point for a future backfill option to supply the Darwin LNG plant.

The section of subsea GEP to be decommissioned traverses the Timor-Leste offshore waters (~34.7 km)[1] and Australian Commonwealth waters (~345 km) (Figure 2-1). The Depths range from 80 m at the Bayu-Undan field to approximately 100 m water depth (east of KP34.7), reaching a maximum depth of 134 m at approximately KP131. The seafloor rises to a depth of less than 100 m in the vicinity of KP180 and follows a general shallowing trend towards Darwin, with a depth of ~54 m at KP380.

The GEP is a 26" diameter welded steel pipeline. The GEP is externally protected by Cathodic Protection (CP) systems using sacrificial anodes with a design life of 25 years. It is also coated with 5 mm asphalt enamel, with High Density Polypropylene (HDPE) Heat Shrink Sleeves (HSS) applied to joints. These coatings are intended to protect the GEP from corrosion. The GEP is coated with High Density Concrete to ensure on bottom stability and protect against physical impacts.

The GEP transports dry natural gas from the Bayu-Undan field to the DLNG Plant located at Wickham Point, Darwin.

[1] While there is approximately 34.7 km of GEP within Timor-Leste waters, the Timor-Leste waters and Commonwealth waters boundary occurs at KP34.2 (Figure 2-1).

3 Regulatory framework

3.1 Introduction

The Bayu-Undan development is approaching the end of its field life, with production planned to cease in 2021/2022. It will be the largest decommissioning project in Timor-Leste offshore waters and Australian Commonwealth waters to date.

The offshore decommissioning industry is in its infancy in the region, but more than 150 offshore assets will be decommissioned in Australia in the next decade. Similarly, Timor-Leste has not seen any decommissioning activity of this scale.

Decommissioning of oil and gas infrastructure in the North Sea is guided by the OSPAR[2] Decision 98/3 which states the dumping, and leaving wholly or partly in place, of disused offshore installations is prohibited within the OSPAR maritime area. However, following assessment, the competent authority may give permission to leave installations or parts of installations in place in the case of:

- steel installations weighing more than ten thousand tonnes in air
- gravity based concrete installations
- floating concrete installations
- any concrete anchor-base which results, or is likely to result, in interference with other legitimate users of the sea.

Alternative decommissioning options may be considered if the potential impacts and viability of each alternative option is assessed. This is largely driven by the wide use of the area by commercial fishermen, and the ongoing risk of leaving large infrastructure in-situ which can snag trawling nets.

Australia's regulatory require complete removal as the default decommissioning strategy. However, in some other international jurisdictions such as the USA and the Asia Pacific region, alternative approaches such as partial removal and leaving structures in place are more widely accepted. As such, under Sections 586 and 587 of the *Offshore Petroleum and Greenhouse Gas Storage Act* 2006, options other than complete removal may be considered, however the titleholder must demonstrate that the alternative decommissioning approach delivers equal or better environmental, safety and well integrity outcomes compared to complete removal, and that the approach complies with all other legislative and regulatory requirements – including requirements under other Commonwealth laws.

Similarly, Timor-Leste requires removal of all infrastructure on completion of petroleum production as the base case for decommissioning.

To provide transparency on decommissioning strategies and methods selection, ConocoPhillips has adopted a Decommissioning Options Evaluation (DOE) methodology, which mirrors the comparative assessment process used in the North Sea (Oil and Gas UK (2015) Guidelines for Comparative Assessment in Decommissioning Programmes). It involves multidisciplinary assessments of decommissioning strategies and methods across five primary criteria:

[2] The 'OSPAR Convention' is the Convention for the Protection of the Marine Environment of the North-East Atlantic.

- Environment
- Safety
- Society
- Technical feasibility
- Economic

A key output of the DOE is documentation of the process used to select the recommended decommissioning strategies and methods for the GEP. This information will be used to support stakeholder consultation and regulatory submissions (where required). In particular, it provides:

- Due diligence demonstration for prospective changes to the Australian offshore decommissioning regulatory framework.
- Independent options evaluation and rationale as the basis for potential leave in-situ strategies.
- Assessment and decision making transparency.
- Support the ALARP risk reduction demonstration.

3.1.1 Regulatory requirements and policy framework

Australia and Timor-Leste signed the *Treaty Between Australia and the Democratic Republic Timor-Leste Establishing Their Maritime Boundaries in the Timor Sea* (the Treaty) in March 2018 to establish maritime boundaries between the two signatory countries. As part of the Treaty, Australia and Timor-Leste agreed that Australia will exercise exclusive jurisdiction over the full length of the Bayu-Undan Pipeline. Therefore, Australian regulations apply to the decommissioning planning for the pipeline whether it is located in Timor-Leste water or Australian waters.

Furthermore, the Timor Sea Maritime Boundaries Treaty Consequential Amendments Bill 2019 states that the section of GEP in Timor-Leste waters needs to be fully removed to the satisfaction of NOPSEMA prior to the surrender of the license.

A number of regulatory requirements and policies will need to be complied with for the decommissioning of the Bayu-Undan GEP. These are summarised below in Table 3-1.

Table 3-1: Relevant legislation and policies

Legislation / Policy	Details
• *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPPGS Act) • Offshore Petroleum and Greenhouse Gas Storage	NOPSEMA is the regulating agency for this legislation. Section 572(3) of the OPGGSA contains a general requirement for a titleholder to remove "all structures that are, and all equipment and other

Legislation / Policy	Details
(Environment) Regulations 2009 • Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011	property that is, neither used nor to be used in connection with the operations". Section 572(3) of the OPGGSA is subject to directions by NOPSEMA or the responsible Commonwealth Minister under subsections 574, 574A and 574B of the OPGGSA. These directions could permit the partial removal or leaving equipment or other property in-situ if it is not being used or to be used by a titleholder. Section 572(3) of the OPGGSA is also subject to any other provision of the OPGGSA or regulations made under the OPGGSA. Importantly, section 270 of the OPGGSA addresses the requirements for the surrender of a title, which is typically the final step taken at the end of a title's useful life. Under section 270, the Joint Authority must not unreasonably withhold consent to the surrender of a title if (among other things) a titleholder has removed all property brought onto the area to be surrendered or made arrangements regarding that property that are satisfactory to NOPSEMA. The Explanatory Memorandum to the Offshore Petroleum Bill in 2005 expressly contemplates the IMO Guidelines where "arrangements satisfactory to the Designated Authority" [now NOPSEMA] are permitted, stating these allow "an operator to leave or partially remove certain items if the complete removal involves significant cost or safety implications". Decommissioning an offshore facility is a "petroleum activity" for the purposes of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 made under the OPGGSA (Regulations). Under the Regulations, NOPSEMA determines the acceptability of a decommissioning proposal through its acceptance of an environment plan prepared by the titleholder. The Environment Plan must demonstrate to NOPSEMA that the environmental impacts and risks of the activity will be reduced to "as low as reasonably practicable" (ALARP).
• *Environmental Protection (Sea Dumping) Act 1981*	The Department of the Environment and Energy (DoEE) is the regulating agency for this legislation. The Act regulates the dumping at sea of controlled material (including installation of anti-trawl structures or dumping rocks over petroleum infrastructure). Permits are required for any authorised sea dumping activities. The DoEE has advised that they use the London Protocol when considering the interpretation of the Sea Dumping Act. The London Protocol, in its definition on dumping, explicitly mentions that abandonment of 'pipelines' are not considered dumping. Potential DoEE Sea Dumping Act permit requirements will be further assessed if in-situ decommissioning of the GEP is further progressed,

4 Decommissioning Options Evaluation Process

This section describes the DOE process used to assess various decommissioning options (strategies and methodologies).

The process involved the following steps (Figure 4-1):

1. Develop a framework for the DOE including:
    a. Grouping facilities together
    b. Identifying decommissioning options to assess for each facility grouping
    c. Defining primary criteria and sub-criteria and scoring system to assess various decommissioning options
2. Score the decommissioning strategies for each facility group to recommend a decommissioning strategy
3. Score the decommissioning methodologies for the recommended strategies for each facility group to recommend a decommissioning method
4. Hold internal DOE discipline meetings and workshops with input from internal and external subject matter experts to review/validate scoring from steps 2 and 3
5. Perform primary criteria sensitivity analysis (i.e. removing the economic criteria from the scoring)
6. Document the process and the results (this report)

The process was iterative where the outputs of certain steps necessitated the review and update of preceding steps.

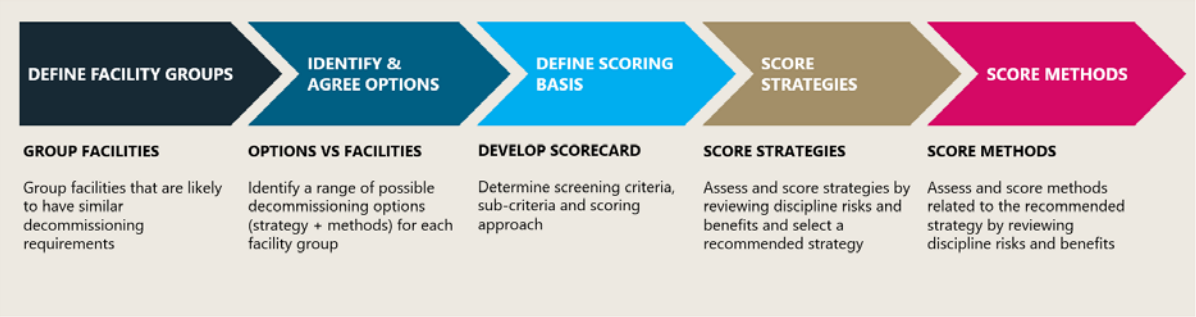

Figure 4-1: Decommissioning evaluations process

4.1 Decommissioning Options Evaluation Framework

4.1.1 GEP Facility Group

For the purpose of the DOE it was decided to group the facilities into 10 independent groups. This was because each facility group had different characteristics which have different benefits and risks and would require different removal methods. The DOE process was therefore applied to each facility group separately. This section will detail the GEP facility group only (Table 4-1). The DOE process for the remaining Bayu-Undan facilities is presented in a separate report.

Table 4-1: GEP infrastructure

Infrastructure	Facility group	Description
GEP section downstream of the SSIV to KP380	GEP	GEP Section in Australian Commonwealth waters (~345km) GEP Section in Timor-Leste offshore waters (~34.7km)

4.1.2 Decommissioning options

Decommissioning options can be split into two main elements to streamline the DOE process. The first includes the selection of a recommended decommissioning strategy for each facility group, such as full removal, partial removal or leaving in-situ. Once a recommended strategy is selected for each facility group using the DOE process, a recommended methodology for undertaking the decommissioning strategy is assessed and selected e.g. trench and bury, in-situ with minimal intervention (Figure 4-2).

Figure 4-2: Decommissioning options

4.1.2.1 Decommissioning strategies

Decommissioning strategies consider removal and leaving in-situ. It therefore takes into account the removal objective (full removal, partial removal, leave in-situ) as well as the final disposal location (onshore, offshore, reefing or in-situ) (Figure 4-3).

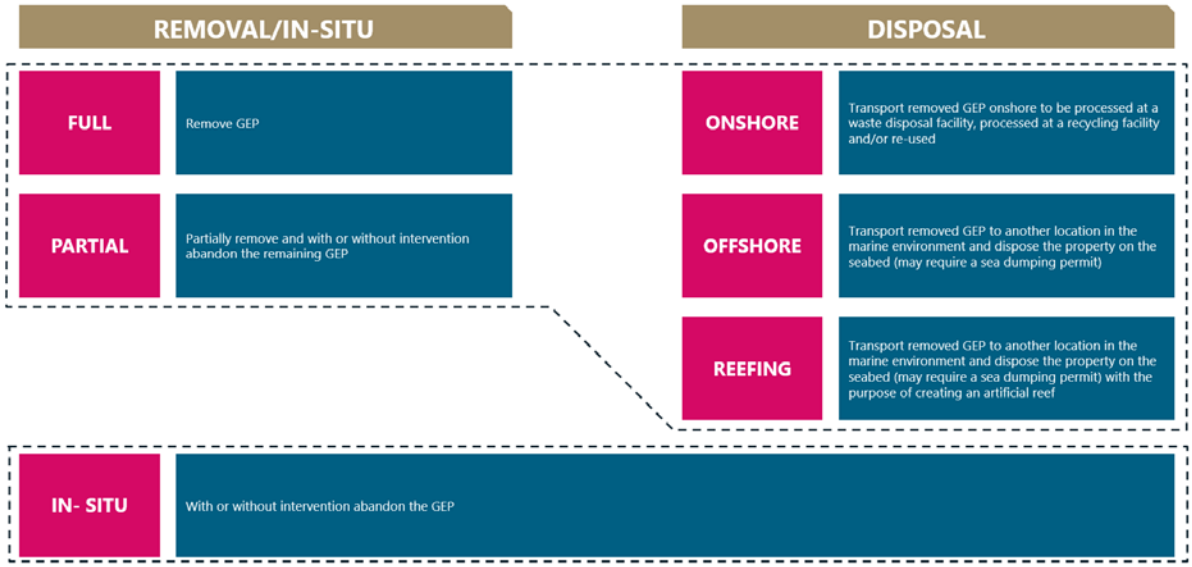

Figure 4-3: Decommissioning strategies

Table 4-2 shows the decommissioning strategies considered for the GEP including details on how these were defined for the DOE. Table 4-3 shows the decommissioning strategies that were excluded from the DOE for the GEP and the justification for their exclusion.

Table 4-2: Decommissioning strategies considered for the GEP

Infrastructure	Facility group	Full removal			Partial removal			Leave in-situ[*2]
		Onshore disposal[*1]	Offshore disposal	Reefing	Onshore disposal	Offshore disposal	Reefing	
GEP section downstream of the SSIV to KP380	GEP (34.7 km section in Timor-Leste offshore waters	✔						
	GEP (345 km section in Australian Commonwealth waters)	✔						✔

[*1] The assumption for the purpose of the DOE is that the onshore disposal of the GEP would be in South East Asia.

[*2] The leave in-situ strategy assumes the infrastructure remains in its current location (on the seabed).

Table 4-3: Decommissioning strategies excluded for the GEP

Infrastructure	Facility group	Excluded strategy	Reason for excluding
GEP	GEP (34.7 km section in Timor-Leste offshore waters)	• **Full removal – Offshore disposal** • **Full removal – Reefing** • **Partial removal (all alternatives)** • **Leave in-situ**	The leave in-situ strategy for the GEP in Timor-Leste offshore waters is currently not considered a feasible option due to the current agreement between the Australian and Timor governments that this infrastructure would be fully removed and disposed onshore (Section 3.1.1). Full removal via offshore disposal or reefing were also excluded because they were thought to be contrary to the spirit/intent of the Timor-Leste-Australian Government agreement for this section to be removed from Timor-Leste offshore waters.
	GEP (~345 km section in Australian Commonwealth waters)	• **Full removal – Offshore disposal** • **Full removal – Reefing**	Full removal with offshore disposal or reefing is not considered feasible. Significant time and cost would be involved with both removing and relocating ~345 km of pipeline. Reefing and offshore disposal is unlikely to be advantageous over leaving the GEP in-situ as significant habitat disturbance and destruction of marine growth would occur in removing the pipeline. Offshore disposal or reefing is unlikely to be considered satisfactory to regulators.

4.1.2.2 Decommissioning methodologies

Once a recommended strategy for the GEP was selected (only relevant to the Commonwealth section of the GEP), various decommissioning methodologies were identified and underwent an evaluation process to determine a recommended methodology. Decommissioning methodologies consider how a specific strategy would be implemented and these are further described in (Table 4-4).

Table 4-4: Decommissioning methodologies

Infrastructure	Facility group	Recommended strategy following Strategy scoring process	Decommissioning method	Description*1
GEP	GEP (34.7 km section in Timor-Leste offshore waters)	Full removal	Cut (diamond wire cutting) and recover	GEP is cut into manageable sections on the seabed using diamond cutting, lifted onto vessel and disposed onshore in South East Asia.
			Cut (shear cutting) and recover	GEP is cut into manageable sections on the seabed using shear cutting, lifted onto vessel and disposed onshore in South East Asia.
			Reverse s-lay	GEP is recovered by reverse s-lay vessel and cut on deck and disposed onshore in South East Asia.
	GEP (345 km section in Australian Commonwealth waters)	Leave in-situ	Trench and bury	Pipeline is trenched below seabed level and/or rock dump is placed to bury the GEP.
			In-situ with minimal intervention (cleaning and stabilisation)	Pipeline is cleaned internally to an ALARP and acceptable level, disconnected, flooded and left in-situ with only minor stabilization work (e.g. mattresses).

*1 Additional information and assumptions on the various methodologies are provided in Section 5

4.1.3 Primary criteria and Scoring

A scoring methodology was developed to score the strategies and methodologies against the primary criteria. The primary criteria were further divided into sub-criteria. Where relevant, short-term and long-term sub-criteria were used. Short-term sub-criteria relate to items relevant to the immediate execution phase of the decommissioning activity. Long-term sub-criteria consider potential impacts/benefits following completion of the decommissioning activity. The COP risk matrix was used to define likelihood and consequence definitions for the Safety primary criteria. The primary criteria and sub-criteria and how these have been defined are presented in Table 4-5.

Table 4-5 Primary criteria and sub-criteria

Primary criteria	Short-term / Long-term	Sub-criteria	Sub-criteria definition	Applicability	
				Strategy scoring	Methodology scoring
Environment	Short-term	Habitat disturbance (physical)	Disturbance/ damage to surrounding habitat from lifting, object impact or infrastructure removal	✔	✔
		Water and sediment quality	Contamination (e.g. spills), turbidity and routine discharges from decommissioning activities leading to ecosystem/habitat impacts	✔	✔
		Emissions	Greenhouse gas emissions (take into account combination of decommissioning and disposal)	✔	✔
	Long-term	Biodiversity effect	Increase/decrease in flora/fauna species diversity/numbers through habitat provision/removal	✔	Only applicable to GEP Australian Commonwealth waters section
		Invasive species	Risk of introduction of IMS (from project vessels and/or facility) based on size of infrastructure and decommissioning methodology/option (number of vessels/trips, in-situ vs relocation, marine growth removed at existing location before being moved, etc).	✔	✔
		Water/sediment quality	Increase/decrease in water/sediment quality from infrastructure – contaminants (e.g. NORMS, heavy metals, plastics, etc)	✔	Only applicable to GEP Timor-Leste offshore waters section

Primary criteria	Short-term / Long-term	Sub-criteria	Sub-criteria definition	Applicability	
				Strategy scoring	Methodology scoring
		Waste management	Reuse/recyclability potential	✔	N/A
Society	Short-term	Access to tourist/ recreational area/ commercial fisheries	Restriction of access to tourism/ commercial fishing area	✔	✔
		Job creation	Workforce size and duration	✔	✔
	Long-term	Tourism effect/commercial fisheries effect	Tourism effect/ commercial fisheries effect	✔	Only applicable to GEP Australian Commonwealth waters section
Technical feasibility	Short-term	Execution complexity	From design to execution – feasibility, engineering and implementation technical risks	✔	✔
		Maturity of approach/track-record	Level of confidence on the proposed decommissioning approach based on previous track-record	✔	✔
		Market capability	Regional and international market capability (e.g. facilities, spread, tools, know-how, etc.)	✔	✔
Safety	Short-term	Personnel exposure (Operations)	Operational risk to personnel during execution of the works (e.g. lifting, welding, vessel collisions, etc.)	✔	✔
		Personnel exposure (Contaminants)	Contamination risk to personnel during execution of the works	✔	✔

Primary criteria	Short-term / Long-term	Sub-criteria	Sub-criteria definition	Applicability	
				Strategy scoring	Methodology scoring
		Asset exposure (3rd Party assets/ vessel collision)	Risk to assets involved in the execution of the decommissioning operations	✔	✔
	Long-term	Residual safety risk	Safety risks (e.g. commercial shipping/ hitting assets left in-situ, etc.); considers the future, post-decommissioning risk exposure in the area generated by the specific alternative	✔	Only applicable to GEP Australian Commonwealth waters section
Economic	Short-term	Capital investment	Cost of work for undertaking decommissioning activities (per specific facility)	✔	✔
	Long-term	Post-execution monitoring	Assumed post-execution monitoring costs for a finite period (two monitoring events during a 5 year post-decommissioning period). At the time of performing the DOE, residual liability associated with the GEP in-situ strategy is assumed to transfer to the Commonwealth upon surrender of title for the GEP. Therefore, for the purpose of the DOE, residual liability has not been taken into account when scoring the GEP in-situ strategy. Residual liability arrangements will be considered further if the GEP leaving in-situ strategy for Australian Commonwealth waters is adopted and progressed.	✔	Only applicable to GEP Australian Commonwealth waters section

A scoring system was developed to enable each strategy and methodology to be scored under each sub-criteria. Depending on the sub-criteria, strategies and methodologies were either scored negatively (-5, -3, -1) if these were likely to have a negative impact or present a risk under the relevant sub-criteria; or positively (+1, +3, +5) if these were likely to have a benefit for the sub-criteria under consideration. A score of 0 is considered neutral or where no impacts or benefits are likely to be observed. Scoring definitions for each sub-criteria are presented in Appendix A.

To determine a recommended strategy and/or methodology, all the scores of each sub-criterion under a primary criterion were averaged to give that primary criterion's overall score. The overall score of each of the five primary criteria were added to obtain a final score and the strategy/methodology with the highest score (least negative or most positive score) was considered the recommended option.

It is important to note that while the results represent the outcome of structured assessment against multiple primary criteria, the scoring itself is based on the subjective assessments of those that participated in the assessment process and assumptions which informed the scoring. The final strategy/methodology that will be used may vary following outcomes of detailed design, completion of further studies and/or stakeholder consultation.

4.1.3.1 Scoring process

Sub-criteria were scored based on the definitions provided in Appendix A and as detailed above. The scoring process included the following steps:

- Advisian experts in the relevant primary criteria fields assigned a score for each sub-criterion under their relevant primary criterion/discipline. The scoring took into account a number of assumptions that were made for each strategy and/or methodology. These assumptions are presented in Section 5. The scoring also took into consideration reference material obtained by Advisian and/or provided by COP to inform the DOE process. This included the following:
    - DNV (2019). Bayu-Undan topsides. Level 1 Hazardous Material Inventory
    - Remote Operated Vehicle (ROV) footage provided by COP
    - Heerema (2019a). Bayu-Undan Decommissioning. KD-03 EPRD Project Execution Plan
    - Heerema (2019b). Bayu-Undan Decommissioning. KD-04 EPRD Cost Estimate
    - Xodus (2019). Bayu-Undan Decommissioning – Concept Studies. Basis of Abandonment
    - Worley Parsons (2015). Bayu-Undan Abandonment of Offshore Upstream Facilities. Footings Removal – Methodology
    - Worley Parsons (2014). Abandonment of the Offshore Upstream Facilities at Bayu-Undan. Decommissioning Methodology
    - Advisian (2019). Bayu-Undan Decommissioning Options Evaluation. Environmental and Societal Sensitivities Assessment

- Primary criteria discipline meetings for each primary criterion were then held with COP counterparts to present, discuss and update the results where required, in particular where new information/assumptions became available not previously held.

- A workshop involving Advisian staff and wider COP personnel was then held to present and discuss the overall findings and discuss any areas of concerns, including any assumptions

made. Scores were updated and finalised and a recommended strategy/methodology was recommended.

4.1.3.2 Weightings

The DOE recognises that certain primary criteria and sub-criteria may hold more or less importance when these are compared against one another. The decision to apply a weighting to a sub-criteria and/or primary criteria was discussed with Advisian and COP staff and determined during the primary criteria discipline meetings and workshop. The importance of a particular sub-criteria to inform the selection process for a particular facility group was considered and a weight of between 0 and 1 applied. Weightings were reduced to less than 1 if they were thought to be not as important/significant as other sub-criteria. Sub-criteria weightings were therefore only adjusted by exception. The sub-criteria weighting was then multiplied by the sub-criteria scores, which were then averaged to produce the overall weighted sub-criteria scores. These weighted sub-criteria scores were then multiplied by their primary criteria's weighting to produce the overall weighted sub-criteria and primary criteria score. Table 4-6 details the sub-criteria weighting that have been applied to the strategy scoring process and the methodology scoring process and the reasoning.

Table 4-6: Sub-criteria strategy and methodology weighting and explanations for the GEP

Primary criteria	Short-term / Long-term	Sub-criteria	Sub-criteria definition	Strategy		Methodology	
				Sub-criteria Weighting	Explanations	Sub-criteria Weighting	Explanations
Environment	Short-term	Habitat disturbance (physical)	Disturbance/ damage to surrounding habitat from lifting, object impact or infrastructure removal	0.5	For GEP commonwealth section habitat disturbances would be temporary but may impact sensitive habitats across large but linear areas with differences between options	0.5	For GEP commonwealth section habitat disturbances would be temporary but may impact sensitive habitats across large but linear areas with differences between options
		Water and sediment quality	Contamination (e.g. spills), turbidity and routine discharges from decommissioning activities leading to ecosystem/habitat impacts in the marine/terrestrial environment	0.25	Not a strong differentiator between options, work would be undertaken in accordance with strict controls minimising risk of unplanned/planned events leading to contamination	0.25	Not a strong differentiator between options, work would be undertaken in accordance with strict controls minimising risk of unplanned/planned events leading to contamination
		Emissions	Greenhouse gas emissions (takes into account combination of decommissioning and disposal)	1	Greenhouse gas emissions has the potential to be high and vary greatly across the various strategies	1	Greenhouse gas emissions has the potential to be high and vary greatly across the various methodologies
	Long-term	Biodiversity effect	Increase/decrease in flora/fauna species diversity/numbers through habitat provision/removal	1	Sub-criteria of high importance due to long-term benefit/ impact it will create	1	Sub-criteria of high importance due to long-term benefit/impact it will create
		Invasive species	Risk of introduction of IMS (from project vessels and/or facility) based on size of infrastructure and decommissioning methodology/option (number of vessels/trips, in-situ vs relocation, marine growth presence or removed at existing location before being moved, etc.)	0.5	Vessel risks as well as from marine growth on pipeline; while strict controls are to be implemented, extensive duration of campaign to remove GEP increases the risk of IMS spreading as sections are transported	0.5	Vessel risks as well as from marine growth on pipeline; while strict controls are to be implemented, extensive duration of campaign to remove/leave in-situ GEP and use of international vessels for some options increases the risk of IMS spreading
		Water/ sediment quality	Increase/decrease in water/sediment quality from infrastructure – contaminants (e.g. NORMS, heavy metals, etc.)	1	Potential for contaminated waste to be left in the field, different options have different outcomes, large facility left in the marine environment degrading over time	1	Potential for contaminated waste to be left in the field and/or concrete/metal debris to be left in the field, different options have different outcomes
		Waste management	Reuse/recyclability potential	1	Large infrastructure with some potential for recycling	N/A	N/A to Methodologies scoring process
Society	Short-term	Access to tourist/ recreational area/ commercial fisheries	Restriction of access to tourism/ commercial fishing area	1	A number of commercial fisheries operate in Australian Commonwealth waters, sub-criteria of high importance	1	A number of commercial fisheries operate in Australian Commonwealth waters, sub-criteria of high importance
		Job creation	Job creation during decommissioning operations (takes into account duration)	1	Workforce size and duration varies between options, potentially of high importance and determining factor	1	Workforce size and duration varies between options, potentially of high importance and determining factor
	Long-term	Tourism effect/ commercial fisheries effect	Increase/decrease in fish stocks in commercial fishing grounds and/or increase/decrease in fishing ground area (Indonesian/Australian)	1	Long-term benefits/ impacts of high importance in particular considering differences between options	1	Long-term benefits/ impacts of high importance in particular considering differences between options
Technical feasib	Short-term	Execution complexity	From design to execution – feasibility, engineering and implementation technical risks	1	All sub-criteria considered of equal and high importance	1	All sub-criteria considered of equal and high importance

Primary criteria	Short-term / Long-term	Sub-criteria	Sub-criteria definition	Strategy		Methodology	
				Sub-criteria Weighting	Explanations	Sub-criteria Weighting	Explanations
		Maturity of approach/track-record	Level of confidence on the proposed decommissioning approach based on previous track-record	1	All sub-criteria considered of equal and high importance	1	All sub-criteria considered of equal and high importance
		Market capability	Local, regional and international market capability (e.g. facilities, spread, tools, know-how, etc.)	1	All sub-criteria considered of equal and high importance	1	All sub-criteria considered of equal and high importance
Safety	Short-term	Personnel exposure (Operations)	Operational risk to personnel during execution of the works (e.g. lifting, welding, vessel collisions, etc.)	1	All sub-criteria considered of equal and high importance	1	All sub-criteria considered of equal and high importance
		Personnel exposure (Contaminants)	Contamination risk to personnel during execution of the works	1	All sub-criteria considered of equal and high importance	1	All sub-criteria considered of equal and high importance
		Asset exposure (3rd Party assets/ vessel collision)	Risk to assets involved in the execution of the decommissioning operations	1	All sub-criteria considered of equal and high importance	1	All sub-criteria considered of equal and high importance
	Long-term	Residual safety risk	Safety risks (e.g. commercial shipping/ hitting assets left in-situ, etc.); considers the future, post-decommissioning risk exposure in the area generated by the specific alternative	1	All sub-criteria considered of equal and high importance	1	All sub-criteria considered of equal and high importance
Economic	Short-term	Capital investment	Cost of work for undertaking decommissioning activities (per specific facility)	1	Most important sub-criteria for economic primary criteria	1	Most important sub-criteria for economic primary criteria
	Long-term	Ongoing monitoring	Cost for ongoing site monitoring (yearly)	0.1	Long-term costs are likely to be a small proportion of the overall cost compared to the capital investment	0.1	Long-term monitoring costs are likely to be a small proportion of the overall cost compared to the capital investment

Further to the sub-criteria weightings, a weighting at the primary criteria level was also considered. This was based on the overall COP SPIRIT values. The approach to weighting of the primary assessment primary criteria was intended to align the comparative assessment process with the Australian regulatory framework for evaluation of options other than full removal where "the titleholder must demonstrate that the alternative decommissioning approach delivers equal or better environmental, safety and well integrity outcomes compared to complete removal" (Department of Industry Innovation and Science Guideline 2018) – acknowledging that each stakeholder will have a unique view about the relative importance of each of the primary criteria. The following primary criteria weightings were applied to the DOE assessment:

- Environment (0.3)
- Safety (0.3)
- Society (0.2)
- Technical Feasibility (0.1)
- Economic (0.1)

Results are presented graphically in three different ways:

- Unweighted, all sub-criteria and primary criteria are not weighted
- Sub-criteria weighted, all sub-criteria are weighted
- Sub-criteria and primary criteria weighted, all sub-criteria and primary criteria are weighted

This allows stakeholders to determine if the recommended strategies/methodologies are significantly influenced by any of the sub-criteria and/or primary criteria.

4.1.3.3 Sensitivity analysis

To check whether the economic primary criteria influenced the selection of the recommended option, the economic primary criteria was weighted 0.

5 Results

5.1 Strategies scoring

Based on the ratification of the maritime boundaries' treaty between Australia and Timor-Leste, COP is required to remove the 34.7 km section of GEP in Timor-Leste offshore waters prior to surrender of title, hence leave in-situ is not considered in the scope of the strategy scoring. Therefore, the ~345 km section in Australian Commonwealth waters is considered. The two strategies assessed are:

- Full removal of the ~345 km section of the GEP in Australian Commonwealth waters
- Leave in-situ the ~345 km section of GEP in Australian Commonwealth waters.

5.1.1 GEP section in Australian Commonwealth waters

Table 5-1 details the assumptions applied for both strategies to inform the scoring.

Table 5-1: Strategy assumptions

Strategy	Assumptions
Full removal of the ~345 km section of the GEP in Australian Commonwealth waters	• Reverse S-lay method for removal of the 345 km section in Australian Commonwealth waters. • All subsea operations will be performed by ROV, diver-less execution. • Cutting of GEP into shorter length sections, would be undertaken on the vessel. • GEP is cleaned to an ALARP and acceptable level. However, onshore worker may be exposed to residual hazardous material e.g. mercury etc. • Multiple vessels will be involved in the execution, including pipelay vessel • Helicopter trips will be required for workers transportation. • Onshore disposal will be at a regional location at a facility able to accept waste stream (South-East Asia). • The final waste disposal facility on land would have all appropriate controls to manage waste, including contaminated waste. • Assumed that appropriate controls in line with company/regulatory requirements will be implemented (pre-decommissioning surveys to identify potential IMS, vessel 'hygiene' protocols, etc).
Leave in-situ the ~345 km section of GEP in Australian Commonwealth waters	• GEP cleaned to ALARP, flooded, stabilised and left in place with minimal intervention. • Requirement for anti-snagging structures to be assessed and installed where deemed necessary. • Commercial fisheries including trawling occurs in Australian waters in the vicinity of the GEP.

Strategy	Assumptions
	• Environment Plan and/or Safety Case requirement for post-execution monitoring of pipeline for a finite period to confirm stability, two campaigns during 5 years post decommissioning. • At the time of performing the DOE, residual liability associated with the GEP in-situ strategy is assumed to transfer to the Commonwealth upon surrender of title for the GEP. Therefore, for the purpose of the DOE, residual liability has not been taken into account when scoring the GEP in-situ strategy. Residual liability arrangements will be considered further if the GEP in-situ strategy for Australian Commonwealth waters is adopted and progressed.

Based on the assumptions listed above, the sub-criteria scores for the strategy options are provided in Table 5-2.

Table 5-2: Strategy scoring sub-criteria unweighted results for GEP section in Australian Commonwealth waters

Primary criteria	Short-term / Long-term	Sub-criteria	Full removal and onshore disposal		Leave in-situ	
			Score	Reasoning	Score	Reasoning
Environment	Short-term	Habitat disturbance (physical)	-3	Overlaps Key Ecological Features and Australian Marine Parks with high likelihood of sensitive habitats (e.g. coral, seagrass) to occur along the pipeline route. Long pipeline with disturbance of surrounding habitat during removal process	-1	Minimal activities (cleaning and stabilisation)
		Water and sediment quality	-3	Risks are vessel based as well as during the onshore disposal of the pipeline which may contain residual contaminants	-1	Minimal activities compared to other option (cleaning and stabilisation)
		Emissions	-5	Options with largest emissions	-1	Minimal emissions compared to other option
	Long-term	Biodiversity effect	-5	Long infrastructure currently provides habitat in the form of an artificial reef	0	Infrastructure would be retained and continue to provide habitat. No impacts
		Invasive species	-1	Increased risks from vessel operations and long duration as well as bringing pipeline back to disposal facility in South East Asia. However, appropriate controls in accordance with international standards would be implemented and has been taken into account in the scoring	0	Limited duration of campaign and minimal vessel based risks considering appropriate controls in accordance with international standards would be implemented
		Water/ sediment quality	1	Contaminants present (mercury), large infrastructure. Likely low volumes of contaminants. The removal would eliminate this potential source of pollution	-1	Contaminants likely present (e.g. residual mercury) and large infrastructure which would be left in marine environment to degrade over time. GEP is cleaned to an ALARP and acceptable level.

Primary criteria	Short-term / Long-term	Sub-criteria	Full removal and onshore disposal		Leave in-situ	
			Score	Reasoning	Score	Reasoning
		Waste management	1	Concrete coated steel pipeline, potential for small components to be recycled/reused	0	Facility not recycled and left in marine environment
Safety	Short-term	Personnel exposure (Operations)	-3	Consequence – potential dropped object during offloading pipe sections to a cargo barge could drop on the vessel or onto cargo barge which could lead to major injury or fatality Likelihood – multiple lifts, Rare (Lifting controls in place) Risk Ranking – Significant	-1	Consequence –exposure to offshore environment helicopter trips which could lead to major safety hazards Likelihood – remote Risk ranking – Medium
		Personnel exposure (Contaminants)	-3	Consequence – assuming GEP line is completely free of hydrocarbon. Worker may expose to residual hazardous material which may cause significant long-term health effects Likelihood – probable (onshore exposure will be higher during hydrocarbon breaking and dust from stripping of concrete, however controls will be in place). Likelihood of workers exposure will be higher due to large GEP length and high numbers of cuts required. Risk ranking – Significant	0	No exposure to HC or hazardous material

Primary criteria	Short-term / Long-term	Sub-criteria	Full removal and onshore disposal		Leave in-situ	
			Score	Reasoning	Score	Reasoning
		Asset exposure (3rd Party assets/ vessel collision)	-3	Consequence – major injury/fatality due to potential collision of vessels/helicopter crash Likelihood – rare Risk ranking – Significant	-1	Consequence – major injury/fatality due to potential collision of vessels/helicopter crash Likelihood – remote Risk ranking – Medium
	Long-term	Residual safety risk	0	No future safety risk concern	-1	GEP potential hazard to other users of the sea Consequence – assuming fishing trawler fishing gear stuck with GEP could lead to sinking of trawlers/major injury or fatality Likelihood – remote (no accidents recorded at this site since the installation) Risk ranking - Medium
Society	Short-term	Access to tourist/ recreational area/ commercial fisheries	-3	Removal activities may cause interference with commercial fisheries e.g. temporary exclusion in the fishing zones	-1	Minimal interference due to small duration of decommissioning activities
		Job creation	5	Longest duration	1	Minimal jobs due to limited activities and short duration compared to other option
	Long-term	Tourism effect/ commercial fisheries effect	-3	Pipeline currently provides habitat in commercial fishing grounds (Australian waters). Its removal may reduce fish stocks in the area	0	Current habitat value that the GEP provides is maintained
Technical feasib	Short-term	Execution complexity	-3	Major risks, however a level of confidence that they can be managed (for s-lay)	-1	Some intervention work may be required with only minor risks

Primary criteria	Short-term / Long-term	Sub-criteria	Full removal and onshore disposal		Leave in-situ	
			Score	Reasoning	Score	Reasoning
		Maturity of approach/ track-record	-5	Never been done before considering length of pipeline	-1	Leave in-situ is understood and has been done before but less frequently considering size of pipeline and pipeline is not buried
		Market capability	-5	Limited capability, requires specific services/facilities available only internationally	-1	Some intervention work may be required but vessels widely available in the region
Economic	Short-term	Capital investment	-5	Considering the length of pipeline, cost is likely to exceed $AUD 200M	-3	Considering minimal intervention and cleaning to ALARP will be required, the cost will likely be towards the low to mid range of the 10 – 100M band
	Long-term	Ongoing monitoring	0	No monitoring requirements	-1	Anticipated that seabed monitoring for a finite period would be required, two campaigns during 5 years post decommissioning considered to be below 10M

Table 5-3 provides a breakdown of the final primary criteria scores unweighted (i.e. the average of the sub-criteria scores under the specific primary criterion considered). Figure 5-1 shows the results of the strategy scoringprocess (the sum of all primary criteria scores) for each strategy. Based on the unweighted score, the recommended strategy is the leave in-situ strategy for the ~345 km section of GEP in Australian Commonwealth waters.

Table 5-3: Non-weighted primary criteria results breakdown for GEP in Australian Commonwealth waters strategies

Primary criteria	Full removal primary criteria scores	Leave in-situ primary criteria scores
Environment	-2.1	-0.6
Safety	-2.3	-0.8
Society	-0.3	0
Technical Feasibility	-4.3	-1
Economic	-2.5	-2

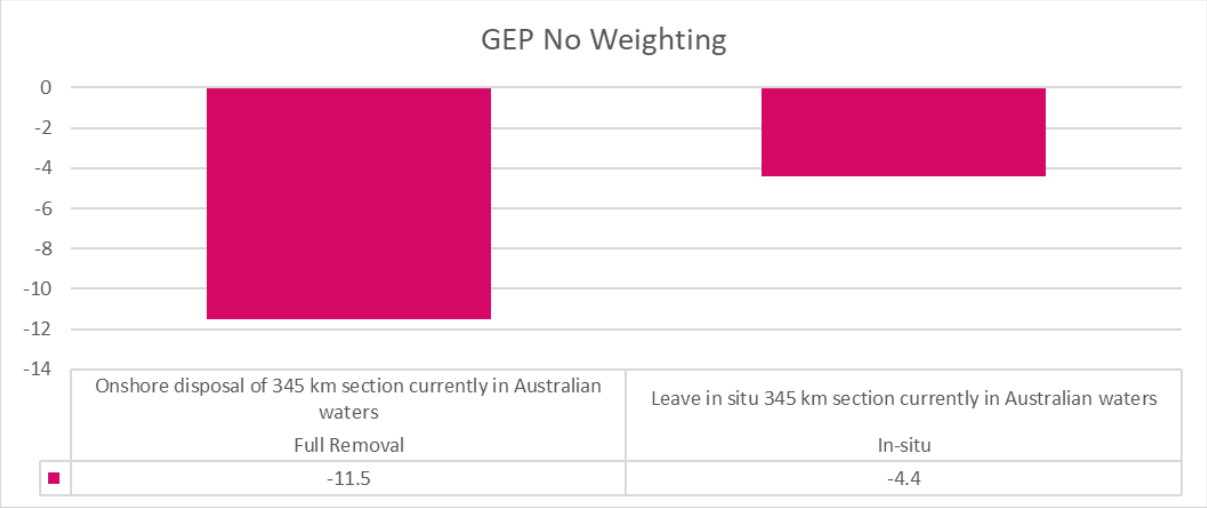

Figure 5-1: GEP non-weighted strategy scoring results

For each primary criteria the conclusions are:

Environment

The full removal of the pipeline will have high short-term impacts resulting from the extensive duration of the campaign to remove (disturbance to sensitive habitats, increased emissions). It would also have high long-term impacts through the removal of a long artificial reef system. While the leave in-situ strategy would leave a large piece of infrastructure on the seabed with some risks of contamination, it will be cleaned to ALARP and the infrastructure will avoid removing a complex habitat providing high benefits. The leave in-situ strategy is recommended.

Safety

The leave in-situ strategy is recommended due to the lower short-term safety risks compared to the full removal strategy which will require an extensive duration offshore to complete. While there is a higher long-term risks involved in leaving the structure in-situ (potential for snagging of trawl nets), the likelihood of this occurring is remote.

Society

While there is a better short-term societal benefit of an increased workforce for the full removal strategy compared to the leave in-situ strategy, leaving the GEP in place would provide improved long-term societal benefits as the GEP would continue to provide marine habitat and fish stock for commercial fisheries operating in the area. The leave in-situ strategy is recommended.

Technical Feasibility

The complexity, maturity of approach and limited market capability of removing the section of GEP from Australian Commonwealth waters scored worse than the leave in-situ option. The leave in-situ strategy is the recommended option.

Economic

Despite some potential post decommissioning monitoring costs of leaving the GEP in-situ, the high capital investment cost of implementing full removal (>AUD$200M) makes this the least recommended strategy compared to the leave in-situ strategy (between AUD$10M-$100M).

Weightings

Weighting of the sub-criteria did not change the outcomes of the selection of the recommended strategy (Figure 5-2).

Weighting of the sub-criteria and primary criteria did not change the outcomes of the selection of the recommended strategy (Figure 5-3).

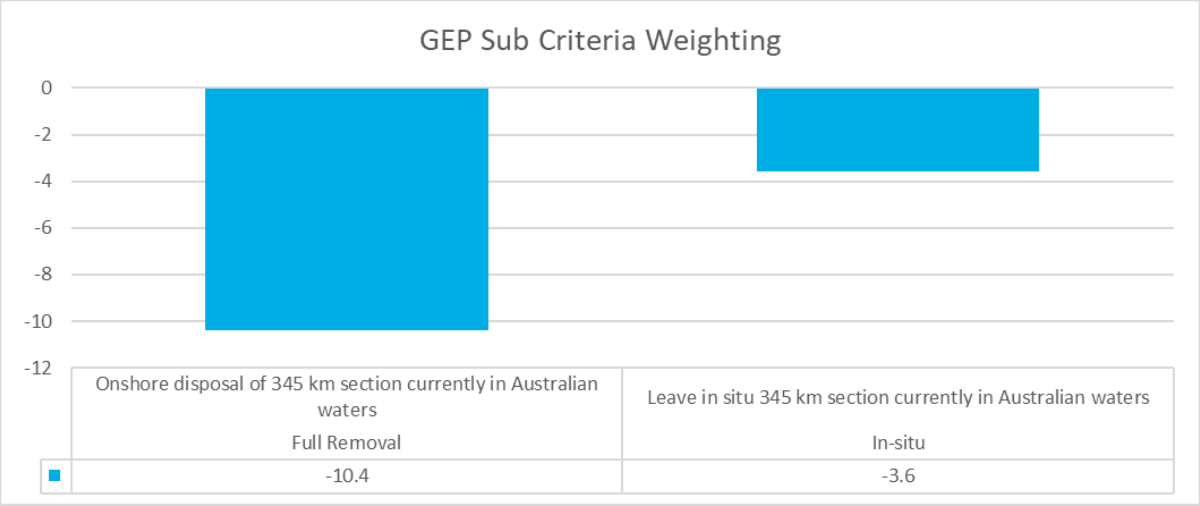

Figure 5-2: GEP in Australian Commonwealth waters sub-criteria weighted strategy scoring results

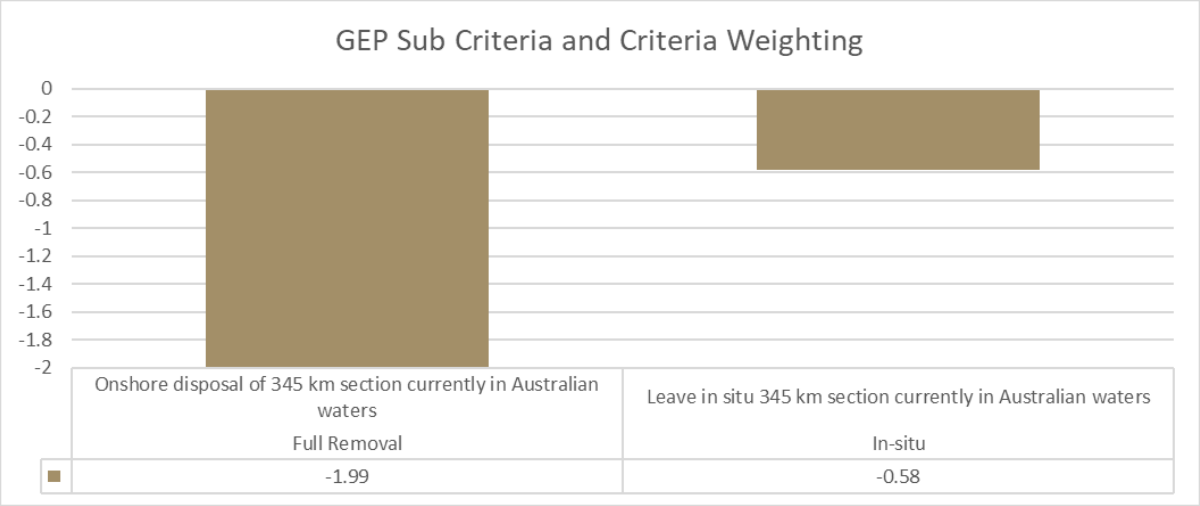

Figure 5-3: GEP Commonwealth primary criteria and sub-criteria weighted strategy scoring results

Sensitivity analysis

A sensitivity analysis was also undertaken by removing the economics primary criteria from the analysis, hence making the economics weighting zero. The recommended strategy outcome did not change (Figure 5-4).

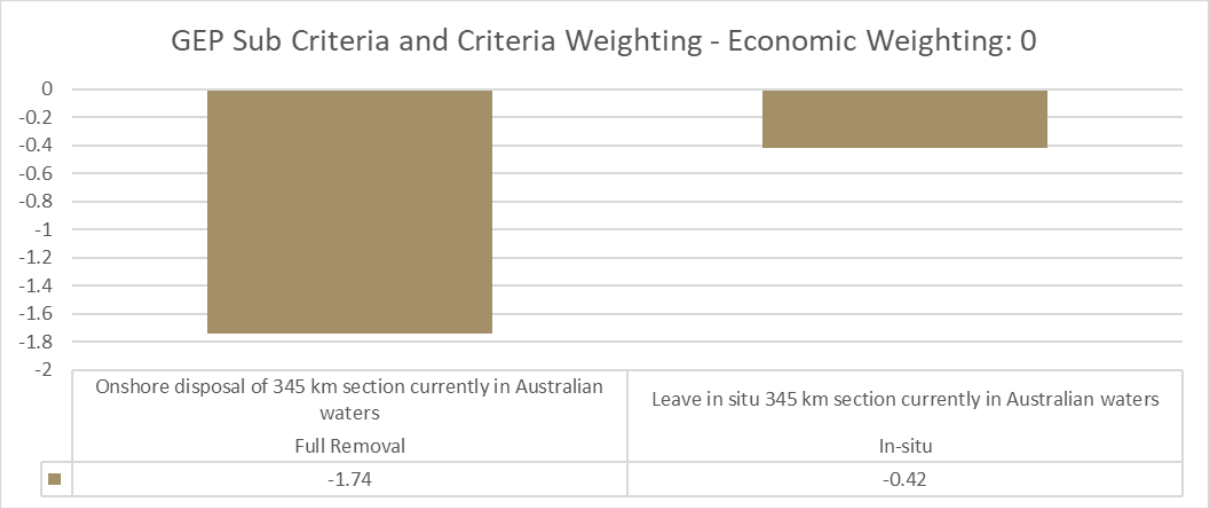

Figure 5-4: GEP Commonwealth primary criteria and sub-criteria weighted strategy scoring results, Economic weighting removed

5.2 Methodologies scoring

The methodologies being considered for the recommended strategies for the GEP section in Timor-Leste offshore waters and Australian Commonwealth waters are:

- GEP – Commonwealth section 345 km to be left in place:
  - Trench and bury
  - In-situ with some intervention
- GEP – Timor-Leste section 34.7 km to be removed and disposed onshore:
  - Diamond wire cut on seabed and recover
  - Shear cut on seabed and recover
  - Reverse S-lay

5.2.1 GEP section in Australian Commonwealth waters

Table 5-4 details the assumptions applied for both methodologies to inform the scoring.

Table 5-4 Methodology assumptions – GEP in Australian Commonwealth waters

Methodology	Assumptions
Trench and bury	• Multiple vessels will be involved in the execution, trenching options range from rock trencher to plough. • Helicopter trips will be required for workers transportation. • Rock dump may be required. • The GEP will be cleaned to an ALARP and acceptable level.

Methodology	Assumptions
	• Appropriate controls inline with company/regulatory requirements will be implemented (pre-decommissioning surveys to identify potential IMS, vessel 'hygiene' protocols, etc). • Environment Plan and/or Safety Case requirement for post-execution monitoring of pipeline for a finite period to confirm stability, two campaigns during 5 years post decommissioning. • At the time of performing the DOE, residual liability associated with the GEP in-situ strategy is assumed to transfer to the Commonwealth upon surrender of title for the GEP. Therefore, for the purpose of the DOE, residual liability has not been taken into account when scoring the GEP in-situ strategy. Residual liability arrangements will be considered further if the GEP in-situ strategy for Australian Commonwealth waters is adopted and progressed.
In-situ with minimal intervention	• The GEP will be cleaned to an ALARP and acceptable level. • Requirement for anti-snagging structures to be assessed and installed where deemed necessary. • Appropriate controls inline with company/regulatory requirements will be implemented (pre-decommissioning surveys to identify potential IMS, vessel 'hygiene' protocols, etc). • Minimal number of manhours and vessels are required compared to trench and bury. • Stabilised by rock dump or mattresses where necessary. • Environment Plan and/or Safety Case requirement for post-execution monitoring of pipeline for a finite period to confirm stability, two campaigns during 5 years post decommissioning. • At the time of performing the DOE, residual liability associated with the GEP in-situ strategy is assumed to transfer to the Commonwealth upon surrender of title for the GEP. Therefore, for the purpose of the DOE, residual liability has not been taken into account when scoring the GEP in-situ strategy. Residual liability arrangements will be considered further if the GEP in-situ strategy for Australian Commonwealth waters is adopted and progressed.

Based on the assumptions listed above, the sub-criteria scores for the strategy options are provided in Table 5-5.

Table 5-5: Methodology scoring sub-criteria unweighted results for leave in-situ of GEP section in Australian Commonwealth waters

Primary criteria	Short-term / Long-term	Sub-criteria	Trench and bury		In-situ with minimal intervention	
			Score	Reasoning	Score	Reasoning
Environment	Short-term	Habitat disturbance (physical)	-3	Overlaps Key Ecological Features and Australian Marine Parks with high likelihood of sensitive habitats (e.g. coral, seagrass) to occur along the pipeline route. Long pipeline with disturbance of surrounding habitat during trench and bury process	-1	Minimal activities (cleaning and stabilisation)
		Water and sediment quality	-3	Risks are vessel based (risks of spills). Cleaning activities will also be required. High turbidity impacts considering methodology and length of pipe	-1	Risks are vessel based (risks of spills). Minimal activities (cleaning and stabilisation).
		Emissions	-5	Options with largest emissions	-1	Minimal emissions compared to other option
	Long-term	Biodiversity effect	-5	Long infrastructure currently provides habitat in the form of an artificial reef would become buried	0	Infrastructure would be retained and continue to provide habitat. No impacts
		Invasive species	-1	Only from vessels. Vessels with appropriate controls in accordance with international requirements. Longest duration and international vessels required increases risk. Vessels with appropriate controls in accordance with international requirements	0	Short duration and vessels from region available. Vessels with appropriate controls in accordance with international requirements

Primary criteria	Short-term / Long-term	Sub-criteria	Trench and bury		In-situ with minimal intervention	
			Score	Reasoning	Score	Reasoning
		Water/ sediment quality	-1	Assumption that GEP will be cleaned to an ALARP and acceptable level. Infrastructure left in marine environment to degrade over time	-1	Assumption that GEP will be cleaned to an ALARP and acceptable. Infrastructure left in marine environment to degrade over time
Safety	Short-term	Personnel exposure (Operations)	-3	Consequence – long exposure to offshore environment/higher number of helicopter trips which could lead to major health hazard Likelihood – rare Risk ranking – Significant	-1	Consequence – long exposure to offshore environment/helicopter trips required which could lead to major health hazards Likelihood – remote Risk ranking – Medium
		Personnel exposure (Contaminants)	0	No exposure to hazardous material	0	No exposure to hazardous material
		Asset exposure (3rd Party assets/ vessel collision)	-3	Consequence – major injury/fatality due to potential collision of vessels/helicopter crash Likelihood – rare Risk ranking – Significant	-1	Consequence – major injury/fatality due to potential collision of vessels/helicopter crash Likelihood – remote (credit is taken for SIMOPS and COMOPS procedures) Risk ranking - Medium
	Long-term	Residual safety risk	0	No future safety risk concern	-1	GEP potential hazard to other users of the sea Consequence – assuming fishing trawler fishing gear stuck with GEP could lead to sinking of trawlers/major injury or fatality Likelihood – remote (no accidents recorded at this site since the installation) Risk ranking - Medium

Primary criteria	Short-term / Long-term	Sub-criteria	Trench and bury		In-situ with minimal intervention	
			Score	Reasoning	Score	Reasoning
Society	Short-term	Access to tourist/ recreational area/ commercial fisheries	-3	Longest duration. May cause some interference with commercial fisheries in the Commonwealth fishing zones the GEP traverses	-1	May cause some minimal interferences with commercial fisheries in the fishing zones the GEP traverses due to short duration of decommissioning activities
		Job creation	5	Longest and extensive duration	1	Shortest duration with minimal intervention required
	Long-term	Tourism effect/ commercial fisheries effect	-3	Pipeline currently provides habitat in commercial fishing grounds (Australian waters). Removing it would likely reduce biomass/commercial fishing catch	0	Pipeline currently provides habitat in commercial fishing grounds (Australian waters). Pipeline would be retained and continue to provide a source of fish stock for commercial fisheries
Technical feasibility	Short-term	Execution complexity	-5	High geotechnical risk	0	Risks likely to be only minor due to minimal intervention
		Maturity of approach/ track-record	-3	Rarely undertaken	-1	Likely existing technology can be applied
		Market capability	-5	Potential for rock trencher to be required with restricted availability	-1	Wide regional capability
Economic	Short-term	Capital investment (including 3rd party compensation)	-5	Cost likely to exceed AUD$200M	-3	Likely to be much less than the trench and bury. Towards the low to mid range of the 10 – 100M band, includes costs for cleaning and stabilisation

Primary criteria	Short-term / Long-term	Sub-criteria	Trench and bury		In-situ with minimal intervention	
			Score	Reasoning	Score	Reasoning
	Long-term	Ongoing monitoring	-1	Anticipated that seabed monitoring for a finite period would be required, two campaigns during 5 years post decommissioning considered to be below 10M	-1	Anticipated that seabed monitoring for a finite period would be required, two campaigns during 5 years post decommissioning considered to be below 10M

Table 5-6 provides a breakdown of the final primary criteria scores unweighted (i.e. the average of the sub-criteria scores under the specific primary criterion considered). Figure 5-5 shows the results of the methodology scoring process (the sum of all primary criteria scores) for each methodology. Based on the unweighted score, the recommended methodology is the leave in-situ with minimal intervention for the ~345 km section of GEP in Australian Commonwealth waters.

Table 5-6: Non-weighted primary criteria results breakdown for GEP in Australian Commonwealth waters methodologies

Primary criteria	Trench and bury primary criteria scores	In-situ with minimal intervention
Environment	-3	-0.7
Safety	-1.5	-0.8
Society	-0.3	0
Technical Feasibility	-4.3	-0.7
Economic	-3	-2

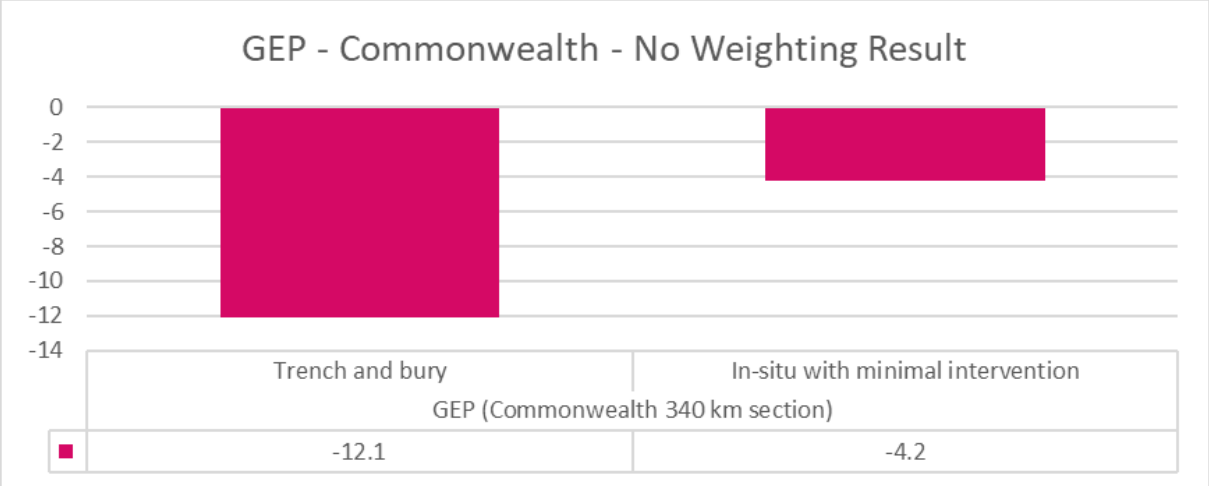

Figure 5-5: GEP section in Australian Commonwealth waters unweighted methodology scoring results

For each primary criteria the conclusions are:

Environment

The trench and bury of the GEP will have higher short-term and long-term impacts compared to the in-situ with minimal intervention option. The trench and bury will be similar to a removal option as the pipeline would be buried and therefore the habitat it currently provides would be lost. The longer duration to trench and bury would also increase emissions and the activity would impact water quality through extensive sediment disturbance, some of which has the potential to occur in sensitive habitats along the GEP. The in-situ with minimal intervention methodology is recommended.

Safety

The in-situ with minimal intervention methodology is recommended due to the lower safety risks compared to the trench and bury methodology which will require an extensive duration at sea to complete. This is despite the higher long-term risks involved in leaving the structure in-situ with minimal intervention which has potential snagging risks, in particular for commercial fishers operating in the region. The in-situ with minimal intervention is recommended.

Society

While there is a better short-term societal benefit of an increased workforce for the trench and bury methodology compared to the in-situ with minimal intervention methodology, the latter would provide improved long-term societal benefits as the GEP would maintain the marine habitat it provides, including fish stocks for commercial fisheries operating in the area. The in-situ with minimal intervention is recommended.

Technical Feasibility

The complexity, maturity of approach (for this length of pipeline) and market capability of trenching and burying the GEP scored worse than the in-situ with minimal intervention option. The in-situ with minimal intervention methodology is recommended.

Economic

Given the length of the GEP, the trench and bury option is substantially more expensive to implement. The in-situ with minimal intervention methodology is recommended.

Weightings

Weighting of the sub-criteria did not change the outcomes of the selection of the recommended methodology (Figure 5-6).

Weighting of the sub-criteria and primary criteria did not change the outcomes of the selection of the recommended methodology (Figure 5-7).

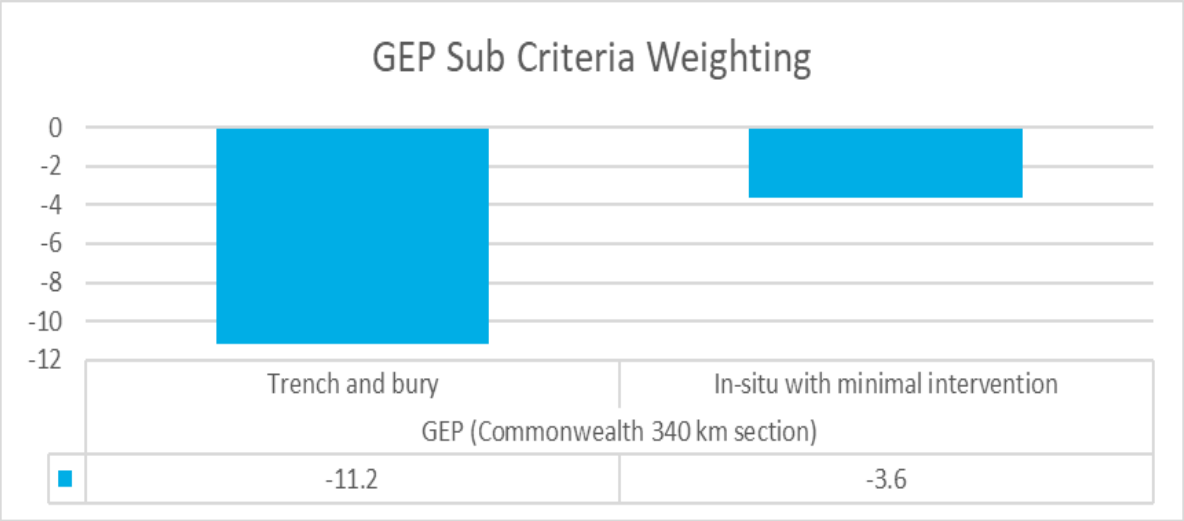

Figure 5-6: GEP section in Australian Commonwealth waters sub-criteria weighted methodology scoring results

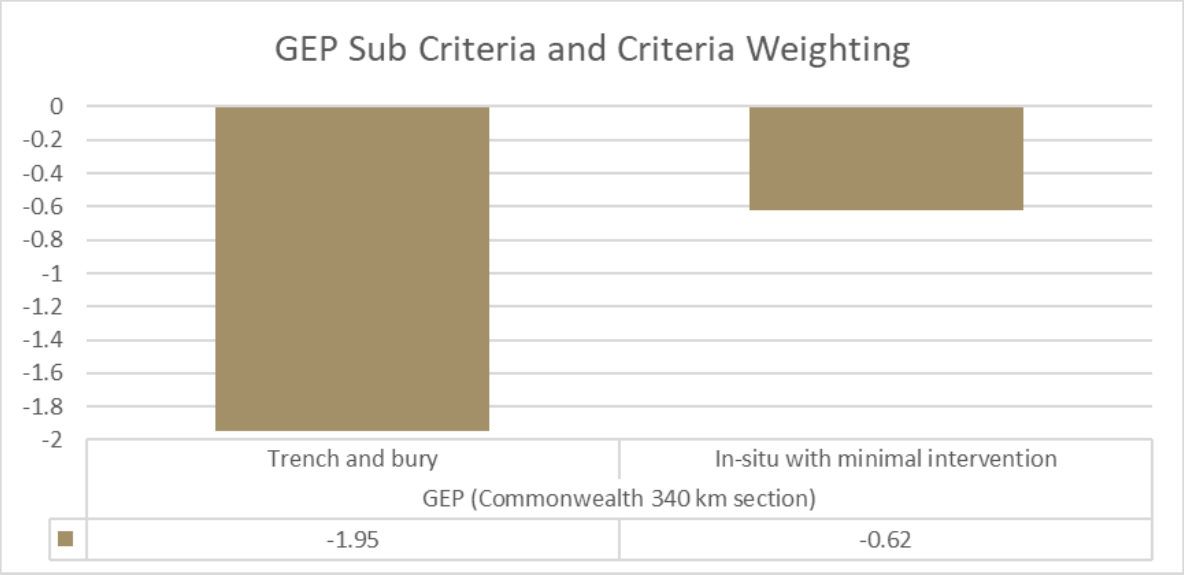

Figure 5-7: GEP section in Australian Commonwealth waters primary criteria and sub-criteria weighted methodology scoring results

Sensitivity analysis

A sensitivity analysis was also undertaken by removing the economics primary criteria from the analysis, hence making the economics weighting zero. The recommended methodology outcome did not change (Figure 5-8).

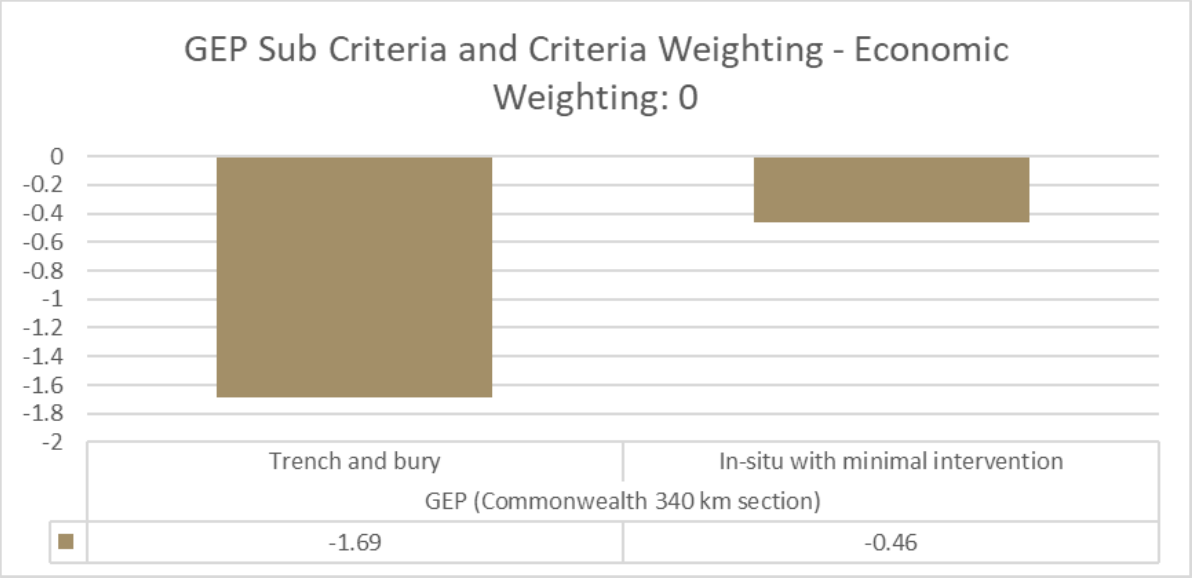

Figure 5-8: GEP section in Australian Commonwealth waters primary criteria and sub-criteria weighted methodology scoring results, Economic weighting removed

5.2.2 GEP section in Timor-Leste offshore waters

Table 5-7 details the assumptions applied for both strategies to inform the scoring.

Table 5-7 Methodologies assumptions – GEP in Timor-Leste offshore waters

Strategy	Assumptions
Diamond wire cut on seabed and recover	• The final waste disposal facility on land would have all appropriate controls to manage waste, including contaminated waste. • Some cleaning will be undertaken prior to removal to minimise the risk of contamination/exposure. • All subsea operations will be performed by ROV, diver-less execution. • Pipeline is free from hydrocarbons and hazardous materials. However, onshore workers may be exposed to residual hazardous material e.g. mercury etc. • All removed items will be sent regionally (South-East Asia) for disposal. • All options will have similar onshore disposal workforce size required. They will differ in offshore crew/duration. • Multiple vessels will be involved in the execution. • Helicopter trips will be required for workers transportation. • Concrete debris created by the cutting process would be left in-situ.
Shear cut on seabed and recover	• The final waste disposal facility on land would have all appropriate controls to manage waste, including contaminated waste.

Strategy	Assumptions
	• Some cleaning will be undertaken prior to removal to minimise the risk of contamination. • All subsea operations will be performed by ROV, diver-less execution. • Pipeline are free from hydrocarbons and hazardous materials. However, onshore workers may be exposed to residual hazardous material e.g. mercury etc. • All removed items will be sent regionally (South-East Asia) for disposal. • All options will have similar onshore disposal workforce size required. They will differ in offshore crew/duration. • Multiple vessels will be involved in the execution. • Helicopter trips will be required for workers transportation. • Concrete debris created by the cutting process would be left in-situ.
Reverse S-lay	• The final waste disposal facility on land would have all appropriate controls to manage waste, including contaminated waste. • Some cleaning will be undertaken prior to removal to minimise the risk of contamination. • Pipeline will need to be dewatered prior to reverse s-lay. • All subsea operations will be performed by ROV, diver-less execution. • Pipeline are free from hydrocarbons and hazardous materials. However, onshore workers may be exposed to residual hazardous material e.g. mercury etc. • All removed items will be sent regionally (South-East Asia) for disposal. • All options will have similar onshore disposal workforce size required. They will differ in offshore crew/duration. • Multiple vessels will be involved in the execution, including pipelay vessel. • Helicopter trips will be required for workers transportation.

Based on the assumptions listed above, the sub-criteria scores for the methodologies options are provided in Table 5-8.

Table 5-8: Methodology scoring sub-criteria unweighted results for full removal section of GEP in Timor-Leste offshore waters

Primary criteria	Short-term / Long-term	Sub-criteria	Diamond wire cut on seabed and recover		Shear cut on seabed and recover		Reverse s-lay	
			Score	Reasoning	Score	Reasoning	Score	Reasoning
Environment	Short-term	Habitat disturbance (physical)	-1	Disturbance to non-sensitive habitats	-1	Disturbance to non-sensitive habitats	-1	Disturbance to non-sensitive habitats
		Water and sediment quality	-3	Cuts undertaken on seabed also increases risks of impacts to marine environment	-3	Cuts undertaken on seabed also increases risks of impacts to marine environment	-1	Cuts made on vessel minimises risk of contamination compared to other options
		Emissions	-5	Longest duration	-3	Between longest and shortest duration	-1	Shortest duration
	Long-term	Invasive species	0	Potential for any IMS on the substructure (if any) to establish in uncontaminated area during transit. However, some cleaning can be undertaken prior to transiting and GEP sections would be stored on vessel/barge under appropriate controls. Vessels with appropriate controls in accordance with international requirements. Surveys to be undertaken prior to removal.	0	Potential for any IMS on the substructure (if any) to establish in uncontaminated area during transit. However, some cleaning can be undertaken prior to transiting and GEP sections would be stored on vessel/barge under appropriate controls. Vessels with appropriate controls in accordance with international requirements. Surveys to be undertaken prior to removal.	0	Potential for any IMS on the substructure (if any) to establish in uncontaminated area during transit. However, some cleaning can be undertaken prior to transiting and GEP sections would be stored on vessel/barge under appropriate controls. Vessels with appropriate controls in accordance with international requirements. Surveys to be undertaken prior to removal
		Water/ sediment quality	-1	Some concrete material would be left in-situ from cutting	-1	Some concrete material would be left in-situ from cutting	0	GEP to be removed from marine environment, cutting to be

Primary criteria	Short-term / Long-term	Sub-criteria	Diamond wire cut on seabed and recover		Shear cut on seabed and recover		Reverse s-lay	
			Score	Reasoning	Score	Reasoning	Score	Reasoning
								performed on the recovery vessel
Safety	Short-term	Personnel exposure (Operations)	-3	Consequence – failure of lifting GEP sections during offloading to a cargo barge which could lead to major injury or fatality Likelihood – multiple lifts, Rare (Lifting controls in place) Risk ranking – Significant	-3	Consequence – failure of lifting GEP sections during offloading to a cargo barge which could lead to major injury or fatality Likelihood – multiple lifts, Rare (Lifting controls in place) Risk ranking – Significant	-3	Consequence – failure of lifting GEP sections during offloading to a cargo could lead to major injury or fatality Likelihood – multiple lifts, Rare (Lifting controls in place) Risk ranking – Significant
		Personnel exposure (Contaminants)	-3	Consequence – assuming pipeline completely free of hydrocarbon. Worker may expose to residual hazardous material which may cause (in time) significant health effects Likelihood – probably Risk ranking – Significant	-3	Consequence – assuming pipeline completely free of hydrocarbon. Worker may expose to residual hazardous material which may cause (in time) significant health effects Likelihood – probably Risk ranking – Significant	-3	Consequence – assuming pipeline completely free of hydrocarbon. Worker may expose to residual hazardous material which may cause (in time) significant health effects Likelihood – probably Risk ranking – Significant
		Asset exposure (3rd Party assets/ vessel collision)	-3	Consequence – major injury/fatality due to potential collision of vessels/helicopter crash Likelihood – Rare Risk ranking – Significant	-3	Consequence – major injury/fatality due to potential collision of vessels/helicopter crash Likelihood – Rare Risk ranking – Significant	-1	Consequence – major injury/fatality due to potential collision of vessels/helicopter crash Likelihood – Remote Risk ranking – Medium

Primary criteria	Short-term / Long-term	Sub-criteria	Diamond wire cut on seabed and recover		Shear cut on seabed and recover		Reverse s-lay	
			Score	Reasoning	Score	Reasoning	Score	Reasoning
Society	Short-term	Access to tourist/ recreational area/ commercial fisheries	0	Limited activities in vicinity of infrastructure	0	Limited activities in vicinity of infrastructure	0	Limited activities in vicinity of infrastructure
		Job creation	5	Longest duration	3	Second longest duration (half of longest)	1	Shortest duration (25% of longest)
Technical feasibility	Short-term	Execution complexity	-3	Major risks and a low confidence that they can be managed. Additional risk from pipeline embedment compared to shear cutting	-1	Moderate risks, reasonable confidence that with further work they will be manageable	-3	Major risks and a low confidence that they can be managed (for s-lay)
		Maturity of approach/ track-record	-5	Never been done considering length of pipeline	-5	Never been done considering length of pipeline	-5	Never been done considering length of pipeline
		Market capability	-3	Limited regional vessel capability	-3	Limited regional vessel capability	-5	Limited capability, requires specific services/facilities available only internationally
Economic	Short-term	Capital investment (including 3rd party compensation)	-5	Cost likely to exceed AUD$100M	-3	Cost likely to be between AUD$50M and AUD$100M	-3	Cost likely to be below AUD$50M

Table 5-9 provides a breakdown of the final primary criteria scores unweighted (i.e. the average of the sub-criteria scores under the specific primary criterion considered). Figure 5-9 shows the results of the methodology scoring process (the sum of all primary criteria scores) for each methodology. Based on the unweighted scores, the recommended methodology is the shear cut on seabed and recover and reverse s-lay methods as they scored very similarly.

Table 5-9: Non-weighted primary criteria results breakdown for GEP in Timor-Leste offshore waters methodologies

Primary criteria	Cut on seabed (diamond wire cutting) and recover	Shear cut on seabed and recover	Reverse s-lay
Environment	-2	-1.6	-0.6
Safety	-3	-3	-2.3
Society	2.5	1.5	0.5
Technical Feasibility	-3.7	-3	-4.3
Economic	-5	-3	-3

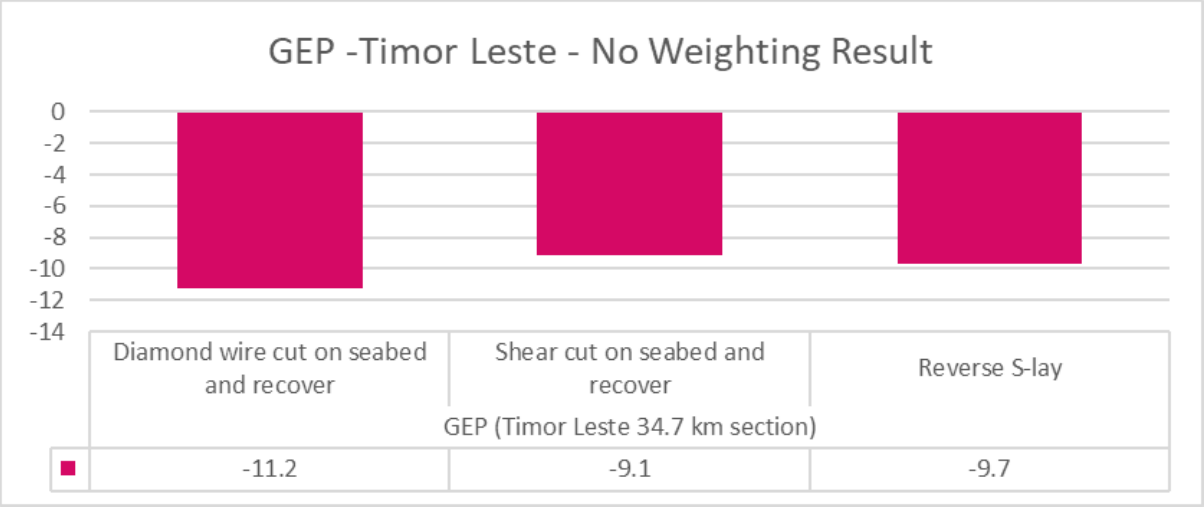

Figure 5-9: GEP section in Timor-Leste offshore waters unweighted methodology scoring results

For each primary criteria the conclusions are:

Environment

The cut on seabed and recover (both cutting methods) scored similarly and worse than the reverse s-lay. This is due to higher short-term emissions and the fact that cutting of the pipeline would be done

on the seabed leading to higher risks of contamination and debris left on the seabed compared to the reverse s-lay method. The reverse s-lay is the recommended methodology.

Safety

All methods scored similarly for all safety sub-criteria. The reverse s-lay is slightly recommended and scored better than the other two options in terms of asset exposure/risk of collision. This is due to shorter duration and reduced number of vessels compared to other options which reduced the likelihood of a safety incident under this methodology. The reverse s-lay is slightly more recommended.

Society

The diamond wire cut on seabed scored the best, followed by the shear cut on seabed with the least recommended method being the reverse s-lay method. This is driven solely by the fact the diamond wire cut on seabed method would require the longest duration/workforce to complete. The diamond wire cut on seabed method is recommended.

Technical Feasibility

The reverse s-lay method scored the worst and was driven by the market capability as international vessels/equipment would be required compared to the other two options where there is regional capability (though restricted). The reverse s-lay method also scored equal worse with the diamond wire cut on seabed in terms of complexity of execution. The recommended method is the shear cut on seabed and recover.

Economic

The diamond wire cut on seabed and the shear cut on seabed are the most expensive methods with the recommended method being the reverse s-lay which is two to four times cheaper than the other two options.

Weightings

Weighting of the sub-criteria did not change the outcomes of the selection of the recommended methodology (Figure 5-10).

Weighting of the sub-criteria and primary criteria changed the outcome of the selection of the recommended methodology with the reverse s-lay being slightly recommended but very close to the shear cut and recover method (Figure 5-11).

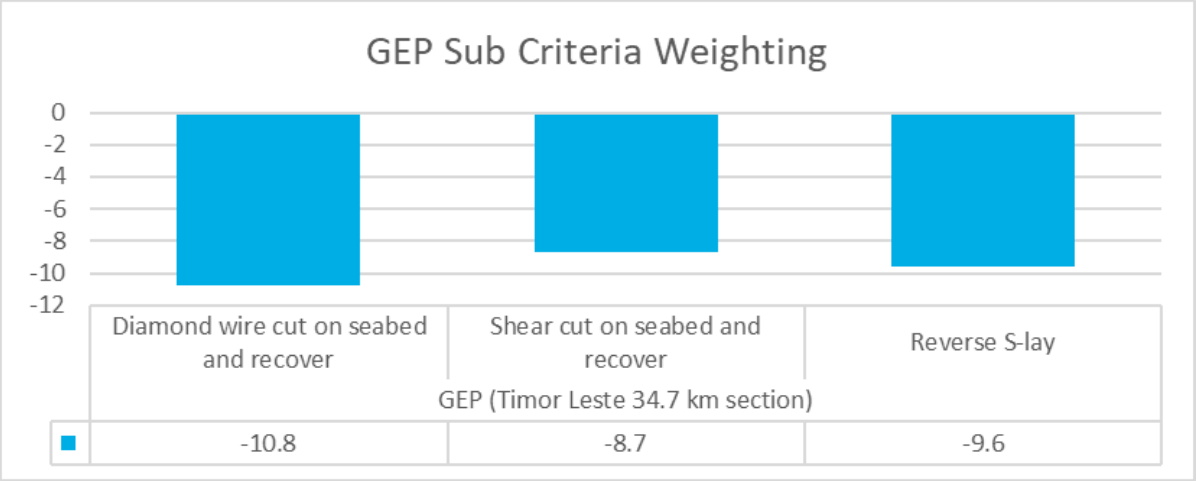

Figure 5-10: GEP section in Timor-Leste offshore waters sub-criteria weighted methodology scoring results

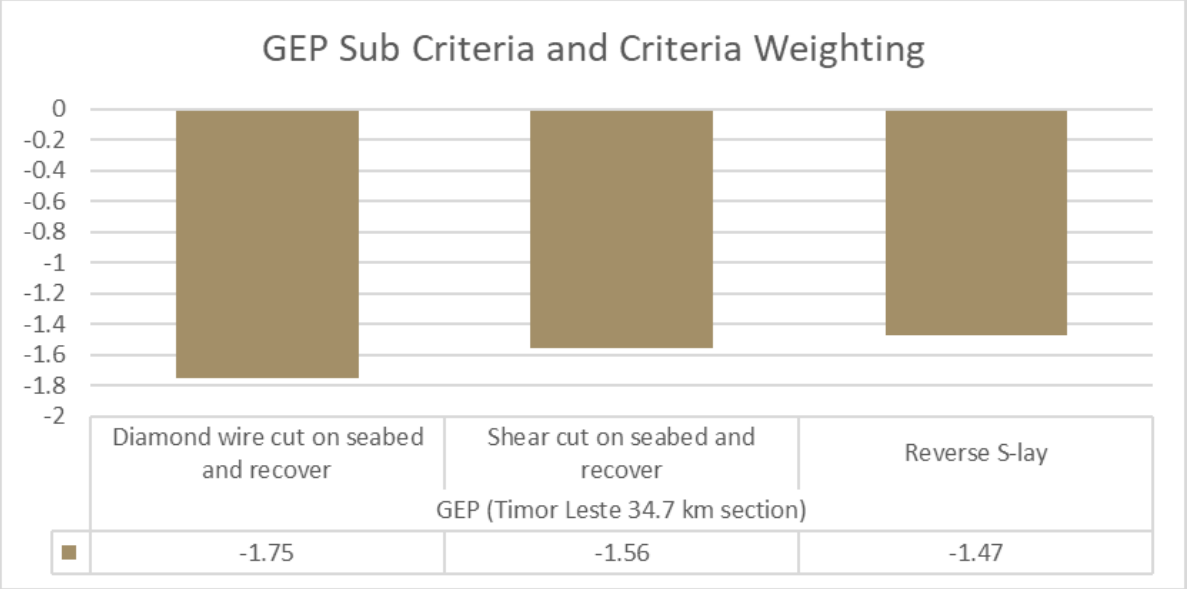

Figure 5-11: GEP section in Timor-Leste offshore waters sub-criteria and primary criteria weighted methodology scoring results

Sensitivity analysis

A sensitivity analysis was also undertaken by removing the economics primary criteria from the analysis, hence making the economics weighting zero. Compared to the fully weighted scores this has resulted in all methods scoring similarly (Figure 5-12).

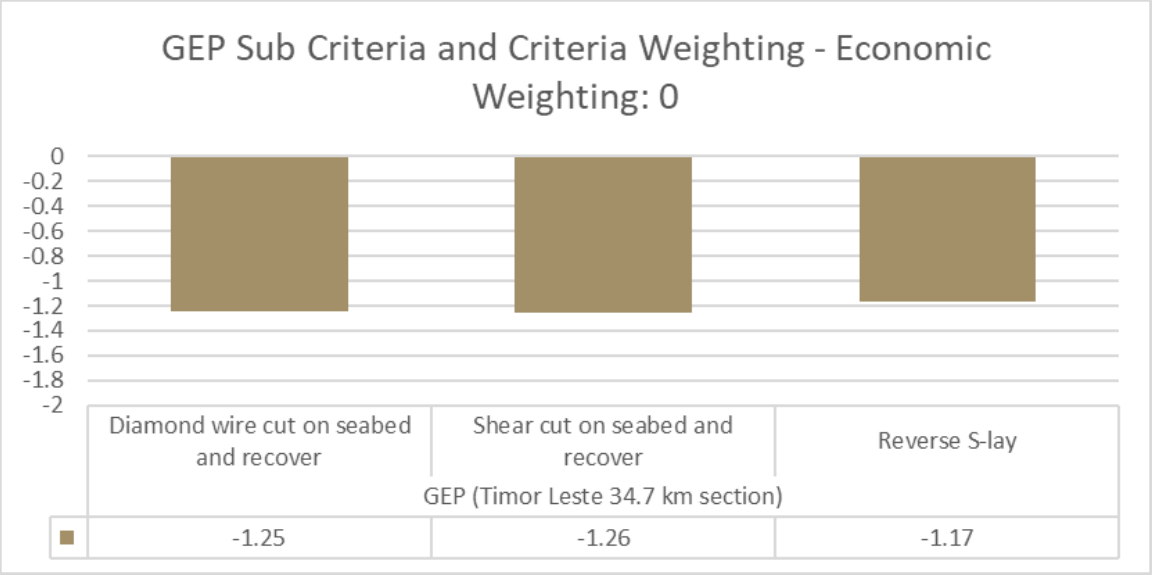

Figure 5-12: GEP section in Timor-Leste offshore waters sub-criteria and primary criteria weighted methodology scoring results, Economic weighting removed

6 Conclusions and Recommendations

The DOE process, through the use of a multi-criteria decision analysis, has recommended a decommissioning strategy and methodology for the GEP.

6.1 GEP section in Australian Commonwealth waters

The DOE process for the GEP section in Australian Commonwealth waters concluded with the following recommended strategy and methodology (based on weighted criteria and sub-criteria scores):

- Leave in-situ strategy with minimal intervention methodology (Cleaning and stabilisation)

This recommendation is driven by the potential long-term environmental benefits of leaving a large structure in-situ that provides valuable habitat for fish and other marine life and the reduction of short-term impacts by reducing the decommissioning activities in the field (e.g. reduction in emissions, decommissioning operational risks). While the cost of leaving the GEP in-situ with minimal intervention is the lowest between the various strategies and methodologies assessed, a sensitivity analysis that eliminated weighting for the economic primary criteria, concluded that cost is not a driving factor in the selection of the recommended options.

6.2 GEP section in Timor-Leste offshore waters

The GEP section in Timor-Leste offshore waters would be fully removed in accordance with the ratification of the maritime boundaries' treaty between both governments, therefore strategy alternatives were not assessed for the GEP section in Timor-Leste offshore waters. The DOE process for the GEP section in Timor-Leste offshore waters concluded with the following recommended methodology (based on weighted criteria and sub-criteria scores):

- Full removal and disposal onshore using the reverse s-lay method or shear cut on seabed and recover method.

Both methodologies have different advantages and risks but overall scored similarly; reverse s-lay method scored better under the environment, safety and economic primary criteria but worse under the technical feasibility and society primary criteria compared to shear cut on seabed and recover. It should be noted that the diamond cut on seabed and recover is only slightly less recommended compared to the other two options and when a sensitivity analysis that eliminated weighting for the economic primary criteria was concluded, all three methodologies scored similarly.

6.3 Divers vs ROVs

During the workshops and discipline meetings there were discussions on the use of divers versus the use of ROVs to undertake some of the activities (e.g. underwater set ups/preparations). The assumption that we have currently taken forward in the DOE process is the use of ROVs which reduces short term safety risks. It is recognised that this may not be feasible at all times and the requirement for divers will need to be determined once further engineering has been performed to refine and confirm execution methods. However, should divers be required, it is likely that divers would be

required for the proposed strategies/methodologies that were being considered and are therefore unlikely to change the outcome of the selection process.

6.4 Limitations and recommendations

It is recognised the DOE process has the following limitations:

- The DOE process has not yet included feedback from relevant stakeholders. It is recommended that stakeholder engagement be incorporated into the next phase of the DOE process to ensure the views of stakeholders that may be potentially affected by the decommissioning activities, in particular commercial fishers and relevant government agencies, are taken into account. Relevant stakeholders should be engaged to seek their feedback and input on the DOE, in particular for the environment, safety and society primary criteria.

- The DOE process had to make a number of assumptions from which to score the alternative strategies/methods. The scores are based on the best available information at the time of writing. However, a number of studies are being completed by COP which will improve baseline knowledge and potentially refine the scoring. It is recommended that the scoring and evaluation of the strategies and methodologies be revisited once the additional studies have been completed.

7 References

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Appendix A Scoring Criteria

Screening Criteria – Environment (Short-term)

Criteria	Descriptor	Risk Score						Benefit
		-5	-3	-1	0	+1	+3	+5
Habitat disturbance (physical)	Disturbance/damage to surrounding habitat from lifting, object impact or infrastructure removal	Disturbance affects sensitive habitats (e.g. seagrass, corals); habitat functions cease (temporarily and/or permanently) and associated ecosystem, sensitive species substantially affected	Disturbance affects sensitive habitats (e.g. seagrass, corals); habitat functions modified but continue such that associated ecosystem, sensitive species are minimally affected	Disturbance to non-sensitive habitats; habitat functions minimally affected	No impact	N/A	N/A	N/A
Water and sediment quality	Contamination (e.g. spills), turbidity and routine discharges from decommissioning activities leading to ecosystem/habitat impacts	Planned event or unplanned event with a rare to frequent likelihood of occurring: Large impact to sensitive habitats and ecosystem functions (non reversible) and/or long term recovery following impact (> 10 years)	Planned event or unplanned event with a rare to frequent likelihood of occurring resulting in Moderate reversible impact to ecosystem functions and/or medium term recovery following impact (>1 year) Or Unplanned events with improbable/remote chance of occurring resulting in large impact to sensitive habitats and ecosystem functions (non reversible) and/or long term recovery following impact (> 10 years)	Planned event or unplanned event resulting in minor reversible impacts to ecosystem functions/habitats and/or short term recovery following impact (< 1 month)	No impact	N/A	N/A	N/A
Emissions	Greenhouse gas emissions (take into account combination of decommissioning and disposal)	High emissions (i.e. between 75% and 100% of highest emissions option)	Moderate emissions (i.e. between 25%-75% of highest emissions option)	Low emissions (i.e. less than 25% of highest emissions option)	No greenhouse gas emissions	N/A	N/A	N/A

Screening Criteria – Environment (Long-term/1)

Criteria	Descriptor	Risk			Score			Benefit
		-5	-3	-1	0	+1	+3	+5
Biodiversity effect	Increase/decrease in flora/fauna species diversity/numbers through habitat provision/removal	Removal of local ecosystem (i.e. removal of large artificial reef)	Moderate decrease in diversity/numbers (i.e. removal of fish attraction device (i.e. small infrastructure))	Minimal loss of diversity/numbers	No change	Minimal increase in diversity/numbers	Moderate increase in diversity/numbers (i.e. new fish attraction device (i.e. small infrastructure))	Creation of new local ecosystem (i.e. new large artificial reef)
Invasive species	Risk of Introduction of Invasive Species (from project vessels and/or facility) based on size of infrastructure and decommissioning methodology/option (number of vessels/trips, in-situ vs relocation, marine growth removed at existing location before being moved, etc) . Assumed that appropriate controls in line with company/regulatory requirements will be implemented (pre-decommissioning surveys to identify potential IMS, vessel 'hygiene' protocols, etc) .	N/A	IMS has rare likelihood of being introduced and establish in uncontaminated environment	IMS has remote likelihood of being introduced and establish in uncontaminated environment	Improbable risk of IMS being introduced and establish in new environment	N/A	N/A	N/A

Screening Criteria – Environment (Long-term/2)

Criteria	Descriptor	Risk			Score			Benefit
		-5	-3	-1	0	+1	+3	+5
Water/Sediment quality	Increase/decrease in water/sediment quality from infrastructure - contaminants (e.g. NORMS, heavy metals, etc)	Facility remains in marine environment. Toxic contaminants present and volumes/toxicity likely to be high and probable likelihood these would become bioavailable and affect life cycle of species	Facility remains in marine environment. Toxic contaminants present and volumes/toxicity likely to be high but remote likelihood these would become bioavailable and affect life cycle of species and/or Composite material with plastics left in the marine environment	Facility remains in marine environment. Toxic contaminants present but volumes/toxicity likely to be low and unlikely these would become bioavailable and affect life cycle of species and/or Non-plastic materials will be left in marine environment leading to long term degradation/corrosion	Toxic contaminants not present or improbable likelihood they would be released and become bioavailable	Facility is removed from marine environment. Toxic contaminants present but volumes/toxicity likely to be low but remote likelihood these would have become bioavailable and affected life cycle of species	Facility is removed from marine environment. Toxic contaminants present and volumes/toxicity likely to be high but remote likelihood these would become bioavailable and affect life cycle of species and/or Composite material with plastics present	Facility is removed from marine environment. Toxic contaminants present and volumes/toxicity likely to be high and probable likelihood these would have become bioavailable and affeced life cycle of species
Waste management	Reuse/recyclability potential.	N/A	N/A	N/A	Material will be removed from marine environment but cannot be recycled/reused (landfill)	Material will be removed from marine environment but only small proportion of waste will be recycled/reused (<25%)	Material will be removed from marine environment and a moderate proportion of waste will be recycled/reused (25-75%)	Material will be removed from marine environment and >75% waste will be recycled/reused

Screening Criteria – Safety

Criteria	Descriptor	Risk			Score			Benefit
		-5	-3	-1	0	+1	+3	+5
Short term								
Personnel exposure (Operations)	Operational risk to personnel during execution of the works (e.g. lifting, welding, vessel collision, etc.)	High risk* concern, unlikely to be tolerable unless no alternative solutions exist	Significant risk*, likely to be managed to acceptable level but requires significant additional safeguards	Moderate risk*, but relatively easily managed with existing and some additional safeguards	Low risk*, but easily managed with existing safeguards	N/A	N/A	N/A
Personnel exposure (Contaminants)	Contamination risk to personnel during execution of the works	High risk* concern, unlikely to be tolerable unless no alternative solutions exist	Significant risk*, likely to be managed to acceptable level but requires significant additional safeguards	Moderate risk*, but relatively easily managed with existing and some additional safeguards	Low risk*, but easily managed with existing safeguards	N/A	N/A	N/A
Asset exposure (3rd Party assets / vessel collision)	Risk to assets involved in the execution of the decommissioning operations	High risk* concern, unlikely to be tolerable unless no alternative solutions exist	Significant risk*, likely to be managed to acceptable level but requires significant additional safeguards	Moderate risk*, but relatively easily managed with existing and some additional safeguards	Low risk*, but easily managed with existing safeguards	N/A	N/A	N/A
Long term								
Residual safety risk	Safety risks (e.g. commercial shipping / hitting assets left in-situ, etc.); considers the future, post-decommissioning risk exposure in the area generated by the specific alternative	High future risk* concern, unlikely to be tolerable	Significant future risk* concern, likely to be managed to acceptable level but requires significant additional safeguards	Moderate future risk* concern, but relatively easily managed with existing and some additional safeguards	No future risk concern	N/A	N/A	N/A

*High, significant, moderate and low risks defined in accordance with COPA's risk matrix and risk ranking categories

Screening Criteria – Society

Criteria	Descriptor	Risk			Score			Benefit
		-5	-3	-1	0	+1	+3	+5
Short term								
Access to tourist/recreational area/commercial fisheries	Restriction of access to tourism/commercial fishing area	Long term access restrictions (1 season/year or more) to important regional tourism/commercial fishing area	Long term access restrictions (1 season/year or more) to important local tourism/commercial fishing area or Medium term access restrictions (<1 season/year) to important regional tourism/commercial fishing area	Short term access restrictions (weeks) to important local/regional tourism/commercial fishing area	No access restrictions and/or access restricted only outside touristic/commercial fishing area	N/A	N/A	N/A
Job creation	Job creation during decommissioning operations (taking into account duration)	N/A	N/A	N/A	Minimal jobs created	Small workforce (i.e. < 25% of highest worforce option)	Medium workforce (i.e. between 25% and 75% of highest worforce option)	Large workforce (i.e. between 75% and 100% of highest worforce option)

Screening Criteria – Society

Criteria	Descriptor	Risk			Score			Benefit
		-5	-3	-1	0	+1	+3	+5
Long term								
Tourism effect and/or Commercial fisheries effect	Recreational fishing and/or diving potential	Loss/reduction in amenity of internationally recognised destination	Loss/reduction in amenity of regionally recognised destination	Loss/reduction in amenity of locally recognised destination	No impact to tourism/recreational activities	Creation of a locally recognised destination	Creation of a regionally recognised destination	Creation of an internationally recognised destination
	Increase/decrease in fish stocks in commercial fishing grounds and/or increase/decrease in fishing ground area (Indonesian/Australian)	Complete loss of existing commercial fishing ground or large (non sustainable) decrease in fish stocks in existing fishing ground due to removal of reef	Moderate decrease in fish stocks in commercial fishing ground (e.g. removal of fish attraction devices (i.e. small infrastructure)) and/or area that can be fished. High likelihood to require management of stocks for it to remain sustainable (e.g. quota restrictions)	Small sustainable decrease in fish stocks and/or area that can be fished. Remote likelihood to lead to decrease in fishing activity.	No impact to commercial fishers (no increase in fish stocks or fishing grounds)	Small increase in fish catch in existing fishing ground and/or increase in fishing ground area. Remote likelihood to lead to increase in fishing activity.	Moderate increase in fish stocks in commercial fishing ground (e.g. installation of fish attraction devices (i.e. small infrastructure)) and/or area that can be fished. High likelihood to increase fishing activity (i.e. revenue)	Creation of new commercial fishing grounds and/or large increase in fish stocks in existing fishing grounds due to reefing

Screening Criteria – Technical Feasibility

Criteria	Descriptor	Risk			Score			Benefit
		-5	-3	-1	0	+1	+3	+5
Short term								
Execution complexity	From design to execution – feasibility, engineering and implementation technical risks	Highly complex, critical risks	Major risks and a low confidence that they can be managed	Moderate risks, reasonable confidence that with further work they will be manageable	Some minor risks, high level of confidence they will be manageable	No risk	N/A	N/A
Maturity of approach / track-record	Level of confidence on the proposed decommissioning approach based on previous track-record	Never done before, unproven	Rarely done	Existing technology / activity, understood and done before but less frequently	Business as usual / proven, acceptable, manageable	N/A	N/A	N/A
Market capability	Regional and international market capability (e.g. facilities, spread, tools, know-how, etc.)	Limited capability, requires specific services/facilities available only internationally	Restricted regional capability	Widely available in the region	Local market capability	N/A	N/A	N/A

Screening Criteria – Economic

Criteria	Descriptor	Risk			Score			Benefit
		-5	-3	-1	0	+1	+3	+5
Short term								
Capital investment Cost of work for undertaking decommissioning activities (per specific facility group)	Topsides, substructure, GEP	>100MM	10 MM - 100 MM	<10 MM	No cost	N/A	N/A	N/A
	Subsea infrastructure	>25 MM	2.5MM - 25 MM	<2.5 MM	No cost	N/A	N/A	N/A
Long term								
Ongoing monitoring Cost for ongoing site monitoring (per specific facility group)	Topsides, substructure, GEP	>100MM	10 MM - 100 MM	<10 MM	No cost	N/A	N/A	N/A
	Subsea infrastructure	>25 MM	2.5MM - 25 MM	<2.5 MM	No cost	N/A	N/A	N/A

12.2 APPENDIX B: EPBC PROTECTED MATTERS SEARCH REPORT

Protected Matters Search Tool Report – Operational Area

Australian Government
Department of the Environment and Energy

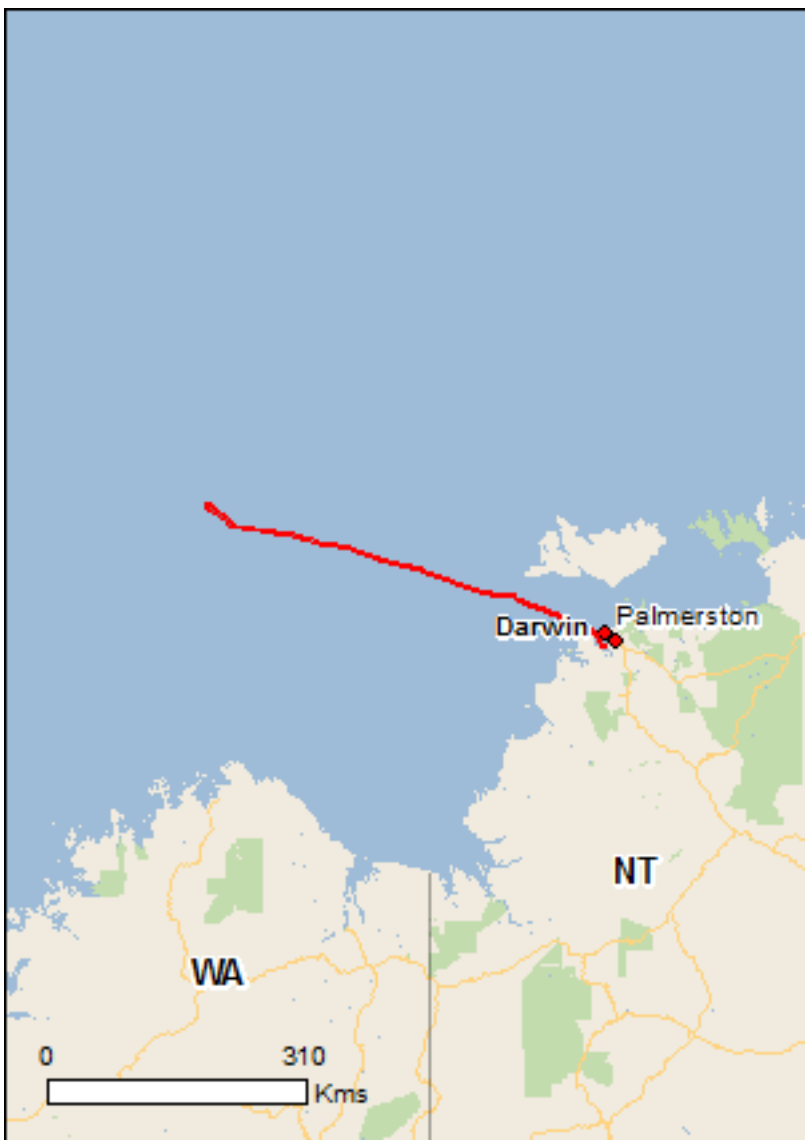
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 08/07/20 09:39:26



Coordinates
Buffer: 1.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	40
Listed Migratory Species:	59

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	100
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	23
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	3

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-	Vulnerable	Species or species

Name	Status	Type of Presence
tailed Godwit [86380]		habitat may occur within area
Limosa lapponica menzbieri		
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tyto novaehollandiae kimberli		
Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
Antechinus bellus		
Fawn Antechinus [344]	Vulnerable	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 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
Conilurus penicillatus		
Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat may occur within area
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Mesembriomys gouldii gouldii		
Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat likely to occur within area
Petrogale concinna canescens		
Nabarlek (Top End) [87606]	Endangered	Species or species habitat likely to occur within area
Phascogale pirata		
Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus		
Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides		
Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		

Name	Status	Type of Presence
[Acanthophis hawkei](#) Plains Death Adder [83821]	Vulnerable	Species or species habitat known to occur within area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Breeding known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
[Lepidochelys olivacea](#) Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
[Glyphis garricki](#) Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
[Glyphis glyphis](#) Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
[Pristis clavata](#) Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
[Pristis pristis](#) Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
[Pristis zijsron](#) Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
[Anous stolidus](#) Common Noddy [825]		Species or species habitat likely to occur within area
[Apus pacificus](#) Fork-tailed Swift [678]		Species or species habitat likely to occur within area
[Calonectris leucomelas](#) Streaked Shearwater [1077]		Species or species habitat known to occur within area
[Fregata ariel](#) Lesser Frigatebird, Least Frigatebird [1012]		Species or species

Name	Threatened	Type of Presence
		habitat known to occur within area
[Fregata minor](#) Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
[Sternula albifrons](#) Little Tern [82849]		Species or species habitat may occur within area
Migratory Marine Species		
[Anoxypristis cuspidata](#) Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
[Balaenoptera borealis](#) Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
[Balaenoptera edeni](#) Bryde's Whale [35]		Species or species habitat may occur within area
[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
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Breeding known to occur within area
[Crocodylus porosus](#) Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
[Dugong dugon](#) Dugong [28]		Species or species habitat known to occur within area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
[Isurus oxyrinchus](#) Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
[Isurus paucus](#) Longfin Mako [82947]		Species or species habitat likely to occur within area
[Lepidochelys olivacea](#) Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
[Manta alfredi](#) Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat likely to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Defence - Patrol Boat Base (DARWIN NAVAL BASE)

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Calidris alba Sanderling [875]		Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat likely to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis squatarola Grey Plover [865]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Sterna albifrons Little Tern [813]		Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnston's River Crocodile [1773]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Australian Marine Parks	[Resource Information]
Name	Label
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Bubalus bubalis Water Buffalo, Swamp Buffalo [1]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass [31754]		Species or species habitat likely to occur within area
Jatropha gossypifolia Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Mimosa pigra Mimosa, Giant Mimosa, Giant Sensitive Plant, ThornySensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Pennisetum polystachyon Mission Grass, Perennial Mission Grass, Missiongrass, Feathery Pennisetum, Feather Pennisetum, Thin Napier Grass, West Indian Pennisetum, Blue Buffel Grass [21194]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Port Darwin	NT

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Van	North
Pinnacles of the Bonaparte Basin	North
Carbonate bank and terrace system of the Sahul	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-11.27011 126.8828,-11.27461 126.88928,-11.27687 126.89597,-11.29719 127.03471,-11.29851 127.06365,-11.3126 127.16528,-11.31304 127.18176,-11.31738 127.19966,-11.35749 127.48879,-11.44368 127.77279,-11.45648 127.85018,-11.45519 127.88518,-11.46819 127.9206,-11.49971 128.10898,-11.58232 128.33806,-11.588 128.36143,-11.59883 128.39221,-11.60672 128.41359,-11.6161 128.43101,-11.63298 128.47833,-11.71478 128.86537,-11.71853 128.87382,-11.73036 128.89011,-11.73508 128.89992,-11.95883 129.56039,-11.96281 129.57666,-11.97572 129.61536,-11.98045 129.63922,-11.99334 129.66368,-12.00542 129.69882,-12.00694 129.7104,-12.00412 129.87603,-12.00592 129.88898,-12.01017 129.89842,-12.01659 129.90652,-12.0601 129.93989,-12.06602 129.94843,-12.30687 130.64178,-12.39534 130.75296,-12.46398 130.8078,-12.4777 130.81506,-12.4985 130.82344,-12.52371 130.83705,-12.52635 130.84419,-12.52079 130.86345,-12.52267 130.86716,-12.52673 130.86779,-12.52961 130.86483,-12.53535 130.84506,-12.53428 130.83723,-12.53045 130.83091,-12.50355 130.81571,-12.46887 130.80007,-12.4014 130.74614,-12.31479 130.63736,-12.0744 129.94496,-12.06596 129.9329,-12.0229 129.89993,-12.01796 129.89374,-12.01473 129.8868,-12.0132 129.87053,-12.01598 129.71027,-12.01411 129.69629,-12.00165 129.66007,-11.98901 129.63626,-11.98443 129.61292,-11.97144 129.57393,-11.9674 129.55747,-11.74364 128.89694,-11.7387 128.88634,-11.7269 128.87011,-11.72339 128.86253,-11.64166 128.47577,-11.62452 128.42768,-11.61495 128.4098,-11.60733 128.38906,-11.59664 128.35873,-11.59085 128.33499,-11.50801 128.10481,-11.47705 127.91879,-11.46411 127.8837,-11.46547 127.84923,-11.45249 127.77075,-11.36635 127.48697,-11.32633 127.19834,-11.32207 127.1811,-11.32157 127.16412,-11.30749 127.0626,-11.30626 127.03428,-11.28596 126.89557,-11.283 126.8858,-11.27724 126.87717,-11.28033 126.87127,-11.27999 126.85995,-11.25626 126.82648,-11.24787 126.81603,-11.23879 126.80808,-11.1085 126.6395,-11.09942 126.62066,-11.0945 126.61344,-11.07729 126.59817,-11.0668 126.59571,-11.05912 126.59783,-11.05425 126.60173,-11.04947 126.61326,-11.0503 126.6229,-11.0539 126.6289,-11.067 126.63719,-11.07991 126.6619,-11.21052 126.8309,-11.22212 126.84177,-11.24872 126.87739,-11.25791 126.88371,-11.26352 126.88444,-11.27011 126.8828

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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Protected Matters Search Tool Report – Hydrocarbon Spill at KP 34.2

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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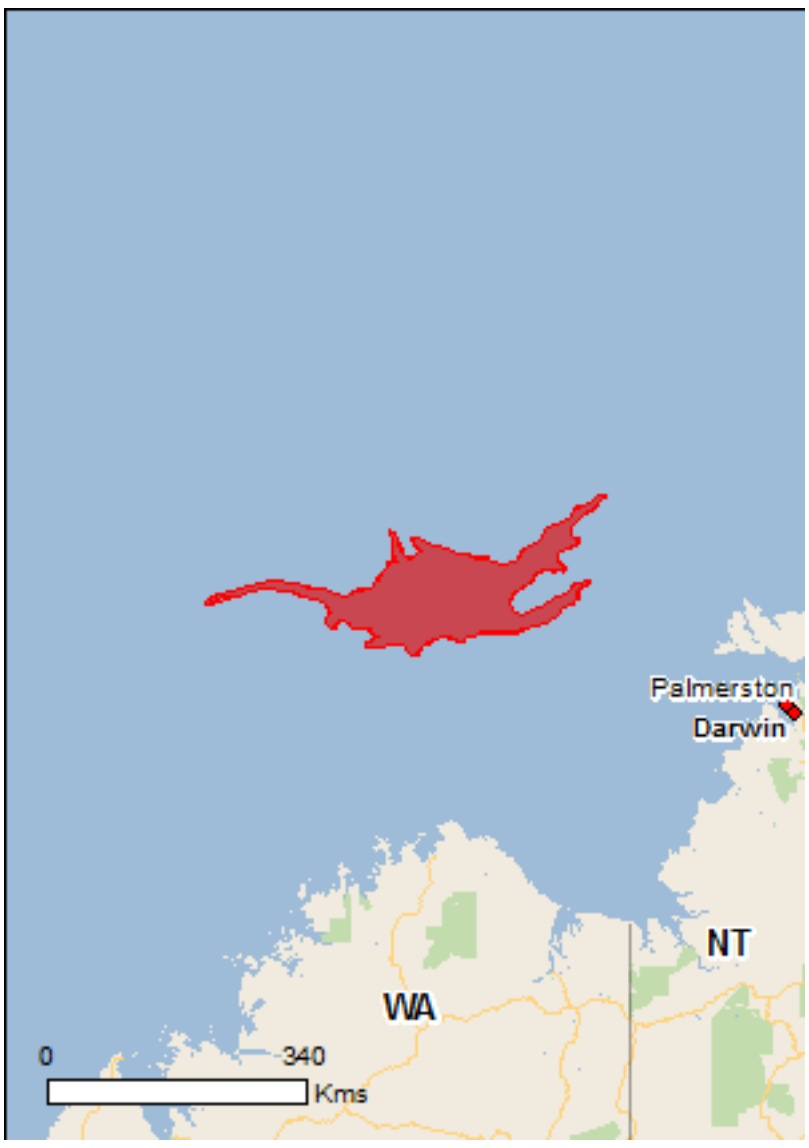

Coordinates
Buffer: 1.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	21
Listed Migratory Species:	34

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	66
Whales and Other Cetaceans:	23
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	2

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	4

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat may occur within area
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
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	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Threatened	Type of Presence
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus		
Sperm Whale [59]		Species or species habitat may occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea		
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos		
Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus		
Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species	[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.	
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Fish		
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area

Name	Status	Type of Presence
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat may occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks	[Resource Information]
Name	Label
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Van	North
Pinnacles of the Bonaparte Basin	North
Carbonate bank and terrace system of the Sahul	North-west
Pinnacles of the Bonaparte Basin	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-10.80757 126.14755,-10.75917 126.15197,-10.72948 126.26398,-10.65192 126.22505,-10.48636 126.21577,-10.39822 126.17436,-10.37027 126.17942,-10.39896 126.23808,-10.62126 126.31849,-10.67754 126.36577,-10.70307 126.41588,-10.69427 126.47143,-10.6239 126.53069,-10.62143 126.55446,-10.54067 126.45498,-10.48354 126.45209,-10.45894 126.48608,-10.56022 126.70188,-10.60323 126.87984,-10.65445 126.97466,-10.65935 127.07954,-10.70473 127.23166,-10.70394 127.33727,-10.75722 127.40452,-10.77457 127.48854,-10.73759 127.66451,-10.71624 127.69661,-10.59684 127.77626,-10.49523 127.9488,-10.35336 128.03716,-10.30715 128.13192,-10.28677 128.23509,-10.24885 128.29076,-10.10987 128.39063,-10.0883 128.48928,-10.05346 128.55504,-9.97197 128.63143,-9.96341 128.66035,-9.97853 128.72254,-9.9946 128.72142,-10.02692 128.66194,-10.10456 128.60186,-10.22056 128.43697,-10.34471 128.31452,-10.42734 128.31452,-10.46711 128.35429,-10.47961 128.39987,-10.51362 128.40826,-10.58363 128.30511,-10.6078 128.20137,-10.67464 128.15281,-10.73019 128.1616,-10.81502 128.25854,-10.83451 128.25792,-10.84667 128.2366,-10.83292 128.19067,-10.84621 128.12173,-10.83411 128.07706,-10.84076 127.99239,-10.87906 127.92005,-10.97931 127.84442,-10.99028 127.80849,-11.11264 127.63748,-11.23091 127.59765,-11.33926 127.66146,-11.3648 127.74004,-11.29762 127.85716,-11.26323 127.98852,-11.15484 128.12351,-11.14341 128.19472,-11.09088 128.30031,-11.01167 128.36538,-10.99101 128.4042,-10.97343 128.5257,-10.9956 128.53627,-11.0676 128.4243,-11.12334 128.39589,-11.16817 128.39257,-11.23181 128.33255,-11.27592 128.23344,-11.34905 128.17264,-11.44035 128.02738,-11.48486 127.87231,-11.52151 127.82539,-11.52995 127.73705,-11.55758 127.69074,-11.5622 127.23555,-11.60267 127.17736,-11.61321 127.08336,-11.67587 127.04448,-11.67481 126.98735,-11.61925 126.89744,-11.61572 126.82238,-11.64719 126.70249,-11.68534 126.65261,-11.70429 126.58659,-11.74087 126.54809,-11.80897 126.53152,-11.82964 126.45832,-11.79944 126.41176,-11.73203 126.38228,-11.70649 126.33217,-11.73682 125.91633,-11.68977 125.90617,-11.64722 126.00135,-11.595 126.04482,-11.59254 125.98365,-11.52899 125.95376,-11.50346 125.90365,-11.52151 125.74178,-11.45247 125.69303,-11.42693 125.64292,-11.43573 125.58737,-11.49334 125.53002,-11.50347 125.48089,-11.45333 125.42534,-11.42325 125.42823,-11.37123 125.4662,-11.31568 125.475,-11.2238 125.42209,-11.17656 125.33539,-11.1698 125.25366,-11.13316 125.1821,-11.12471 125.10217,-11.07873 125.0149,-11.0566 124.70155,-11.08366 124.53323,-11.13373 124.40009,-11.13029 124.34177,-11.15414 124.23866,-11.23293 124.04661,-11.21886 124.01146,-11.20279 124.01257,-11.16498 124.06481,-11.10975 124.18483,-10.96395 124.75829,-10.99252 125.0902,-11.02916 125.15394,-11.03761 125.23327,-11.06063 125.28312,-11.06466 125.37634,-11.14661 125.63262,-11.14319 125.68271,-11.07368 125.8007,-11.05273 125.9579,-10.95029 126.03241,-10.94546 126.05502,-10.87691 126.08353,-10.80757 126.14755

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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Protected Matters Search Tool Report – Hydrocarbon Spill at KP 380

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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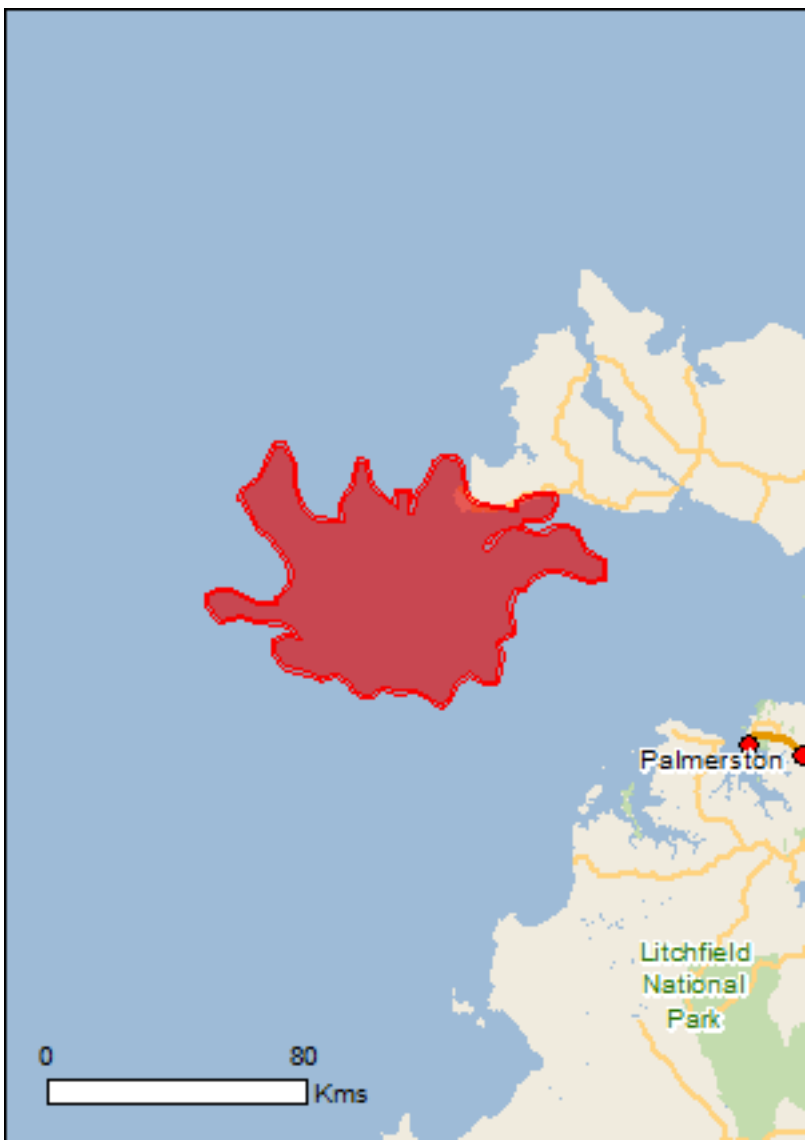
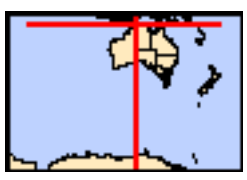


Coordinates
Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	39
Listed Migratory Species:	47

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	85
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	10
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	1

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Geophaps smithii smithii Partridge Pigeon (eastern) [64441]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Melanodryas cucullata melvillensis Tiwi Islands Hooded Robin, Hooded Robin (Tiwi Islands) [67092]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence
		area
Tyto novaehollandiae melvillensis Tiwi Masked Owl, Tiwi Islands Masked Owl [26049]	Endangered	Species or species habitat known to occur within area
Mammals		
Antechinus bellus Fawn Antechinus [344]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	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 may occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Phascogale pirata Northern Brush-tailed Phascogale [82954]	Vulnerable	Species or species habitat likely to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area
Sminthopsis butleri Butler's Dunnart [302]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Burmannia sp. Bathurst Island (R.Fensham 1021) [82017]	Endangered	Species or species habitat likely to occur within area
Hoya australis subsp. oramicola a vine [55436]	Vulnerable	Species or species habitat known to occur within area
Typhonium jonesii a herb [62412]	Endangered	Species or species habitat likely to occur within area
Typhonium mirabile a herb [79227]	Endangered	Species or species habitat likely to occur within area
Xylopia monosperma a shrub [82030]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
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
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Species or species habitat may occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species

Name	Threatened	Type of Presence
		habitat likely to 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 may 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 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
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may 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 likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may 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
Ardea alba Great Egret, White Egret [59541]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Name	Threatened	Type of Presence
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area
[Calonectris leucomelas](#) Streaked Shearwater [1077]		Species or species habitat known to occur within area
[Charadrius veredus](#) Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
[Fregata ariel](#) Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
[Fregata minor](#) Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
[Glareola maldivarum](#) Oriental Pratincole [840]		Species or species habitat may occur within area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
[Hirundo daurica](#) Red-rumped Swallow [59480]		Species or species habitat may occur within area
[Hirundo rustica](#) Barn Swallow [662]		Species or species habitat may occur within area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat likely to occur within area
[Rostratula benghalensis (sensu lato)](#) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
Fish		
[Bhanotia fasciolata](#) Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
[Campichthys tricarinatus](#) Three-keel Pipefish [66192]		Species or species habitat may occur within area
[Choeroichthys brachysoma](#) Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys haematopterus Reef-top Pipefish [66201]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippichthys parvicarinatus Short-keel Pipefish, Short-keeled Pipefish [66230]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Large-headed Seasnake, Pacific Seasnake [1112]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Breeding known to occur

Name	Threatened	Type of Presence within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Parahydrophis mertoni Northern Mangrove Seasnake [1090]		Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat may 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 may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat likely to occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area

Name	Status	Type of Presence
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Australian Marine Parks	[Resource Information]
Name	Label
Oceanic Shoals	Habitat Protection Zone (IUCN IV)

Extra Information

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Plants		
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Mimosa pigra Mimosa, Giant Mimosa, Giant Sensitive Plant, ThornySensitive Plant, Black Mimosa, Catclaw Mimosa, Bashful Plant [11223]		Species or species habitat likely to occur within area
Pennisetum polystachyon Mission Grass, Perennial Mission Grass, Missiongrass, Feathery Pennisetum, Feather Pennisetum, Thin Napier Grass, West Indian Pennisetum, Blue Buffel Grass [21194]		Species or species habitat may occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Key Ecological Features (Marine)

[Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Carbonate bank and terrace system of the Van	North

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-12.31662 129.7916,-12.31641 129.76519,-12.30639 129.74573,-12.28037 129.72535,-12.26196 129.69661,-12.27143 129.64798,-12.25664 129.61753,-12.24236 129.55087,-12.20277 129.52307,-12.17686 129.52362,-12.16344 129.55541,-12.16536 129.59702,-12.12772 129.56404,-12.11867 129.53445,-12.11808 129.47094,-12.10137 129.42413,-12.11513 129.37455,-12.07652 129.33792,-12.05008 129.3388,-12.03708 129.3638,-12.03764 129.39983,-12.0746 129.47138,-12.07315 129.53083,-12.05936 129.5322,-12.02051 129.56499,-11.98458 129.57131,-11.94952 129.56124,-11.88419 129.50789,-11.86225 129.47382,-11.78551 129.42989,-11.7693 129.43236,-11.72885 129.48604,-11.64305 129.52494,-11.64283 129.54608,-11.69102 129.57342,-11.75044 129.56985,-11.81324 129.59537,-11.84021 129.62752,-11.85167 129.67442,-11.84745 129.71062,-11.80013 129.70791,-11.74553 129.74381,-11.69221 129.74991,-11.68544 129.7577,-11.69044 129.77514,-11.72999 129.77865,-11.76003 129.79395,-11.81463 129.85944,-11.77026 129.86077,-11.7693 129.89135,-11.82889 129.89527,-11.82473 129.90363,-11.77105 129.91917,-11.74518 129.94644,-11.68989 129.96967,-11.67646 129.98462,-11.67959 130.02643,-11.70154 130.03675,-11.76754 130.04532,-11.79192 130.06437,-11.80739 130.09116,-11.82065 130.19569,-11.79784 130.19706,-11.78537 130.21786,-11.77562 130.25424,-11.7781 130.2951,-11.80417 130.29771,-11.82792 130.28572,-11.83857 130.26485,-11.83861 130.21221,-11.8648 130.20022,-11.86569 130.1969,-11.86573 130.17487,-11.86672 130.1636,-11.87456 130.13947,-11.89361 130.11509,-11.92148 130.09927,-11.92674 130.11468,-11.92121 130.12383,-11.87752 130.15614,-11.86602 130.17726,-11.88617 130.24715,-11.88176 130.27496,-11.86602 130.3035,-11.86602 130.33311,-11.87823 130.35485,-11.93037 130.38165,-11.95964 130.43078,-11.99823 130.42998,-12.00991 130.397,-11.97961 130.31038,-11.97745 130.27951,-11.99151 130.24289,-12.02683 130.20919,-12.02813 130.19029,-12.07627 130.1689,-12.14866 130.17937,-12.1716 130.13319,-12.20771 130.14637,-12.27963 130.13289,-12.2801 130.10092,-12.25748 130.06127,-12.29209 130.02101,-12.33068 130.00175,-12.34362 129.98681,-12.34261 129.97323,-12.31715 129.94565,-12.30618 129.91378,-12.30754 129.86711,-12.29725 129.81547,-12.31662 129.7916

Acknowledgements

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-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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12.3 APPENDIX C: PRE-SPILL SIMA ASSESSMENT AND ALARP ASSESSMENT OF RESPONSE STRATEGIES

Response option	Scenario	Evaluation	Recommendation
Monitor and evaluate	**Scenario 1 –** Vessel collision (700 m^3/6 hours)	The requirement for situational awareness is critical in order to implement a coordinated, focussed and effective spill response. This strategy has several tactics (e.g. tracking buoys, aerial surveillance) and is scalable according to the nature and scale of the spill. SIMA will always support the implementation of 'Monitor and Evaluate' given the clear benefits in maintaining situational awareness throughout the duration of a spill event and little or no environmental impact associated with its implementation. Therefore, the benefits of undertaking this response are considered to significantly outweigh the potential environmental risks/impacts.	Primary response option
	Scenario 2 – Vessel collision (1,125 m^3/6 hours)		Primary response option
Source control	**Scenario 1 –** Vessel collision (700 m^3/6 hours)	In the event of a vessel spill, the Vessel Master would revert to the Ship Oil Pollution Emergency Plan (SOPEP) and/or ERP depending on the nature of the spill.	Primary response option
	Scenario 2 – Vessel collision (1,125 m^3/6 hours)		
Containment and recovery	**Scenario 1 –** Vessel collision (700 m^3/6 hours)	Unlikely to be effective as diesel products will rapidly degrade in the open ocean environment. For containment and recovery to be effective, a sufficient oil thickness is required be achieved by the containment booms (minimum of 50g/m^2). This is often limited to Group 3 and 4 (ITOPF) hydrocarbons.	Not recommended
	Scenario 2 – Vessel collision (1,125 m^3/6 hours)		
(Mechanical) physical dispersion	**Scenario 1 –** Vessel collision (700 m^3/6 hours)	The benefits of undertaking this response are not considered to significantly outweigh the potential risk to human health due to the volatility of the hydrocarbon products. Mechanical dispersion is not considered a suitable response option for these scenarios.	Not recommended
	Scenario 2 – Vessel collision (1,125 m^3/6 hours)		
Chemical dispersion – surface application	**Scenario 1 –** Vessel collision (700 m^3/6 hours)	MDO is not a persistent hydrocarbon and has high natural spreading, dispersion and evaporation rates in the marine environment. Dispersant application has a low probability of being effective in increasing the dispersal rate of MDO and would introduce more chemicals to the marine environment. The benefits of applying chemical dispersant do not significantly outweigh the potential environmental risks/ impacts and therefore this response option is not considered suitable.	Not recommended
	Scenario 2 – Vessel collision		

Response option	Scenario	Evaluation	Recommendation
	(1,125 m^3/6 hours)		
Shoreline protection	**Scenario 1 –** Vessel collision (700 m^3/6 hours)	Modelling indicates low probability of shoreline contact and low exposures (**Table 7-4**). Contact exposure levels are also well below thresholds that would cause significant impact. The exposed nature of the shorelines and typical metocean conditions (large tidal range and associated strong currents) means that shoreline protection and deflection is unlikely to be effective along much of the shoreline. 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. 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 protection and deflection. The benefits of conducting this response option are not considered to significantly outweigh the potential environmental and safety risks/ impacts associated with its implementation. Therefore, shoreline protection and deflection is not considered a suitable response option.	Not recommended
	Scenario 2 – Vessel collision (1,125 m^3/6 hours)	Modelling indicates no shoreline contact above moderate shoreline accumulation thresholds (>100g/m^2).	n/a
Shoreline clean-up	**Scenario 1 –** Vessel collision (700 m^3/6 hours)	Modelling indicates low probability of shoreline contact. Contact exposure levels are also well below thresholds that would cause significant impact. Shoreline clean-up activities involve mobilising personnel and equipment to remote coastal 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. The benefits of conducting this response option are not considered to significantly outweigh the potential environmental and safety risks/ impacts associated with its implementation. Therefore, shoreline clean-up is not considered a suitable response option.	Not recommended
	Scenario 2 – Vessel collision (1,125 m^3/6 hours)	Modelling indicates no shoreline contact above moderate shoreline accumulation thresholds (>100g/m^2).	n/a
Oiled wildlife response	**Scenario 1 –** Vessel collision (700 m^3/6 hours)	This strategy would only be triggered if the monitor and evaluate option and/or operational monitoring showed wildlife were at risk of being impacted or had already been impacted by the spill, and it is safe and practicable to implement wildlife response tactics.	Secondary response option

Response option	Scenario	Evaluation	Recommendation
	Scenario 2 – Vessel collision (1,125 m^3/6 hours)		

N/A - Response option excluded after SIMA assessment

12.4 APPENDIX D: NOPSEMA REPORTING FORMS

Report of an accident, dangerous occurrence or environmental incident

For instructions and general guidance in the use of this form, please see the last page.

Part 1 is required within 3 days of a notified incident.
Part 2 is required within 30 days of notified incident.

What was the date and time of the initial verbal incident notification to NOPSEMA?			
Date		**Time**	

NOTE: It is a requirement to request permission to interfere with the site of an accident or dangerous occurrence. Refer OPGGS(S)R, Reg. 2.49.

What is the date and time of this written incident report?			
Date		**Time**	

What type of incident is being reported?	*Please tick appropriate incident type*	
Accident or dangerous occurrence		Complete parts 1A, 1B & part 2
Environmental Incident		Complete parts 1A, 1C
BOTH (Accident or dangerous occurrence AND environmental incident)		Complete ALL parts (1A, 1B, 1C, 2)

Please tick all applicable (one or more categories) *To use electronically: MS Word 2007-10 – click in check box*

Categories *Please select one or more*	Accidents	Death or Serious injury Lost time injury ≥3 days	☐ ☐
	Dangerous occurrences	Hydrocarbon release >1 kg or ≥80 L (gas or liquid) Fire or explosion Collision marine vessel and facility Could have caused death, serious injury or LTI Damage to safety-critical equipment Unplanned event - implement ERP Pipeline incident Well kick >50 barrels Other _____	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
	Environmental incidents	Hydrocarbon release Chemical release Drilling fluid/mud release Fauna Incident Other _____	☐ ☐ ☐ ☐ ☐

Part 1A – Information required within 3 days of an accident, dangerous occurrence or environmental incident

General information – all incidents

1.	**Where did the incident occur?**	Facility / field / title name		
		Site name and location *Latitude/longitude*		
2.	**Who is the registered operator/titleholder or other person that controls the works site or activity?**	Name		
		Business address		
		Business phone no.		
3.	**When did the incident occur?**	Time and time zone		
		Date		
4.	**Did anyone witness the incident?**	Yes or no *If yes, provide details below*		
	Witness details	Witness no 1	Witness no 2	Witness no 3
	Full name			
	Phone no. (Business hours)			
	Phone no. (Home) (Mobile)			
	Email (Business) (Private)			
	Postal address			
	NB: If more witnesses, copy and insert this section (4) here , and add extra witness numbers appropriately			
5.	**Details of person submitting this information**	Name		
		Position		
		Email		
		Telephone no.		
6.	**Brief description of incident**			
7.	**Work or activity being undertaken at time of incident**			

Part 1A – Information required within 3 days of an accident, dangerous occurrence or environmental incident

General information – all incidents

8.	**What are the internal investigation arrangements?**					
9.	**Was there any loss of containment of any fluid (liquid or gas)?**	Yes or no *If Yes, provide details below*				
		Type of fluid (liquid or gas) *If hydrocarbon release please complete item no.15 as well*	Hydrocarbon ☐ *Please specify*_____ Non-hydrocarbon ☐ *Please specify*_____			
		Estimated quantity *Liquid (L), Gas (kg)*				
		Estimation details	Calculation ☐		Measurement ☐	
			*Please specify*_____			
		Composition *Percentage and description*				
		Known toxicity to people and/or environment	Toxicity to people			
			Toxicity to environment			
		How was the leak/spill detected?	F&G detection ☐ CCTV ☐		Visual ☐ Other ☐	
		Did ignition occur?	No ☐ Yes ☐		Immediate ☐ Delayed ☐	
			If yes, what was the likely ignition source		Hotwork ☐ Spark electrical source ☐ Spark metallic contact ☐ Hot surface ☐ Other ☐	
10.	**Has the release been stopped and/or contained?**	Yes or no				
		Duration of the release *hh:mm:ss*				
		Estimated rate of release *Litres or kg per hour*				
11.	**Location of release**	What or where is the location of the release?				
		What equipment was involved in the release?				
		Is this functional location listed as safety-critical equipment?				

Part 1A – Information required within 3 days of an accident, dangerous occurrence or environmental incident

General information – all incidents

12.	**Weather conditions** *Please complete as appropriate*	Ambient temperature C°	
		Relative humidity %	
		Wind speed m/s *NB: for enclosed areas use* Air change per hour	
		Wind direction e.g. from SW	
		Significant wave height m	
		Swell m	
		Current speed m/s	
		Current direction e.g. from SW	
13.	**Hydrocarbon release details** *If hydrocarbon fluid (liquid or gas) was released, please complete this section as well*	System of hydrocarbon release	Process ☐ Drilling ☐ Subsea / Pipeline ☐ Utilities ☐ Well related ☐ Marine ☐
		Estimated inventory in the isolatable system *Litres or kg*	
		System pressure and size of piping or vessel *diameter (d in mm) length (l in m) or volume (V in L)*	Pressure MPag
			Size Piping (d) and Piping (l) or Vessel (V)
		Estimated equivalent hole diameter *d in mm*	

Part 1B - Complete for accidents or dangerous occurrences

Accidents and dangerous occurrences information

	Was NOPSEMA notified through the dedicated notification phone line? *Phone No. 08 6461 7090*		Yes	☐	No	☐
15.	**Action taken to make the work-site safe**	Was permission given by a NOPSEMA inspector to interfere with the site? OPGGS(S)R 2.49.	Yes	☐	No	☐
		Action taken				
		Details of any disturbance of the work site				

Part 1B - Complete for accidents or dangerous occurrences

Accidents and dangerous occurrences information

16.	**Was an emergency response initiated?**		Yes	☐	No	☐
		Type of response	Manual Automatic alarm	☐ ☐	Muster Evacuation	☐ ☐
		How effective was the emergency response?				

17.	**Was anyone killed or injured?** *Provide details below*		Yes	☐	No	☐		
	Injured persons (IP)	**Casualty No 1**						
	If different from item 2. Employer name		Employer address					
	Employer phone no.		Employer email					
	IP full name							
	IP date of birth		Sex	M	☐	F	☐	
	IP residential address							
	IP phone no. (Work)		IP phone no. (Home) (Mobile)					
	IP occupation/job title		Contractor or core crew					
	Details of injury							
	Based on TOOCS (refer last page) Nature of injury	a. Intracranial injury b. Fractures c. Wounds, lacerations, amputations, internal organ damage	☐ ☐ ☐	d. Burn e. Nerve or spinal cord injury f. Joint, ligament, muscle or tendon injury g. Other _____	☐ ☐ ☐ ☐			
	Part of body	G1. Head or face G2. Neck G3. Trunk G4. Shoulder or arm	☐ ☐ ☐ ☐	G5. Hip or leg G6. Multiple locations G7. Internal systems G8. Other _____	☐ ☐ ☐ ☐			
	Mechanism of injury	G0. Falls, stepping, kneeling, sitting on object G1. Hitting object G2. Being hit or trapped	☐ ☐ ☐	G3. Exposure to sound or pressure G4. Muscular stress G5. Heat, cold or radiation G6/7 Chemical, biological substance G8. Other _____	☐ ☐ ☐ ☐ ☐			
	Agency of injury	1. Machinery or fixed plant 2. Mobile plant or transport 3. Powered equipment 4. Non-power equipment	☐ ☐ ☐ ☐	5/6. Chemicals, materials, substances 7. Environmental agencies 8. Human or animal agencies 9. Other _____	☐ ☐ ☐ ☐			

Part 1B - Complete for accidents or dangerous occurrences

Accidents and dangerous occurrences information

	Details of job being undertaken					
	Day and hour of shift	Day *e.g. 5th day of 7 (5 / 7)*		Hour *e.g. 3rd hour of 12 (3 / 12)*		
	NB: If more casualties, please copy/paste this section (19) for each additional casualty and insert here					
18.	**Was there any serious damage?** *Provide details below*			Yes	☐	No ☐
	Details	**Item 1**		**Item 2**		**Item 3**
	Equipment damaged					
	Extent of damage					
19.	**Will the equipment be shut down?** *Yes or No*					
	If Yes, for how long?					
	NB: If more equipment seriously damaged, please copy/paste this section as required					
20.	**Will the facility be shut down?**	Yes or no *If yes provide details below*				
	Facility shutdown	Date				dd/mm/yyyy
		Time				24 hour clock
		Duration				days / hours / minutes
21.	**Immediate action taken/intended, if any, to prevent recurrence of incident.**	**Action**		**Responsible party**		**Completion date** *Actual or intended*
22.	**What were the immediate causes of the incident?**					

Attachments

Are you attaching any documents?			Yes or no *If yes provide details below*	
No.	**ID**	**Revision**	**Date**	**Title/description**

Attachments

Are you attaching any documents?			Yes or no *If yes provide details below*	

Insert or delete rows as required

Part 1C – Complete for environmental incidents

Environmental Impacts

23.	**What is the current environment plan for this incident?**	Environment plan		
24.	**Has the incident resulted in an impact to the environment?**	Yes or no *If yes provide details below*		
		Incident details *e.g. estimated area of impact, nature/significance of impact*		
		ENVIRONMENTAL RECEPTORS		
		Open ocean ☐ Shoreline ☐ Population centre ☐ Stakeholders ☐ Other sensitivity ☐ *e.g. conservation area, nesting beach*		Macroalgae ☐ Coral Reef ☐ Benthic invertebrates ☐ Seagrass ☐ Mangrove ☐
		Further details		

Details	**Environment 1**	**Environment 2**	**Environment 3**
Location of receiving environments *Lat/Long*			
Date & time of impact			
Action taken to minimise exposure			
Specify each matter protected under Part 3 of the EPBC Act impacted			

NB: If more environments were damaged, please copy/paste this section (Item E3) and add extra data

25.	**Are any environments at risk?** ***Including as a result of spill response measures***	Yes or no *If yes, provide details*	
		Details *e.g. zone of potential impact*	
		AT RISK ENVIRONMENTS	

Part 1C – Complete for environmental incidents

Environmental Impacts

		Open ocean ☐ Shoreline ☐ Population Centre ☐ Stakeholders ☐ Other sensitivity ☐ *e.g. conservation area, nesting beach*			Macroalgae ☐ Coral Reef ☐ Benthic Invertebrates ☐ Seagrass ☐ Mangrove ☐		
	Details	**Environment 1**		**Environment 2**		**Environment 3**	
	Estimated location of 'at-risk' environments						
	Estimated impact date & time						
	Action required to minimise exposure						
	Specify each matter protected under Part 3 of the EPBC Act at risk						
	NB: If more environments at risk of damage, please copy/paste this section (Item E2) and add extra data						
26.	**Was an oil pollution emergency plan activated?**	Yes or no					
		If yes, what action has been implemented /planned?					
		If yes, how effective is/was the spill response?					
27.	**Was an environmental monitoring program initiated?**	Yes or no					
		If yes, what actions have been implemented and/or planned?					
28.	**Did the incident result in the death or injury of any fauna?**	Yes or no (If yes provide details of species in the table below)					
	Injured fauna	**Species 1**		**Species 2**		**Species 3**	
	Species name (common or scientific name)						
	Number of individuals killed or injured	Killed: Injured:		Killed: Injured:		Killed: Injured:	
	NB: If more species were injured or killed, please copy/paste this section (Item E4) and add extra data						
29.	**Actions taken to avoid or mitigate any adverse environmental impacts of the incident.**	**Action**		**Responsible party**		**Completion date** *Actual or intended*	
	NB: If more actions, please add extra rows as required						

Part 1C – Complete for environmental incidents

Environmental Impacts

		Action	Responsible party	Completion date *Actual or intended*
30.	**Corrective actions taken, or proposed, to stop, control or remedy the incident.**			
	NB: If more actions, please add extra rows as required			
		Action	**Responsible party**	**Completion date** *Actual or intended*
31.	**Actions taken, or proposed, to prevent a similar incident occurring in the future.**			
	NB: If more actions, please add extra rows as required			

Attachments

Are you attaching any documents?			Yes or no *If yes provide details below*	
No.	**ID**	**Revision**	**Date**	**Title/Description**
Insert or delete rows as required				

Part 2 – Information required within 30 days of accident or dangerous occurrence

NOPSEMA acknowledges that in many circumstances an operator may not have completed an investigation within 3 days of an accident or first detection of a dangerous occurrence and agrees that these items must be provided within 30 days unless otherwise agreed, in writing with NOPSEMA. In circumstances where an investigation has been completed within 3 days, and these items are available (supplemented, as required by any attachments) this part should also be completed at that time.

32.	**Has the investigation been completed?**	Yes or no	
	Root cause analysis *What were the root causes?*	Root cause 1	
		Root cause 2	
		Root cause 3	
		Other root causes	
	Full report *Describe investigation in detail, including who conducted the investigation and in accordance with what standard/procedure with reference to attachments listed in the 'attachments table' (following) as applicable*		

33.	**Actions to prevent recurrence of same or similar incident**	**Action**	**Responsible party**	**Completion date** *Actual or intended*
	NB: Add or delete rows as appropriate			

Attachments (Insert/delete rows as required)

Are you attaching any documents?	Yes or no *If yes provide details below*	

No.	ID	Revision	Date	Title/description

Instructions and general guidance for use:

1. The use of this form is voluntary and is provided to assist operators and titleholders to comply with their obligations to give notice and provide reports of incidents to NOPSEMA under the applicable legislation.
2. Accidents, dangerous occurrences or environmental incidents can all be reported using this same form.
3. The applicable legislation for incident reporting is:
    a. Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 [OPGGS(S)R]; and
    b. Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 [OPGGS(E)R], for facilities located in Commonwealth waters; or
    c. for facilities located in designated coastal waters, the relevant State or Territory Act and associated Regulations where there is a current conferral of powers to NOPSEMA.
4. In the context of this form an incident is a reportable incident as defined under:
    a. OPGGSA, Schedule 3, Clause 82.
    b. OPGGS(E)R, regulation 4.
5. This form should be used in conjunction with NOPSEMA Guidance Notes available on the NOPSEMA website:
    a. N-03000-GN0099 Notification and Reporting of Accidents and Dangerous Occurrences
    b. N-03000-GN0926 Notification and Reporting of Environmental Incidents
6. Part 1 requires completion for all incidents; then ALSO complete part 2 if the incident is an accident or dangerous occurrence.
7. NOPSEMA considers that a full report will contain copies of documentary material referenced and/or relied on in the course of completing this form, which may include (but not be limited to) as appropriate: witness statements, management system documents, drawings, diagrams and photographs, third party reports (audit, inspection, material analysis etc.), internal records and correspondence.
8. This form is intended to be completed electronically using Microsoft Word by completing the unshaded cells which will expand as required to accept the information required and the check boxes where relevant (NB: check boxes may appear shaded and have reduced functionality in MS Word versions prior to 2010).
9. The completed version of this form (and any attachments, where applicable) should be emailed to: submissions@nopsema.gov.au or submitted via secure file transfer at: https://securefile.nopsema.gov.au/filedrop/submissions as soon as practicable, but in any case within three days of the incident.

References

NOPSEMA website: www.nopsema.gov.au

TOOCS – Type of Occurrence Classification System.

The *Type of Occurrence Classifications System, Version 3.0* (TOOCS3.0) was developed to improve the quality and consistency of data. This system aligns with the International Classification of Diseases –Australian Modification (ICD10-AM).

http://www.safeworkaustralia.gov.au/sites/SWA/AboutSafeWorkAustralia/WhatWeDo/Publications/Documents/207/TypeOfOccurrenceClassificationSystem(TOOCS)3rdEditionRevision1.pdf

OPGGS(S)R. Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009. Select Legislative Instrument 2009 No. 382 as amended and made under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006.*Commonwealth of Australia.

OPGGS(E)R. Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. Statutory Rules 1999 No. 228 as amended and made under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006.* Commonwealth of Australia.

Privacy Notice

NOPSEMA collects your personal information for the purpose of investigating accidents, dangerous occurrences and environmental incidents under the Offshore Petroleum and Greenhouse Gas Storage Act 2006.

NOPSEMA will not use or disclose your personal information for any other purpose without your consent, unless it is required or authorised by law, or relates to NOPSEMA's enforcement activities. Your personal information may be disclosed to the following organisations, entities or individuals:

- individuals who make a request under the *Freedom of Information Act 1982*
- the Australian National Audit Office and other privately-appointed auditors
- other law enforcement bodies (for example, the police or the Coroner)
- NOPSEMA's legal advisors.

NOPSEMA may occasionally be required to disclose information to overseas recipients in order to discharge its functions or exercise its powers, or to perform its necessary business activities.

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NOPSEMA
Australia's offshore energy regulator

FORM

Recordable Environmental Incident Monthly Report

Document No: N-03000-FM0928 A198750

Date: 04/05/2020

Due Date: By the 15th day of the following month.

Send completed form to: submissions@nopsema.gov.au via secure file transfer at https://securefile.nopsema.gov.au/filedrop/submissions

Reference: Regulation 26B

Please check the following boxes if applicable to this report **Nil Incident Report:** ☐ **Final report for this activity:** ☐

Titleholder name:		**Titleholder business address:**		**Title of environment plan for the activity:**	
Activity type: (e.g. drilling, seismic, production)		**Month, Year:**		**Facility name and type :** (e.g. MODU, Seismic Vessel, FPSO)	
Contact person:		**Email:**		**Phone:**	
Incident date	**All material facts and circumstances** (including release volumes to environment if applicable)	**Performance outcome(s) and/or standard(s) breached**	**Action taken to avoid or mitigate any adverse environmental impacts of the incident**	**Corrective action taken, or proposed, to stop, control or remedy this incident**	**Action taken, or proposed, to prevent a similar incident occurring in future**

Note 1: As at 28 February 2014, amendments to the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations changed from environmental performance objective to environmental performance outcome. If you are reporting against an EP accepted under the old Regulations please report against the environmental performance objective for that activity.

Note 2: This form may be submitted in conjunction with the 'Injuries and Fatalities – Monthly Summary Report' Form available at www.nopsema.gov.au

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12.5 APPENDIX E: STAKEHOLDER CONSULTATION

CONFIDENTIAL APPENDIX SEPARATELY ATTACHED