

Bayu-Undan Gas Export Pipeline Environment Plan

Activity overview

Santos operates the Bayu-Undan to Darwin Gas Export Pipeline (the Pipeline) that transports natural gas from the Bayu-Undan offshore platform in the Timor Sea to the Darwin Liquefied Natural Gas (DLNG) Plant at Wickham Point in Darwin Harbour in the Northern Territory (NT). The 502 km Pipeline traverses Timor-Leste offshore, Australian Commonwealth and NT waters and has been in operation since 2005.

The Bayu-Undan field is now approaching end of field life, at which time production will cease at the Bayu-Undan facility.

The Pipeline will then be put into preservation under a revision to the existing in-force Environment Plan ahead of a future decision on whether to proceed with plans to re-purpose the Pipeline for Carbon Capture and Storage (CCS) at the depleted Bayu-Undan field. Activities planned during the operations and preservation phase are outlined on Page 3 and typically include infrequent and short duration vessel-based inspection, maintenance, monitoring and repair (IMMR) activities.

If CCS occurs, the Pipeline will be brought back into service to transport CO₂ from DLNG to Bayu-Undan, rather than being decommissioned. Proposed activities beyond preservation would be subject to separate government environmental approvals and consultation.

Consultation and feedback

Under government Environmental Regulations, all proposed petroleum activities must have an Environment Plan (EP) accepted by the relevant Regulator before any activities can take place. Consultation is required as part of EP development.

Santos meets this requirement by undertaking consultation in two phases:

- **Preliminary consultation** to understand values and sensitivities and confirm

consultation expectations of authorities, persons and organisations whose functions, interests or activities may be affected by proposed activities (relevant persons).

- **Consultation** of relevant persons on specific activities.

Activity specific consultation is planned to commence on **27 October 2023**, with the consultation period closing on **27 November 2023**. More details on consultation and providing feedback can be found on the back page of this fact sheet.

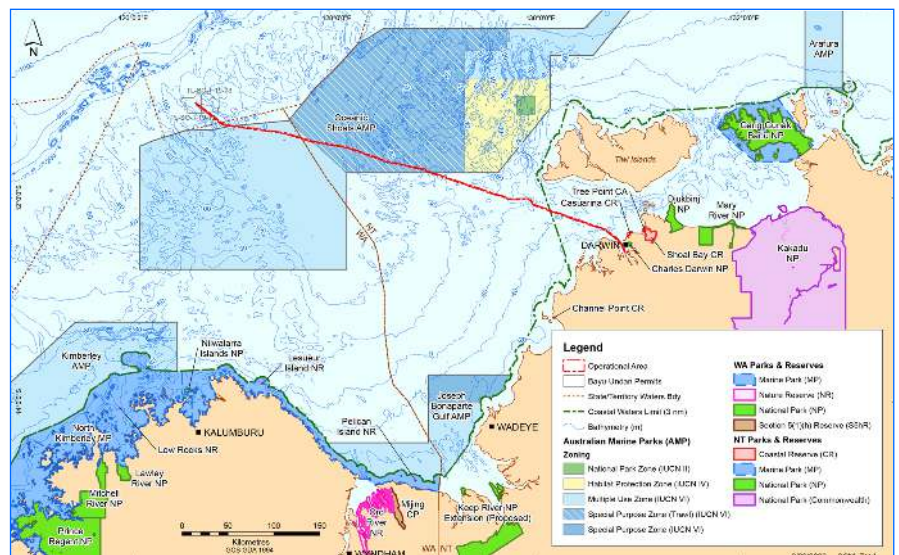


Figure 1. Bayu-Undan Gas Export Pipeline location

Activity description

Activity details	
Timing	The Pipeline is currently in the operations phase, with preservation estimated to commence in approximately Q3 2024.
Duration	Dependant on Santos decision-making for decommissioning or re-purposing the Pipeline for CCS.
Water depth	The water depth along the Pipeline route varies from a maximum of approximately 134 m to 0 m.
Planned activities	<p>Operations phase:</p> <ul style="list-style-type: none"> • Transporting dry natural gas from the BU Field to Darwin LNG Plant. • Linepacking the Pipeline up to maximum operating pressure (during periods of maintenance and towards the end of production at the BU Facility). • Back-feed of gas from the Pipeline to BU CPP for power generation (during maintenance and testing and once production ceases from the BU Field). <p>Preservation phase (begins when the gas is no longer being used for power generation at BU CPP):</p> <ul style="list-style-type: none"> • The Pipeline remains filled with reservoir gas. • Pipeline inspection, maintenance, monitoring and repair. • Pipeline IMMR activities, environmental monitoring/sampling (e.g. sediment and marine growth), including vessel-related activities will continue through all the above phases.
Vessels	Typically, a single vessel would be used to conduct inspection, maintenance, monitoring and repair (IMMR) activities. However, depending on the nature and location of a repair activity, additional vessels may be required.
Aircraft	Helicopters may be used during IMMR activities and emergency response.
Description of the natural environment	<ul style="list-style-type: none"> • The majority of the benthic habitat expected in the Operational Area is classified as bare sand. • The seabed within the vicinity of the Pipeline in Timor-Leste waters is predominantly flat and featureless. Benthic habitats are generally consistent across the Operational Area within Timor-Leste waters and comprise predominantly bare soft sediment habitats with varying amounts of bioturbation. • The NT waters section is typically a silty/clay habitat, with shelly sand and very sparse biota (soft corals and crinoids). • Within the shallow NT coastal waters, 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. In Darwin Harbour, Bladin Point and Wickham Point support communities of soft and hard corals.
Operational Area	The area extending 500 m from the Pipeline centreline, along the length of the Pipeline, within which the Petroleum Activity will take place.
Petroleum production licences	<ul style="list-style-type: none"> • Timor-Leste offshore waters – BU-1-PL. • Australian Commonwealth waters – WA-8-PL and NT/PL1. • NT waters – NTC/PL1 and NTC/PL20.

Activity purpose and approvals

The in-force Bayu-Undan to Darwin Gas Export Pipeline Environment Plan details the environmental management measures implemented by Santos for operation of the Pipeline. The EP was assessed by NOPSEMA and accepted in February 2019, enabling a further five years of operations.

Activities proposed to be managed under a revision to the in-force EP include:

Operations phase

- Transporting dry natural gas from the BU Field to Darwin LNG Plant.
- Line packing the Pipeline up to maximum operating pressure during periods of maintenance and towards the end of production at the BU Facility.
- Back-feed of gas from the Pipeline to BU Facility for power generation during maintenance and testing and once production ceases from the BU Field.

Preservation phase (begins when the gas is no longer being used for power generation at BU Facility):

- The Pipeline will remain filled with reservoir gas.
- Pipeline inspection, maintenance, monitoring and repair, including environmental monitoring/sampling (e.g. sediment and marine growth).

Vessel-related activities will be undertaken during operations and preservation phases.



Image 1. Typical vessel used for IMMR activities.

IMMR activities conducted on the Pipeline will be infrequent and of relatively short duration.

Inspections will generally involve a vessel travelling along the route of the Pipeline using towed acoustic instruments or may involve using a Remotely Operated Vehicle (ROV) launched and recovered from the vessel. Typically, vessels will be within the Operational Area for approximately 5 – 60 days per year depending on the type of inspection.

The *Commonwealth Offshore Petroleum and Greenhouse Gas Storage Environment Regulations 2009* require a titleholder to have an Environment Plan accepted by NOPSEMA before any petroleum activity can commence.

An accepted revision of the Bayu-Undan to Darwin Gas Export Pipeline EP must be in place to enable the suspension and cessation of Pipeline operations.

Defining the environment area for proposed activities

Santos has undertaken an initial assessment to identify the environmental, social, economic and cultural values and sensitivities that may be affected by impacts and risks of proposed activities.

To do this we have considered the totality of the areas where activity impacts and risks may occur.

These areas are summarised in **Table 1**. The widest extent of these areas is called the Environment that May Be Affected (EMBA), which for

this activity is the outer boundary of a worst-case marine gas oil spill resulting from a vessel collision during Pipeline inspection, maintenance and repair activities. The EMBA for proposed Bayu-Undan Pipeline operations activities is illustrated in **Figure 2**.

Oil spill EMBA's are defined by overlaying a great number (usually hundreds) of individual, computer simulated, hypothetical oil spill events into a single map. Each simulation run starts from the same location (release point)

but each run will be subject to a different set of wind and weather conditions derived from historical data. The use of advanced and sophisticated models enables us to present all the areas that could be affected.

While the EMBA represents the largest possible spatial extent that could be contacted by the worst-case spill events modelled, an actual spill event is more accurately represented by a single simulation run, resulting in a smaller spatial extent in the event of an actual spill. Often one or more simulation runs are selected to be representative of the 'worst-case' based on the nature and scale of the activity and the local environment.

Please see the [NOPSEMA Spill Modelling Video](#) for more information on oil spill modelling and why it is required for the preparation of Environment Plans.

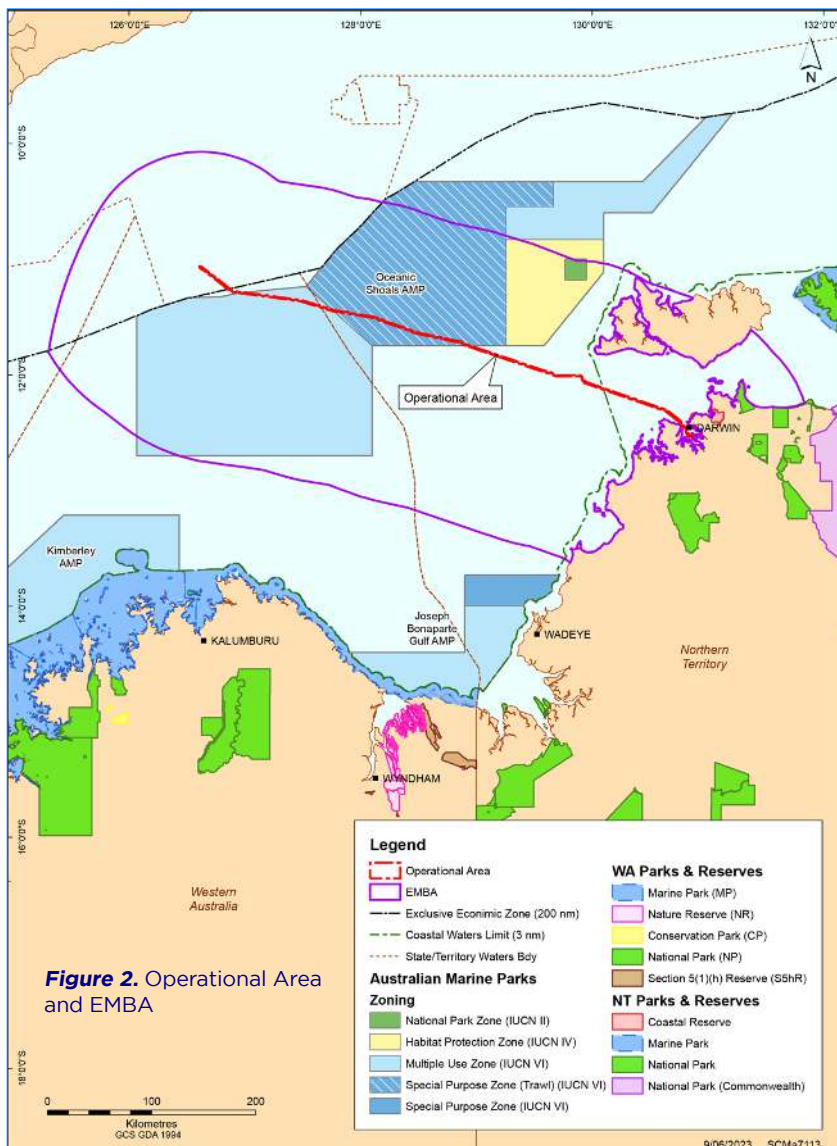


Figure 2. Operational Area and EMBA

Table 1. Environment area for proposed activities

Operational Area
Santos has defined the Operational Area as the area extending 500 m from the Pipeline centreline, along the length of the Pipeline from the subsea isolation valve (SSIV in Timorese Waters) to the beach valve at Darwin, within which the Petroleum Activity will take place.
Environment that May Be Affected (EMBA)
The spatial extent of activity impacts (e.g., Pipeline presence, light, noise) and risk (e.g., hydrocarbon spill).

Environmental, social, economic and cultural features

Santos has undertaken a review of publicly available information to identify environmental, social, economic and cultural features and/or values that may be affected by activity impacts and risks. The outcomes of this review are summarised in **Table 2**.

Table 2. Environmental, social, economic and cultural features

Feature	Description	Within Operational Area	Within EMBA	Public information review
Aboriginal heritage	Registered Aboriginal heritage sites protected under the: <ul style="list-style-type: none"> • <i>Aboriginal Torres Strait Islander Heritage Protection Act 1984</i>. 	No	No	There are no registered Indigenous heritage sites within the EMBA. The Tiwi Islands and Daly River region are declared Aboriginal reserves and comprise of a number of protected registered sacred sites under the Northern Territory Aboriginal Sacred Sites Act. Culturally significant heritage sites for Tiwi, Larrakia and Wulna people and important diving sites are located at the Vernon Islands.
Biologically important areas	Biologically important areas (BIAs) are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration.	Yes	Yes	The Operational Area includes BIAs for dolphins and turtles.
Cultural heritage	Registered cultural sites under the: <ul style="list-style-type: none"> • <i>Underwater Cultural Heritage Act 2018</i>. 	Yes	Yes	A number of listed heritage sites overlap the operational area, predominantly sunk historic military equipment. There is a potential impact to underwater cultural heritage in the event of a hydrocarbon spill and response.

Table 2. Environmental, social, economic and cultural features ... continued

Feature	Description	Within Operational Area	Within EMBA	Public information review
Defence	Designated defence activity areas.	No	Yes	The Operational Area is adjacent to the North Australian Exercise Area (NAXA) and a maritime military zone administered by the Department of Defence. The Australian Border Force also undertake civil and maritime surveillance and enforcement activities in Australian offshore maritime waters.
Energy industry	Petroleum and Carbon Capture and Storage activities.	No	Yes	Several offshore petroleum projects are in operation and there is exploration activity within the region.
Fishing	Commercial fishing.	Yes	Yes	A number of Commonwealth, State and Territory fisheries overlap the EMBA, some of which are active in the Operational Area.
	Indigenous, subsistence or customary fishing.	Yes	Yes	Traditional Australian Indigenous fishing in NT waters predominately occurs within inshore tidal waters. Indonesian and East Timorese Indigenous fishing traditionally occurs in the Timor Sea and is unlikely to occur within the Operational Area or EMBA within Timor-Leste waters.
	Recreational fishing.	Yes	Yes	Recreational fishing occurs within the Operational Area and the EMBA.
Key ecological features	Key ecological features (KEFs) are elements of the Commonwealth marine environment that are considered to be of regional importance for either a region's biodiversity or its ecosystem function and integrity.	Yes	Yes	The Operational Area includes KEFs for the carbonate bank and terrace system of the Van Diemen Rise, the carbonate bank and terrace system of the Sahul Shelf and the Pinnacles of the Bonaparte Basin.

Table 2. Environmental, social, economic and cultural features ... continued

Feature	Description	Within Operational Area	Within EMBA	Public information review
Protected areas (nearest Commonwealth and Territory)	Australian Marine Park.	Yes	Yes	In Commonwealth Waters the Pipeline crosses through the Oceanic Shoals Marine Park and the Special Purpose Zone (Trawl).
	Northern Territory Reserves.	No	Yes	There are no Northern Territory Reserves located within the Operational Area. The closest Northern Territory Reserves in distance from the Operational Area are: <ul style="list-style-type: none"> • Charles Darwin 7.4 km NE • Casuarina 12.4 km E • Channel Point 108 km S • Marri-Jabin (Thamurrurr - Stage 1) 160 km S
Shipping	Shipping routes.	Yes	Yes	The closest major commercial port to the EMBA is Darwin. The port serves multiple shipping and cargo markets, including cruise and naval vessels, livestock exports, dry bulk ore, offshore oil and gas rig services, and container and general cargo.
Telecommunications	Subsea telecommunications cables.	Yes	Yes	The Pipeline crosses four cables within Darwin Harbour. The Pipeline crosses a fibre optic telecommunication cable and a Telstra telecommunication cable crosses over the Pipeline in Commonwealth waters.
Tourism	Marine and coastal tourism.	Yes	Yes	Within Darwin Harbour common tourism/recreational activities include fishing, boating, scuba-diving, sailing, water-skiing, and beach use.
Towns / communities	Darwin.	No	Yes	Darwin is the nearest city and is approximately 2.6 km NE of the Operational Area.

Activity impacts and risk management

We have summarised in **Table 3** the potential environmental impacts risks and associated management measures for the proposed activity. These aspects will be risk-assessed with the Environment Plan on a case-by-case basis.

Table 3. Activity impacts and risk management

Potential activity impacts	
Acoustic disturbance to fauna	
<p>Description of risks</p> <p>Potential impacts from noise emissions may occur from the following sources:</p> <ul style="list-style-type: none"> • Vessel activities. • Equipment such as multibeam echo sounder (MBES) and sidescan sonar (SSS) used during IMR activities. • Low frequency transponders used to track pig trains. • Pipeline excavation using water jetting tools. • Pipeline cutting tools. • Pipeline coating removal tools. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Santos procedure for interacting with marine fauna. • Watchkeeping maintained on bridge.
Atmospheric emissions	
<p>Description of risks</p> <p>Potential impacts from atmospheric emissions may occur in the operational area from the following sources:</p> <ul style="list-style-type: none"> • Operation of vessel engines, helicopters, generators, mobile and fixed plant and equipment. These emissions will include greenhouse gas (GHG) emissions, such as carbon dioxide (CO₂), methane (CH₄) and nitrous oxide (N₂O), and non-GHG emissions, such as sulphur oxides (SOX) and nitrogen oxides (NOX). • Operation of incinerators on vessels. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Vessel planned maintenance system to maintain vessel dynamic positioning (DP), engines and machinery. • Fuel oil quality. • International Air Pollution Prevention Certification (IAPP).

Table 3. Activity impacts and risk management ... continued

Physical presence and interaction with other marine users	
<p>Description of risks</p> <p>Potential interactions with other marine users may occur as a result of:</p> <ul style="list-style-type: none"> • Vessel operations. • Helicopter activities. • Pipeline presence. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Watchkeeping maintained on bridge. • Lighting will be used as required for safe work conditions and navigational purposes. • Seafarer certification. • Stakeholder consultation strategy. • No fishing from vessel. • Notify AHO prior to commencing activities.
Light emissions	
<p>Description of risks</p> <p>Light emissions in the marine environment will occur as a result of:</p> <ul style="list-style-type: none"> • Safety and navigational lighting on the vessels. • Spot lighting that may also be used as needed, such as equipment deployment and retrieval. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Lighting will be used as required, for safe work conditions and navigational purposes. • Premobilisation review and planning of lighting on vessels prior to IMMR activities commencing. • A Lighting Management Plan or equivalent sections within a Project Execution Plan or similar.
Operational discharges	
<p>Description of risks</p> <p>Planned discharges associated with the Pipeline include:</p> <ul style="list-style-type: none"> • Cathodic protection system discharges from subsea Pipelines. • Discharges from repair activities (e.g., during minor repairs or initial response to damage resulting in the ingress of seawater into the Pipeline (ultimately requiring major repair, which is out of scope of this EP). • Pipeline coating and chemicals from cleaning, inspection and repair of the Pipeline. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Santos chemical selection procedure.

Table 3. Activity impacts and risk management ... continued

Routine vessel discharges	
<p>Description of risks</p> <p>Planned discharges from vessels to the marine environment include:</p> <ul style="list-style-type: none"> • Deck drainage/run off. • Sewage and grey water. • Food wastes. • Cooling water. • Bilge water. • Brine (if a reverse osmosis unit is used for water treatment). 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Vessel sewage system. • Vessel oily water treatment system. • Vessel waste (garbage) management plan. • Deck cleaning product selection procedure. • Santos chemical selection procedure.
Seabed and benthic habitat disturbance	
<p>Description of risks</p> <p>Disturbance to the seabed and benthic habitats could potentially occur as a result of the following IMMR activities:</p> <ul style="list-style-type: none"> • Marine growth removal for infrastructure inspection. • Environmental Monitoring Activities such as sampling of seabed material (i.e. sediment) or biotic material (i.e. marine growth) for environmental studies as and if required. • Subsea inspection surveys: Turbidity and increased sedimentation due to the use of ROVs (thrusters), AUVs and placement of equipment. • Span rectification. • Pipeline repairs. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Recovery of all deployed temporary equipment. • Santos Pipeline Integrity Management Plan.

Table 3. Activity impacts and risk management ... continued

Potential activity risks	
Unplanned oil spill resulting from a vessel collision	
<p>Description of risks</p> <ul style="list-style-type: none"> • A worst-case credible scenario for the proposed activity is a marine gas oil (MGO) / marine diesel oil (MDO) spill resulting from a vessel collision. • This worst-case estimated volume would be typical for similar vessel-based or maintenance activities and significantly less than for commercial shipping activities in the region. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • In the event of a hydrocarbon spill, an activity specific Oil Pollution Emergency Plan (OPEP) will be implemented to mitigate environmental impacts. • The OPEP sets out environmental protection priorities and appropriate response measures for a range of spill scenarios. • The OPEP is developed in conjunction with the Regulator assessing the plan and in accordance with National, State and Territory marine pollution plans.
Unplanned hazardous liquid release	
<p>Description of risks</p> <p>Sources of risk from a minor hazardous liquids release may occur as a result of:</p> <ul style="list-style-type: none"> • Vessel and vehicle and equipment operations. • ROV/diver operations. • Refuelling of equipment / machinery (on deck). • Spills or leaking machinery. • Loss of primary containment. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Vessel planned maintenance system (PMS) to maintain vessel DP, engines and machinery. • Vessel oily water treatment system. • Deck cleaning product selection. • Vessel spill response plans (shipboard oil pollution emergency plan (SOPEP)/ shipboard marine pollution emergency plan (SMPEP)). • Santos chemical selection procedure. • Remotely operated vehicle inspection and maintenance procedures. • General Chemical Management Procedure. • Hazardous Chemical Management Procedure.
Unplanned release of dry natural gas	
<p>Description of risks</p> <p>A Pipeline breach could result in a release of dry gas to the marine environment.</p>	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Pipeline operating procedures. • Pipeline Integrity Management Plan (PIMP, H8-10000001725). • Bayu-Undan Export Pipeline Safety Case, (BU/HSE/MAN/010). • Repairs to the Pipeline carried out to design specification. • Santos emergency response procedures.

Table 3. Activity impacts and risk management ... continued

Unplanned release of solid objects	
<p>Description of risks</p> <p>Solid objects, such as those listed below, can be accidentally released to the marine environment, and potentially impact on sensitive receptors:</p> <ul style="list-style-type: none"> • Non-hazardous solid wastes, such as paper, plastics and packaging, PPE, small tools and unsecured deck equipment. • Hazardous solid wastes, such as batteries, fluorescent tubes, medical wastes, and aerosol cans. • Equipment and materials, such as hard hats, tools or infrastructure parts. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Vessel planned maintenance system to maintain vessel DP, engines and machinery. • Vessel waste (garbage) management procedure. • Dropped object prevention procedures. • Dropped object recovery.
Unplanned introduction of invasive marine species (IMS)	
<p>Description of risks</p> <p>Introduction of invasive marine species (IMS) may occur due to:</p> <ul style="list-style-type: none"> • Biofouling on vessels and external/internal niches (such as sea chests, seawater systems). • Biofouling on equipment that is routinely submerged in water (such as survey equipment). • Discharge of high-risk ballast water. • Cross-contamination between vessels. 	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Compliance with the <i>Biosecurity Act 2015</i>. • Anti-foulant system.
Unplanned interaction with marine fauna	
<p>Description of risks</p> <p>There is the potential for vessels or equipment (for example, ROV, AUV) involved in IMMR activities to interact with marine fauna, including potential strike or collision, potentially resulting in severe injury or mortality.</p>	<p>Compliance with the following key management measures</p> <ul style="list-style-type: none"> • Santos procedure for interacting with marine fauna. • Watchkeeping maintained on bridge.

Consultation

Consultation provides Santos with an opportunity to receive feedback from authorities, persons and organisations whose functions, interests or activities may be affected by proposed petroleum activities.

This feedback helps us to refine or change the management measures we are planning to address potential activity impacts and risks. Our objective for proposed activities is to reduce environmental impacts and risks to a level that is As Low As Reasonably Practicable (ALARP) and acceptable over the life of the activity.

Consultation also helps us to identify values and sensitivities where information is not publicly available, such as spiritual and cultural connection to land and sea country, as well as first-hand feedback on commercial and recreational fishing, tourism and local community activities and interests.

Providing feedback

All petroleum activities in Commonwealth waters must have an Environment Plan (EP) accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) before any activities can take place.

Under Commonwealth Environmental Regulations, Santos is required to consult with relevant persons about proposed activities when preparing an EP. A relevant person includes authorities, persons or organisations whose functions, interests or activities may be affected by the proposed activity.

You might be a relevant person if, for example, you have spiritual or cultural connections to land and sea country in accordance with Indigenous tradition that might be affected by our activity, if you otherwise carry out recreational or commercial fishing, tourism or other activities that might be affected by our proposed activity, or if you are part of a local community that might be affected by our proposed activity.

If you consider you may be a relevant person, please contact us by **26 October 2023** to allow Santos time to initiate consultation with you, so you can tell us how you would like to be consulted throughout this process or if you need additional information.

The merits of relevant person feedback provided through the consultation process will be considered during EP development, with a summary of responses summarised and included in the EP submitted to NOPSEMA for assessment. Please let us know if you would like your personal/organisational details or any part of your feedback to remain private and we will ensure this remains confidential to NOPSEMA.

Contact

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