

Darwin Pipeline Duplication (DPD) Project – Onshore Construction Environmental Management Plan (CEMP)

PROJECT / FACILITY	Barossa DPD Project
REVIEW INTERVAL (MONTHS)	No Review Required
SAFETY CRITICAL DOCUMENT	NO

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	Project Environmental Lead	Project HSE Manager	Project Director

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Appendix 1 Santos Environment, Health and Safety Policies

Appendix 2 Summary of management actions and associated performance criteria for the proposed activity

Acronyms, Terms, Definitions and Units of Measurement

Term	Definition
Acronyms	
AAPA	Aboriginal Areas Protection Authority
ALARP	As low as reasonably practicable
AMSA	Australian Maritime Safety Authority
AQIS	Australia Quarantine and Inspection Service
ASS	Acid sulfate soils
ASSDMP	Acid Sulfate Soils and Dewatering Management Plan
BOM	Bureau of Meteorology
CAMBA	China-Australia Migratory Bird Agreement
DAWE	Commonwealth Department of the Agriculture, Water and the Environment
DEPWS	Norther Territory Department of Environment, Parks and Water Security
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DITT	Northern Territory Department of Industry, Tourism and Trade
DLNG	Darwin Liquefied Natural Gas
DoE	Commonwealth Department of the Environment
DoEE	Commonwealth Department of the Environment and Energy
DIPL	Northern Territory Department of Infrastructure, Planning and Logistics
DPD	Darwin Pipeline Duplication
DSEWPaC	Commonwealth Department of Sustainability, Environment, Water, Population and Communities
EDP	Exceptional Development Permit
ENVID	Environmental impact identification
EP Act	<i>Environment Protection Act 2019</i>
EP Regulations	Environment Protection Regulations 2020
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EPL	Environmental Protection Licence
EPO	Environmental performance objectives
EPS	Environmental performance standard
FCGT	Flood / clean / gauge / testing
GEP	Gas export pipeline
GHG	Greenhouse gas

Term	Definition
HAT	Highest astronomical tide
HSE	Health, safety and environment
JAMBA	Japan-Australia Migratory Bird Agreement
KP	Kilometre point
LNG	Liquid natural gas
LOR	Limit of reporting
MARPOL	The International Convention for the Prevention of Pollution from Ships
MMNMP	Marine Megafauna Noise Management Plan
MNES	Matters of National Environmental Significance
MoC	Management of change
NICNAS	National Industrial Chemicals Notification and Assessment Scheme
NR	Natural resource
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
ODS	Ozone depleting substances
OEMP	Operations Environmental Management Plan
PASS	Potential acid sulfate soils
PLET	Pipeline end termination
PMP	Pipeline management plan
PMST	Protected Matters Search Tool
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
Santos	Santos NA Barossa Pty Ltd
SER	Supplementary Environmental Report
SMS	Santos Management System
TPWC Act	<i>Territory Parks and Wildlife Conservation Act 1976</i>
TSDMMP	Trenching and Spoil Disposal Management and Monitoring Plan
WONS	Weeds of National Significance
Legislation terms	
Licence	A licence granted under Part III or section 43 of the <i>Energy Pipelines Act 1981</i> (NT)
Licensee	The registered holder of a licence
Non-Indigenous	Refers to heritage artefacts or sites that are not deemed “sacred sites” per the <i>Northern Territory Aboriginal Sacred Sites Act 1989</i> (NT) or deemed Aboriginal or Macassan archaeological sites or artefacts per the <i>Heritage Act 2011</i> (NT).

Term	Definition
Pipeline	<p>A pipe or system of pipes that has or have a maximum allowable operating pressure greater than 1050 kilopascals or a hoop stress (being a circumferential stress arising from internal pressure) that is, at one or more positions, greater than 20% of the specified minimum yield stress specified in the manufacturing standard with which the pipe complies and that are used or intended to be used for the conveyance of an energy-producing hydro-carbon, and includes:</p> <p>(a) all structures for protecting or supporting a pipeline; and</p> <p>(b) all loading terminals, works and buildings and all fittings, pumps, tanks, appurtenances and appliances,</p> <p>used in connection with a pipeline, but does not include:</p> <p>(c) a pipeline as defined in the <i>Petroleum (Submerged Lands) Act 1981</i>;</p> <p>(e) a pipeline constructed or to be constructed on land used for residential, business, agricultural, commercial or industrial purposes, designed for use solely for the residential, business, agricultural, commercial or industrial purposes carried on that land and situated wholly within the boundaries of that land; or</p> <p>(f) a pipeline or a pipeline of a class declared under section 4(2) to be a pipeline in respect of which a licence is not required</p>
Pipeline management plan	<p>Pipeline management plan in force, in relation to a pipeline, means:</p> <p>(a) a pipeline management plan for the pipeline submitted by or for the pipeline licensee and accepted under these Regulations; or</p> <p>(b) if the pipeline management plan is accepted in part – that part of the pipeline management plan that is accepted, as revised from time to time under these Regulations, but does not include a pipeline management plan for which the acceptance has been withdrawn.</p>
Definitions	
DLNG team	The DLNG contractors
Environmental Performance Standard	A statement of performance required of a management action.
Environmental Performance Objective	Measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks are of an acceptable level.
Measurement Criteria	A system of measurements that define whether a project is successful.
Onshore Project Area	Onshore Project Area is the same area as the Project Area, except it extends between the onshore termination point and the upstream weld of the beach valve.
Onshore termination point	The point (KP122.484; approximately 2 m above highest astronomical tide) to which the pipeline will be pulled ashore to by the shore-pull activity.
Performance Criteria	The standards by which success of management actions is evaluated.
Project Area	Project Area extends between the 3 nautical mile boundary and the upstream weld of the beach valve. Refer to
Target	Specific and measurable performance requirements to achieve EPOs.
Units of measurement	

Term	Definition
°	degrees
µS	microSiemens
cm	centimetre
dB	decibels
dB(A)	a-weighted sound pressure level in decibels
kHz	kilohertz
km	kilometre
km ²	square kilometre
m	metre
m ²	square metre
m AHD	metres Australian Height Datum
mg/L	milligrams per litre
nm	nautical mile

1 Introduction

1.1 Project overview

Santos NA Darwin Pipeline Pty Ltd is the operator of the existing Bayu-Undan to Darwin Gas Export Pipeline (GEP). The Bayu-Undan to Darwin GEP is a dry natural gas export pipeline transporting gas from the Bayu-Undan field located in Timor-Leste waters to the Darwin Liquefied Natural Gas (DLNG) facility at Wickham Point peninsula near Darwin, Northern Territory (NT), Australia. The Bayu-Undan to Darwin GEP has been operational since 2005. In anticipation of the end of the Bayu-Undan field's commercial production in 2022 / 2023, the Barossa Field is being developed to supply gas to the DLNG facility. The original base case for the supply of backfill gas to the DLNG facility was originally for the installation of a 262 kilometres (km) Barossa GEP to a tie-in point on the existing Bayu-Undan to Darwin GEP.

In recognition of potential Carbon Capture and Storage opportunities at the Bayu-Undan, Santos NA Barossa Pty Ltd (Santos) has approved an alternative solution to transport backfill gas to the DLNG facility through the construction of an additional segment of pipeline to extend the Barossa GEP to the DLNG facility, instead of tying into the Bayu-Undan to Darwin GEP. Construction of this segment of pipeline is referred to as the Darwin Pipeline Duplication (DPD) Project, as it will be installed, parallel to the existing Bayu-Undan to Darwin GEP. The effective 'duplication' of the existing Bayu-Undan to Darwin GEP is considered the optimal route to minimise potential environmental and social impacts.

The pipeline will run from a location where the Barossa GEP approaches the existing Bayu-Undan pipeline and continue through Darwin Harbour into the DLNG facility (**Figure 1-1**). Santos' DPD Project includes a ~23 km segment in Commonwealth waters and a ~100 km segment in NT waters and lands adjacent to the existing Bayu-Undan to Darwin GEP. The DPD Project pipeline will be located for the most part approximately 50-100 m from the existing Bayu-Undan to Darwin pipeline, to minimise potential environmental and social impacts. The Project Area for the DPD Project includes a 2 km buffer around the pipeline route in NT waters, the onshore construction area at the DLNG facility and an offshore spoil disposal ground, and buffer, for the trench spoil disposal (**Figure 1-1**). The construction of the pipeline onshore is covered under this Construction Environmental Management Plan (CEMP) (**Figure 2-2**).

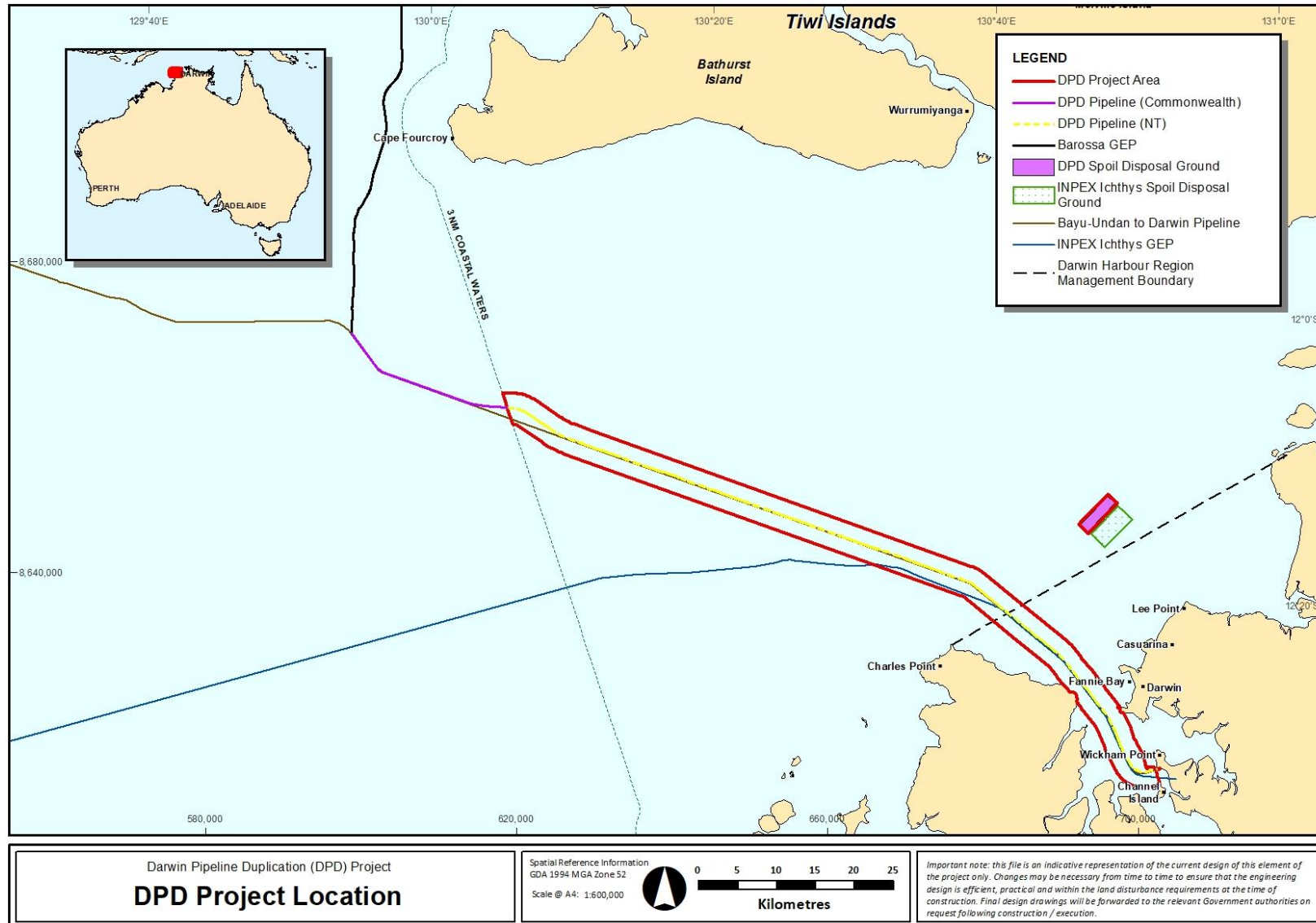


Figure 1-1: DPD Project Location

1.2 Purpose

This CEMP has been prepared to detail and provide guidance on environmental management requirements, to ensure the DPD Project pipeline construction activities on NT land are undertaken in an environmentally responsible manner and in line with regulatory requirements.

This CEMP will be submitted with the DPD Project Supplementary Environmental Report (BAS-210 0020) (SER) under the NT *Environment Protection Act 2019* and supporting regulations. This CEMP will be provided to the relevant Minister in support of the Pipeline Management Plan (PMP) required to construct a pipeline under the *Energy Pipelines Act 1981* (NT) and supporting regulations.

The purpose of this onshore CEMP is to meet the relevant requirements of the:

- + Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) as administered by Department of Climate Change, Energy, the Environment and Water (DCCEEW), including relevant management and recovery plans and conservation advice for Matters of National Environmental Significance (MNES).
- + The EP Act and Environment Protection Regulations 2020 (EP Regulations), as administered by the NT EPA.
- + The Draft Guideline for the Preparation of an Environmental Management Plan (NT EPA, 2015)
- + the Energy Pipelines Act 1981 (NT), and Energy Pipelines Regulations 2001 as administered by the NT Department of Industry, Tourism and Trade (DITT).

This CEMP details the environmental impacts and risks associated with the onshore activities and demonstrates how these will be reduced to an acceptable level. This CEMP provides an implementation strategy that will be used to measure and report on environmental performance during planned activities and unplanned events, to ensure impacts and risks are continuously reduced and are maintained at an acceptable level. The environmental management of the activity described in this CEMP complies with the Santos Environment, Health and Safety Policy (**Appendix 1**). This CEMP has considered all relevant stakeholder consultation performed during its development (**Section 9**).

1.3 Scope

This CEMP is relevant to the onshore section of the DPD pipeline only, which is approximately 200 metres (m) in length between the onshore termination point (kilometre point (KP) 122.484) which is approximately 2 m above highest astronomical tide [HAT]) to which the pipeline will be pulled ashore by the shore-pull activity) and the upstream weld of the beach valve (KP 122.692). This onshore section of the DPD pipeline will be designed and constructed by the Santos DLNG team and contractors. This CEMP is therefore termed the onshore CEMP. The construction of the remainder of the DPD pipeline, from the onshore termination point to the 3 nautical mile (nm) Commonwealth/NT waters boundary, will be designed and constructed by the Santos Barossa DPD Project team (and contractors) (referred to in this document as the Barossa team) and subject to another CEMP termed the DPD Project Offshore CEMP (BAS-210 0024).

A summary of activities relevant to each CEMP is provided in **Table 1-1**.

This CEMP forms part of a suite of environmental management plans which collectively cover all activities from the 3 nm Commonwealth/NT waters boundary to the upstream weld of the beach valve. (**Figure 1-2**).

There are three additional draft management plans that address specific activities during construction (**Figure 1-2**). These are the:

- + Trenching and Spoil Disposal Monitoring and Management Plan (TSDMMP) (BAS-210 0023) that addresses all trenching and spoil disposal activities from the 3 nm Commonwealth/NT waters boundary to the onshore termination point.
- + Marine Megafauna Noise Management Plan (MMNMP) (BAS-210 0045) that addresses all activities associated with underwater noise impacts to marine megafauna from the 3 nm Commonwealth/NT waters boundary to the onshore termination point.
- + Acid Sulfate Soil and Dewatering Management Plan (ASSDMP) (BAS-210 0049) that addresses all activities associated with acid sulfate soils (ASS) from lowest astronomical tide (LAT) to the upstream weld of the beach valve.

Table 1-1: DPD Project Activities within the Project Area covered by the CEMPs

Phases	Activities		
	Offshore CEMP	Onshore CEMP	Outside scope of CEMPs
Surveys	<ul style="list-style-type: none"> + Offshore Surveying during construction + Environmental surveys during construction 	Onshore surveying during construction	<ul style="list-style-type: none"> + Low impact pre-construction surveys required to gather information for Project planning and approvals are out of scope for the CEMPs. These surveys include, but are not limited to, environment, heritage, geotechnical, geophysical and unexploded ordinance (UXO) surveys + Any surveys in Commonwealth waters
Pre-lay works	<ul style="list-style-type: none"> + Installation of offshore pipeline from the onshore termination point to the 3 nm Commonwealth/NT waters boundary + Trenching and spoil disposal from the onshore termination point to the 3 nm Commonwealth/NT waters boundary + Spoil disposal at nominated spoil disposal grounds and in situ + Pre-lay span rectification + Cable crossings along the Pipeline pathway + Installation of site buildings and generators + Construction of the site access road + Installation of traffic plates over the existing Bayu-Undan pipeline + Preparation of the site pad, including installation of geotextile 	<p>Onshore trenching of the onshore pipeline from the upstream weld of the beach valve to the onshore termination point and onshore stockpile of trench material for use as trench backfill.</p> <p>This will involve:</p> <ul style="list-style-type: none"> + Excavation of trench from the upstream weld of the beach valve to site pad + Extension of trench to the onshore termination point through the site pad once no longer in use + Storage of any identified ASS / PASS on limestone pads and treated with lime prior to reuse or disposal to landfill 	Any pre-lay works within Commonwealth waters

Phases	Activities		
	Offshore CEMP	Onshore CEMP	Outside scope of CEMPs
	and site hard stand areas, installation of holdback anchor, linear winch, trench and shore pull wire.		
Pipeline installation and pre-commissioning	<ul style="list-style-type: none"> + Pipelay activities + In-line tee installation + Pipeline shore pull + Rock backfill + Post-lay span rectification + Testing and pre-commissioning the offshore pipeline + Post-lay trenching + Pipelay contingencies 	<ul style="list-style-type: none"> + Installation of the onshore pipeline from the upstream weld of the beach valve to the onshore termination point + Testing and pre-commissioning the onshore pipeline + Tie-in onshore pipeline to the offshore pipeline at the onshore termination point 	<ul style="list-style-type: none"> + Any installation or pre-commissioning within Commonwealth waters, including: + DPD Project Pipeline end termination (PLET) installation + Spool installation (between DPD Project PLET and Offshore Barossa GEP PLET) + Installation of the beach valve and the pipeline between the beach valve and the DLNG facility + Installation of the shore crossing CP monitoring system
Demobilisation	<ul style="list-style-type: none"> + Removal of the pre-commissioning spread + Removal of the hard stand and geotextile + Re-contouring of the site as applicable + Removal of causeway/s 	<ul style="list-style-type: none"> + Backfilling onshore pipeline trench + Site returned to pre-construction condition 	
Operations	N/A	N/A	<ul style="list-style-type: none"> + Operations + Inspection maintenance and repair
Decommissioning	N/A	N/A	<ul style="list-style-type: none"> + Decommission pipeline + Removal of subsea infrastructure + Onshore decommissioning and rehabilitation + As-left/ post-surveys

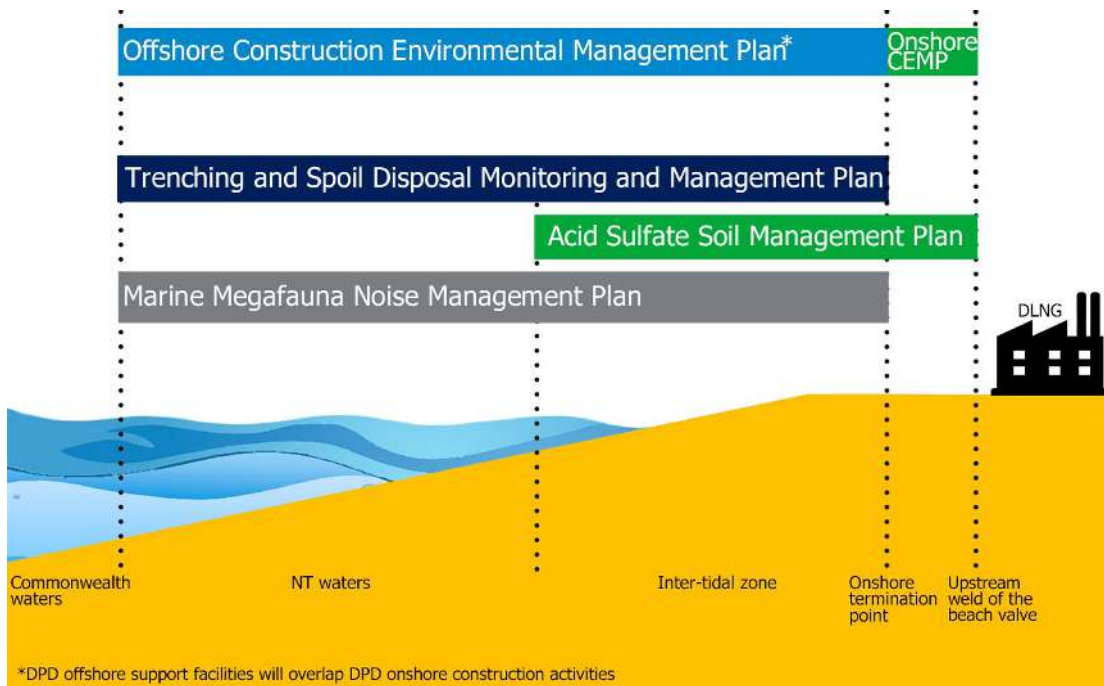


Figure 1-2: Conceptual model of management plan geographical scopes

1.4 Plan structure

This CEMP has been prepared and structured in accordance with the Guideline for the Preparation of an Environmental Management Plan (in draft) (NT EPA, 2015). The guideline requirements and where they have been addressed within the CEMP are detailed in **Table 1-2**.

Table 1-2: Construction Environmental Management Plan Structure

Regulatory requirement	Relevant CEMP section
Guideline for the Preparation of an Environmental Management Plan	
+ Project overview + Proponent details + Key contacts	Section 1: Introduction
Clear and comprehensive project description	Section 2: Detailed Activity Description
Legal and other obligations	Section 3: Legal and Other Obligations
Environmental management framework	Section 4: Environmental Management Framework
Existing environment	Section 5: Existing Environment
+ Conceptual site model + Environmental risk assessment	Section 6: Risk Assessment The requirement for a Conceptual Site Model is addressed within the risk assessment.

Regulatory requirement	Relevant CEMP section
Guideline for the Preparation of an Environmental Management Plan	
Environmental management strategies	Section 7: Environmental management strategies
+ Corrective actions and contingencies + Audit, reporting and review + Training and awareness	Section 8: Implementation Strategy
Communication	Section 9: Stakeholder Consultation

1.5 Proponent

1.5.1 Details of the proponent

Santos, as the operator of the Barossa Joint Venture, has applied to the DITT for two pipeline licences for the nearshore section of the DPD pipeline:

- + Coastal and Territorial Waters Licence for the section of the pipeline under the jurisdiction of the *Petroleum (Submerged Lands) Act 1981* (NT) (i.e. between the NT Coastal Waters Limit and the Territorial Sea Baseline)
- + Inland Waters Licence for the section of pipeline under the jurisdiction of the *Energy Pipelines Act 1981* (NT) (i.e. between the Territorial Sea Baseline and the upstream weld of the beach valve at the DLNG Facility).

The Inland Waters Licence is applicable to the section of pipeline within the scope of this CEMP. The proposed proponent details are provided in **Table 1-3**, with the nominated operator shown in bold.

Table 1-3: Proponent details for Barossa DPD Project’s future Inland Waters Licence

Title	Proponent (nominated operator in bold)	ABN	Interest	Contact details
Inland Waters License	Santos NA Barossa Pty Ltd	44 109 974 932	25.0%	Business Address: Level 7, 100 St Georges Terrace, Perth, Western Australia, 6000 Telephone number: (08) 6218 7100 Fax number: (08) 6218 7200 Email address: barossa.regulatory@santos.com
	Santos Offshore Pty Ltd	38 005 475 589	25.0%	
	SK E&S Australia Pty Ltd	55 158 702 071	37.5%	Business Address: Level 6, 60 Martin Place, Sydney NSW 2000, Australia Telephone number: (02) 21213304 Fax number: None Email address: hyunjoon-kim@sk.com
	JERA	18 654 004 387	12.5%	Business Address: Level 9 Brookfield Place, 125 St Georges Tce, PERTH, WA, 6000

1.5.2 Details of nominated liaison person

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

Name Dr Lachlan MacArthur

Title: Environmental Approvals Adviser

Business address: Level 7, 100 St Georges Terrace, Perth, WA 6000

Telephone number: (08) 6218 7100

Email address: Barossa.regulatory@santos.com

1.5.3 Notification procedure in the event of changed details

If there is a change in the nominated operator, or a change in the contact details for the operator or liaison person, Santos will notify the DITT and provide the updated details.

1.6 Document review, revision and availability

This CEMP has been prepared for submission in draft form with the SER (BAS-210 0020) and other supporting documents to the NT EPA, under the EP Act, and will be updated to reflect any relevant regulatory conditions associated with the DPD Project approvals. This CEMP will be provided to the relevant Minister in support of the PMP required to construct a pipeline under the *Energy Pipelines Act 1981* (NT) and Energy Pipelines Regulations 2001. A pipeline licensee for a pipeline for which a PMP is in force must submit to the Minister a proposed revision of the PMP in the event of a change, or proposed change, of circumstances or operations under Regulation 33, when requested by the Minister under Regulation 34 or at the end of each five-year period under Regulation 35.

Santos will review and update the document as required based on regulatory feedback and any regulatory conditions on DPD Project approval as applicable. The final CEMP will be made publicly available on an Australian website.

2 Detailed Activity Description

2.1 Overview

Table 2-1 provides the key attributes of the construction activity covered by this CEMP. A detailed activity description is provided in **Sections 2.3.1** and **2.3.8**.

Table 2-1: Attributes of the Activity

Attribute	Summary
Activity location	<p>The relevant onshore section of the DPD pipeline extends from the onshore termination point (KP 122.484) to the upstream weld of the beach valve. The beach valve is located at KP122.692. It is located at the shore crossing of the DLNG Facility on the Wickham Point peninsula, near Darwin (Figure 2-1). The onshore termination point is two metres above HAT.</p> <p>The onshore section of the Project Area is located within the existing DLNG disturbance footprint.</p>
Pipeline installation	<p>Approximately 200 m of 34-inch diameter carbon steel pipe.</p> <p>Pre-lay works phase:</p> <ul style="list-style-type: none"> + Onshore trenching from the upstream weld of the beach valve to onshore termination point <p>Pipeline installation and pre-commissioning phase:</p> <ul style="list-style-type: none"> + Installation of the onshore pipeline from the upstream weld of the beach valve to the onshore termination point + Testing and pre-commissioning the onshore pipeline + Tie-in (welding) of the onshore pipeline to the offshore pipeline at the onshore termination point <p>Demobilisation phase:</p> <ul style="list-style-type: none"> + Backfilling onshore pipeline trench + Undertaking site remediation <p>Refer to further detail in Table 1-1.</p>
Machinery and vehicles	<ul style="list-style-type: none"> + Light vehicles + Mobile equipment such as excavators, graders, trucks, fuel trucks + Heavy equipment such as cranes + Water cart
Proposed schedule	<p>Work is scheduled to be performed in early 2024 and take up to 12 months</p>

The locations for activities along the DPD Project pipeline are described using ‘kilometre points’ (KP), where KP 0 is the beginning of the DPD Project pipeline from the “pipeline end termination point C” (PLET C) in Commonwealth waters and KP 122.692 is the end of the onshore section of the DPD Project Pipeline.

Table 2-2: Onshore pipeline start and end locations.

Location	Kilometre Point	MGA Zone *	Easting*	Northing*
Onshore termination point	KP122.484	52	702272.73 E	8614606.40 S
Upstream weld of the beach valve	KP122.692	52	702,472.29 E	8,614,655.73 S

*Coordinates in GDA 94, MGA zone 52

2.2 Onshore project area

The Onshore Project Area is defined as the area within which the construction activity will take place and extends between the onshore termination point and the upstream weld of the beach valve (**Figure 2-1**). The onshore Project Area is contained within the existing DLNG disturbance envelope, which was previously subject to vegetation clearing. Areas within the DLNG disturbance envelope outside of the onshore Project Area may be used by the DLNG team for equipment laydown or trench material stockpiling.

The Project Area is shown in **Figure 2-1** with the DPD offshore support facilities shown in **Figure 2-2**.

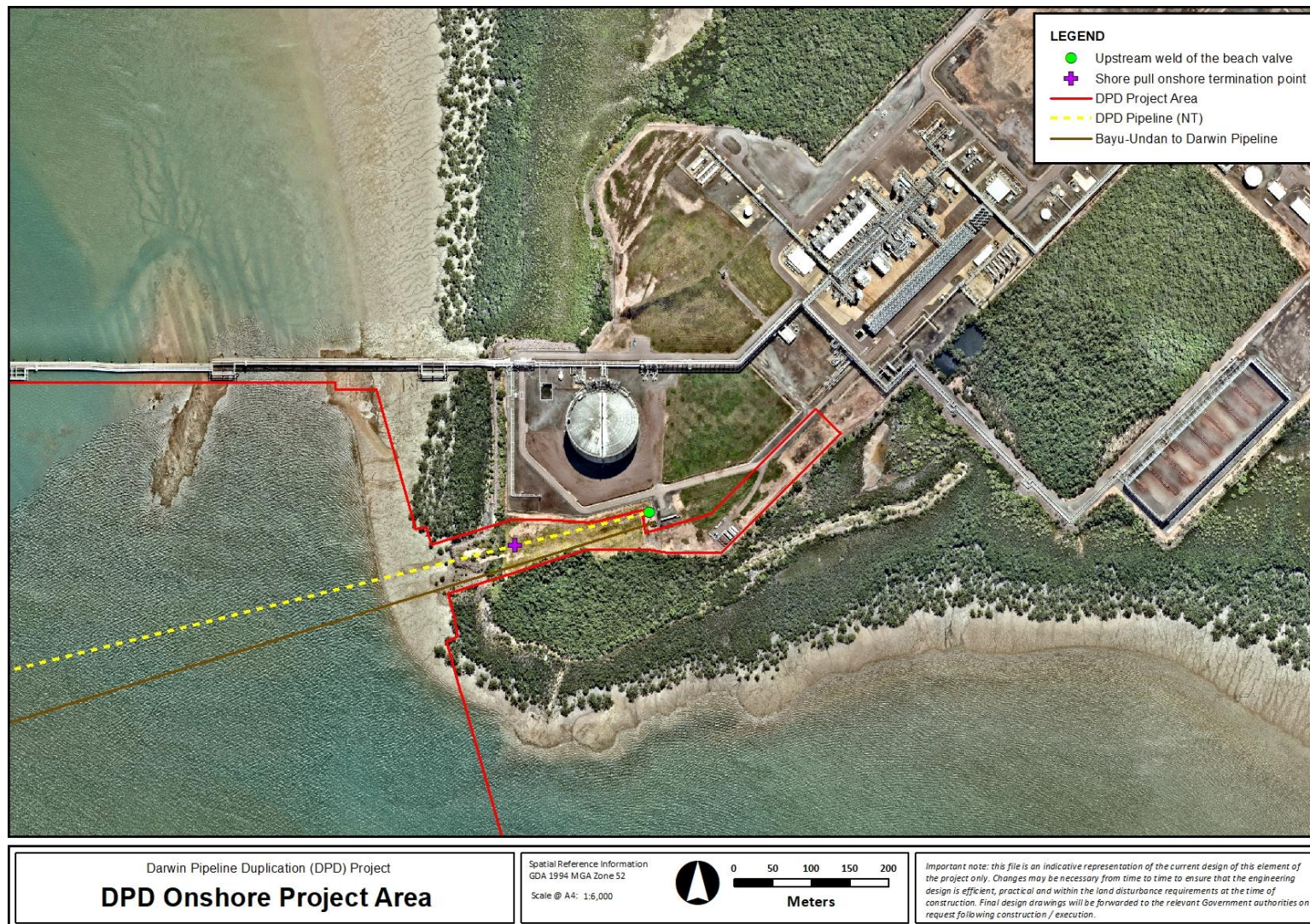


Figure 2-1: Onshore Project Area

2.3 Onshore construction

2.3.1 Onshore pre-lay works

2.3.1.1 Site establishment

The onshore construction site layout for the Barossa team is illustrated in **Figure 2-2**. The DLNG team's support facilities (i.e. site office, spoil stockpile, laydown areas) will be located within the existing DLNG disturbance envelope. Primary site access for both the Barossa and DLNG teams will be via the site access road shown in **Figure 2-2**.

2.3.1.2 Onshore trenching

Geophysical and/or geotechnical surveys will be undertaken before the commencement of construction of the onshore site, which will involve digging test pits and sampling extending down to the anticipated depth of the trench of ~2.5 m.

The construction works will be undertaken simultaneously with the Santos Barossa DPD Project team's onshore and intertidal construction works. Therefore, trenching will initially be completed from the upstream weld of the beach valve location to the extent of the DPD site pad (which will be used by the Barossa team). This section will be approximately 130 m in length. Once the shore crossing facilities have been removed by the Barossa team, the DLNG team will extend the trench from the extent of the DPD site pad down to the onshore termination point. This trench will be approximately 70 m in length and up to a maximum of 40 m wide. The onshore construction site layout is shown in **Figure 2-2**.

Trenching works may be scheduled either during or after the offshore pipeline's pre-commissioning works have been completed. Timing will be detailed through simultaneous operations (SIMOPS) once a detailed schedule of all onshore activities is developed.

The onshore trenching works will be undertaken during wet and/or dry seasons. Dewatering due to rainwater will be primarily managed by a diesel-powered suction pump combined with a silt separator, where the water that has been separated from solids is then discharged to grade (Downer, 2022). Additional sparges and hoses may be used to manage removal of water. While unlikely, dewatering of groundwater may be required, and is included in the Acid Sulfate Soils Management Plan (ASSDMP [BAS-210 0049]) to ensure management of any acidic groundwater.

Excavation will be completed by a 35-tonne excavator, articulated dump trucks and a water truck for dust suppression (Downer, 2022). The area of the onshore pipeline has been previously disturbed and was cleared of native vegetation during construction of the Bayu-Undan to Darwin Gas Export Pipeline. It is currently covered with naturally regrown native grasses and weeds. The grasses and topsoil will be stripped, and the trench will be excavated to ~2.5 m deep and will be ~3m wide at the base. At each welded pipeline connection, a wider excavation will be completed to provide suitable access and working area for the piping and welding crew (Downer, 2022). When trenching, all sides will be adequately supported by either shoring, benching or battering.

The trenched material will be placed on the non-working side of the trench (Downer, 2022) or stockpiled within the onshore Project Area or the DLNG disturbance envelope for future reuse as backfill. Surplus material will be removed offsite. The trenched material will be stockpiled onsite for testing and will be removed offsite to an appropriately licensed landfill as required.

While considered highly unlikely, if ASS or Potential ASS (PASS) are identified during trenching works the ASS / PASS material will be stored on limestone pads within the onshore Project Area or the DLNG disturbance envelope and treated with lime prior to reuse or disposal to an appropriately licensed landfill. Further context on ASS/PASS is provided in the ASSDMP (BAS-210 0049).

2.3.2 Onshore pipeline installation

The DLNG team are responsible for the fabrication of the structural steel and pipework, which will occur offsite at the nominated subcontractor's fabrication workshop (Downer, 2022). The pipe spool configuration will require field welding; therefore surface treatment and non-destructive examination (NDE) will be completed offsite and final weld testing, surface treatment and hydrostatic testing will be completed onsite. Structural steel will be fabricated by either welded assembly or stick build. Standalone pipe supports will be fabricated as one item and will require no assembly. The piping and structural steel will be transported to site by road and unloaded by a site-based crane at a laydown area onto timbers or dunnage (Downer, 2022). Lay-down areas will be defined by the installation contractor during detailed design (**Figure 2-2**).

The onshore pipeline will be approximately 200 m length of 34-inch diameter carbon steel with an external anti-corrosion coating to maintain the pipeline integrity. The pipeline assembly configurations between the upstream weld of the beach valve and the onshore termination point are outlined in the Barossa Onshore Tie-In Project Delivery Management Plan (Downer, 2022). Pipe will be strung out alongside the trench, lifted onto temporary pipe supports and cut to length, subjected to end preparation works and aligned for welding. This will be followed by butt welding of the joint and NDE until the sub-assembly is completed. The sub-assemblies will be lifted onto temporary pipe supports in the trench, aligned for welding and butt welding of the joint. The final NDE and coating will be completed prior to the hydrotesting. A 25-tonne Franna crane will be available for minor lifts and pipe placement and two 55-tonne rough terrain cranes will be used for placement of the welded pipes into the trench.

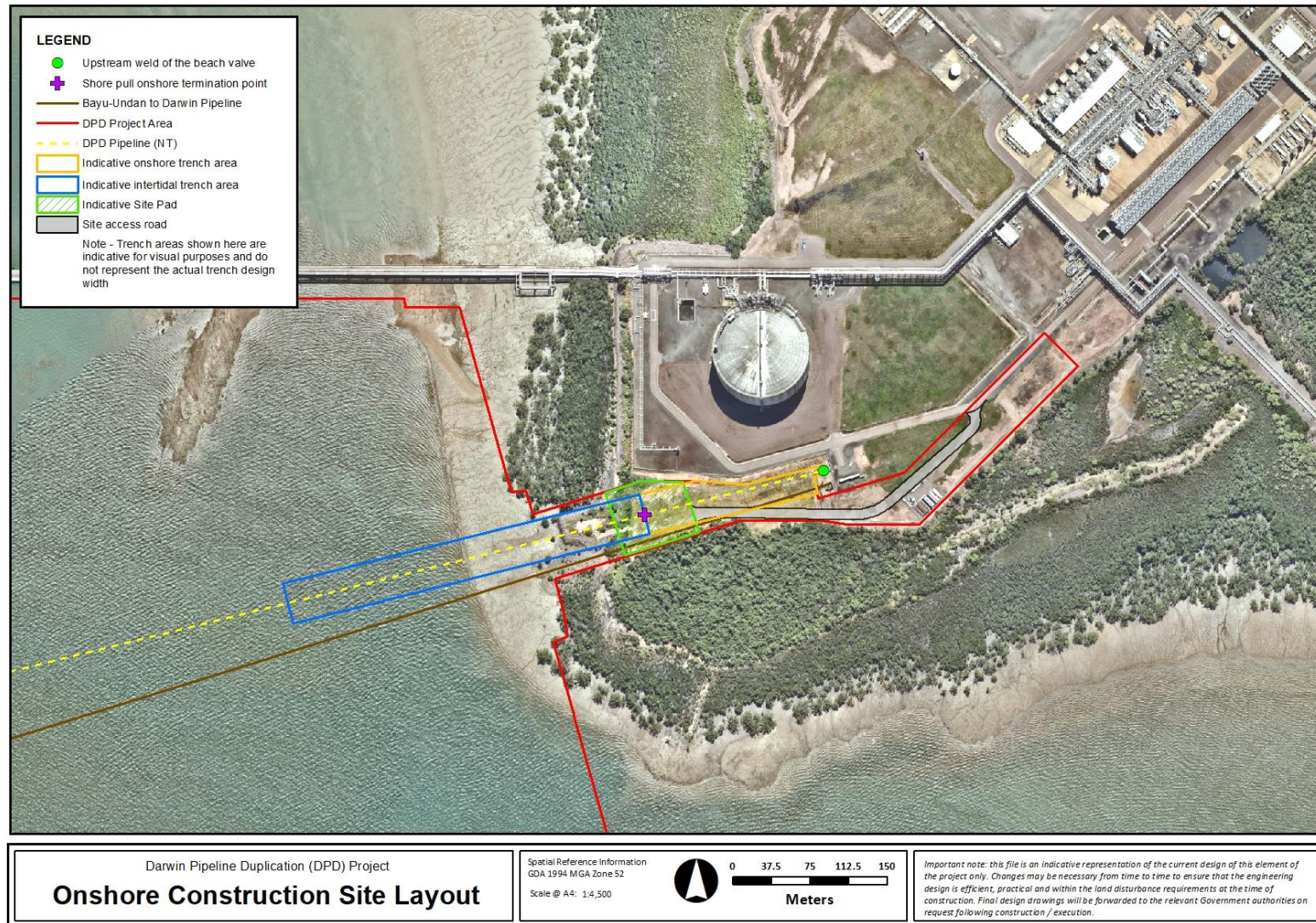


Figure 2-2: Onshore site layout and Santos Barossa DPD Project teams shore crossing at the intertidal area

2.3.3 Pre-commissioning

Once the DLNG team has installed the onshore pipeline, it will be subjected to a hydrostatic pressure test (hydrotest). Hydrotesting will be completed in line with Santos' specification, Pressure Testing of Process and Utility Piping (1540-120-SPC-0018), and Downer standard, Hydrostatic Testing (SM-QA-ST014) (Downer, 2022). The Barossa team will source hydrotesting water for pre-commissioning the offshore pipeline by water extraction from Darwin Harbour. The water will be filtered to remove particulates and then chemically treated. The DLNG team will use this treated seawater for their hydrotesting activities of the onshore pipeline. As water extraction from Darwin Harbour and filter backflushing is managed by the Barossa team and is described and assessed in the Offshore CEMP (BAS-210 0024) it is not described or assessed further within this CEMP.

A volume of chemically treated seawater will be pushed into the pipeline to raise its pressure. This hydrotest pressure will be held for a period of time as per the relevant standard to test the pipeline integrity. The discharged hydrotest water will be temporarily stored in an enclosed bladder for offsite disposal (enclosed bladder within steel retaining wall). This bladder will be installed in the onshore Project Area, potentially on the DPD site pad, where bulk chemical storage will also be located.

In the event of a pipeline issue that requires remedial construction work, contingency plans will be implemented and the onshore pipeline's hydrotest section will be emptied to the bladder to facilitate these repairs. Once the onshore pipeline is successfully tested and pre-commissioned, the DLNG team will complete the tie-in with a golden weld to the offshore pipeline at the onshore termination point.

Alternatively, the onshore pipeline may be connected to the offshore pipeline at the onshore termination point (KP122.484) before the offshore pipeline is pre-commissioned so that FCGT can be undertaken by the Barossa team for the entire DPD pipeline (onshore and offshore sections).

2.3.4 Trench backfill and demobilisation at shore crossing

At the completion of the pipeline installation and pre-commissioning activities, the onshore trench will be backfilled with soil and topsoil from trenching and additional fill of specific parameters should engineering backfill be required. The disturbed onshore area relevant to the DLNG team will be returned to natural grade to match existing topography. Revegetation works are not proposed in this CEMP.

The Barossa team will be responsible for removal of the onshore support facilities shown in **Figure 2-2**. The DLNG team will be responsible for the removal of equipment and demobilisation as relevant to their scope.

2.3.5 Resource requirements and access

Other requirements of the onshore construction activity include the following:

- + Personnel will be required during the construction period. Labour will be recruited from the domestic and local labour market where possible; this is subject to the contractors' resourcing requirements at the time. Accommodation will be provided for the workforce within the Darwin area.
- + Power will likely be supplied by onsite generators to support construction amenities and operation of equipment.
- + Water usage including for dust suppression, washdown facilities and ablutions supply will likely be sourced from mains water supply within the DLNG Facility, or provided as self-sufficient water through containerised water trucks; and

- + Access to the onshore site will be via the existing DLNG access at the end of Middle Arm Peninsula into Wickham Point.

2.3.6 Fuels and chemicals

Chemical and fuel storage will be stored onsite within self-bunded fuel storage/tanks. Fuel trucks will likely be used to supply fuel to construction equipment, including excavators, graders, cranes, and generators, in accordance with standard refuelling procedures. Hydrotest chemicals will also be stored onshore within a bunded hydrotest spread (i.e. biocides, oxygen scavenger and dye).

2.3.7 Atmospheric Emissions

A GHG emissions study was conducted to determine the scope 1, 2 and 3 emissions from the DPD Project. The scope 1 emissions, within NT jurisdiction, are emissions that result directly from the construction DPD Project and include those from:

- + Vessel-based construction activities (offshore activities only)
- + Onshore power generating equipment (i.e. engines and generators)

Scope 2 and Scope 3 emissions are associated with the broader Barossa project and comprise emissions related to electricity use, transport and construction of materials and consumption of Barossa products by customers.

The total scope 1 emissions for the DPD offshore and onshore Project construction activities in the NT are approximately 50,000 tCo2-e

2.3.8 Wastes

Construction of the pipeline will produce the following wastes:

- + Onshore wastes including water from dewatering and general rubbish / food waste.
- + Trench spoil

Section 4.4.3 outlines waste management for the DPD project in more detail.

2.4 Indicative construction schedule

The indicative schedule to complete construction works is shown in **Figure 2-3**.

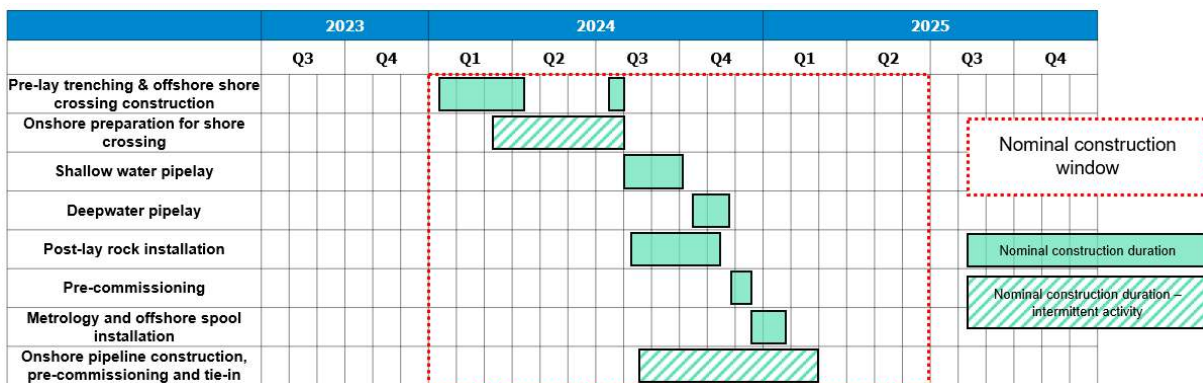


Figure 2-3: Nominal construction sequence and durations for the DPD Project

3 Legal and Other Obligations

The following sections describe the legislative framework governing the impacts from the construction of the DPD Pipeline (NT).

3.1 Barossa DPD project approvals

3.1.1 Commonwealth environmental approvals

The DPD Project including the DPD Pipeline section in Commonwealth waters was referred to the DCCEEW under the EPBC Act on 7 October 2022 (EPBC 2022/9372). On 6 December 2022 the DPD Project was determined to be a Controlled Action requiring further assessment based on Preliminary Documentation. Further information was requested under section 95A(2) of the EPBC Act on 23 December 2022.

It was determined that the Project may have a significant impact on the following controlling provisions under the EPBC Act:

- + Listed threatened species and communities (sections 18 & 18A)
- + Listed migratory species (sections 20 & 20A)
- + Commonwealth marine areas (sections 23 and 24A)

The Preliminary documentation is currently being prepared for submission to DCCEEW.

This CEMP will be updated to reflect any relevant regulatory conditions associated with this approval.

3.1.2 Northern Territory environmental approvals

The DPD Project was referred to the NT EPA on 14 January 2022 under Section 55 of the EP Act. The NT EPA determined the DPD proposal required assessment by SER (Tier 2) in accordance with the EP Regulations. The SER is required to address public submissions and include information additional to the referral document in relation to specific aspects of potential significance. This CEMP has been prepared for submission in draft form with the SER (BAS-210 0020) and other supporting documents to the NT EPA under the EP Act and will be updated to reflect any relevant regulatory conditions associated with the Santos Barossa DPD Project approvals. It will also be submitted to DITT for approval under the *Energy Pipelines Act 1981* (NT).

The following approvals are also required for construction of the DPD Project under NT legislation:

- + Department of Infrastructure, Planning and Logistics (DIPL) – Development Permit (*Planning Act 1999*) and Occupational Licence (*Crown Lands Act 1992*)
- + DITT – Energy Division Consent to construct and Consent to Test (*Energy Pipeline Act 1981* and *Petroleum (Submerged Lands) Act 1981*) Pipeline Licence (*Energy Pipeline Act 1981*)

Conditions within these permits, where they are relevant to the environmental management of works will be incorporated into future revisions of the CEMP.

Native vegetation clearing in the NT requires a permit issued under either the *Planning Act 1999* (NT) or the *Pastoral Land Act 1992* (NT). The onshore Project Area is within freehold land, therefore any native vegetation clearing for the activity will be controlled, as required, by the *Planning Act 1999* (NT) through a Development Permit.

3.1.3 Aboriginal Areas Protection Authority certificates

Aboriginal Areas Protection Authority (AAPA) certificates aim to protect indigenous sacred sites preventing damage from nearby works and outlines conditions to be followed when carrying out works on land and sea near to sacred sites across NT. The AAPA administer these certificates under the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT).

Santos has received an AAPA Authority Certificate (C2022-098) from AAPA on 23 December 2022 and will ensure the requirements of the certificate (including avoidance of restricted work areas) and the *Northern Territory Aboriginal Sacred Sites Act 1989* are met.

3.2 Legislative framework

Environmental legislative requirements governing DPD project are described in the following sections. All activities will comply with legislative requirements established under relevant Commonwealth and NT legislation. Key legislation is described below in **Sections 3.2.1.1, 3.2.1.2 and 3.2.1.3**. Other relevant legislation is described in **Table 3-1** and **Table 3-2**.

3.2.1 Key legislation

3.2.1.1 Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The EPBC Act is administered by DCCEEW. The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places, which are defined in the EPBC Act as matters of national environmental significance. There are nine matters of national environmental significance to which the EPBC Act applies these are: world heritage properties, national heritage places, wetlands of international importance, nationally threatened species and ecological communities, migratory species, Commonwealth marine areas, the Great Barrier Reef Marine Park, nuclear actions, and water resources (in relation to coal seam gas development and large coal mining development) (DCCEEW, 2022a). When a person proposes to take an action that they consider may need approval under the EPBC Act, they must refer the proposal to the Commonwealth Minister for Environment.

Section 3A of the EPBC Act sets out the principles of ecologically sustainable development, 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 construction and operation of the DPD Project (including the Commonwealth waters section) has been referred to DCCEEW under the EPBC Act and assessed to be a Controlled Action (referral number EPBC 2022/9372) requiring further assessment based on Preliminary Documentation (in progress).

3.2.1.2 Environment Protection Act 2019 (NT)

The EP Act and associated EP Regulations are administered by DEPWS. The EP Act protects the environment and related purposes of the NT. The Act also:

- + Promotes ecologically sustainable development
- + Recognises the role of environmental impact assessment and environmental approval in promoting the protection and management of the environment of the Territory
- + Provides for broad community involvement during the process of environmental impact assessment and environmental approval
- + Recognises the role that Aboriginal people have as stewards of their country as conferred under their traditions and recognised in law, and the importance of participation by Promotion of ecologically sustainable development

This CEMP has been developed under the guidance of this Act incorporating the identified core aspects above, as well as the NT EPA’s EMP guideline, and will be submitted as a draft to NT EPA with the DPD SER (BAS-210 0020) for assessment.

3.2.1.3 Energy Pipelines Act 1981 (NT)

The *Energy Pipelines Act 1981* (NT) allows for the creation of provisions for the construction, operation, maintenance and cessation of use or abandonment of pipelines for the conveyance of energy-producing hydrocarbons, and for related purposes. The *Energy Pipelines Act* applies to the DPD pipeline inshore from the NT Territorial Sea Baseline to the Onshore termination point.

The *Energy Pipelines Act 1981* (NT) and subsidiary Energy Pipelines Regulations require the proponent to operate 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, however it is DITT- Energy Division policy that an environmental management plan (EMP), is submitted to, with the PMP for approval. This CEMP and supporting plans will constitute the EMP to be provided with the PMP for approval under the *Energy Pipelines Act 1981*.

3.2.2 Other relevant legislation

3.2.2.1 Commonwealth legislation

Commonwealth legislative requirements relevant to the DPD Project onshore construction activities are outlined in **Table 3-1**.

Table 3-1: Commonwealth legislation relevant to the activity

Commonwealth	
Title	Description
<i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984</i>	The purpose of this act is to preserve and protect places and objects in Australia and in Australian waters from injury or desecration; places or objects in question must be of particular significance to Aboriginal people with Aboriginal tradition.
<i>Biosecurity Act 2015</i>	The Act describes how to manage biosecurity threats to plant, animal and human health in Australia and its external territories, ensuring a very low level of risk.

Commonwealth	
Title	Description
Industrial Chemicals (Notification and Assessment) Regulations 1990 (Cth) National Industrial Chemicals Notification and Assessment Scheme (NICNAS)	Industrial chemicals are regulated by the Australian Government and administered by NICNAS. NICNAS provides a national notification and assessment scheme to protect the health of the public, workers and the environment from the harmful effect of industrial chemicals. NICNAS also assess all chemicals new to Australia and existing chemicals on a priority basis, in response to concerns about their safety on health and environmental grounds.
<i>National Greenhouse and Energy Reporting Act 2007</i>	Introduces a single national reporting framework for the reporting and dissemination of information about GHG emissions, GHG projects and energy use and production of corporations.
<i>Native Title Act 1993</i>	This Act provides for the recognition and protection of native title and provides or permits for the validation of past acts and intermediate period acts, invalidated because of the existence of native title. It additionally establishes ways in which future dealings affecting native title may proceed and sets standards for those dealings and establishes mechanisms for determining claims to native title. There is a Native Title Determination (Tribunal ID DCD2006/001) over the onshore Project Area, Larrakia (Part A – consolidated proceeding). The outcome of the determination found that Native Title does not exist (National Native Title Tribunal, 2022).
<i>Ozone Protection and Synthetic Greenhouse Gas Management Act 1989</i>	This act, and associated regulations, implements the requirements of the Vienna Convention and Montreal Protocol to avoid using ozone depleting substances.

3.2.2.2 Northern Territory legislation

NT legislative requirements relevant to the DPD Project onshore construction activities are outlined in **Table 3-2**.

Table 3-2: Northern Territory legislation relevant to the activity

Northern Territory	
Title	Description
<i>Aboriginal Land Rights (Northern Territory) Act 1976</i>	The Act provides the basis upon which Aboriginal Australian people in the Northern Territory can claim rights to land based on traditional occupation
<i>Aboriginal Land Act 1978</i>	This Act provides for the access to Aboriginal land, certain roads bordered by Aboriginal land and the seas adjacent to Aboriginal land.
<i>Bushfires Management Act 2016</i> Bushfires Management (General) Regulations 2017	The Act establishes the Bushfires Council and provides for the prevention and control of bushfires in the NT.

Northern Territory	
Title	Description
<i>Dangerous Goods Act 1998</i> and <i>Dangerous Goods Regulations 2017</i>	This Act provides for the safe storage, handling, and transport of certain dangerous goods. These being explosives (including fireworks) and fuel gas (including Autogas) (NT WorkSafe, 2020).
<i>Environmental Offences and Penalties Act 2011</i>	This Act defines levels and penalties for environmental offences
<i>Fire and Emergency Act 1996</i> Fire and Emergency Regulations 1996	This Act provides for the establishment and operation of the NT Fire and Rescue Service and their operational and emergency response activities. The Regulations outline general requirements under the Act, such as storing flammable or combustible material and using cutting, heating and welding equipment.
<i>Northern Territory Environment Protection Authority Act 2012</i>	This act aims to: a) promote ecology sustainable development; b) to protect the environment, having regard to the need to enable ecologically sustainable development; (c) to promote effective waste management and waste minimisation strategies; and (d) to enhance community and business confidence in the environmental protection regime of the Territory.
<i>Planning Act 1999</i> Planning Regulation 2000	The Act provides framework of controls for the orderly use and development of land. The objective of the Act includes ensuring that strategic planning is applied to planning schemes and implemented in individual planning decisions, promotion of sustainable development of land and promotion of the responsible use of land and water resources to limit the adverse effects on development of ecological processes. Division 2 of the Act provides the planning basis for the submission, review and authorisation of Exceptional development permits (EDPs), and related EDP variations. An EDP has been issued for the DLNG Facility. Approval for the DPD Project will be obtained under the <i>Planning Act 1999</i> (NT), Santos is consulting with DIPL regarding the pathway for this approval.
<i>Territory Parks and Wildlife Conservation Act 1976</i>	This Act provides for the establishment of Territory Parks and other parks and reserves and for the study, protection, and conservation of wildlife in NT. This includes provisions on changes and revocation of parks, reserves and sanctuaries, the preparation and implementation of plans of management, the creation and management of sanctuaries and on the management of wildlife, flora, and fauna.
<i>Waste Management and Pollution Control Act 1998</i> Waste Management and Pollution Control (Administration) Regulations 1998	This Act provides for the protection of the environment through encouragement of effective waste management and pollution prevention and control practices and for related purposes.
<i>Weeds Management Act 2001</i>	This Act allows for the classification of declared weeds or potential weeds, requirements for managing declared weeds or potential weeds and preparing management plans.

3.2.3 International conventions and agreements

Australia is signatory to numerous international conventions and agreements that obligate the Commonwealth government to prevent pollution and protect specified habitats for flora and fauna. Those which are relevant to the activity are outlined in **Table 3-3**.

Table 3-3: International agreements and conventions relevant to the activity

International agreements and conventions	
Title	Description
China-Australia Migratory Bird Agreement (CAMBA)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and China. Implemented in the EPBC Act.
Japan-Australia Migratory Bird Agreement (JAMBA)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and Japan. Implemented in the EPBC Act.
Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)	This agreement recognises the special international concern for the protection of migratory birds and birds in danger of extinction that migrate between Australia and Korea. Implemented in the EPBC Act.
United Nations Convention on Biological Diversity – 1992	An international treaty to sustain life on earth.
United Nations Framework Convention on Climate Change (1992)	The objective of the convention is to stabilise GHG concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system. Australia ratified the convention in December 1992, and it came into force on 21 December 1993.

3.3 Standards, codes and guidelines

There are several Australian Standards, Codes of Practice and Guidelines relevant to this CEMP, which have been identified below.

- + AS2885 Pipelines – Gas and Liquid Petroleum
- + AS/NZS 4801 Occupational Health and Safety Management
- + AS/NZS ISO 9001:2008, Quality management systems – Requirements
- + AS/NZS ISO 14001:2004, Environmental management system – Requirements with guidance for use
- + AS/NZS ISO 31000:2009, Risk management – Principles and guidelines
- + HB 203:2006 Environmental Risk Management – Principles and Process
- + Draft Guidelines for the Preparation of an Environmental Management Plan (NT EPA, 2015)
- + Guideline for Reporting on Environmental Monitoring (NT EPA, 2016)

4 Environmental Management Framework

4.1 Santos management system

Santos's Management System (known as the SMS) exists to support its moral, professional, and legal obligations to undertake work in a manner that does not cause harm to people or the environment. The framework of policies, standards, processes, procedures, tools, and control measures that, when used together by a properly resourced and competent organisation, result in:

- + A common HSE approach is followed across the organisation.
- + HSE is proactively managed and maintained.
- + The mandatory requirements of HSE management are implemented and are auditable.
- + HSE management performance is measured, and corrective actions are taken.
- + Opportunities for improvement are recognised and implemented.
- + Workforce commitments are understood and demonstrated.

The Implementation Strategy and Stakeholder Consultation sections within this CEMP (**Section 8** and **Section 9**) align with the Santos Management System structure and are designed to require that:

- + environmental impacts and risks continue to be identified for the duration of the activity and reduced to ALARP.
- + controls are effective in reducing environmental impacts and risks to ALARP and acceptable levels.
- + environmental performance objectives (EPOs) and environmental performance standards (EPSs) set out in this CEMP are met.
- + consultation with relevant and interested persons is maintained throughout the activity as appropriate.

4.2 Santos' Environment, Health, and Safety Policy

Santos' Environment, Health and Safety Policy (**Appendix 1**) clearly sets out its strategic environmental objectives and the commitment of the management team to continuous environmental performance improvement. This CEMP has been prepared in accordance with the fundamentals of this policy. By accepting employment with Santos, each employee and contractor is made aware during the recruitment process that he or she is responsible for the application of this policy.

4.3 DPD Project environmental management plans

This CEMP is part of a suite of environmental management plans covering all activities from the 3 nm Commonwealth/NT waters boundary to the upstream weld of the beach valve. This onshore CEMP covers activities between the onshore termination point and the upstream weld of the beach valve and the offshore CEMP (BAS-210 0024) covers activities between the Commonwealth/NT waters boundary and onshore termination point. The TSDMMP (BAS-210 0023), ASSDMP (BAS-210 0049) and MMNMP (BAS-210 0045) sit under the CEMPs addressing specific activities. These activities are described in **Section 1.3**. outlines this management plan hierarchy.

4.4 Supporting management processes and procedures

4.4.1 Contractor Health, Safety and Environment requirements

The HSE requirements for contracts/contractor management during pre-contract planning, contracting, contract execution and contract completion and evaluation are outlined in the HSE Contractor Management Operating Standard (SMS-HSS-OS08) and the Contracting and Procurement Operating Standard (SMS-PRC-OS01). It includes the following minimum requirements:

- + Contractors to comply with all applicable HSE laws and regulations and any additional guidelines, operating standards, policies and management plans provided to the Contractor.
- + A review of the Contractor HSE Management System is completed before being contracted.
- + Provisions for Santos to conduct audits/inspections of the Contractor's operations, equipment and emergency procedures at any time.

4.4.2 Chemical selection and assessment procedure

All chemicals that are planned to be used on site during the DLNG construction activity will be evaluated using a defined framework and set of tools to ensure potential impacts are acceptable, ALARP and met Santos' expectation for environmental performance.

DLNG construction personnel and contractors will adhere to the process outlined in the Chemical Management Procedure (ALL/HSE/PRO/044) and approved chemicals and hazardous substances will be recorded on the DLNG Approved Chemicals and Hazardous substances register (DLNG/HSE/REG/001).

4.4.3 Santos waste management process

As per the Santos Environment Hazard Controls Procedure (SMS-EXA-OS01-PD02), Santos requires that for all waste generated at its facilities and by contractors under its influence, the hierarchy of waste management applies whereby wastes are (in order of preference) avoided, reduced, re-used, recycled, treated and/or disposed of at an appropriately licensed facility. A waste inventory must be documented and records of waste disposal from the onshore site are standardised (Waste Monitoring and Reporting Procedure - SMS-EXA-OS01-PD02-PD01) to allow accurate and consistent waste tracking. Contractors under this CEMP will demonstrate waste management processes aligned with regulatory and Santos' requirements through a Waste Management Plan.

5 Existing Environment

This section describes the key physical, biological, socio-economic and cultural characteristics of the existing environment that may be impacted by planned and unplanned events associated with the activity.

The description of the environment applies to the terrestrial land within which planned activities will occur (onshore Project Area; see **Figure 2-1**), and the terrestrial land and coastal waters that may be impacted by unplanned events. While highly unlikely, unplanned events could impact marine receptors within a few kilometres of the onshore Project Area.

5.1 Information sources

A summary of information derived from the following documents are provided in this section:

- + Darwin Pipeline Duplication (DPD) Project – EPBC Referral Supporting Information (BAA-201 0004; Santos, 2022a), including a Protected Matters Search Tool (PMST) report undertaken in October 2021 for a 5 km radius from the DPD pipeline
- + DLNG Operations Environmental Management Plan (OEMP) (ConocoPhillips, 2018)
- + Ichthys Gas Field Development Project – Draft Environmental Impact Statement (INPEX Browse Ltd, 2010)
- + Fauna conservation advice and recovery plans relevant to the onshore Project Area and within a few kilometres of it.

5.2 Key environmental factors

5.2.1 Terrestrial environmental quality

5.2.1.1 Bioregion

Based on the Interim Biogeographic Regionalisation for Australia Version 7, the onshore Project Area and surrounding areas are within the Darwin Coastal bioregion (Australian Government, 2022).

The Darwin Coastal bioregion comprises gently undulating plains on lateritised Cretaceous sandstones and siltstones; sandy and loamy red and yellow earths and siliceous sands from near the mouth of the Victoria River to just west of Cobourg Peninsula. The most notable vegetation feature is the extensive and diverse floodplain environment associated with the lower reaches of the many large river systems. There are also substantial areas of mangroves, and rainforest and other riparian vegetation fringing the rivers. Inland from the coast, the dominant vegetation type is eucalypt tall open forest, typically dominated by Darwin woollybutt (*Eucalyptus miniata*) and Darwin stringybark (*E. tetradonta*) (Baker *et al.*, 2005).

5.2.1.2 Geology, soils and geomorphology

The bedrock of the onshore Project Area is comprised of meta-sediments that have metamorphosed and undergone one major deformation, resulting in steep dips and a north-north-east orientated strike of the strata (BAA-201 0003; Santos, 2021). The shore crossing's Burrell Creek Formation comprises of a sequence of phyllite, siltstone, shale, sandstone and conglomerate (ConocoPhillips, 2019).

The Koolpinyah Surface was developed in the Later Tertiary through an extensive cycle of deep weathering, erosion, re-sorting and lateralisation occurred throughout the Top End of the NT (Dames & Moore Pty Ltd, 1997). Parts of the Koolpinyah Surface are present on the Wickham Point peninsula,

forming laterite deposits on the lower slopes' bench areas of the flanks of the ridges and as extensive platforms near sea level. There is a prominent ferricrete pavement near sea level that extends seawards out to the low tide level. It forms a capping on the shallow near shore reefs (ConocoPhillips, 2019).

Tidal mudflats surround the Wickham Point peninsula, which includes mangrove flats or salt flats. The mudflats are composed of Quaternary marine alluvium which consists of clay, silt and some fine sand, commonly with shell and coral fragments and organic matter in the mangrove zone and salt crusting on the salt flats (Dames & Moore Pty Ltd, 1997).

5.2.1.3 Topography and land units

The Darwin Coastal bioregion is characterised by generally flat, low-lying country that is drained by several large rivers (Bastin and the ACRIS Management Committee, 2008). The local topography at 1:2,500 scale of the onshore pipeline area is approximately 8 to 10 metres above Australian Height Datum (m AHD) and the broader onshore Project Area gently slopes to 6 m AHD along its southern boundary (DEPWS, 2022). The majority of the onshore Project Area has a slope of less than 2% (BAA-201 0003; Santos, 2021).

Two land units have been mapped over the onshore Project Area, noting that this area has been highly disturbed due to the DLNG Facility and the Bayu-Undan pipeline. The land units included (DEPWS, 2022; DLRM, 2015):

- + Low Hills – Steeply sloping ridge terrain; gradient 10 – 40%; shallow stony lithosols: Eucalypt Woodland, minor Open Woodland
- + Rises – Low rises (adjacent to estuarine areas); gradient 1 – 2.5%; shallow gravelly lithosols: Variable Tall Shrubland or Eucalypt Open Forest.

Soil orders across Wickham Point vary with the land units, generally Kandosols in the higher landscapes and Hydrosols in the lower landscapes (BAA-201 0003; Santos, 2021). The Keefers Hut and Littoral land systems overlap the onshore Project Area (DEPWS, 2022). The Keefers Hut land system area has largely been disturbed by the DLNG Facility and is described as plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products and sandy and earth soils. The Littoral land system which encompasses most of Wickham Point, is characterised as tidal mudflats and coastal floodplains with channels and estuaries. It is subject to tidal inundation and has poorly drained clays and muds.

5.2.1.4 Rainfall and cyclone activity

The mean annual rainfall for Darwin is 1723.8 mm with the majority of this (87%) rainfall coming in wet season months between November and March. Mean 9am and 3pm relative humidity is also higher in the wet season following similar trends to rainfall (BOM, 2022).

5.2.1.5 Acid sulfate soils

ASS are formed naturally and often occur in low lying coastal areas (BAA-201 0003; Santos, 2021). Coastal estuarine and mangrove environments develop ASS due to its typical waterlogged nature, saltwater influences and anaerobic soils.

ASS mapping over the Darwin region indicates that the onshore Project Area has a high potential for PASS to occur (BAA-201 0003; Santos, 2021). As a result of the historical earthworks undertaken as part of the development of the DLNG facility, the natural material has been removed across the onshore zone and replaced by imported (non-ASS) fill material (generally sand) up to a depth of approximately 6 m below ground level (Santos, 2022b).

5.2.2 Terrestrial ecosystems

5.2.2.1 Flora, vegetation communities and weeds

5.2.2.1.1 Flora

A search of the DEPWS Natural Resource (NR) Maps database for threatened flora and significant flora within 5 km of the onshore Project Area identified one significant flora species, *Byblis* (*Byblis aquatica*) (DEPWS, 2022). This species is listed as near threatened under the *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act) and was recorded approximately 5 km to the south-east of the onshore Project Area. It grows in semi-aquatic conditions and is insectivorous to acquire nutrients in nutrient-poor environments (Atlas of Living Australia, 2022). This species is commonly found in areas specifically between Darwin and Berry Springs.

Previous flora surveys of the DLNG Facility disturbance envelope did not identify the presence of any threatened or conservation significant flora species (BAA-201 0003; Santos, 2021). The *Byblis* is unlikely to occur within the onshore Project Area as it has been previously disturbed and there are no permanent freshwater habitats present (BAA-201 0003; Santos, 2021).

5.2.2.1.2 Vegetation communities

The vegetation on the Middle Arm Peninsula and inland of Darwin is consistent with the Darwin Coastal Bioregion and is classified as various closed forest and woodland communities, that is dominated by *Eucalyptus* woodlands and *Acacia* forest (BAA-201 0003; Santos, 2021).

CDM Smith (2021b) undertook a vegetation assessment of the DPD shore crossing location, inclusive of the approximately 200 m of onshore pipeline. The onshore pipeline alignment is maintained in a cleared state and is currently covered with naturally regrown native grasses and weeds. Visible vegetation along the southern extent of the onshore Project Area is dominated by common and fast growing *Acacia* species (*A. auriculiformis*) (CDM Smith, 2021b). Vegetation mapped outside of the onshore Project Area is described as closed forests, including *Acacia* closed forest, *Rhizophora* mid closed forest and *Sonneratia* low closed forest (DEPWS, 2022). No ecological communities listed under territory or Commonwealth legislation were recorded by CDM Smith (2021b) within the Project Area.

5.2.2.1.3 Mangroves

Monitoring of the mangrove communities surrounding the DLNG Facility has been ongoing since 2006 (CononoPhillips, 2018). They are comprised of predominately *Rhizophora* and *Sonneratia* species and to a lesser extent *Aegialitis*, *Avicennia*, *Osbornia* and *Aegiceras* species. The data collected indicates that the mangrove communities are in good health, with no significant deterioration or stress resulting from DLNG Facility operations.

CDM Smith's (2021b) vegetation assessment of the DPD shore crossing location identified less than five individuals of one mangrove species, *Sonneratia alba*, within 20 m either side of the DPD pipeline alignment. This species of mangrove is a common taxon that is well represented and characterised in the DLNG Facility's mangrove monitoring program. CDM Smith (2021b) concluded that the vegetation in proximity to the DPD pipeline is of low ecological value and well represented in the area.

These mangroves are located outside of the pipeline alignment for the approximately 200 m section of onshore pipeline, therefore are unlikely to be impacted by the onshore works relevant to this CEMP.

5.2.2.1.4 Introduced flora species

A desktop assessment of the NT DEPWS's NR Maps identified 11 introduced species (weeds) within approximately 5 km of the onshore Project Area (DEPWS, 2022) (**Table 5-1**). Three of the weed species

are declared under the *Weeds Management Act 2001* (NT) and are Weeds of National Significance (WONS) (Centre for Invasive Species Solutions, 2020).

The DLNG Facility currently manages weeds in accordance with the DLNG OEMP (ConocoPhillips, 2018) which includes annual monitoring of weeds within the DLNG Facility site and lease area, and active weed management through herbicide application by grounds services contractor. Considering the onshore Project Area is entirely within the DLNG disturbance envelope, control measures to limit the introduction or spread of weeds during construction will be in line with the DLNG operational requirements (BAA-201 0003; Santos, 2021).

Table 5-1: Introduced species potentially found within and proximate to the onshore Project Area

Name	Status		Potential for occurrence within the onshore Project Area
	Declared under <i>Weeds Management Act 2001</i> (NT)	WONS	
<i>Adenosma indiana</i>	No	No	The closest recording of <i>Adenosma indiana</i> is approximately 3 km to the south-east on the Wickham Point peninsula. It is possible that this species could occur within the onshore Project Area.
Gamba Grass <i>Andropogon gayanus</i>	Yes	Yes	Gamba Grass may occur within the onshore Project Area as it has been previously identified within the DLNG Facility site (Greening Australia, 2015).
Aristolochia <i>Aristolochia indica</i>	No	No	The closest recordings of Aristolochia are on Channel Island, approximately 2.4 km to the south. It is possible that this species could occur within the onshore Project Area.
Rubber Bush <i>Calotropis procera</i>	Yes	No	The closest recording of a Rubber Bush is approximately 3.5 km to the south-east on the Wickham Point peninsula. It is possible that this species could occur within the onshore Project Area.
Golden Rain Tree <i>Cassia fistula</i>	No	No	The closest recordings of Golden Rain Tree are on Channel Island, approximately 3 km to the south. It is possible that this species could occur within the onshore Project Area.
Couch Grass <i>Cynodon dactylon</i>	No	No	The closest recording of Couch Grass is approximately 2 km to the south-east on the Wickham Point peninsula. It is possible that this species could occur within the onshore Project Area.
Bellyache Bush <i>Jatropha gossypifolia</i>	Yes	Yes	The closest recordings of Bellyache Bush are on Channel Island, approximately 3 km to the south. It is possible that this species could occur within the onshore Project Area.

Name	Status		Potential for occurrence within the onshore Project Area
	Declared under Weeds Management Act 2001 (NT)	WONS	
Lantana <i>Lantana camara</i>	Yes	Yes	Lantana may occur within the onshore Project Area as it has been previously identified within the DLNG Facility site (Greening Australia, 2015) and it has been recorded immediately adjacent to the onshore Project Area's southern boundary (DEPWS, 2022).
Coffee Bush <i>Leucaena leucocephala</i> subsp. <i>leucocephala</i>	No	No	The closest recordings of Coffee Bush are on Channel Island, approximately 3.3 km to the south. It is possible that this species could occur within the onshore Project Area.
Passiflora <i>Passiflora foetida</i>	No	No	Passiflora may occur within the onshore Project Area as it has been previously identified within the DLNG Facility site (Greening Australia, 2015).
Flannel Weed <i>Sida cordifolia</i>	Yes	No	The closest recording of Flannel Weed is approximately 2 km to the south-east on the Wickham Point peninsula. It is possible that this species could occur within the onshore Project Area.

5.2.2.2 Terrestrial fauna and fauna habitat

5.2.2.2.1 Threatened and migratory terrestrial fauna

A desktop assessment of the NT EPA referral's PMST search results and the NT DEPWS's NR Maps identified a number of threatened and significant fauna species within 5 km of the onshore Project Area (BAA-201 0003; Santos, 2021; DEPWS, 2022). These species may be present proximate to the onshore Project Area. However, given that the onshore Project Area has been previously cleared and is currently comprised of regenerating native grasses and weeds, it is not considered to be representative of habitat where most of the identified fauna species would likely occur (BAA-201 0003; Santos, 2021).

The criteria applied to define the likelihood of occurrence for terrestrial fauna is:

- + Unlikely: the Project Area is not within the species known distribution; and/or suitable habitat is not present within the Project
- + Potential: the Project Area is within the species known distribution, but the species has not been recorded within 5 km of the Project; and the Project Area contains suitable habitat for the species.
- + Likely: the species has been recorded within 5 km of the Project in the past 10 years; and the Project Area contains suitable habitat for the species.
- + Known to occur: the species has been recorded (directly by commissioned surveys or from database records) within the Project Area in the past 10 years.

The likelihood of conservation significant terrestrial fauna species occurring within the onshore Project Area, as determined in the NT EPA referral, is summarised in **Table 5-2**. Note the terrestrial fauna with a likelihood defined as "unlikely" are not listed in **Table 5-2**.

Table 5-2: Conservation significant terrestrial fauna species potentially found within and proximate to the onshore Project Area

Name	Status		Occurrence likelihood	Potential for occurrence within the onshore Project Area
	EPBC Act	TPWC Act		
Terrestrial mammals				
Migratory Terrestrial / Wetland Species				
Common Sandpiper <i>Actitis hypoleucos</i>	Migratory	Not Listed	Potential	In Australia, the common sandpiper is found along all coastlines and in many areas inland, the common sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats (DCCEEW, 2022b). The common sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream, around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties. There is no suitable habitat for nesting or roosting within the onshore Project Area. However, there is potential habitat for foraging in the surrounding area, therefore individuals may traverse the onshore Project Area.
Oriental Plover <i>Charadrius veredus</i>	Migratory	Not Listed	Potential	This species has not been recorded within a 5 km radius of the onshore Project Area (DEPWS, 2022). The oriental plover is a non-breeding visitor to Australia where it occurs in both coastal and inland areas (DCCEEW, 2022c). In coastal habitats this species is found on estuarine mudflats and sandbanks, sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands. In inland regions the oriental plover inhabits flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns, and cattle camps. There are regrown grasses located near the coastline within the onshore Project Area, which may provide habitat for the oriental plover. Therefore, individuals may occasionally visit the onshore Project Area.

Name	Status		Occurrence likelihood	Potential for occurrence within the onshore Project Area
	EPBC Act	TPWC Act		
Osprey <i>Pandion haliaetus</i>	Migratory	Not Listed	Potential	Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands (DCCEEW, 2022d). They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish, or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterhole. Nests are usually located near a suitable area of foraging habitat and are a bulky structure made from piled sticks, often positioned in a tall dead tree or artificial structures such as telecommunication towers or poles. There is no suitable habitat for nesting or roosting within the onshore Project Area, however the onshore Project Area and surrounds contain suitable foraging habitat for the species. There is an osprey nest on the DLNG Facility site (BAA-201 0003; Santos, 2021).
Grey Plover <i>Pluvialis squatarola</i>	Migratory	Not Listed	Potential	Non-breeding birds occur around coastal Australia, with approximately 12,000 annually migrating to Australia (DCCEEW, 2022e). They inhabit intertidal mud flats, salt marshes, sand flats and beaches and feed on polychaete worms, molluscs and crustaceans. There is no suitable habitat for nesting or roosting within the onshore Project Area. However, there is suitable habitat for foraging in the surrounding area, therefore individuals may traverse the onshore Project Area.

5.2.2.2.2 Introduced terrestrial fauna species

There are six introduced species that have been recorded within 5 km of the onshore Project Area (DEPWS, 2022). This included Rock Dove (*Columba livia*), Cane Toad (*Rhinella marina*), Asian House Gecko (*Hemidactylus frenatus*), Cat (*Felis catus*), Pig (*Sus scrofa*) and Black Rat (*Rattus rattus*).

Cats are established at Wickham Point, likely prior to the DLNG Facility was constructed, and are currently present in relatively low numbers (ConocoPhillips, 2018). Wild dogs are also present in low numbers, according to the presence of scats and tracks and observations by the DLNG Facility staff. There are no cat or dog control programs in place as there is no reason to implement one at this time. Cane toads are established at Wickham Point and may pose a threat to native predator populations (ConocoPhillips, 2018). Browsing ants (*Lepisiota frauenfeldi*) have been recorded at Darwin Port region in 2015, with known infestations found at Wickham Point, East Arm, Frances Bay and Berrimah (NT Government, 2022). Browsing ants can cause native species decline and alter ecosystem function by forming large colonies that displace native ants and invertebrates and strip native vegetation.

5.2.2.2.3 Biting pests

The Middle Arm Peninsula is known to have large populations of biting insects (i.e. mosquitos and midges) due to nearby mudflats and mangroves breeding sites along the peninsula shoreline, Hudson Creek and Bleasers Creek (Department of Health, 2011). There are also a number of breeding sites within constructed surfaces, including large mud ponds, shallow depressions on reclaimed land and on a site used for borrowing material, drainage lines and small sediment traps (BAA-201 0003; Santos, 2021).

Two mosquito species, northern salt marsh mosquito (*Aedes vigilax*) and common banded mosquito (*Culex annulirostris*), have been recorded in high numbers during the wet season at Middle Arm (Warchot and Whelan, 2010). They can occupy the same breeding sites, with breeding occurring when flooding lasts over seven days (BAA-201 0003; Santos, 2021). The northern salt marsh mosquito is recorded in high numbers from December to January, while the common banded mosquito is recorded in high numbers from January to April.

5.2.3 Inland and intertidal water quality

5.2.3.1 Groundwater and surface water

There are no permanent surface water features located in the onshore Project Area or its surrounds, however there are several minor creek lines that flow from high areas into Darwin Harbour during the wet season (ConocoPhillips, 2019). Surface water runoff can erode sediments and transport them into the harbour due to intense rainfall causing strong surface water flows and the structureless and sodic nature of soils in the Darwin regions (BAA-201 0003; Santos, 2021).

There are currently six groundwater bores located at the DLNG Facility and one offsite reference bore that have been monitored biannually since 2015 (DEPWS, 2022 and BAA-201 0003; Santos, 2021). Groundwater levels vary seasonally, with higher levels during the wet season and lower levels during the dry season. Groundwater levels averaged 5.43 mAHD in the wet season and 2.45 mAHD in the dry season in 2021 (CDM Smith, 2021a). Field measurements of groundwater from March 2015 to August 2021 found that pH was mostly acidic, ranging from 4.1 to 7.7 with an average of 6 pH units, and conductivity ranged from 98 microSiemens per centimetre ($\mu\text{S}/\text{cm}$) to 91,800 $\mu\text{S}/\text{cm}$ with an average of 16,994 $\mu\text{S}/\text{cm}$. Conductivity varies subject to the seasons and bore proximity to the saline Darwin Harbour. Heavy metals are naturally elevated in all bores, which reflects the geology of the area (ConocoPhillips, 2019). The onshore Project Area overlaps the DLNG Facility's Irrigation Area, which is irrigated with wastewater from the DLNG wastewater treatment plant. All average metal concentrations, except arsenic, iron and manganese, are higher at the reference bore than the onsite

bores which is likely a result from the irrigation water diluting natural concentrations (ConocoPhillips, 2019). Total nitrogen concentrations range from below the limit of reporting (LOR) to 66 mg/L and total phosphorus concentrations range from below the LOR to 1.76 mg/L (CDM Smith, 2021a). In comparison to the reference bore, some of the onsite bores have recorded elevated nutrient concentrations (ConocoPhillips, 2019).

5.2.3.2 Wetlands

The Port Darwin wetlands (NT029 Port Darwin) are listed as a Nationally Important Wetland under the Directory of Important Wetlands in Australia (Australian Government, 2022). The wetlands are located on the inner shores of the entire embayment of Port Darwin and includes 48,000 hectares (BAA-201 0003; Santos, 2021). The onshore Project Area is adjacent to a mangrove wetland to the south which is of low ecological value (BAA-201 0003; Santos, 2021; Australian Government, 2022).

5.2.3.3 Intertidal area

Part of the DPD Project Area is situated in a low-lying intertidal area. The clayey nature of the underlying soils and the surrounding area results in localised pooling of rainfall and limited/low infiltration rates. The site is largely cleared of large vegetation due to historical earthworks associated with the installation of the existing Bayu-Undan to Darwin GEP.

The coastline of the site is fringed by mangroves and clayey tidal flats to the north and south of the site.

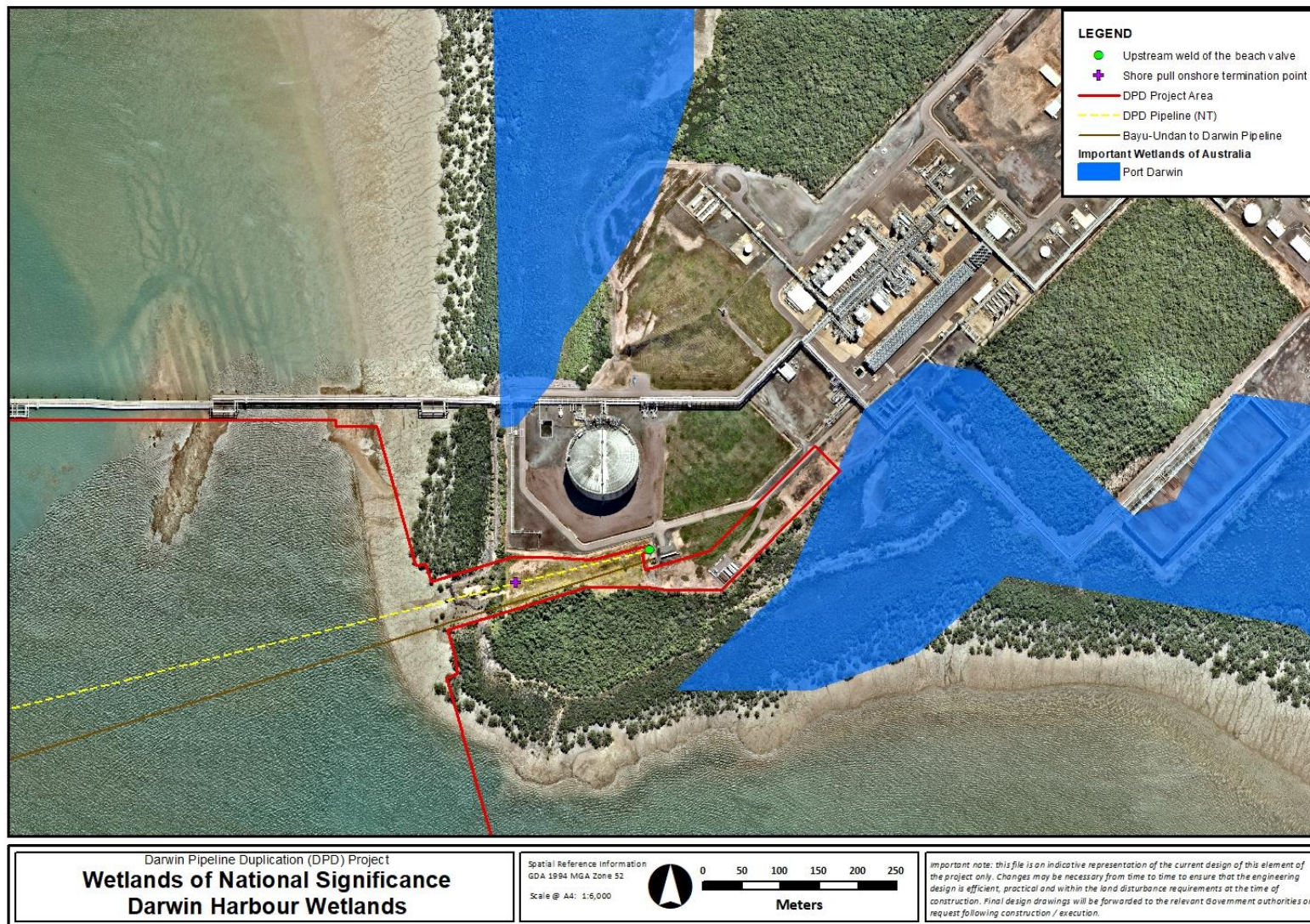


Figure 5-1: Wetlands of national significance - Darwin Harbour wetlands

5.2.4 Climate and air quality

5.2.4.1 Climate

The climate of the onshore Project Area is characterised by a tropical monsoonal climate with a distinct dry season (June to September) and wet season (October to April) (BOM, 2019). As described at the Darwin Airport weather station (BOM, 2022), the dry season is dominated by cooler temperatures, low humidity and minimal rainfall, whereas the wet season is dominated by warmer temperatures, high humidity and high rainfall, with high rainfall rates usually occurring during storm events.

Wind speeds are generally stronger in the dry season, generally coming from a south-easterly direction in the morning and from an easterly or north-westerly direction in the afternoons (BOM, 2022). Winds generally come from a westerly direction in the morning and from a north-westerly direction in the afternoon during the wet season.

Tropical cyclones occur on average once every four years (BOM, 2018). Storm surges often result in flooding, raised tidal levels and increased wave heights resulting in damage. These impacts are mostly felt within 50km of the coastline.

5.2.4.2 Air quality

Within nearshore NT coastal waters, particularly within Darwin Harbour, local and regional air quality is impacted by several anthropogenic influences, such as local industry, shipping and urban traffic and bushfires on a seasonal basis (BAA-201 0003; Santos, 2021). Air quality monitored by the NT EPA monitoring network in Darwin and its surrounds, including particular matter, carbon monoxide, sulphur dioxide, nitrogen dioxide, nitrogen oxide and ozone, found that Darwin has good air quality (Katestone, 2016).

5.2.5 Community and economy

5.2.5.1 Baseline noise

Noise modelling for the DLNG Facility by Bechtel Australia Pty Ltd (2001) predicted that the operational facility would not exceed 70 decibels A-weighted (dB (A)) at the property boundary with levels at Darwin predicted to be well below 45 dB (A) during normal atmospheric conditions. Noise monitoring that was undertaken in 2006 (SVT, 2007) to measure ambient background and construction noise for the DLNG Facility validated these findings, as the results indicated typical minimum noise levels at commercial or residential areas ranged from 34.2 dB (A) to 41.0 dB (A).

5.2.5.2 Petroleum industry

The onshore Project Area is entirely within the DLNG disturbance envelope. Gas produced offshore is conveyed via the Bayu-Undan to Darwin GEP to be converted into LNG at the DLNG Facility. The LNG is then transported to international markets (BAA-201 0003; Santos, 2021).

There is another LNG facility on Middle Arm, which is operated by INPEX, called the Ichthys LNG Project and is located approximately 5.5 km to the east of the DLNG.

5.2.6 Culture and heritage

There are no World Heritage properties and no heritage places on the National Heritage List or the Register of the National Estate within the onshore Project Area (DCCEEW, 2022f). No European heritage sites are currently listed at Wickham Point, with the remnants of artefacts documented and removed prior to the construction of the DLNG Facility (BAA-201 0003; Santos, 2021).

There are no Aboriginal sacred sites identified by the Aboriginal Areas Protection Authority under the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) within the onshore Project Area (BAA-201 0003; Santos, 2021). There are no known Aboriginal burial grounds on Wickham Point, and possible burial grounds located at the northern extremity of Wickham Peninsula are well separated from the onshore Project Area (ConocoPhillips, 2018). A number of middens within and adjacent to the DLNG Facility disturbance envelope were subject to investigation with the former Heritage Branch of Department of Infrastructure, Planning and Environment. Shell middens are the most commonly recorded type of archaeological site within the Darwin region.

5.2.7 Recovery plans

Recovery Plans set out the research and management actions necessary to stop the decline of and support the recovery of listed Threatened species under the EPBC Act. **Table 5-3** summarises the current threats relevant to the activity, with more information about the specific requirements of the relevant management plans (including Conservation Advice and Conservation Management Plans) that would be applicable to the activity and demonstrates where current management requirements have been considered.

Table 5-3: Threats and strategies from relevant recovery plans, conservation advice and management plans

Name	Recovery Plan/Conservation Advice/Management Plan	Threats identified as relevant to the activity	Addressed (where relevant)
Migratory Terrestrial / Wetland Species			
Shorebirds (including common sandpiper, Oriental plover and grey plover) Seabirds (including Osprey)	National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds (Department of the Environment and Energy [DoEE], 2020) Wildlife Conservation Plan for Seabirds (DAWE, 2020)	Light pollution Habitat loss and modification	Section 7.6.3 Section 7.6.1, 7.6.2, and 7.7.2

6 Impact and risk Assessment

This CEMP has employed a systematic impact and risk assessment process for the environmental management of the DPD Project construction activities. The impact and risk assessment process has been developed in line with Santos' Environmental Impact Identification (ENVID) process and is consistent with the requirements of the NT EPA Draft Guideline for the Preparation of an Environmental Management Plan (NT EPA, 2015).

6.1 Conceptual Site Model

A conceptual site model, as required by the NT EPA, is a written or illustrated representation of the nature, fate and transport of discharges, wastes or contaminants that allows assessment of potential and/or actual exposure of the environment to contaminants (NT EPA, 2015). The conceptual site model for this CEMP is embedded within the risk assessment detailed in **Table 6-7**.

6.2 Impact and risk assessment methods

The CEMP environmental impact and risk assessment was performed consistent with the Santos' Risk Matrix Procedure (SMS-LRG-OS01-TP02) and identification of management actions was consistent with Santos' Environment Hazard Controls Procedure (SMS-EXA-OS01-PD02). An environmental aspect, for the purpose of this environmental management plan, is defined as characteristics of the construction activities that could potentially affect the environment.

6.2.1 Identification of environmental hazard

Environmental hazards for this CEMP were identified using Santos' DPD Project NT EPA Referral (BAA-201 0002; Santos, 2021), DPD Project Basis of Approval (BAS-210 0005; Santos, 2022c) and discussion by the DPD Project team and environmental specialists. Key DPD Project construction activities and associated hazards and results from key technical studies were presented during ENVID workshops to inform the impact and risk assessment process.

6.2.2 Standard controls

The standard controls identified in **Table 6-7** were drawn from:

- + Santos' DPD Project NT EPA Referral (BAA-201 0002; Santos, 2021)
- + Santos' environmental plans and procedures for similar activities
- + Regulator approved management plans developed by other proponents.

Additional controls were provided by ENVID workshop attendees based on their relevant experience.

6.2.3 Impact and risk assessment

All hazards identified were assigned a consequence level following the six levels and criteria outlined in Santos' Risk Matrix Procedure (SMS-LRG-OS01-TP02). More detailed criteria were developed to assist in addressing NT EPA Key Environmental Factors. These are the NT EPA consequence descriptors shown in **Table 6-1**.

The consequence is defined as the resulting impact from an event occurring. The consequence level for this assessment was based on the credible worst-case scenario and assumed no management actions were in place. Categories of environmental consequence and detailed definitions of each severity level are outlined in **Table 6-2**

The likelihood can be described as the probability that that the described consequence will occur. When determining the likelihood of consequences, proposed prevention and mitigation controls identified to mitigate potential impacts were considered. A detailed description of likelihood levels is outlined in **Table 6-3**

A likelihood level was only assigned to unplanned events as per the Santos Risk Matrix Procedures (SMS-LRG-OS01-TP02), shown in **Table 6-4**. The consequence and likelihood for each impact was then assessed to determine the residual risk that remained after proposed standard controls were considered.

Table 6-1: NT EPA consequence descriptor

Consequence Level		I	II	III	IV	V	VI
Acceptability		Acceptable	Acceptable	Unacceptable	Unacceptable	Unacceptable	Unacceptable
Consequence Level Description		Negligible No impact of negligible impact	Minor Detectable but insignificant change to local population, industry or ecosystem factors Localised effect	Moderate Significant impact to local population industry or ecosystem factors	Major Major long-term effect on local population industry or ecosystem factors	Severe Complete loss of local population industry or ecosystem factors AND/OR extensive regional impacts with slow recovery	Critical Irreversible impacts to regional population industry or ecosystem factors
Environmental Receptors	Marine Ecosystems Fauna, habitat, conservation significant areas and ecological function, processes and integrity	Short term behavioural impacts only to small proportion of local population and not during critical lifecycle activity. No decrease in local population size / area of occupancy of species / loss or disruption of habitat critical / disruption to the breeding cycle/ vales of a protected area. No introduction of disease and no reduction in habitat area/function.	Detectable but insignificant decrease in local population size and threat to local population viability. Insignificant disruption to the breeding cycle of local population / area of occupancy of species / loss of habitat critical to survival of a species/ values of a protected area. Detectable but insignificant loss of area/function of habitat with rapid recovery within 2 years.	Moderate. Significant decrease in local population size but no threat to overall population viability. Significant behavioural disruption or disruption to the breeding cycle of local population / Significant reduction in area of occupancy of species / loss of habitat critical to survival of a species. Modify, destroy, remove or decrease availability of quality habitat to the extent that a long-term decline in local population or function of habitat is likely with recovery over medium term (2-10 years) Introduction of disease likely to cause significant population decline	Long term decrease in local population size and threat to local population viability. Major disruption to the breeding cycle of local population / area of occupancy of species / loss of habitat critical to survival of a species/ values of a protected area Fragmentation of existing population / Loss or change of habitat to the extent that a long-term decline in local population and function of habitat is likely with slow recovery over decades Introduction of disease likely to cause long term population decline	Complete loss of local population, habitat critical to survival of local population or protected area/conservation significant area Widespread (regional) decline in population size or habitat critical to regional population Extensive destruction of local habitat with no recovery or long term (decades) or widespread loss of area or function of primary producers on a regional scale	Complete loss of regional population Complete loss of habitat critical to survival of regional population
	Marine Environmental Quality Water quality, sediment quality, ecosystem health and parameters that support fishing, aquaculture, recreation, aesthetics and cultural/spiritual values	Negligible. No or negligible reduction in physical environment nor decrease in ecosystem function/health. No or negligible loss of value to socio-economic activities	Detectable but localised, short term and insignificant impact to physical environment or ecosystem function/health or value to socio-economic activities. Rapid recovery evident within ~ 2 years.	Significant wide-scale medium term impact to physical environment, decrease in ecosystem function/health or value to socio-economic activities. Recovery over medium term (2-10 years).	Wide-scale, long term impact to physical environment, long term decrease in ecosystem function/health or value to socio-economic activities. Slow recovery over decades.	Extensive impact to/destruction of physical environment with no recovery or shutdown of socio-economic activities Long term (decades) and widespread loss of ecosystem function/health on a regional scale that damages value to socio-economic activities.	Complete destruction of regional physical environment / habitat with no recovery Complete loss of area or function of primary producers on a regional scale

Consequence Level		I	II	III	IV	V	VI
<p>Coastal Processes Geophysical processes, primary productivity/ nutrient cycling, conservation significant areas/coastal landforms and cultural, aesthetic or recreation values</p>	<p>Coastal Processes Geophysical processes, primary productivity/ nutrient cycling, conservation significant areas/coastal landforms and cultural, aesthetic or recreation values</p>	Short term changes to local geophysical/hydrological processes, widespread loss of area or function of primary producers/nutrient cycling or conservation significant areas on a regional scale	Detectable but insignificant loss or change to local geophysical/hydrological processes, area or function of primary producers/nutrient cycling or conservation significant areas with rapid recovery within 2 years.	Moderate. Significant modification, destruction, removal or change of local geophysical/hydrological processes, wide-scale loss of area or function of primary producers/nutrient cycling or conservation significant areas on a regional scale with recovery over medium term (2-10 years).	Long term loss or change of local geophysical/hydrological processes, widespread loss of area or function of primary producers/nutrient cycling or conservation significant areas on a regional scale with slow recovery over decades	Extensive destruction of local geophysical/hydrological processes, widespread loss of area or function of primary producers/nutrient cycling or conservation significant areas on a regional scale with no recovery or long term (decades)	Complete loss or change of geophysical/hydrological processes. Complete loss of area or function of primary producers/nutrient cycling or conservation significant areas on a regional scale.
	<p>Community and Economy Includes: fisheries (commercial and recreational); tourism; oil and gas; defence; commercial shipping</p>	No or negligible loss of value of the local industry. No or negligible reduction in key natural features or populations supporting the activity.	Detectable but insignificant short-term loss of value of the local industry. Detectable but insignificant reduction in key natural features or population supporting the local activity.	Significant loss of value of the local industry. Significant medium-term reduction of key natural features or populations supporting the local activity.	Major long-term loss of value of the local industry and threat to viability. Major reduction of key natural features or populations supporting the local activity.	Shutdown of local industry or widespread major damage to regional industry. Permanent loss of key natural features or populations supporting the local industry.	Permanent shutdown of local or regional industry Permanent loss of key natural features or populations supporting the local or regional industry
	<p>Culture and heritage Includes: Indigenous heritage and maritime heritage (i.e. shipwrecks)</p>	No or negligible impact on the area's cultural or heritage values. No or negligible alteration, modification, obscuring or diminishing of the area's cultural or heritage values.	Detectable but insignificant impact on one or more of the area's cultural or heritage values. Detectable but insignificant alteration, modification, obscuring or diminishing of the area's cultural or heritage values.	Significant impact on one or more of the area's cultural or heritage values. Significant alteration, modification, obscuring or diminishing of the area's cultural or heritage values.	Major long-term effect on one or more of the area's cultural or heritage values. Major alteration, modification, obscuring or diminishing of the area's cultural or heritage values.	Complete loss of one or more of the area's cultural or heritage values.	Permanent loss of one or more of the area's cultural or heritage values with no recovery.
<p>Terrestrial Impacts Includes terrestrial fauna and flora</p>	<p>Terrestrial Impacts Includes terrestrial fauna and flora</p>	Short term behavioural impacts only to small proportion of local population and not during critical lifecycle activity. No decrease in local population size / area of occupancy of species / loss or disruption of habitat critical / disruption to the breeding cycle/ vales of a protected area. No introduction of disease and no reduction in physical environment/ habitat area/function.	Detectable but insignificant decrease in local population size and threat to local population viability. Insignificant disruption to the breeding cycle of local population / area of occupancy of species / loss of habitat critical to survival of a species/ values of a protected area. Detectable but insignificant loss of area/function of physical environment/ habitat with rapid recovery within 2 years.	Significant decrease in local population size but no threat to overall population viability. Significant behavioural disruption or disruption to the breeding cycle of local population / Significant reduction in area of occupancy of species / loss of habitat critical to survival of a species. Modify, destroy, remove or decrease availability of local physical environment/ habitat to the extent that a long-term decline in local population or function of habitat is likely with recovery over medium term (2-10 years) Introduction of disease likely to cause significant population decline	Long term decrease in local population size and threat to local population viability. Major disruption to the breeding cycle of local population / area of occupancy of species / loss of habitat critical to survival of a species/ values of a protected area Fragmentation of existing population / Large scale loss or change of physical environment/ habitat to the extent that a long-term decline in local population and function of habitat is likely with slow recovery over decades Introduction of disease likely to cause long term population decline	Complete loss of local population, habitat critical to survival of local population or protected area/conservation significant area Widespread (regional) decline in population size or habitat critical to regional population Extensive destruction of local physical environment/ habitat with no recovery or long term (decades) or widespread loss of area or function of primary producers on a regional scale	Complete loss of regional population, complete loss of habitat critical to survival of regional population Complete destruction of regional physical environment / habitat with no recovery. Complete loss of area or function of primary producers on a regional scale.

Table 6-2: Environmental consequence level descriptions

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

Table 6-3: Likelihood descriptions

No.	Matrix	Description
F	Almost Certain	Occurs in almost all circumstances OR could occur within days to weeks
E	Likely	Occurs in most circumstances OR could occur within weeks to months
D	Occasional	Has occurred before in Santos OR could occur within months to years
C	Possible	Has occurred before in the industry OR could occur within the next few years
B	Unlikely	Has occurred elsewhere OR could occur within decades
A	Remote	Requires exceptional circumstances and is unlikely even in the long term

Table 6-4: Risk assessment matrix

		Consequence					
		I	II	III	IV	V	VI
Likelihood	F	Low	Medium	High	Very High	Very High	Very High
	E	Low	Medium	High	High	Very High	Very High
	D	Low	Low	Medium	High	High	Very High
	C	Very Low	Low	Low	Medium	High	Very High
	B	Very Low	Very Low	Low	Low	Medium	High
	A	Very Low	Very Low	Very Low	Low	Medium	Medium

6.3 Residual consequences and risks

6.3.1 Planned events

The residual consequence levels from the planned events following implementation of standard and additional (as low as reasonably practicable; ALARP) management actions (detailed in **Section 7**) are summarised in **Table 6-5**. Given the likelihood of a planned event occurring is 100% (in other words, it will occur), the risk ranking is not assessed. A comprehensive impact assessment for each of the planned events, and subsequent management actions proposed by Santos to reduce the risk and

impacts to ALARP and/or acceptable levels are detailed in the following subsections. Within the ENVID developed by Santos some environmental aspects had multiple residual consequence ratings since multiple environmental factors were assessed against, in these cases the residual consequence of greatest severity was chosen.

Additional management actions have been adopted from the NT EPA referral’s environmental management and mitigation measures (BAA-201 0003; Santos, 2021) and the DLNG OEMP (ConocoPhillips, 2018). The NT EPA referral’s management actions were included to ensure this CEMP was consistent with the actions identified in the DPD Project NT EPA referral, and the DLNG OEMP’s management actions were included to ensure that management of onshore works will be compliant with the DLNG Facility’s operational environmental requirements.

Table 6-5: Summary of the residual consequence levels associated with planned events

CEMP Section	Event	Residual consequence
7.6.1	Ground disturbance and clearing – physical presence	II – Minor
7.6.2	Ground disturbance and clearing – acid sulfate soils	I – Negligible
7.6.3	Light emissions	II – Minor
7.6.4	Noise emissions	II – Minor
7.6.5	Atmospheric emissions	I – Negligible

6.3.2 Unplanned events

The residual risk levels from unplanned events following implementation of standard and additional (as low as reasonably practicable; ALARP) management actions (detailed in **Section 7**) are summarised in **Table 6-6**. Comprehensive risk assessment for each of the unplanned events, and subsequent management actions proposed to reduce the risk to ALARP and acceptable levels are detailed in the following subsections. Within the ENVID some unplanned events had multiple residual risk ratings since multiple environmental factors were assessed against, in these cases the residual risk of greater severity was chosen for this summary.

Subsequent to the completion of ENVID workshops, an additional environmental risk associated with the activity was identified; specifically the risk of a fire on site spreading to surrounding bushland.

Table 6-6: Summary of the residual risk levels associated with unplanned events

CEMP Section	Unplanned event	Residual risk level
7.7.1	Interaction with terrestrial fauna	Very low
7.7.2	Introduction or spread of invasive species (plants, insects and fauna)	Low
7.7.3	Release of non-hazardous and hazardous materials	Very low
7.7.4	Spread of fire to surrounding bushland	Low

6.4 Impact/risk assessment summary

The outcomes of the impact/risk assessment are presented in **Table 6-7**, and includes reference to the relevant management strategy within this CEMP used to manage individual environmental aspects.

Table 6-7: Summary of onshore construction impact and risk assessment outcomes

Aspect	Activity	Description of hazard	Spatial scale	Temporal scale	Potential impacts/risks	Sensitive receptors	Residual consequence (planned event) /risk level (unplanned event)	Management strategy
Planned events								
Ground disturbance and clearing – physical presence	Onshore construction including: + temporary storage of fill to be stockpiled in the disturbance footprint for use as backfill + disposal of excess filltrenching done by DLNG from nominal shorepull termination point (2 m above HAT) to the upstream weld of the beach valve	Clearing of regrown native grasses and weeds in a previously disturbed area will be required prior to excavating a trench for onshore pipeline section. Excavated soil will be temporarily stockpiled within the onshore Project Area to be used as fill or disposed of if in excess. The Barossa team will prepare the DPD site pad (Figure 2-3), including vegetation clearing, which overlaps part of the onshore pipeline alignment. As such, the DLNG team will only be required to partially clear the onshore pipeline alignment.	Localised within the onshore Project Area.	Temporary duration when the section of trench will be open. The trench will be backfilled at the conclusion of pre-commissioning works. The clearing of any vegetation currently present onsite will be permanent.	Excavating the trench may result in: + minimal clearing of the ground/vegetation + digging soil and placing it adjacent for later re-use + bringing in of geotextile and hardstand + additional fill of specific parameters to be brought to site if engineered backfill required. This may require disposal of excess ‘original’ soil – may need to be tested/treated prior to disposal + potential risk from erosion + spread of weeds Site clearing may impact terrestrial fauna and may require some ground clearing. If heavy rainfall is received, water may need to be pumped from the trench to adjacent land area. If stormwater runoff enters Darwin Harbour, coastal water quality may be impacted. Onshore construction activities have the potential to generate dust in the immediate and surrounding areas.	+ Terrestrial impacts (sediment quality, vegetation and terrestrial fauna) + Marine environmental quality (coastal water quality) + Marine ecosystem (marine fauna)	II – Minor	Section 7.6.1
Acid Sulfate Soils disturbance	Onshore construction including trench / excavation	The alignment of the onshore pipeline has been previously disturbed to install the Bayu-Undan to Darwin pipeline, however trenching works for the DPD pipeline may disturb natural ASS or PASS materials. This presents a risk of oxidation of ASS and subsequent mobilisation of heavy metals and acidification products.	The location of ASS or PASS materials potentially disturbed would be localised to the onshore Project Area. Any subsequent mobilisation of heavy metals and acidification products may extend outside the onshore Project Area and into the coastal waters of Darwin Harbour.	Temporary duration when trenching occurs.	Excavating the trench may disturb acid sulfate soils. This presents a risk of oxidation of acid sulfate soils and subsequent mobilization of heavy metals and acidification products. ASS disturbance may potentially impact ground water, surface water and fauna that come into contact with acidification products.	Terrestrial impacts (terrestrial fauna, groundwater and surface water quality).	I – Negligible	Section 7.6.2

Aspect	Activity	Description of hazard	Spatial scale	Temporal scale	Potential impacts/risks	Sensitive receptors	Residual consequence (planned event) / risk level (unplanned event)	Management strategy
		<p>If encountered, the ASS or PASS materials will be stored on limestone pads within the onshore Project Area and treated with lime prior to reuse or disposal to landfill.</p> <p>Dewatering is dependent on the groundwater levels at the time of excavation. While it is considered unlikely that dewatering be required dewatering measures that may be implemented are outlined in the ASSDMP</p>						
Light emissions	Onshore construction including operation of onshore plant and equipment e.g. trenching, pipelay and backfill	<p>Potential impacts from light emissions may occur in the onshore Project Area from:</p> <ul style="list-style-type: none"> + Lighting of the work areas + Lighting on the required onshore equipment and machinery <p>Lighting will typically consist of bright white (in other words, metal halide, halogen, fluorescent) lights. It is expected that majority of activities will be undertaken during daylight hours, for safety and logistical reasons (BAA-201 0003; Santos, 2021).</p>	Localised: Limited light 'spill' or 'glow' on land and surface waters surrounding the onshore location. The night environment is already compromised by artificial light sources from the DLNG Facility. Potential impacts from lighting used during construction (if required) will be minor in this context.	Lighting for night works will be ongoing for the duration of the activity (if required).	Change in fauna behaviour due to light emissions.	Terrestrial impacts (terrestrial fauna)	II – Minor	Section 7.6.3
Noise emissions	Onshore construction including operation of onshore plant and equipment	<p>Onshore sources of noise emissions will be generated by the operation of required equipment and machinery (i.e., during excavation of trench). The greatest noise emissions will be from air compressors used during dewatering and pre-commissioning works.</p> <p>These noise emissions could change terrestrial fauna behaviour (avoidance / attraction / disruption of normal behaviour).</p>	Noise levels are not expected to impact on the community and economy receptors due to its being localised to the DLNG facility in an industrial setting.	Noise is ongoing for the duration of the activity.	Change in fauna behaviour due to noise emissions including avoidance / attraction / disruption of normal behaviour.	Terrestrial impacts (terrestrial fauna)	II – Minor	Section 7.6.4

Aspect	Activity	Description of hazard	Spatial scale	Temporal scale	Potential impacts/risks	Sensitive receptors	Residual consequence (planned event) /risk level (unplanned event)	Management strategy
Atmospheric emissions	Atmospheric emissions from onshore combustion engines	<p>Potential impacts from atmospheric emissions may occur in the onshore Project Area from the following source:</p> <ul style="list-style-type: none"> + Operation of generators, and mobile and fixed equipment and vehicles 	Broad: The quantities of gaseous emissions are relatively small however wind will disperse carbon dioxide evenly throughout the atmosphere	Temporary and intermittent for the duration of the duration of the onshore construction and pre-commissioning activity.	<p>Atmospheric emissions from combustion engines can result in deterioration of local air quality. Atmospheric emissions can cause an incremental increase in global GHG concentrations.</p> <p>The onshore site is an industrial site (DLNG Plant) and removed from residential/commercial areas.</p> <p>Given the nature and scale of gas export pipeline installation activities (low frequency and relatively short duration), the risk is considered to have a negligible impact.</p>	<ul style="list-style-type: none"> + Terrestrial impacts + Air quality / Atmospheric emissions (local air quality) 	I – Negligible	Section 7.6.5
Unplanned events								
Interaction with terrestrial fauna	Onshore construction e.g.trenching, backfilling, excavation, trucking movements, and transportation to/from site	<p>There will be an increased presence of personnel and machinery and vehicle movements in the onshore Project Area during the construction and pre-commissioning works. In addition, the onshore pipeline's trench will remain open for several months until its pre-commissioning works are completed.</p> <p>Increased traffic may result in changes to fauna behaviour or interaction with terrestrial fauna, including potential strike or collision, potentially resulting in severe injury or mortality. The open onshore pipeline trench could potentially result in severe injury or mortality from fauna entrapment.</p>	Localised within the onshore Project Area.	Temporary and intermittent interaction with terrestrial fauna.	Behavioural impacts, injury or death to terrestrial fauna.	Terrestrial impacts (terrestrial mammals, reptiles, and birds)	Very low	Section 7.7.1
Introduction and spread of invasive species (plants, insects and fauna)	Onshore construction e.g. excavators, trucks and transportation to/from site.	The introduction or spread of invasive plant species or weeds may occur due to vegetation clearing, improper stockpiling of cleared vegetation containing weeds, machinery and vehicle movements, and importing rock	Localised to the onshore Project Area, and its surrounding local environment	Temporary to long-term (if invasive species and pests become established above current levels)	<p>Potential establishment of an invasive species because of the activity requires that invasive species to:</p> <ul style="list-style-type: none"> + Be present on a vector + Be released from the vector 	Terrestrial impacts (terrestrial flora and fauna)	Low	Section 7.7.2

Aspect	Activity	Description of hazard	Spatial scale	Temporal scale	Potential impacts/risks	Sensitive receptors	Residual consequence (planned event) /risk level (unplanned event)	Management strategy
		and fill from offsite locations. Wind-borne incursions of weeds may also occur, as weeds are present within the DLNG Plant and the broader surrounds (BAA-201 0003; Santos, 2021). The introduction or spread of invasive insects and fauna (e.g., ants, cane toads) may occur due to machinery and vehicle movements, and attraction to construction or pre-commissioning activities.			+ Establish in the receiving environment. Potential spread of an invasive species observed around the DLNG Plant because of the activity may also occur. Invasive species could displace and outcompete local species.			
Release of non-hazardous and hazardous materials	+ Onshore construction e.g., excavators, trucks and transportation to/from site. + Storage of hazardous and non-hazardous liquids + Storage of waste	Minor hydrocarbon and chemical spills to land may occur during the storage, handling and transfer of fuel and chemicals during construction and pre-commissioning works. Uncontained waste dispersed into surrounding marine and terrestrial setting.	Localised: Volumes are likely to be minor and be restricted to within the onshore Project Area.	Temporary duration for the activity.	Contamination of soils, surface water or groundwater	+ Marine environmental quality (coastal water quality) + Marine ecosystem (marine fauna) + Terrestrial impacts (physical environment, terrestrial flora and fauna)	Very low	Section 7.7.3
Spread of fire to surrounding bushland	Onshore construction e.g. excavators, trucks and transportation to/from site.	The onshore works have the potential to increase the risk of starting a bushfire, as there will be additional fuel and ignition sources located onsite. A bushfire would lead to destruction of surrounding terrestrial ecosystems and associated terrestrial vegetation and fauna. Bushfires can occur in most vegetated areas with an ignition source, suitable climatic conditions, and sufficient fuel.	Localised to Wickham Point	Temporary duration for the activity	Fire damage to a potentially large area of terrestrial ecosystems and associated terrestrial fauna and vegetation (ConocoPhillips, 2018).	+ Terrestrial impacts + Air quality	Low	Section 7.7.4

6.5 Assessment of potential for cumulative impacts

The following section provides a summary of potential cumulative impacts associated with the onshore DPD Project construction activities. Further detail is provided within the DPD Project Supplementary Environmental Report (SER) (BAS-210 0020).

6.5.1 Cumulative assessment methodology

The SER (BAS-210 0020) provides a whole of project assessment of cumulative impacts to three key NT EPA environmental factors: Marine Environmental Quality, Marine Ecosystems and Atmospheric Processes, and three other NT EPA environmental factors: Coastal Processes, Community and Economy and Culture and Heritage (NT EPA, 2022).

Identified projects and activities with the potential for cumulative impacts with the DPD Project are discussed in further detail within Section 12.4 of the SER (BAS-210 0020). Two of the NT EPA environmental factors were considered sensitive for cumulative impacts under the scope of this CEMP and are discussed in **Sections 6.5.2 and 6.5.3**.

6.5.2 Cumulative impacts to atmospheric processes

This Project construction activities will generate atmospheric emissions which will contribute to the overall concentration of GHG in the Earth's atmosphere. Emissions resulting from construction activities (i.e. use of combustion engines) will occur on a short-term basis. The DPD project is included in Santos' Climate transition action plan and will adhere to the Santos GHG management plan and energy management program.

6.5.3 Cumulative impacts to community and economy

Direct impacts to social, recreational and ecological values from activities detailed within this CEMP are not predicted to be significant and will be localised to an existing disturbance area (DLNG facility) where public access is restricted, therefore direct cumulative impacts to these values are not predicted.

7 Environmental management strategies

This section outlines the environmental management strategies (EMSs) that will be implemented for management of areas and activities associated with the DPD Project construction works, therefore minimising and/or mitigating impacts and risks to the environment.

The EMSs to be implemented as part of this CEMP comprise of the following:

- + Planned impact management strategies (**Section 7.6**)
- + Unplanned risks management strategies (**Section 7.7**).

These EMS outline the commitments and objectives that are relevant and state specific measurable targets to achieve proposed objectives. Performance indicators and monitoring activities are used to quantify success in meeting requirements and identify the need for corrective actions. This ensures the continuous improvement of the effectiveness of the DPD Project’s EMS. The EMS define the reporting requirements, terms and responsibilities.

All EMS are structured to align with the template presented in **Table 7-1**.

Table 7-1: Environmental management strategies template

Item	Content
Environmental Performance Objectives (EPO)	Environmental management goal(s) tailored to each aspect per NT EPA requirements.
Target	Aspect specific measurable performance necessary to successfully achieve objective. Part 1 of NT EPA required performance criteria.
Performance Indicator	Quantitative or qualitative measures representing the performance related to Target(s). Part 2 of NT EPA required performance criteria.
Management actions	Tasks to be undertaken to meet objective/s.

7.1 NT EPA hierarchy

In the development of the EMS outlined within this CEMP Santos applied the Environmental Decision-Making Hierarchy outlined within the EP Act. This hierarchy being:

- + To ensure that actions are designed to avoid adverse impacts on the environment
- + To identify management options to mitigate adverse impacts on the environment to the greatest extent practicable
- + And if appropriate, provide for environmental offsets in accordance with the EP Act for residual adverse impacts on the environment that cannot be avoided or mitigated¹.

¹ No offsets were deemed appropriate for this project.

7.2 Environmental performance objectives

To ensure environmental risks and impacts will be of an acceptable level, environmental performance objectives (EPOs) have been defined and are listed in following sections for planned and unplanned events. The EPOs were developed based on each environmental aspect and associated impact/risk.

7.3 Performance criteria

To assess whether EPOs are being achieved it is important to define specific performance criteria, which will take the form of targets and performance indicators. Detailed specific measurable targets must be defined and then met to achieve overarching EPOs. Performance indicators are the factor that is measured to assess whether the performance targets have been achieved.

7.4 Management actions

To mitigate impacts of the DPD Project construction activities and to achieve EPOs and performance criteria, management actions will be defined and implemented. This will include standard, additional (ALARP) and adaptive management actions.

7.5 Adaptive management mechanism

The consequences of all planned events impacts were assessed as minor to negligible and the level of unplanned events risks were assessed as low to very low. A monitoring and adaptive management mechanism will be applied to the following event to ensure EPOs are met:

- + Acid sulfate soils: It is understood that the soil across the onshore zone (within the onshore Project Area) is likely to be non-ASS material. The ASSDMP (BAS-210 0049) provides operating strategies for earthworks and contingency dewatering in the onshore zone, which includes adaptive management measures in the event of encountering PASS or ASS material.

Adaptive management can also be triggered through Santos' incident response and assurance processes, with corrective actions and management adapted as required to address any incidents and non-conformances identified.

7.6 Planned events impact management strategies

Santos' environmental impact assessment identified six impacts arising from planned events to be undertaken in the onshore Project Area. Management strategies have been adopted in this CEMP based on the ENVID outcomes and additional review (refer to **Section 6**).

7.6.1 Ground disturbance and clearing – physical presence

7.6.1.1 Environmental performance objectives, performance criteria and management actions

The EPOs and performance criteria for ground disturbance and clearing – physical presence are described in **Table 7-2**.

Table 7-2: Ground disturbance and clearing – physical presence EPOs and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
Avoid impacts to native vegetation and fauna from ground disturbance and clearing	Planned ground disturbance is limited to within previously cleared areas	Recorded areas disturbed via excavation logs
	Zero incidents of disturbance to vegetation outside previously cleared areas	Number of recorded incidents of damage to environment outside of previously cleared areas
	Zero incidents of injury to terrestrial native fauna as a result of the DPD construction activities	Number of recorded incidents relating to terrestrial fauna injury or mortality as a result of ground disturbance.

This EPO aligns with the following NT EPA Factor objectives (NT EPA, 2022):

- + Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
- + Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
- + Marine environmental quality (coastal water quality)
- + Marine ecosystem (marine fauna)

The management actions considered for this planned event are shown in **Table 7-3**. EPS and measurement criteria for these management actions will be developed in consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-3: Management actions for ground disturbance and clearing – physical presence during onshore DPD construction activities

MA Reference	Management Action
Standard management actions	
Avoidance	
DPD-DLNG-MA01	Restrict disturbance to within the onshore Project Area and existing DLNG site area
DPD-DLNG-MA02	Establish appropriate access restrictions to the onshore Project Area
Mitigation	
DPD-DLNG-MA03	Pump water through a silt separator when dewatering in the excavated trench in sections where the trench does not naturally drain to harbour
DPD-DLNG-MA04	Geotextiles will be installed under primary construction area (i.e. site pad)
DPD-DLNG-MA05	Trench inspections to be performed daily to check for trapped wildlife
DPD-DLNG-MA06	Insert caps on ends of pipe if the pipe is to be unattended for periods >12 hours; to prevent fauna ingress.
DPD-DLNG-MA07	Ensure any native vertebrates injured by DPD construction activities are referred to an appropriate wildlife carer group or veterinarian
DPD-DLNG-MA08	Return onshore site to natural grade to match existing topography following completion of the activity
DPD-DLNG-MA09	Maintain batters or install fauna ladders on trench entry and exit to allow fauna to exit the trench
Additional (ALARP) management actions	
Avoidance	
DPD-DLNG-MA10	Limit vehicles to access roads, prepared site pad or defined boundaries within the onshore Project Area/DLNG disturbance envelope
Mitigation	

MA Reference	Management Action
DPD-DLNG-MA11	Use water truck for dust suppression
DPD-DLNG-MA12	Establish and implement vehicle speed controls

7.6.1.2 Demonstration of ALARP and residual impact

Construction works for the activities in this CEMP will be confined to the Project Area and previously disturbed areas within the DLNG site area. Given the type of construction occurring there were no credible alternatives to reduce ground disturbance identified in the ENVID workshops. Table 7.3 details the management actions to reduce impact to onshore sediment quality, water quality, air quality, and terrestrial fauna.

Inclusion of additional fauna impact mitigations means that there will be regular inspections of trenches and preventative measures in place to prevent fauna ingress into the pipeline. Trench batter design will provide a gradient that prevents entrapment and injury, allowing fauna to move freely, with trench ends left open to assist with fauna egress.

Given the temporary and localised nature of the impacts and the existing disturbance at the site, the management actions in place are appropriate for the nature and scale of this activity. Any known impacts and potential risks have been reduced to ALARP and the impact level is considered Minor and acceptable.

7.6.2 Ground disturbance and clearing – acid sulfate soils

7.6.2.1 Environmental performance objectives, criteria and management actions

The EPO and performance criteria for ground disturbance and clearing – acid sulfate soils are described in **Table 7-4**.

Table 7-4: Ground disturbance and clearing – acid sulfate soils EPO and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
Prevent project attributable mobilisation of heavy metals and acidification products to the surrounding environment	No incidents of project attributable mobilisation of heavy metals and acidification products to the surrounding environment	Records of ASS presence in sediment/soil via excavation logs/ daily observations/ photographs Incident investigation records

These EPOs align with the following NT EPA Factor objectives (NT EPA, 2022):

- + Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
- + Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The management actions considered for this planned event are shown in **Table 7-5**. Environmental Performance Standards and measurement criteria for these management actions will be developed in consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-5: Management actions for ground disturbance and clearing – Acid Sulfate Soils during onshore DPD construction activities

MA Reference	Management Action
Standard management actions	
Mitigation	
DPD-DLNG-MA13	Implement ASS and groundwater management and monitoring requirements within the ASSDMP (BAS-210 0049) if ASS or groundwater is encountered during onshore construction activities. The ASSDMP includes requirements for: <ul style="list-style-type: none"> + ASS stockpiling, laboratory testing and treatment + Groundwater laboratory testing and treatment + Maintenance of testing and inspection records + Contingency dewatering
Additional (ALARP) management actions	
Mitigation	
DPD-DLNG-MA14	Treat ASS material such that no acidic soil or runoff can be released to the environment before it can be used as backfill within the Project Area

7.6.2.2 Demonstration of ALARP and residual impact

During the construction of the Bayu-Undan to Darwin GEP natural material within the onshore Project Area was replaced by imported (non-ASS) fill material (generally sand) up to a depth of approximately 6 m below ground level. Hence it is considered that material at the site is likely to be non-ASS.

None-the-less, should ASS material be encountered during earthworks within the onshore Project Area, it will be managed in line with the ASSDMP (BAS 210 0049). Any suspected ASS will be removed from the onshore zone’s excavation area and stockpiled separately from non-ASS materials on a bunded limestone pad ahead of confirmatory testing.

Terrestrial fauna and vegetation may interact with stockpiled soils, however given that these will be managed within short temporal scales in accordance with the ASSDMP, there no significant impact is expected.

Following implementation of standard and additional (ALARP) management actions, including the implementation of the ASSDMP (BAS-210 0049), the assessed residual consequence for this impact is negligible and cannot be reduced further. It is considered therefore that the impact of the activities conducted is ALARP and is considered acceptable.

7.6.3 Light emissions

7.6.3.1 Environmental performance objectives, criteria and management actions

The EPOs and performance criteria for light emissions are described in **Table 7-5** .

Table 7-6: Light emissions EPOs and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
No harm to native fauna from project lighting	No reports of injury or mortality to native fauna from light generated during DPD construction activities	Reports of sighting of live, injured, or dead terrestrial fauna
	Limit light to that required for safe work environment	Records of light inspections

This EPO aligns with the following NT EPA Factor objectives (NT EPA, 2022):

- + Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
- + Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The management actions considered for this planned event are shown in **Table 7-7**. Environmental Performance Standards and measurement criteria for these management actions will be developed in consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-7: Management actions for light emissions during onshore DPD construction activities

MA Reference	Management Action
Standard management actions	
Mitigation	
DPD-DLNG-MA15	Lights to be orientated directly over the area of work and overspill reduced where practicable by using screens or hoods on lights
DPD-DLNG-MA16	Light audit undertaken within 14 days of commencing construction activities
Additional (ALARP) management actions	
N/A	
Additional (ALARP) management actions not adopted	
1	<p>Marine fauna observers specifically looking out for turtle hatchlings entrapped within light spill with adaptive management measures should a significant number be spotted.</p> <p>Reason for rejection:</p> <ul style="list-style-type: none"> + The onshore construction area is not near turtle nesting beaches.
2	<p>Construction activities limited to non-nesting timeframes</p> <p>Reason for rejection:</p> <ul style="list-style-type: none"> + Cost disproportionate to benefit given proximity to important nesting beaches and existing lighting from DLNG facility

7.6.3.2 Demonstration of ALARP and residual impact

Artificial lighting will be required to maintain safe working conditions if night works are undertaken. The onshore Project Area is directly adjacent to the operational DLNG Facility, any artificial lights required for night works are unlikely to have a noticeable effect on the existing night environment, which is already influenced by lighting at the DLNG Facility. No threatened or migratory species are expected to be impacted by the minor and temporary increase in light emissions. Further, the use of artificial lighting, will be oriented away from adjacent vegetation/marine environment and at an intensity to allow work to proceed safely.

The potential consequences of the anthropogenic light in the onshore Project Area are expected to be restricted to short-term behavioural impacts on individual fauna that may be present in the onshore Project Area during the activity. Terrestrial fauna may be disturbed or attracted by artificial light, which may increase their risk of predation or interaction with machinery or vehicles. The short duration of the activity is unlikely to lead to any significant impacts to local populations.

The assessed residual consequence for this impact is minor, following implementation of standard management actions. Therefore, due to management actions in place, the terrestrial impacts from artificial lighting are ALARP and considered environmentally acceptable.

7.6.4 Noise emissions

7.6.4.1 Environmental performance objectives, criteria and management actions

The EPO and performance criteria for noise emissions are described in **Table 7-8**.

Table 7-8: Noise emissions EPO and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
Limit harm to native fauna from noise emissions from onshore construction	Full compliance with preventative maintenance procedures for power generating equipment and compressors, including industry standard noise reduction equipment.	Recorded incidents of non-compliance

This EPO aligns with the following NT EPA Factor objectives (NT EPA, 2022):

- + Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
- + Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The management actions considered for this planned event are shown in **Table 7-9**. Environmental Performance Standards and measurement criteria for these management actions will be developed in consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-9: Management actions for noise emissions during onshore DPD construction activities

MA Reference	Management Action
Standard management actions	
Mitigation	
DPD-DLNG-MA17	Preventative maintenance of equipment and machinery
Additional (ALARP) management actions	
N/A	
Additional (ALARP) management actions not adopted	
1	Avoid night works. Reason for rejection: + This would have schedule implications which would extend duration of works thereby extending the period in which the impact is realised. Additionally the cost of implementing far exceeds the benefit gained. ALARP justification will be reviewed if safety risks are unacceptable for certain night activities.

7.6.4.2 Demonstration of ALARP and residual impact

Equipment and machinery used onshore are considered essential to undertaking the installation and pre-commissioning works for the onshore pipeline and noise emissions are an unavoidable consequence of construction activities. Given the routine maintenance of the equipment and machinery by suitably qualified personnel, and adherence to industry standards, all practicable management measures are considered to have been implemented.

Noise emitted by the equipment and machinery during onshore construction and pre-commissioning works may affect fauna behaviour. Avoidance behaviour is likely to be localised to the onshore Project Area and temporary. Considering the location within the existing DLNG Facility disturbance envelope and the surrounding industrial land uses of Darwin Harbour local impacts to fauna may result in detectable but insignificant impacts to in local population size and local population viability.

The residual consequence of noise emissions on receptors is assessed as minor, following the implementation of standard management actions, and will not have a significant impact. The impact of noise emissions to the receiving environment are therefore ALARP and considered acceptable.

7.6.5 Atmospheric emissions

7.6.5.1 Environmental performance objectives, criteria and management actions

The EPO and performance criteria for atmospheric emissions are described in **Table 7-10**.

Table 7-10: Atmospheric emissions EPOs and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
Minimise atmospheric emissions generated during DPD construction activities.	Full compliance with preventative maintenance procedures for power generating equipment.	Recorded incidents of non-compliances

This EPO aligns with the following NT EPA Factor objectives (NT EPA, 2022):

- + Air quality – Protect air quality and minimise emissions and their impact so that environmental values are maintained.
- + Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The management actions considered for this planned event are shown in **Table 7-11**. Environmental Performance Standards and measurement criteria for these management actions will be developed in consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-11: Management actions for atmospheric emissions during onshore DPD construction activities

MA Reference	Management Action
Standard management actions	
Mitigation	
DPD-DLNG-MA17	Preventative maintenance of equipment and machinery
Monitoring	
DPD-DLNG-MA18	Monitor and report fuel consumption
Additional (ALARP) management actions	
Monitoring	
DPD-DLNG-MA19	The Barossa project is included in Santos' Climate transition action plan and will adhere to the Santos GHG management plan and energy management program

7.6.5.2 Demonstration of ALARP and residual impact

Power generation through combustion of fossil fuels is essential to undertaking the onshore construction and pre-commissioning works, either by power generation or by operating equipment and vehicles. There are no practicable alternatives to the use of equipment, vehicles and mobile plant powered by combustion engines for the activity. Given the routine maintenance of these systems by suitably qualified personnel, all practicable management measures are considered to have been implemented.

Records of fuel consumption during the onshore works will be maintained to identify the quantity of GHG emissions that were generated from fuel combustion. This information would inform annual reporting under the *National Greenhouse and Energy Reporting Act 2007*.

The location of the activity is within an industrial site that is removed from residential areas. Given the nature and scale of the activity (low number of equipment and short duration), the residual consequence on air quality and sensitive receptors is expected to be negligible, following the implementation of standard management actions and impacts from emissions that are generated by the activity are considered environmentally acceptable.

7.7 Unplanned events risk management strategies

Santos’ environmental risk assessment identified four potential sources of environmental risk associated with the activity. Management strategies have been adopted in this CEMP based on the ENVID outcomes (refer to **Section 6**).

7.7.1 Interaction with terrestrial fauna

7.7.1.1 Environmental performance objectives, criteria and management actions

The EPO and performance criteria are described in **Table 7-12**.

Table 7-12: Interaction with terrestrial fauna EPOs and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
No harm to native terrestrial fauna from ground disturbance and clearing	Ground disturbance limited to within previously cleared areas	Recorded areas disturbed via excavation logs
	Zero injury to terrestrial native fauna as a result of the DPD construction activities	Recorded number of incidents relating to terrestrial fauna injury or mortality.

This EPO aligns with the following NT EPA Factor objectives (NT EPA, 2022):

- + Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
- + Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The management actions considered for this planned event are shown in **Table 7-13**. Environmental Performance Standards and measurement criteria for these management actions will be developed in consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-13: Management actions for interaction with terrestrial fauna during onshore DPD construction activities

MA Reference	Management Action
Standard management actions	
Avoidance	
DPD-DLNG-MA10	Limit vehicles to access roads, prepared site pad or defined boundaries within the onshore Project Area/DLNG disturbance envelope
Mitigation	
DPD-DLNG-MA07	Ensure any native vertebrates injured by DPD construction activities are referred to an appropriate wildlife carer group or veterinarian
DPD-DLNG-MA12	Establish and implement vehicle speed controls
DPD-DLNG-MA20	Maintain the onshore Project Area as a cleared site during construction activities
Additional (ALARP) management actions	
N/A	

7.7.1.2 Demonstration of ALARP and residual risk

There are no alternative options to using vehicles and machinery to undertake the activity. Any impact caused by the physical presence of vehicles and machinery is likely to be localised and temporary, with terrestrial species expected to resume normal behaviours in the surrounding environment once construction activities are completed.

In the event that vehicles or machinery come in close proximity to terrestrial fauna, management actions will be implemented to reduce the likelihood of a terrestrial fauna collision to ALARP. This includes limiting the vehicle speed, restricting vehicles to designated access roads, informing personnel of risks to environment and maintaining a cleared onshore Project Area. Should fauna become harmed during the activity, they will be appropriately rehabilitated and relocated as required.

The inherent likelihood of encountering fauna in the onshore Project Area is limited by the short duration of the activity, lack of suitable habitat within the onshore Project Area, the fact that the onshore Project Area is highly disturbed and the expected behaviour of individuals to move away from vehicle and machinery noises. With the controls adopted, the assessed residual risk for this impact is very low and considered to be reduced to ALARP and is therefore acceptable.

7.7.2 Introduction and spread of invasive species

7.7.2.1 Environmental performance objectives, criteria and management actions

The EPOs and performance criteria for the introduction and spread of invasive species are described in **Table 7-14**.

Table 7-14: Introduction and spread of invasive species EPOs and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
No introduction and spread of invasive species	Zero incidents of increase in abundance or distribution of invasive species from DPD project onshore construction activities.	Records of incidents relating to the introduction of invasive species attributed to the construction works
	Ground disturbance limited to within previously cleared areas	Records of areas disturbed via excavation logs

This EPO aligns with the following NT EPA Factor objectives (NT EPA, 2022):

- + Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
- + Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The management actions considered for this planned event are shown in **Table 7-15**. Environmental Performance Standards and measurement criteria for these management actions will be developed in consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-15: Management actions for introduction and spread of invasive species during onshore DPD construction activities

MA Reference	Management Action
Standard management actions	
Avoidance	
DPD-DLNG-MA02	Establish appropriate access restrictions to the onshore Project Area
DPD-DLNG-MA10	Limit vehicles to access roads, prepared site pad or defined boundaries within the onshore Project Area/DLNG disturbance envelope
Mitigation	
DPD-DLNG-MA21	Comply with DLNG inspection requirements for new vehicles, plant, and equipment to site
DPD-DLNG-MA22	All equipment and material imported from overseas will be inspected by the Australia Quarantine and Inspection Service (AQIS)
DPD-DLNG-MA23	Provide and routinely collect onsite covered putrescible waste bins

7.7.2.2 Demonstration of ALARP and residual risk

Importation of equipment and material, and vehicle movement, is required for the activity. Management for invasive species for this activity will comply with the *Weeds Management Act 2001* (NT) and the requirements of the DLNG Facility. The risk of bringing invasive species into the onshore Project Area will be minimised by the inspection requirements of DLNG and AQIS, while the spread of invasive species will be minimised by restricting access to the onshore Project Area and access roads.

Vehicles for construction will not transit to or from the worksite each day. In most cases, they will enter the site, then remain onsite until no longer required, reducing the risks of contamination. Given the existing presence of invasive species and ongoing weed management by the DLNG Facility, with the controls adopted, the residual risk of the introduction or spread of invasive species is assessed as ALARP.

The pathways for introducing and spreading invasive species and the existing presence of invasive flora and fauna species within the DLNG Facility and its surrounds are well known. Following the implementation of management actions, the residual risk of introduction and spread of invasive species is low and therefore considered acceptable.

7.7.3 Release of non-hazardous and hazardous materials

7.7.3.1 Environmental performance objectives, performance criteria and management actions

The EPOs relevant to the release of non-hazardous and hazardous materials, including performance criteria, are described in **Table 7-16**.

Table 7-16: Release of non-hazardous and hazardous materials EPOs and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
No significant environmental impact resulting from release of non-hazardous and hazardous materials associated with the DPD construction activities	Zero incidents of release of hazardous materials to the terrestrial or marine environment during DPD construction activities	Number of recorded incidents

These EPOs align with the following NT EPA Factor objectives (NT EPA, 2022):

- + Marine environmental quality – Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.
- + Marine ecosystems – Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.
- + Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained.
- + Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The management actions considered for this planned event are shown in **Table 7-17**. Environmental Performance Standards and measurement criteria for these management actions will be developed in

consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-17: Management actions for release of non-hazardous and hazardous material

MA reference	Management actions
Standard management actions	
Mitigation	
DPD-DLNG-MA24	Waste Management Plan in place which includes standards for bin types, lids and covers, waste segregation and bin storage
DPD-DLNG-MA25	HSE inductions – cover requirements for waste management, e.g. label and cover waste skips and bins
DPD-DLNG-MA26	No Perfluorinated Chemicals (PFAS)/ Perfluorooctane sulfonate (PFOS) will be used in firefighting foam
DPD-DLNG-MA27	Inspection and maintenance of all equipment using chemicals
DPD-DLNG-MA28	Implement approved chemical selection procedure
DPD-DLNG-MA29	Implement Santos’ approved procedures for handling of treated seawater
DPD-DLNG-MA30	Comply with Australian Standards for storage and secondary containment of hazardous chemicals
DPD-DLNG-MA31	Maintain spill response equipment and procedures
DPD-DLNG-MA32	Implement and comply with the existing DLNG Emergency Response Plan (DLNG/HSE/ER/002), including in the event of a storm.
Additional (ALARP) management actions	
N/A	

7.7.3.2 Demonstration of ALARP and Residual risk

The storage and use of hydrocarbons and chemicals is required to undertake the activity. As such their removal from the activity is not practicable.

The identified management actions implemented include chemical selection process, treated seawater handling procedure and spill clean-up equipment and procedures to reduce the impact in a spill event. Management actions relating to waste management are incorporated within the Santos waste management plan and preventative measures are also documented in the DLNG Emergency Response Plan to prevent impact during a cyclone event.

Containment of small spills with secondary containment and spill response equipment will prevent spills spreading into the terrestrial and marine environment. The maintenance of bunding and spill response equipment provides assurance that these are available to contain spills in the event of a small leak. Hazardous liquids will be managed in accordance with relevant legislation and industry standards and Santos’ procedures.

The management actions proposed are in line with applicable actions described in relevant recovery plans and conservation advice to reduce the risk of habitat degradation and deteriorating water quality (for example, from pollution) to a level considered to be ALARP by Santos. The assessed residual risk for this impact is low. It is therefore considered that the impact of the activities is acceptable.

7.7.4 Spread of fire to surrounding bushland

7.7.4.1 Environmental performance objectives, criteria and management actions

The EPO and performance criteria for the spread of fire to surrounding bushland are described in **Table 7-18**.

Table 7-18: Spread of fire to surrounding bushland EPOs and associated performance criteria

EPO	Performance Criteria	
	Target/s	Performance Indicator/s
No bushfires caused by onshore construction activities	Zero incidents of bushfires resulting from the DPD Project onshore construction activities	Number of recorded incidents

This EPO aligns with the following NT EPA Factor objectives (NT EPA 2022):

- + Terrestrial environmental quality – Protect the quality and integrity of land and soils so that environmental values are supported and maintained. Terrestrial ecosystems – Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The management actions considered for this planned event are shown in **Table 7-19** . Environmental Performance Standards and measurement criteria for these management actions will be developed in consultation with the DLNG team and construction contractors, for inclusion in this CEMP prior to the commencement of DPD Project construction activities.

Table 7-19: Management actions for spread of fire to surrounding bushland

MA Reference	Management Action
Standard management actions	
Mitigation	
DPD-DLNG-MA30	Comply with Australian Standards for storage and secondary containment of hazardous chemicals
DPD-DLNG-MA32	Implement and comply with the existing DLNG Emergency Response Plan (DLNG/HSE/ER/002), including in the event of a storm.
DPD-DLNG-MA33	Implement and comply with the existing DLNG Work Permit Procedure (SMS-OS-OS02-PD03) and associated manuals. This includes the requirement to have firefighting equipment close by whilst undertaking hot work activities.

7.7.4.2 Demonstration of ALARP and residual risk

The use of machinery and undertaking hot works (i.e. welding) and storage and use of potential fuel sources, such as hydrocarbons and chemicals, are required to undertake the activity. As such their removal from the activity is not viable.

The DLNG HSE site induction, which contractors present onsite will be required to complete, will provide information on the facility safety protocols, muster and evacuation processes and emergency response arrangements (ConocoPhillips, 2017). The DLNG Facility has several existing and substantive controls in place to protect the facility, which include:

- + maintaining fire breaks on the property boundary
- + managing weeds as required to reduce the fuel load risk (ConocoPhillips, 2018).
- + Protocols for storage of hydrocarbons and chemicals
- + Permitting required for hotwork activities

Following the implementation of the standard management actions, the residual risk for this impact is assessed as Low and cannot be reduced further. It is considered therefore considered that the impact of the activities is reduced to ALARP and is acceptable.

7.8 Summary of management actions

Appendix 2 contains a summary of all management actions within this CEMP.

8 Implementation Strategy

This section presents the processes and procedures that will be implemented to ensure the environmental requirements within this CEMP will be met, including:

- + Specific systems, practices and procedures that ensure both environmental impacts and risks are reduced to ALARP and Environmental Performance Objectives (EPOs), Performance Criteria and Performance Standards of this CEMP are being met;
- + A clear chain of command, outlining roles and responsibilities of personnel involved in the implementation, management and review of this CEMP;
- + Measures to ensure that employees and/or contractors working in relation to this activity are aware of their responsibilities regarding the environment and have the appropriate skill and training;
- + Auditing, review and revision processes;
- + Incident recording and reporting in line with Santos and regulatory requirements;
- + Maintenance of quantitative records of discharges and emissions; and
- + Details of emergency response and oil spill arrangements.

This implementation strategy is consistent with the Barossa Health, Safety & Environment Management Plan for Execute (BAA-200 0003).

Stakeholder engagement is assessed separately for the requirements of the activity. Ongoing stakeholder management strategies are discussed in **Section 9**.

While the scope of work covered by this CEMP is located primarily outside the battery limits of the DLNG facility, some activities, including access to the onshore construction site, will occur within the DLNG perimeter and the construction activity will be in close proximity to the DLNG facility perimeter. Therefore, additional DLNG HSE requirements (e.g. permit to work requirements) will apply in some situations.

Environmental requirements for the DLNG facility, including an implementation strategy, are outlined within the DLNG Operations Environmental Management Plan (DLNG/HSE/PLN/001).

8.1 Leadership, accountability and responsibility

To enable the DPD Project to succeed in meeting environmental objectives as outlined within this CEMP, the following measures apply:

- + Appropriately skilled and qualified DPD Project team is established with HSE accountabilities, responsibilities, and resources clearly defined;
- + Setting of EPOs and Performance Criteria (incl. Targets and Performance Indicators) and establishment of the practices and tools used to measure performance and drive continual improvement (**Section 7**); and
- + Implementing HSE Leadership Teams with key contractors to discuss HSE performance and improvement

The Barossa Project Director is responsible for delivery of the Barossa Development, including the DPD Project, and has responsibilities for:

- + Accountability for project HSE performance

- + Demonstrating strong and visible HSE leadership
- + Endorsing HSE performance indicators and targets
- + Communicating HSE performance and events to the Chief Operating Officer, Upstream Oil & Gas and Group Executive Committee.
- + Providing HSE resources.
- + Engaging with senior regulatory managers.

The Barossa Project Director is supported by the Barossa Project Management Team. The effective implementation of this CEMP requires collaboration and cooperation among Santos Barossa Team personnel and contractors. The accountabilities of key Santos and contractor personnel in relation to the implementation, management and review of the CEMP is outlined in **Table 8-1**. Santos’ OPEP will outline the roles and responsibilities in an emergency.

Roles and responsibilities at the DLNG facility, relevant to environmental management, are outlined within the DLNG Operations Environmental Management Plan (DLNG/HSE/PLN/001).

Table 8-1: Chain of command and key roles and responsibilities

Title (role)	Environmental responsibilities
Office-based personnel	
Santos Darwin Life Extension (DLE) Manager	<ul style="list-style-type: none"> + Confirm that the campaign is undertaken in accordance with this CEMP. + Provide sufficient resources to implement the management controls in this CEMP. + Confirm Contractor personnel attend an environmental induction (Section 8.2.1) upon commencing work on the campaign. + Action the management controls, as detailed in the EPSs in this CEMP (Section 7) as required, prior to the commencement of the activity. + Confirm the Contractor meets the requirements of the Santos management system and relevant standards/procedures.
Santos Barossa HSE Manager	<ul style="list-style-type: none"> + Provide assurance that adequate resources are provided to support all environmental activities associated with this CEMP. + Develop a program to implement and monitor CEMP commitments. + Liaise with NT EPA, DITT, DCCEEW and other regulators. + Ensure incident notification process is in place and investigations completed to identify root causes. + Review and submit environmental performance reports and external environmental incident notification reports.

Title (role)	Environmental responsibilities
DLE Pipeline Onshore Scope Lead	<ul style="list-style-type: none"> + Confirm the campaign is undertaken in accordance with this CEMP. + Communicate any changes to the activity that may affect the risk and impacts assessment, EPOs, EPSs and MAs detailed in this CEMP to the Santos HSE team. + Coordinate resources required to enable the commitments in this CEMP to be maintained. + Confirm the reporting of environmental incidents meets both external and Santos' incident reporting requirements. + Liaise with Santos Environmental Advisor on environmental incidents and what constitutes a reportable incident. + Track and close out of any corrective actions raised from environmental audits as required by this CEMP.
Santos Barossa Crisis and Emergency Management Specialist	<ul style="list-style-type: none"> + Develop Santos Crisis Management and Emergency Response Plans and procedures. + Ensure emergency response drills are undertaken as per Santos Crisis Management and Emergency Response plans and procedures.
Santos Emergency Response Coordinator	<ul style="list-style-type: none"> + Undertake Santos Incident Management Team (IMT) drills and exercises in accordance with the Crisis and Incident Management Exercise Schedule. + Undertake assurance activities on oil spill response arrangements + Review Santos Emergency Response Plans and procedures.
Santos Barossa Environmental Advisor/s	<ul style="list-style-type: none"> + Develop onshore environmental approval documents, including DPD Project EMPs, for submission and acceptance by DITT. + Provide environmental inductions to contractor personnel. + Ensure environmental inspections and audits are undertaken against EMP commitments as per the Barossa Project Environmental Compliance Assurance Plan (BAA-200 0635). + Review and approve chemical products + Prepare environmental performance reports. + Advise on environmental incident reporting requirements, including what constitutes a reportable incident
Santos Barossa External Relations Advisor	<ul style="list-style-type: none"> + Prepare and implement the relevant and interested persons consultation program for the DPD activity. + Manage and report on any relevant and interested persons consultation received in relation to the activity. + Undertake ongoing engagement with relevant and interested persons, for the duration of the activity, as required.

Title (role)	Environmental responsibilities
Contractor Project Manager	<ul style="list-style-type: none"> + Undertake the onshore construction activity in accordance with this CEMP. + Provide the resources required to enable the commitments in this CEMP to be maintained. + Ensure that all Contractor site personnel attend HSE inductions, as required, and that attendance records are saved. + Ensure incidents are reported and investigated, as required.
Site based personnel	
Santos Senior Client Site Representative	<ul style="list-style-type: none"> + Confirm contractors undertake the activity in a manner consistent with the EPOs and environmental management procedures detailed in this CEMP. + Confirm the management measures detailed in this CEMP are implemented. + Communicate any changes to the activity to the Santos Environmental Advisor. + Confirm all chemical components and other fluids that may be used on site are approved for use. + Advise the Santos DLE Onshore Pipeline Scope Lead of any changes in activities that may lead to nonconformance with the EPOs in this CEMP. + Report environmental incidents to Santos DLE Onshore Pipeline Scope Lead.
Construction Superintendent (Contractor Personnel)	<ul style="list-style-type: none"> + Responsible for ensuring that pipeline construction activities are performed in accordance with this CEMP.

Title (role)	Environmental responsibilities
Onsite HSE Advisors (Santos and/or Contractor)	<ul style="list-style-type: none"> + Support the Santos Senior Client Site Representative to ensure that the controls detailed in this CEMP relevant to onshore activities are implemented and assist in collection and recording of evidence of implementation (other controls are implemented and evidence collected onshore). + Support the Santos Senior Client Site Representative to ensure environmental incidents or breaches of objectives and/ or standards outlined in this CEMP, are reported, and corrective actions for incidents and breaches are developed, tracked and closed out in a timely manner. + Ensure periodic environmental inspections/reviews are completed and corrective actions from inspections are developed, tracked and closed out in a timely manner. + Review Contractors procedures, input into Toolbox talks and JSAs. + Provide day to day environmental support for activities in consultation with the Santos Environmental Advisor.
All Project personnel	<ul style="list-style-type: none"> + Act in an environmentally responsible manner. + Undertake work in accordance with accepted HSE systems and procedures. + Comply with this CEMP and all regulatory requirements as applicable to assigned role. + Report any unsafe conditions, near misses or environmental incidents immediately to supervisors. + Attend environmental inductions and HSE meetings, and complete training as required. + Report wildlife sightings as applicable in accordance with Project requirements

8.2 Workforce training and competency

This section describes the mechanisms that will be in place, so all Project personnel (including employee and contractor roles) are aware of his or her responsibilities in relation to the CEMP and has appropriate training and competencies.

8.2.1 Inductions

Santos and its contractors will develop a mandatory project induction, which will detail CEMP requirements. Project induction attendance will be logged and held with the Project Administration Assistant. Santos personnel will be required to complete required contractor site and facility inductions, including DLNG facility inductions, including permitting requirements, as applicable for working in and around the DLNG facility.

All Project site roles will complete an induction that will include a component addressing their CEMP responsibilities. Induction attendance records for all personnel will be maintained. Inductions will include information about:

- + Environment, Health and Safety Policy
- + Regulatory regime
- + Operating environment
- + Activities with highest risk
- + CEMP EPOs, Performance Indicators and management commitments (e.g. **Section 7**)
- + Incident reporting and notifications
- + Regulatory compliance reporting
- + Process for assessing changes to CEMP activities
- + Spill response.

8.2.2 Training and competency

The implementation of training requirements will ensure project personnel have the skills, knowledge and competencies to conduct work in a safe manner without harm to their health or the environment.

All members of the workforce will complete relevant training and/or hold relevant qualifications and certificates for their roles.

Santos and its contractors are individually responsible for ensuring that their personnel are qualified and trained. The systems, procedures and responsible persons will vary and will be managed using online databases, staff on-boarding process and training departments, etc.

Personnel qualification and training records will be sampled before and/or during an activity. Such checks may be performed during the procurement process, inductions, crew change, and operational inspections and audits.

8.2.3 Workforce involvement and communication

Daily operational meetings will be held at which HSE will be a standing agenda item. It is a requirement that supervisors attend daily operational meetings and that all personnel attend daily toolbox or pre-shift meetings. Toolbox or pre-shift meetings will be held to plan jobs and discuss work tasks, including HSE risks and their controls.

HSE performance will be monitored and reported during the activity, and performance metrics (including environmental performance indicators and the number of environmental incidents) will be regularly communicated to the workforce. Findings, learnings and corrective actions identified from assurance activities and incident investigations will be communicated to project personnel to drive continuous improvement (e.g. through HSE Alerts, pre-shift / toolbox meetings).

8.3 Audits and inspections

Environmental Audits and Inspections undertaken to provide assurance of requirements within this CEMP are being met may include:

- + Routine environmental inspections (during Project execution)
- + Contractor Environmental Audits
- + Regulator Inspections and Audits (as required by Regulator)

For this CEMP the environmental audit and inspection processes are described in the Barossa Project Environmental Compliance Assurance Plan (BAA-200 0635).

An Environmental Assurance Activities Schedule (EAS) will be developed and maintained by the Barossa HSE Team which will align with the Barossa Project Integrated Audit Schedule. The EAS will provide an overview and schedule of assurance (verification) activities required to meet compliance for each activity (e.g., inspections, audits, assessments, and reviews). Additionally, it will allow Santos and the Barossa HSE Team to plan and resource appropriately to ensure all environmental assurance requirements can be met.

Audit criteria, as included within a terms of reference (ToR), will typically include a selection of management actions and environmental performance standards and outcomes; however, may also include parts of the activity description, stakeholder consultation and implementation strategies.

Audit findings may include opportunities for improvement and non-conformances (requirements not met). Audit non-conformances are managed as described in **Section 8.5**

8.4 Environmental Incident Reporting

8.4.1 Internal incident reporting

All personnel will be informed through inductions and daily operational meetings of their duty to report HSE incidents and hazards. Reported HSE incidents and hazards will be shared during daily operational meetings and will be documented in the incident management systems as appropriate. HSE incidents will be investigated and reported in accordance with the Santos Incident Reporting and Investigation Procedure (SMS-HSS-OS07-PD01) and contractor procedures.

The incident reporting requirements will be provided to all crew on-board the facilities and support vessels with special attention to the reporting time frames to provide for accurate and timely reporting.

8.4.2 External incident reporting

Certain incidents will require notification to external Regulatory authorities under NT and Commonwealth legislation. This includes requirements below; additional requirements may apply as conditions of approval of the DPD Project.

8.4.2.1 Reportable Incident – Waste Management and Pollution Control Act 1998 (NT)

As per Part 3 Section 14 of the Waste Management and Pollution Control Act 1998 (WMCA Act 1998), incidents causing, or that may threaten to cause, pollution resulting in material environmental harm or serious environmental harm, will be reported to the NT EPA as soon as practicable after (and in any case within 24 hours after) first becoming aware of the incident. An incident includes *“an accident, emergency or malfunction and a deliberate action, whether or not that action was taken by the person conducting the activity in the course of which the incident occurred”*.

A notification to the NT EPA of an incident as per Part 3 Section 14 of the WMCA Act 1998 will specify:

- + the incident causing or threatening to cause pollution;
- + the place where the incident occurred;
- + the date and time of the incident;
- + how the pollution has occurred, is occurring or may occur;
- + the attempts made to prevent, reduce, control, rectify or clean up the pollution or resultant environmental harm caused or threatening to be caused by the incident; and
- + the identity of the person notifying.

8.4.2.2 Wildlife incident reporting

Any incident resulting in a significant impact to a species listed as threatened or migratory under the *Environmental Protection and Biodiversity Protection Act 1999* (EPBC Act 1999) is to be reported to DCCEEW as soon as practicable (and in any case within 24 hours) of becoming aware of the event occurring.

The report will contain:

- + time, location and description of the incident
- + a summary of the response being undertaken
- + details of the relevant contact person.

8.5 Corrective actions

Corrective actions identified from environmental assurance activities and incident investigations will be derived in collaboration with contractors. For this CEMP, corrective actions and contingency processes are described as per the Barossa Project Environmental Compliance Assurance Plan (BAA-200 0635) and Barossa Health, Safety & Environment Management Plan for Execute (BAA-200 0003).

CEMP non-conformances will be addressed and resolved by a systematic corrective action process as outlined in Santos' Management System. Santos' incident and action tracking management system (HSE Toolbox) will be used to track corrective actions in the following instances:

- + Where there has been or potentially been a reportable incident
- + Where there has been a non-compliance in accordance with a statutory plan
- + Where any corrective action requires notification to an external regulatory or statutory body
- + Where there are corrective actions from formal audits (Contractor Pre-Start Audit, external regulator audit etc.).

Once entered, corrective actions, time frames and responsible persons (including action owners and event validators) will be assigned. Corrective action 'close out' will be monitored using a management escalation process.

Environmental corrective actions identified through compliance assurance activities are to be promptly managed to ensure timeframes for external reporting are met and that decision making is made visible.

8.6 Continuous improvement

For this CEMP, continuous improvement will be driven by the list below and may result in a review of the CEMP.

- + Improvements identified from the review of business-level HSE key performance indicators
- + Actions arising from Santos and departmental HSE improvement plans
- + Corrective actions and feedback from HSE audits and inspections, incident investigations and after-action reviews
- + Opportunities for improvement and changes identified during pre-activity reviews and MoC documents
- + Actions taken to address concerns and issues raised during the ongoing stakeholder management process

Identified continuous improvement opportunities will be assessed in accordance with the MoC process (**Section 8.9.2**) to ensure any potential changes to this CEMP are managed in a controlled manner.

8.7 Emergency preparedness and response

Emergency preparedness and response arrangements, applicable to activities covered by this CEMP, including for spill response, will be included in Santos and Contractor procedures.

Emergency response arrangements as outlined within the DLNG facility Emergency Response Plan (DLNG/HSE/ER/002) may apply for some incidents.

8.7.1 Contractor Emergency Plans

DPD Project contractors are responsible for having comprehensive Emergency Response Plans (ERP) that address emergency response actions associated with all credible incidents for the activity. These will describe the interface arrangements between Contractor and Santos Incident Management structures and cover all aspects of emergency response including technical, logistical and medical support.

Contractor ERPs will outline 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.

8.7.2 Santos Incident Management and Oil Spill Response Arrangements

Santos maintains Incident and Crisis Management Teams (IMT and CMT) and support arrangements to respond to all-hazard incidents, including oil spill incidents, at its sites and for activities under its control or influence, including activities covered under this CEMP. Santos' crisis and incident management arrangement are outlined within the Crisis, Incident Management & Emergency Response Procedure (SMS-HSS-OS05-PD01). IMT and CMT training and exercise requirements are included within an annual training and exercise plan and schedule.

8.8 Reporting and notifications

Environmental reporting for the DPD Project construction activities will include reports between Subcontractors and Contractors, Contractors and Santos, and Santos and Stakeholders, including Regulatory authorities. Reports will be delivered within agreed upon timeframes. outlines an initial assessment of reporting requirements relevant to this CEMP.

External reporting requirements may be dictated by approval conditions associated with the DPD Project and finalisation of this CEMP will include all relevant external regulatory reporting requirements.

A detailed schedule of reporting requirements and submission dates for the DPD Project will be developed as per the Barossa Project Environmental Compliance Plan (BAA-200 0635).

Table 8-2: Summary of key environmental reporting requirements.

Report/ Notification	Responsibility	Content	Frequency	Recipient
Pre-start				
Pre-start contractor audit	Santos DLNG/Barossa Team	Confirmation of compliance with CEMP commitments relating to operational procedures and processes that Santos require to be in place prior to the commencement of the activity.	Prior to commencement of the activity	Santos
Pre-start notifications	Santos Barossa Team / Contractors	Details on DPD Project commencement to meet requirements of stakeholders (including Regulatory authorities)	Prior to commencement of the activity	Various stakeholders
Execution and completion				
Regular Stakeholder updates	Santos Barossa Team	Regular updates on DPD Project during planning and execution as per Stakeholder Management Plan (refer Section 9)	Throughout planning and execution	Various stakeholders
Contractor environmental execution audit	Santos Barossa Team	Confirmation of compliance with CEMP commitments relevant to execution of the activity.	Prior to completion of the activity	Santos
Daily Reports	Contractor Site Superintendent	Update on day's activities, including any identified non-conformance against this CEMP, and any issues that may need addressing.	Daily	Santos
Environmental Reports/Checklists	Contractor Site Superintendent	Compliance against key regulatory and contractual commitments (including CEMP commitments). Reporting of fuel usage, discharges and emissions etc.	Monthly at minimum	Santos

Report/ Notification	Responsibility	Content	Frequency	Recipient
HSE Meetings Records	Contractor and Santos Barossa Team	Monthly, dedicated HSE meetings are held with the onshore and Perth-based management (including contractor management) and advisors to address targeted health, safety and environment incidents and initiatives. Minutes of these meetings are produced and distributed as appropriate.	Monthly	Santos
Completion notifications	Santos Barossa Team / Contractors	Details on DPD Project completion to meet requirements of stakeholders (including Regulatory authorities)	Following completion of the activity	Various stakeholders
Acid Sulfate Soils Monitoring, Inspection and Testing Records (as required)	Santos Contractor and ASS Monitoring Contractor	Records of ASS monitoring, inspection and testing (if applicable) as per requirements of the DPD Project Acid Sulfate Soils and Dewatering Management Plan (BAS-210 0049)	Dependent upon detection of ASS	Santos DEPWS DITT NT EPA
Environmental Performance/ Compliance Assurance Report	Santos Barossa Team	Provides a summary of compliance performance, including the environmental performance objectives, standards and measurement criteria within this CEMP and any other conditions of approval on the DPD Project.	At completion of the activity and not less than annually	DITT NTEPA (DEPWS) DCCEEW (if required)
Incident reporting				

Report/ Notification	Responsibility	Content	Frequency	Recipient
Incident Report – Internal	Contractor and Santos Barossa Team	Provides framework for Internal notification of incidents including spills. The first report contains tools for assessing the severity of the incident and escalating as per the incident notification procedure. Incident reporting will also be undertaken through Santos’ online EHS Toolbox system.	Incident specific	Santos
Incident Report – Reportable Environmental Incident (WMPC Act 1998)	Santos Barossa Team	Reporting of Reportable Incidents as per Part 3 of the Waste Management and Pollution Control Act 1998 (WMPC Act 1998) (Refer Section 8.4.2.1)	Incident specific	NT EPA
Incident Report – Wildlife Incidents	Santos Barossa Team	Reporting of incidents involving EPBC Act species (Refer Section 8.4.2.2)	Incident specific	DCCEW DEPWS

8.9 Document management

This CEMP will be revised based on conditions of environmental approvals and/or licences and submitted to the appropriate regulator, for review and approval as required, prior to DPD Project implementation (i.e. commencement of construction activities).

8.9.1 Information management and document control

This CEMP, as well as any approved management of change (MoC) documents, are controlled documents and current versions will be available on Santos' document control system and made available to Project contractors.

8.9.2 Management of change

Following regulatory review and approval of this CEMP any changes to Project activities as described in this document, which have the potential to materially increase environmental impacts and risks, will be evaluated and controlled following the impact and risk assessment process followed in **Section 6**. The documentation and approval of management of change (MoC) assessments will follow the process outlined within the Santos Management of Change Procedure (SMS-LRG-OS01-PD04). MoC records will be retained and details of MoCs outlined within Regulatory compliance/performance reports.

If there is a change in the petroleum instrument holder, or operator for the activity, a revision of the CEMP will be submitted to DITT as soon as practicable after the change.

8.9.3 Reviews

This CEMP addresses a temporary construction activity. The CEMP will be reviewed annually, or as required in response to regulatory requirements and any changes to impacts, risks or management actions raised in Santos' assurance processes, incident response, stakeholder engagement or contractor engagement. These changes will be evaluated through the MoC process, and significant updates required to be communicated to regulators will be sent for review.

9 Stakeholder Consultation

The stakeholder engagement approach used for the Project is in accordance with Santos's corporate approach to stakeholder engagement and industry leading standards and practice. The approach recognises and is aligned with the NT EPA's Guidance for Proponents – Stakeholder Engagement (NT EPA 2021a), the NT EPA's guidance for Preparing a Supplementary Environmental Report (NT EPA 2021b) and the International Association for Public Participation's (IAP2) Quality Assurance Standard for Community and Stakeholder Engagement (IAP2 2015).

Due to the iterative nature of the stakeholder process all relevant details have been contained in one document, the SER (BAS-210 0020), to contain updates to one location. The SER provides an outline of the objectives, process and key stakeholders consulted for the DPD Project. Additionally, the Stakeholder Engagement Plan (SEP) is attached to the SER. It details all consultation undertaken to date and information on future engagement activities.

In preparing the SER, and project management plans, Santos has considered and assessed each submission individually, and taken into consideration the issues raised when engaging with stakeholders to assess potential impacts and proposed management measures.

The SER provides a summary of the issues raised relevant to the Project and Santos' assessment and response to these issues. A full register, with all submissions and responses, is provided as an attachment to the SER.

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Appendix 1 Santos Environment, Health and Safety Policies

Environment, Health & Safety



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

Status: APPROVED

Document Owner:	Jodie Hatherly, General Counsel and VP Legal, Risk and Governance		
Approved by:	The Board	Version:	3

Appendix 2 Summary of management actions and associated performance criteria for the proposed activity

MA reference	Management Actions
DPD-DLNG-MA01	Restrict disturbance to within the onshore Project Area and existing DLNG site area
DPD-DLNG-MA02	Establish appropriate access restrictions to the onshore Project Area
DPD-DLNG-MA03	Pump water through a silt separator when dewatering in the excavated trench in sections where the trench does not naturally drain to sea
DPD-DLNG-MA04	Geotextiles will be installed under primary construction area (i.e. site pad)
DPD-DLNG-MA05	Trench inspections to be performed daily to check for trapped wildlife
DPD-DLNG-MA06	Insert caps on ends of pipe if the pipe is to be unattended for periods >12 hours; to prevent fauna ingress.
DPD-DLNG-MA07	Ensure any native vertebrates injured by DPD construction activities are referred to an appropriate wildlife carer group or veterinarian
DPD-DLNG-MA08	Return onshore site to natural grade to match existing topography following completion of the activity
DPD-DLNG-MA09	Maintain batters or install fauna ladders on trench entry and exit to allow fauna to exit the trench
DPD-DLNG-MA10	Limit vehicles to access roads, prepared site pad or defined boundaries within the onshore Project Area/DLNG disturbance envelope
DPD-DLNG-MA11	Use water truck for dust suppression
DPD-DLNG-MA12	Establish and implement vehicle speed controls

MA reference	Management Actions
DPD-DLNG-MA13	Implement ASS and groundwater management and monitoring requirements within the ASSDMP (BAS-210 0049) if ASS or groundwater is encountered during onshore construction activities. The ASSDMP includes requirements for: <ul style="list-style-type: none"> + ASS stockpiling, laboratory testing and treatment + Groundwater laboratory testing and treatment + Maintenance of testing and inspection records
DPD-DLNG-MA14	Treat ASS material such that no acid can be released to the environment before it can be used as backfill within the Project Area
DPD-DLNG-MA15	Lights to be orientated directly over the area of work and overspill reduced where practicable by using screens or hoods on lights
DPD-DLNG-MA16	Light audit undertaken within 14 days of commencing construction activities
DPD-DLNG-MA17	Preventative maintenance of equipment and machinery
DPD-DLNG-MA18	Monitor and report fuel consumption
DPD-DLNG-MA19	The Barossa project is included in Santos' Climate transition action plan and will adhere to the Santos GHG management plan and energy management program
DPD-DLNG-MA20	Maintain the onshore Project Area as a cleared site during construction activities
DPD-DLNG-MA21	Comply with DLNG inspection requirements for new vehicles, plant, and equipment to site
DPD-DLNG-MA22	All equipment and material imported from overseas will be inspected by the Australia Quarantine and Inspection Service (AQIS)
DPD-DLNG-MA23	Provide and routinely collect onsite covered putrescible waste bins
DPD-DLNG-MA24	Waste Management Plan in place which includes standards for bin types, lids and covers, waste segregation and bin storage
DPD-DLNG-MA25	HSE inductions – cover requirements for waste management, e.g. label and cover waste skips and bins
DPD-DLNG-MA26	No Perfluorinated Chemicals (PFAS)/ Perfluorooctane sulfonate (PFOS) will be used in firefighting foam
DPD-DLNG-MA27	Inspection and maintenance of all equipment using chemicals
DPD-DLNG-MA28	Implement approved chemical selection procedure

MA reference	Management Actions
DPD-DLNG-MA29	Implement Santos' approved procedures for handling of treated seawater
DPD-DLNG-MA30	Comply with Australian Standards for storage and secondary containment of hazardous chemicals
DPD-DLNG-MA31	Maintain spill response equipment and procedures
DPD-DLNG-MA32	Implement and comply with the existing DLNG Emergency Response Plan (DLNG/HSE/ER/002), including in the event of a storm.
DPD-DLNG-MA33	Implement and comply with the existing DLNG Work Permit Procedure (SMS-OS-OS02-PD03) and associated manuals. This includes the requirement to have firefighting equipment close by whilst undertaking these activities.