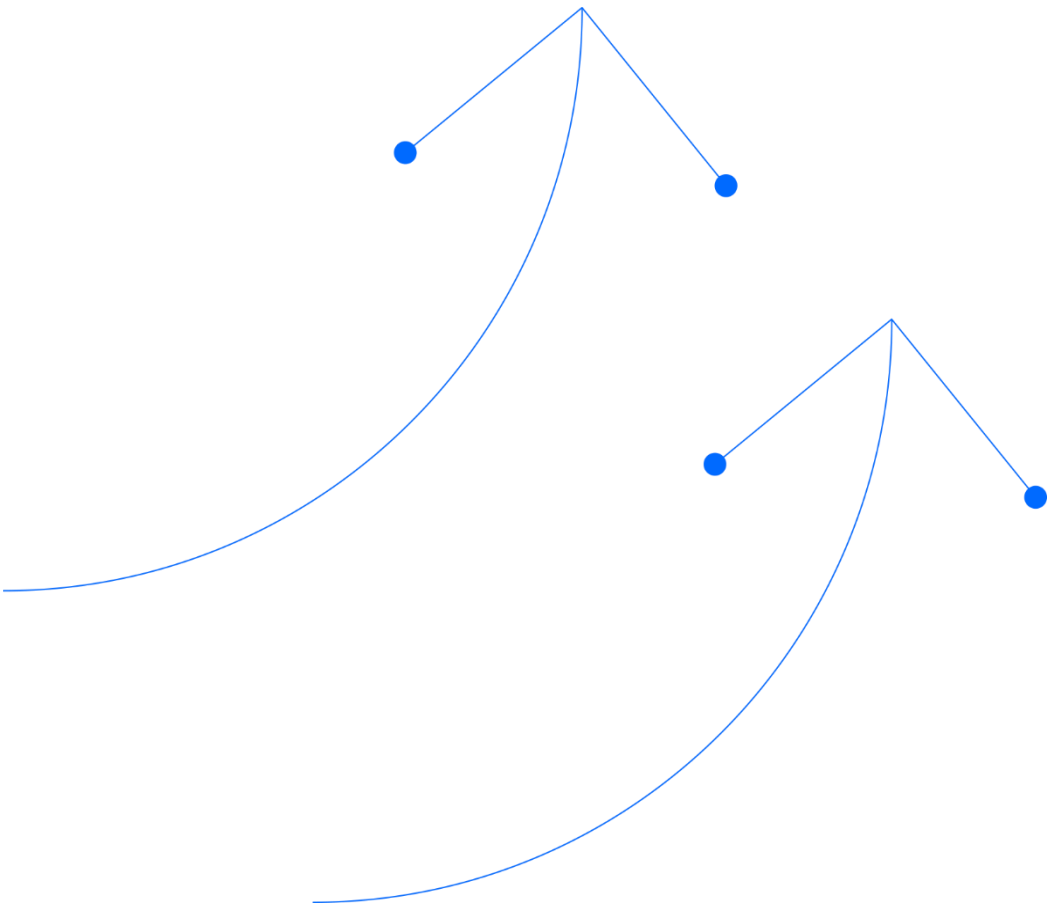




BEETALOO BASIN APPRAISAL PILOT

Environment Management Plan

April 2026



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Common acronyms and abbreviations

Acronym/short form	Long form
4WD	4-wheel drive
AAPA	Aboriginal Areas Protection Authority
AEP	Annual Exceedance Probability
ALARP	As Low As Reasonably Practicable
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AS	Australian Standard
ASME	American Society of Mechanical Engineers
ATV	All-Terrain Vehicle
BoM	Bureau of Meteorology
BOP	Blowout Preventor
CE	Critically Endangered
CEO	Chief Executive Officer
CH ₄	Methane
CLA	Cambrian Limestone Aquifer
CO ₂	Carbon dioxide
CO ₂ -e	Carbon dioxide equivalents
CoP-Well Integrity	Code of Practice: Well Integrity 2025
CPESC	Certified Professional Erosion Sediment Control
DCCEEW	Australian Government Department of Climate Change, Energy, the Environment and Water
DFIT	Diagnostic Fracture Injection Test
DLI	Department of Logistics and Infrastructure
DLPE	Department of Land, Planning and Environment
DME	Department of Mining and Energy
DNA	Deoxyribonucleic Acid
DOH	Department of Health
EC	Electrical Conductivity
EHS	Environment, Health and Safety
EMP	Environment Management Plan
EN	Endangered
EO	Environmental Outcome
EP	Exploration Permit
EP Act	<i>Environment Protection Act 2019 (NT)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>

EPS	Environmental Performance Standard
ESC	Erosion and Sediment Control
ESCP	Erosion and Sediment Control Plan
ESD	Ecologically Sustainable Development
EV	Environmental Value
FIFO	Fly in / Fly out
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse Gas
GIS	Geographic Information System
GPS	Global Position System
GRF	Gum Ridge Formation
ha	Hectares
HDPE	High-Density Polyethylene
HFS	Hydraulic Fracture Stimulation
HSE	Health, Safety and Environment
HV	Heavy Vehicle
IBA	Important Bird Area
IBRA	Interim Biogeographic Regionalisation for Australia
IESC	Independent Expert Scientific Committee
ILUA	Indigenous Land Use Agreement
IMS	Integrated Management System
km	Kilometre
KOP	Kick off Point
LAA	Land Access Agreement
LACA	Land Access and Compensation Agreement
LOR	Limit of Reporting
LV	Light Vehicle
LWD	Logging While Drilling
m	Metres
mbgl	Metres below ground level
MC	Measurement Criteria
ML	Megalitres
MNES	Matters of National Environmental Significance
NAFI	Northern Australia Fire Information
NATA	National Association of Testing Authorities
NGER	National Greenhouse and Energy Reporting scheme

NLC	Northern Land Council
NORM	Naturally Occurring Radioactive Material
NP	National Park
NT	Northern Territory
NT EPA	Northern Territory Environment Protection Authority
NTG	Northern Territory Government
PER	<i>Petroleum (Environment) Regulations 2016 (NT)</i>
PMST	Protected Matter Search Tool
QNT	Queensland and Northern Territory
RBL	Rating Background Level
RTN	Right to Negotiate
SA	South Australia
SDS	Safety Data Sheet
SME	Subject Matter Expert
SMS	Santos Limited's Santos Management System
SPL	Sound Pressure Level
SREBA	Strategic Regional Environmental and Baseline Assessment
STP	Sewage Treatment Plant
TD	Total Depth
TDS	Total Dissolved Solids
TEC	Threatened Ecological Communities
the Code	Code of Practice: Onshore Petroleum Activities in the Northern Territory 2025
TMP	Traffic Management Plan
TOC	Table of Contents
TPWC Act	<i>Territory Parks and Wildlife Conservation Act 1976 (NT)</i>
TVD	Total Vertical Depth
TVDSS	Total Vertical Depth Subsea
UHF	Ultra-High Frequency
VHF	Very High Frequency
VSP	Vertical Source Profiling
VU	Vulnerable
WEL	Water Extraction Licence
WHS	Workplace Health and Safety
WMPC Act	<i>Waste Management and Pollution Control Act 1998 (NT)</i>
WOMP	Well Operations Management Plan
WoNS	Weeds of National Significance

WWMP	Wastewater Management Plan
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Definitions

Terminology	Definition
Acceptability	Determined by both impacts and risks. Acceptability of events is in part determined by the consequence of the impact after management controls. Acceptability of unplanned events is in part determined from the risk ranking after management controls. For both impacts and risks, acceptability is also determined from a demonstration of the ALARP principle, consistency with Santos Policies and all applicable legislation and consideration of information received through relevant persons consultation when determining management controls.
ALARP	As Low as Reasonably Practicable: All reasonably practicable measures are in place to reduce a risk or impact considering the level of consequence and cost, time and resources involved to mitigate it.
Aquifer	Means a geological structure or formation, or an artificial land-fill, permeated or capable of being permeated permanently or intermittently with water.
Aquitard	A geologic unit or confining bed that retards but does not prevent the flow of water to an adjacent aquifer. It does not readily yield water to wells or springs.
Cumulative impact	The cumulative effects of those impacts and risks when considered with each other and in conjunction with any other activities or events that occurred, or may occur in, or near, the permit area.
Disturbance footprint	The anticipated location for project activities. Includes the disturbance extents required within the project area to locate infrastructure required as part of the activity. This may move within the project area during delivery, but not exceed the remnant vegetation disturbance values as identified within this EMP.
Environmental factors and objectives	Those parts of the environment that may be impacted by an aspect of a Regulated Activity. They provide a systematic approach to organising environmental information for the purpose of assessment.
Environmental impact	Any adverse change, or potential change, to the environment resulting wholly or partly from a regulated activity.
Environmental outcome	An outcome that will be achieved if the environmental impacts and environmental risks of a regulated activity are reduced to a level that is ALARP and acceptable.
Hydraulic fracturing	The petroleum extraction process that involves the injection of fluids at high pressure into a geological formation to induce fractures that conduct petroleum for extraction.
Interest holder	A person / company who holds a petroleum interest for a regulated activity. For the purpose of this EMP, the interest holder is Santos QNT Pty Ltd (the Operator).
Non-operational	Any time when there is no crewed works occurring on the site. A non-operational site may include field monitoring.
Operational	Any time where there is crewed works occurring on the site. A short visit to the site for inspection / monitoring does not constitute site works.
Project area	The broader areas surrounding the disturbance footprint. The project area is the outer extent in which all major and minor infrastructure may be located associated with the activity, for example access tracks, borrow pits, groundwater bores and well pads.
Recordable incident	Has the meaning given in Regulation 3 PER being an incident arising from a regulated activity: a) that: i. Has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or ii. Has resulted in a contravention of an environmental performance standard specified in the current plan for the activity; or iii. Is inconsistent with an environmental outcome specified in the current plan for the activity; and

	b) is not a reportable incident
Regulated Activities	The Regulated Activities for this EMP are set out in Section 3. As defined in Regulation 5, a regulated activity is an activity or a stage of an activity: a) Carried out, or proposed to be carried out, in connection with a technical works programme for a petroleum interest; and b) That has, or will have, an environmental impact or environmental risk. This EMP contains the separate plans for multiple regulated activities (including previously approved regulated activities) as per Reg 8(5) of the PER.
Reportable incident	An incident, arising from a regulated activity, that has caused or has the potential to cause material environmental harm or significant environmental harm.
Residual risk	The measure of a risk after mitigation measures and controls have been applied, and it has been demonstrated that the risk is ALARP and acceptable. The term 'residual risk' has the same meaning as ISO 31000,
Significant Impact	As per the definition under the <i>Environmental Protection Act 2019 (NT)</i>, being: Is an impact of major consequence having regard to: a) The context and intensity of the impact; and b) The sensitivity, value and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact.
Suitably Qualified Person	A person who has professional qualifications, training or skills or experience relevant to the nominated subject matter or tasks and can give authoritative assessment, advice and analysis about performance relevant to the subject matters using relevant protocols, standards, methods or literature or conduct tasks in accordance with requirements.
'this EMP' or 'the EMP'	Is a reference to this document, entitled the 'Beetaloo Basin Appraisal Pilot Environment Management Plan', which contains the separate plans for multiple regulated activities (including previously approved activities) as per Reg 8(5) of the PER.
Traditional Owner	Has the meaning given in the <i>Aboriginal Land Rights (Northern Territory) Act 1976 (Cth)</i> being: Traditional Aboriginal Owners, in relation to land, means a local descent group of Aboriginals who: <i>have common spiritual affiliations to a site on the land, being affiliations that place the group under a primary spiritual responsibility for that site and for the land: and are entitled by Aboriginal tradition to forage as of right over that land.</i>

Foreword

Santos, an Australian energy pioneer, has been working to provide reliable, affordable energy to homes and businesses across Australia and Asia for more than 70 years. The Northern Territory (NT) is in our name and in our DNA.

Santos is proud of the employment and economic benefits that have flowed from our work, and the strong relationships we have built with landholders, traditional custodians and local communities since we were established in Adelaide in 1954.

We recognise and respect the connection Traditional Owners have to country. Across Australia, Santos works with 23 Traditional Owner groups and 6 Aboriginal Land Councils. Due to the nature of our operations, Santos wouldn't be able to do what we do without meaningful and lasting engagements and partnerships with the people who host our infrastructure on their land.

Santos has been operating in the NT for decades and our projects have been a mainstay of NT jobs, prosperity and economic development. Our operations in the NT include the Santos-operated Darwin Liquefied Natural Gas (LNG) project, located at Wickham Point, a single train liquefaction, storage and shipping facility that started production in 2006. Gas was supplied via pipeline from the Bayu-Undan field in Timor-Leste offshore waters.

With Bayu-Undan having reached the end of its field life, the Barossa gas field – located in Commonwealth waters approximately 285 kilometres (km) offshore north-northwest from Darwin – will be the source of gas to backfill Darwin LNG. Barossa LNG remains on track to ship its first LNG cargo in the fourth quarter of 2025.

Natural gas is an essential part of Australia's energy mix and the federal government's Future Gas Strategy shows that there will be no energy transition to renewables without gas backup and no Future Made in Australia without the gas that is required to make things.

Onshore gas has played a major role in the NT's economy since its discovery in the 1960s. Santos has 2 active, onshore exploration projects in the NT – in the Amadeus Basin and Beetaloo Sub-Basin, part of the greater McArthur Basin. The exploration permit (EP) within the Beetaloo Sub-Basin is EP 161, located approximately 160 km east of Daly Waters on a perpetual pastoral lease held by private interests.

With energy demand increasing, the scale of shale gas resources in the Beetaloo Sub-Basin, if appraisal confirms its potential, would be a gamechanger not only for the Territory, but also for the Australian east coast domestic gas and Asian LNG markets.

Development of the Beetaloo Sub-Basin has the potential to significantly increase gas supply supporting energy security. Increased supply will also help to lower costs for households, manufacturers and businesses, creating jobs and driving significant economic growth in the NT and across Australia more broadly. Since 2012, Santos has successfully delivered seismic and drilling exploration activity within EP 161 and is now seeking approval to undertake further appraisal works to determine the size, potential production rate, and characteristics of the shale gas reservoir.

This Environment Management Plan (EMP) covers the installation of up to 12 new petroleum appraisal wells at 2 separate well pads within EP 161. The footprint of the activity is small, comprising just two well pads. Given all the risk mitigation measures, the EMP demonstrates how the risk of any impact to the environment is low.

The EMP provides a comprehensive description of Santos' proposed approach to identifying, assessing and managing the potential environmental impacts and risks associated with proposed activities.

Santos is committed to minimising the impact of its operations on the local environment. The environmental risk assessment in the EMP concludes that the risk of unacceptable environmental impacts associated with the proposed activities will be reduced to As Low As Reasonably Practicable (ALARP) and acceptable levels.

In developing the EMP, Santos has undertaken extensive stakeholder engagement with pastoralists, Traditional Owners, and other interested parties whose rights or activities may be directly affected by the environmental impacts or environmental risks of the proposed Regulated Activities.

Santos has incorporated feedback from these stakeholders in the EMP: including relocation of access tracks to accommodate pastoral operations; clarification of our commitment to measures that identify, protect and manage

cultural heritage on an ongoing basis; and our commitment to maintaining infrastructure access to Telstra (Amplitel).

We are committed to a meaningful, ongoing partnership with stakeholders, and these amendments demonstrate that engagement outcomes have been appropriately considered, assessed and integrated into the final EMP.

As we have seen in other Australian gas fields, including in Queensland – onshore gas projects such as what is proposed in the Beetaloo – are multi-decade, legacy-building developments which build and sustain vibrant regional communities.

With our experience pioneering much of the onshore gas development across the Cooper Basin and Queensland's Bowen and Surat Basins, there is no better operator than Santos to bring the energy, economic and social potential of the Beetaloo to life.

If large-scale development of the Beetaloo Basin's shale gas reserves goes ahead in the future, construction and operation of the project will boost economic activity in the NT and Australia more broadly.

The NT could be on the cusp of a shale gas boom akin to the coal seam gas boom experienced by Queensland from around 2010 onwards. It will be important that the lessons learned in Queensland are heeded in the NT – in particular, the need to ensure security of Australia's gas supply and affordability, and the need to achieve efficiency in infrastructure build (such as gas transmission pipelines), while recognising that the capital intensity of a greenfield shale gas industry will need to be underpinned by foreign investment and the scale of Asian LNG markets and customers.

Responsible and successful appraisal of the Beetaloo Sub-Basin could, with the necessary agreements and approvals, lead to further development with significant benefits for the NT including:

- Local jobs and attraction of interstate migration to the NT, growing the taxation base and the population to support expanded and higher-quality services and infrastructure
- Contracting and supplier opportunities for local companies
- Increased regional and Aboriginal employment and procurement opportunities
- Royalties paid to the Territory contributing to improving local community services, regional roads, more police, schools, hospitals and infrastructure
- Important community investment programs developed in partnership with Traditional Owners.

In addition, with necessary approvals and agreements in place, appraisal gas recovered under this EMP would contribute to energy security for the NT, increasing supply to the domestic market.

Santos has been part of the NT for many years, supporting local jobs, business growth and economic development. We are committed to the Territory's growth and building strong, lasting relationships with stakeholders. We understand that being active in the community and engaging openly with Territorians is essential for our success.

This EMP will now be comprehensively assessed by the NT Government to ensure the project meets the high environmental standards applicable in the jurisdiction. This assessment process will include opportunities for interested parties and the community to review the document and make public submissions relating to our EMP.

Santos welcomes this engagement process and recognises the important role it has in ensuring the project is successfully developed with consideration of community interests and to deliver much needed exploration and appraisal of natural gas reserves in Australia in a way that minimises any potential impacts on the environment.



Brett Darley

Executive Vice President – Eastern Australia & PNG

Executive summary

Santos QNT Pty Ltd (Santos) is an Interest Holder and operator of EP 161 located in the Beetaloo basin, approximately 350 km south-east of Katherine in the NT.

Herein after in this EMP, unless expressly stated otherwise, a reference to Santos, is a reference to Santos in its capacity as Interest Holder and operator for the purposes of this EMP.

Santos proposes to drill and test petroleum appraisal wells across two locations within EP 161, collectively referred to as the Beetaloo Appraisal Pilot. Prior to commencing these activities, Santos is required to obtain approval for an EMP addressing the environmental management measures and controls associated with the proposed operations.

The EMP outlines how the environmental impacts and potential environmental risks associated with the Beetaloo Appraisal Pilot will be reduced to a level that is as ALARP. It has been prepared in accordance with the *Petroleum (Environment) Regulations 2016* (PER 2016) and the *Code of Practice: Petroleum Activities in the Northern Territory* (the Code).

Summary of proposed Regulated Activities

This EMP covers the installation of up to 12 new petroleum appraisal wells (up to 3 wells to be drilled per year, over 4 years) at two separate well pads within EP 161. The EMP provides a comprehensive description of Santos' proposed approach to identifying, assessing, and managing the potential environmental impacts and risks associated with the proposed Regulated Activities, which include:

- **Clearing and earthworks for two new well pad locations** – The clearing and construction to create 2 new well pads and ancillary infrastructure (as listed below) at well pad locations referred to as Jibera South and Newcastle South.
- **Drilling** – Up to 12 appraisal wells, being either vertical or horizontal well types, distributed across the Jibera South and Newcastle South well pads.
- **Operating, testing, maintenance and decommissioning** – Up to 12 installed wells distributed across Jibera South and Newcastle South well pads.
- **Hydraulic fracture stimulation (HFS)** – Up to 12 appraisal wells with an average of 60 stages of HFS for horizontal wells and 4 stages for verticals.
- **Wastewater management** – Each well pad will include open top and / or closed top tanks, storage tanks, drilling sumps, cutting pits and any transfer infrastructure within the well pad. This also includes recycling, transportation, and disposal of these wastes (unless otherwise approved for reuse or burial).
- **Ancillary infrastructure and activities** – Infrastructure and activities required to support the appraisal activities includes:
 - Water supply bores – up to 10 bores installed at each well pad
 - Clean water storage – onsite tanks or dams
 - Groundwater monitoring bores – impact and control bores (included as part of total new bores proposed to be installed)
 - Borrow pits
 - Production testing
 - Airstrip operations
 - Office, workshop and laydowns
 - Bulk chemical storage and handling
 - Installation and operation of camps at each the Jibera South and Newcastle South well pads
 - Traffic Management
 - Flaring – a routine activity during the well testing phase and will be managed in accordance with the EMP flaring controls and applicable regulatory requirements.

Incorporation of previously approved EMPs into this EMP

This EMP also includes previously authorised and ongoing Regulated Activities within EP 161. The inclusion of these activities is to allow Santos to continue to undertake these activities, but operate under a single, contemporary EMP document whilst ceasing to operate under the previously approved EMPs. A list of the existing EMPs for EP 161, and the activity approved under each, is provided in Table 2 and Section 1.3.10.

A breakdown of the Regulated Activities, activity status, environmental performance standards, and outcomes and obligations are provided in Appendix A. Upon approval of this EMP, Santos will submit a regulation 14 letter to the Department of Land, Planning and Environment (DLPE) to seek close-out the below previously approved EMPs in accordance with the regulations.

To the extent that there is simultaneous operation of this EMP and the previously approved EMPs in respect of ongoing Regulated Activities as set out in Table 2 below, this EMP incorporates and replaces the environmental management requirements of the previously approved EMPs in respect of those activities. It is intended that approval of this EMP under regulation 11 of the PER will have the effect that this EMP will prevail to the extent of any inconsistency with the previously approved EMPs, including during any transitional period in which this EMP and the previously approved EMPs remain simultaneously in force. Following approval, Santos will engage with DLPE to formalise the close-out of the previously approved EMPs by way of notice under Regulation 14 of the PER.

Table 1 and Table 2 summarise the components of the activities to be carried out under this EMP. Further detail on the Regulated Activities for this EMP are set out in Section 3.

Table 1: Key components of the activities covered by this EMP

Overview	Units	Unit of measure
Exploration Permit	EP 161	
Total area of EP	1,050,870	ha (hectares)
Total project area	429 ¹	ha
Total area of surface disturbance (including existing disturbed areas)	87.34 ²	ha
Total area of remnant vegetation disturbance	46.9 ³	ha
Rehabilitation commenced from previous EMP Activities	121.9 ⁴	ha
Total number of new wells under this EMP (to be delivered over 5 years)	12	Maximum number of wells over the EMP period
Anticipated wells delivered per year	Up to 3	Wells
Groundwater		
Water Extraction Licence (WEL)	The Interest Holder intends to apply for an increased allocation to ensure consistency with the appraisal works proposed in this EMP. Activities will commence under its existing WEL and operate within the requirements of this allocation until an increase volume is approved.	
Extraction Licence - existing	193.5	Megalitres (ML) /year

¹ Project Area includes previous 2D Seismic and Ground Gravity program previously disturbed area of 125 ha, Mount Browns and Inacumba project area of 99.4 ha and the new Jibera South, Newcastle South project area of 204.59 ha.

² This is a total disturbance area which includes both pre-disturbed and new remnant vegetation areas as per Table 14.

³ Total area of 46.9 ha of remnant vegetation will be cleared as part of this project, which will be rehabilitated.

⁴ Rehabilitation that commenced as part of the 2D Seismic and Ground Gravity program.

Extraction Licence – target	750	ML / year
Number of bores for extraction	Up to 10	Per well pad
Estimated total groundwater usage	2,350	ML
Potable water		
Potable water usage	4	ML / year
Produced fluid/flowback		
Anticipated flowback rate based on previous appraisal campaigns	10%	Of injected stimulation water
Anticipated flowback volume	14-28	ML per well
Maximum storage requirements per 3 well yearly campaign	Up to 108	ML
Tank size	Between 7-13.5	ML
Number of tanks	- Up to 8 x 13.5 ML (4 each well pad), or - Up to 16 x 7 ML (8 on each well pad), or - A mixture of tank sizes ranging from 7 ML to 13.5 ML	ML
Anticipated volume of open tanks for evaporation	13.5 ML	Per well pad
Potential evaporation	0.35 (open tanks) or 0.25 (closed tanks)	ML / month
Traffic movements		
Average traffic movements – during active drilling and HFS operations	30 light vehicles (LVs) 15 heavy vehicles (HVs)	Vehicles per day
Average traffic movements – during other operations	5 LVs 2 HVs	Vehicles per day
Emissions		
Total Scope 1 greenhouse gas emissions ⁵	276,896	metric tonnes of carbon dioxide equivalent (t-CO ₂ -e)

⁵ The activity does not have any Scope 2 emissions

Table 2: Previously approved EMPs for EP 161

Approved EMP	EMP Name	Approved	Activities approved	Status
STO7-4: 2D Seismic and Ground Gravity Survey Program	EP 161 2D Seismic and Ground Gravity Survey Program	September 2024	2D seismic and survey – approximately 240 km of seismic lines & 10 km of connection lines.	Completed
			Rehabilitation of up to 240 km of seismic lines and 10 km of connection lines.	Ongoing
STO2-7: McArthur Basin Drilling Program <i>(responsibility for rehabilitation activities was transferred to STO1-4 in accordance with Condition 2 of the relevant EMP's Statement of Reasons (SOR))</i>	McArthur Basin 2019 Drilling Program Revised and added program in STO 2-7 (Inacumba program cancelled)	21 February 2021	Drilling of Mount Brown-1 (formerly Tanumbirini-1).	Completed
			Marmbulligan - 1 stratigraphic Core hole Program.	Completed
			Drilling of water bores in Mount Brown (formerly Tanumbirini) North.	Completed
			Drilling of water bores at Mount Brown (formerly Tanumbirini) South and Inacumba North and South.	Completed / Cancelled
			Drilling of Inacumba-1 pilot well.	Cancelled
			Plug and decommission of the deepest section of the Inacumba-1 pilot well.	Cancelled
			DFIT of Mount Brown-1 (formerly Tanumbirini-1).	Complete
			Drilling of Mount Brown-2H (formerly Tanumbirini-2H) well.	Complete
			Well integrity monitoring.	Ongoing
			Evaluation of Inacumba-1/1 H and Mount Brown-2H (formerly Tanumbirini-2H) (including mudlogging, wireline/LWD, coring).	Ongoing
			Suspension and/or plugging and decommissioning of Mount Brown (formerly Tanumbirini-2H) and Inacumba-1/1 H.	Ongoing
			Drilling of Mount Brown (formerly Tanumbirini)-3H well.	Complete
			Drilling of Inacumba-2H well.	Complete
			Evaluation of Inacumba-2H and Mount Brown (formerly Tanumbirini)-3H (including mudlogging, wireline/LWD, and coring).	Ongoing
			Suspension and/or plugging and decommissioning of Inacumba-2H and Mount Brown (formerly Tanumbirini)-3H.	Cancelled / Ongoing

STO1-4: McArthur Basin Civil and Seismic Program	Environment Management Plan: McArthur Basin Civil and Seismic Program - Revision 4	June 2019	Expansion of the Mount Brown (formerly Tanumbirini) lease pad and construction of the Inacumba lease pad	Complete / Cancelled
			Civil engineering activity - upgrading and creation of new roads and access tracks, clearing of laydown areas, borrow pits, campsites, and tank pads.	Ongoing
			Acquisition of a 10 km 2D seismic line (Rehabilitation only)	Complete, Rehabilitation ongoing
			The reprofiling of access tracks and lease pads	Ongoing
			(Formerly captured within STO2-7) Rehabilitation of the Mount Brown (formerly Tanumbirini)-3H and Inacumba-2H wells.	Ongoing
			(Formerly captured within STO2-7) Rehabilitation of the Mount Brown-1 (formerly Tanumbirini-1), Mount Brown-2H (formerly Tanumbirini-2H) and Inacumba-1H wells.	Ongoing

Location

The Regulated Activities will be undertaken in EP 161, which is located approximately 350 km south-east of Katherine in the NT, as shown in Figure 1 below. The Project Area is located on Tanumbirini Station, a 5,000 km² cattle grazing property within NT Portion 701 of Arnold. The proposed Regulated Activities are primarily located at two sites within EP 161, as shown on Figure 2.

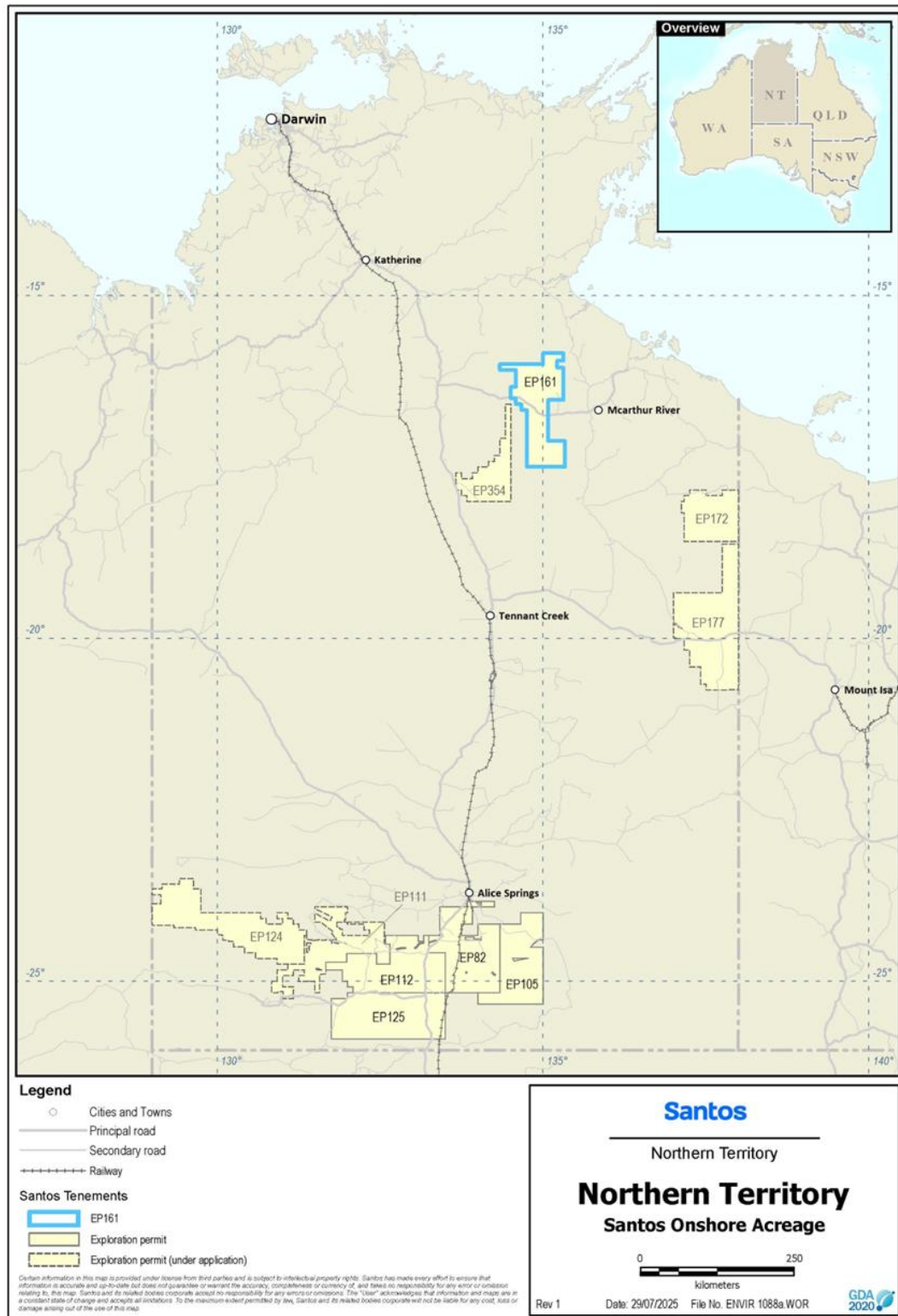


Figure 1: EP 161 location within the Northern Territory

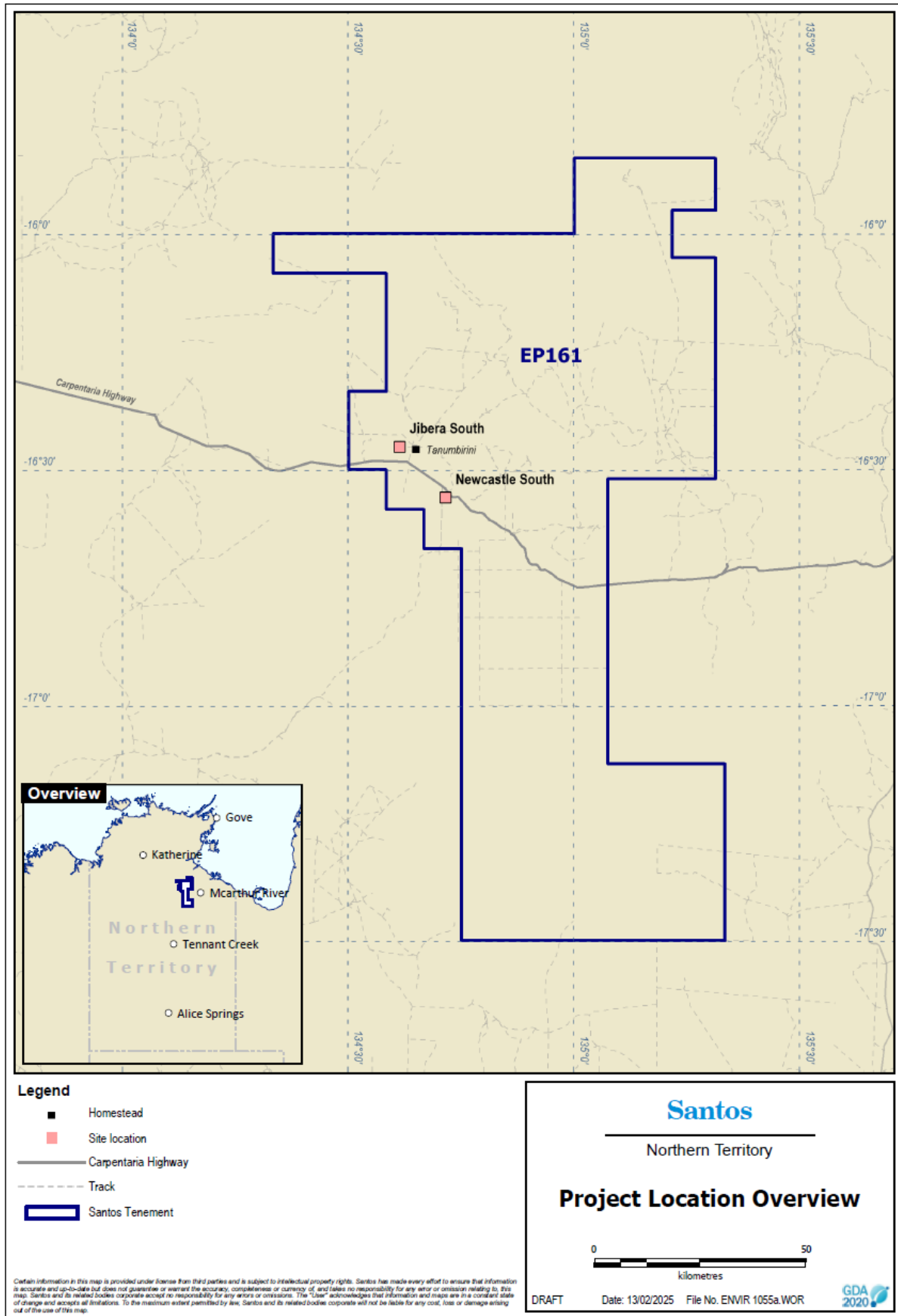


Figure 2: Location of the activity sites within EP 161

Description of the environment

A summary of the physical and social environment of the Project Area is provided in Table 3. A detailed description of the existing environment is provided in Section 4 of the EMP.

Table 3: Summary of environmental and social values of EP 161

Environmental factors	Environmental values and sensitivities	Summary
Terrestrial flora and fauna	Vegetation communities and threatened ecological communities	There are no Threatened Ecological Communities (TECs) or threatened flora listed under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) and/or TPWC Act known to occur within 10 km of the Project Area. 9 vegetation communities were reported within the Project Area. None of the vegetation communities identified comprise a sensitive or significant vegetation type.
	Groundwater dependent ecosystems (GDEs)	There are 3 GDE communities within 5 km of the Newcastle South and Jibera South well pad. These GDEs are likely to be accessing a localised, shallow perched groundwater system given the inferred depth of the regional-scale Cambrian Limestone Aquifer (CLA) in the study area.
	Threatened fauna species and their habitat	The Protected Matter Search Tool (PMST) and NT database searches identified 24 fauna species as threatened that could potentially occur in the Project Area. These included 11 birds, 6 mammals, 6 reptiles and one shark ⁶ . Of these, the Gouldian finch has a likely occurrence on the site; and the red goshawk, grey falcon, northern shrike-tit, plains death adder, northern blue-tongue skink and yellow-spotted monitor a possible likelihood of occurrence.
	Listed migratory species	The PMST search identified 12 listed migratory species and 17 marine species within 50 km of the site that were potentially occurring in the Project Area. Of these, the fork-tailed swift has a known likelihood of occurrence and Oriental cuckoo is possible.
	Threatened flora species	Forty-two individual flora species were identified during the field surveys in December 2024. The desktop and field surveys indicated that no threatened flora species listed under the EPBC Act or TPWC Act could potentially occur in the Project Area.
	Weeds	A desktop survey and the December 2024 field survey identified a single species of <i>Hyptis</i> occurred sporadically around the Jibera South well pad. No other weed species were identified.
Terrestrial environmental quality	Soils	Most of the area for both Jibera South and Newcastle South was mapped as containing Kandosols, with Vertosol scattered around access tracks. Kandosols are typically red to brown in colour, have a sandy to loamy texture and are well drained and permeable.
Inland water environmental quality	Groundwater	The CLA is a regional scale aquifer that provides groundwater resources for pastoral enterprises, domestic bores at homesteads and town water supplies at a number of small communities across the region.
	Surface water	The site is located in the head waters of floodplains, with no watercourses within the Project Area. In significant rainfall events, this flood plain drains into larger rivers eventually into the Gulf of Carpentaria. Eighty km downstream of the works area the rivers traverse the Limmen Bight NP.

⁶ The PMST identified a shark and other marine species during desktop assessments associated with the Regulated Activities. Santos has conducted appropriate validation and assessments of these species and determined that they are unlikely to occur in this location.

Hydrological processes	Supply and quantity of water	Ephemeral creeks adjacent to the Project Areas are located at the headwaters of the Limmen Bight River catchment and feed into the Limmen Bight River during significant rainfall events.
Social, economic and cultural surroundings	Aboriginal cultural heritage, sacred sites	An application for an Aboriginal Areas Protection Authority (AAPA) Certificate or Authority Certificate Variation was submitted to AAPA in January 2019 (awarded on 13 May 2019 as Authority Certificate C2019/043, as a variation to C2014/053) to ensure that the locations and activities covered under this EMP have been appropriately surveyed and subsequently conditioned. A cultural heritage (archaeological) survey and assessment of Aboriginal Heritage was completed by an independent consultant to support this EMP (Appendix L).
Human health	People and communities	There are a number of pastoral properties with livestock and infrastructure in the vicinity of the Project Area. The nearest sensitive receptor is Tanumbirini Homestead, located approximately 3.7 km east of Jibera South well pad.

Environmental risk assessment summary

An evaluation of environmental, cultural, and social risks associated with the proposed Regulated Activities has been carried out using the Santos Limited's Risk Matrix. This process identified potential impacts and risks from planned and unplanned events, the likelihood and consequence of those events, proposed mitigations, and assigned residual risk levels through the assessment of both the likelihood and consequence of potential impact the mitigation and management measures required to reduce residual risk to a level that is as low as reasonably practicable (ALARP) and acceptable.

Section 6 of the EMP addresses a range of key risk themes associated with the activity, including groundwater and aquifer protection, wastewater and chemical management, well integrity, erosion and sediment control, biodiversity and weed management, cultural heritage protection, community amenity, traffic and workforce interactions, bushfire, greenhouse gas emissions, and cumulative impacts.

Key controls include:

- Well design, construction, operation, suspension and decommissioning in accordance with the *Northern Territory 2025 Code of Practice – Well Integrity* and the approved Well Operations Management Plan (WOMP).
- Wastewater, spill and chemical management measures to prevent uncontrolled releases to land and water.
- Groundwater extraction, monitoring and adaptive management in accordance with the applicable Water Extraction Licence and monitoring program.
- Erosion and sediment controls for disturbed areas.
- Biodiversity, fauna management and weed hygiene controls to minimise impacts to native vegetation, fauna habitat and ecological values.
- Cultural heritage avoidance, approval and unexpected finds procedures.
- Noise, light, traffic and stakeholder management measures to minimise impacts to nearby landholders and other receptors.
- Methane emissions management, venting and flaring controls, and emissions reporting.
- Bushfire prevention and response measures.
- Progressive rehabilitation and monitoring of disturbed areas.

It was concluded that with the proposed mitigation measures in place, all identified risks will be reduced to low or very low and acceptable levels (see Table 4), with no medium, high or very high residual risks remaining.

Table 4: Summary of residual risk ratings

Environmental Risk Rating	Very Low	Low	Medium	High	Very High
Number	16	21	0	0	0

This assessment demonstrates that the risk of unacceptable environmental impacts associated with the activities will be reduced to ALARP and acceptable levels. The activities will be undertaken in accordance with the Code, and all reasonably practicable controls identified in the EMP and supporting appendices will be implemented. proposed Regulated ies

Environmental outcomes

The environmental outcomes of the proposed Regulated Activities are:

- Air quality is maintained and dust generated by the activity does not cause environmental harm or unreasonable nuisance.
- Greenhouse gas emissions are minimised to ALARP and reported in accordance with legislative requirements.
- There is no unauthorised disturbance to sacred sites, Aboriginal cultural heritage places, artefacts or other protected cultural heritage values.
- Soil disturbance is limited to approved areas, erosion and sediment release is controlled, and disturbed landforms and drainage are reinstated to a stable condition.
- Surface water and groundwater are protected from contamination, aquifer separation is maintained throughout the life of the well, and groundwater extraction remains within approved limits.
- There are no uncontrolled releases of wastewater, drilling by-products, hazardous chemicals, dangerous goods or other wastes to the environment.
- Native flora, fauna and habitat are protected by avoiding or minimising unnecessary disturbance, managing fauna interactions, and preventing the spread of weeds.
- Disturbed areas are rehabilitated progressively and returned to a stable, safe and self-sustaining condition consistent with agreed post-activity land use outcomes.
- Noise, light, traffic and visual amenity impacts on landholders and other receptors are managed in accordance with applicable requirements, and complaints are recorded and addressed.
- Bushfire risk arising from the activity is prevented and managed.
- The workforce conducts activities in a manner that avoids adverse interactions with landholders, infrastructure and the broader community..

Chemical risk assessment

A tiered risk assessment was conducted on the compiled hydraulic fracturing fluid systems using screening of the potential human health and ecological hazards from potential exposure to the hydraulic fracturing fluids during transportation, hydraulic fracturing activities (including storage) and subsequent treatment and disposal of flowback fluids. The tiered assessment includes the following steps:

- **Tier 1** – Identify chemicals of low human health and ecological concern that do not require additional chemical risk assessment in the tiered assessment process.
- **Tier 2** – Chemicals that are not identified as a low human health and ecological concern and using a quantitative evaluation of the risks based on the potential exposure pathways and Tier 1 assessment.

Of the chemicals evaluated for the 2 hydraulic fracturing system formulations, the following additives were carried through to Tier 2 assessments:

- Hydrotreated light petroleum distillate (CAS RN 64742-47-8) based on the potential for inhalation exposure to workers during hydraulic fracturing activities.

- Chemicals identified with a high ecotoxicity hazard and therefore having a potential avian wildlife exposure to fluids stored in open treatment tanks, and having the requisite toxicity data include:
 - Amine oxides, cocoalkldimenthy (CAS RN 61788-90-7)
 - Chlorous acid, sodium salt (CAS RN 7758-19-2)
 - Crontonaldehyde (CAS RN 4170-30-3)
 - Gluteraldehyde (CAS RN 111-30-8)
 - Tributyl tetradecyl phosphonium chloride (CAS RN 81741-28-8)

A Tier 2 assessment has been undertaken (Appendix D) on these chemicals with the results showing no unacceptable risks to workers or avian species from the activity.

A list of chemicals proposed to be used for HFS are provided in Table 5.

Table 5: Anticipated HFS chemicals to be used

Proppant type (e.g. sand)	Anticipated volumes (informed from offset well activities)		
	Kilograms	% of total volume	
Ceramic	66,361	1.14%	
Sand	123,241	2.07%	
Chemical additives	Purpose	Litres	% of total volume
Nitrogen	Lighten fluid	37,854	1.72%
Water in products	To ease chemical addition	11,621	0.528%
Acrylamide, sodium acrylate polymer	Friction reduction / viscosity	3,323	0.151%
Hydrotreated light petroleum distillate	To ease chemical addition	3,173	0.144%
Choline Chloride	Clay control	2,068	0.0940%
Hydrochloric acid	Acid	1,215	0.0552%
Sodium perborate tetrahydrate	Crosslinker	870	0.0395%
Alcohols, C6-12, ethoxylated propoxylated	Wetting agent / solvent	719	0.0327%
Ethanol	Wetting agent / solvent	493	0.0224%
Cocobetaine	Wetting agent / solvent	375	0.0170%
1,4-Dioxane-2,5-dione, 3,6-dimethyl-, (3R,6R)-, polymer with rel-(3R,6S)-3,6-dimethyl-1,4-dioxane-2,5-dione and (3S,6S)-3,6-dimethyl-1,4-dioxane-2,5-dione	Fluid loss control	366	0.0166%
Alcohols, C10-16, ethoxylated propoxylated	Wetting agent / solvent	257	0.0117%
Fatty acids, tall-oil, ethoxylated	Wetting agent / solvent	250	0.0113%
Amides, tall-oil fatty, N,N-bis(hydroxyethyl)	Wetting agent / solvent	246	0.0112%
Butyl alcohol	Wetting agent / solvent	239	0.0109%
Alcohols, C12-15, ethoxylated	Wetting agent / solvent	224	0.0102%
Sodium Chloride	To ease chemical addition	202	0.00917%
Sodium polyacrylate	Scale inhibitor	198	0.00901%

Ethoxylated branched C13 alcohol	Wetting agent / solvent	171	0.00778%
Sorbitan, mono-9-octadecenoate, (Z)	Stabilising agent	169	0.00766%
Sodium diacetate	Stabilising agent	158	0.00719%
Sorbitan monooleate polyoxyethylene derivative	Stabilising agent	154	0.00699%
Guar gum	Friction reduction / viscosity	141	0.00640%
Acetic acid	Buffer	126	0.00572%
Potassium chloride	Clay control	124	0.00562%
Glycerine	Wetting agent / solvent	78	0.00355%
Tributyl tetradecyl phosphonium chloride	Biocide	62	0.00280%
Cinnamaldehyde	Wetting agent / solvent	59	0.00269%
Diethylene glycol	Wetting agent / solvent	54	0.00246%
Ethylene glycol	Wetting agent / solvent	50	0.00227%
Methanol	Wetting agent / solvent	46	0.00211%
Polyethylene glycol	Wetting agent / solvent	45	0.00204%
Polypropylene glycol	Wetting agent / solvent	44	0.00199%
Citric acid	Buffer	41	0.00186%
Sodium bisulfite	Stabilising agent	40	0.00184%
Sodium hydroxide	Buffer	24	0.00107%
Diethanolamine	Wetting agent / solvent	22	0.00100%
Ulexite	Crosslinker	21	0.00094%
Amine oxides, cocoalkyldimethyl	Stabilising agent	18	0.00084%
Sodium thiosulfate	Stabilising agent	15	0.00067%
Siloxanes and Silicones, di-Me, reaction products with silica	Wetting agent / solvent	15	0.00067%
Hydroxylpropyl guar	Friction reduction / viscosity	14	0.00063%
Triethanolamine	Chemical activator	9.8	0.00045%
Benzaldehyde	Wetting agent / solvent	8.3	0.00038%
Chlorous acid, sodium salt	Breaker	5.5	0.00025%
Alcohols, C12-16, ethoxylated	Wetting agent / solvent	3.5	0.00016%
Disodium octaborate tetrahydrate	Crosslinker	2.0	0.000091%
Crystalline silica, quartz	Stabilising agent	1.4	0.000064%
Sodium iodide	Stabilising agent	0.94	0.000043%
Acrylamide acrylate copolymer	Friction reduction / viscosity	0.90	0.000041%
Sodium persulfate	Breaker	0.69	0.000031%
Sodium Sulfate	Stabilising agent	0.55	0.000025%
Sodium Sulfite	Stabilising agent	0.32	0.000014%
Glutaraldehyde	Biocide	0.18	0.000008%

Silica dioxide	To ease chemical addition	0.093	0.000004%
Sodium carbonate	To ease chemical addition	0.081	0.000004%
Acrylonitrile	Friction reduction / viscosity	0.003	0.000000%
Benzoic acid (group)	Tracer	0.750	0.000035%

Stakeholder engagement

The Petroleum (Environment) Regulation 2016 (PER) defines a 'stakeholder' as:

- A person or body whose rights or activities may be directly affected by the environmental impacts or environmental risks of the regulated activity proposed to be carried out; or
- An agent or representative or a person or body mentioned in the point above.

The proposed Regulated Activities are located within a pastoral station, in a remote location, and the disturbance footprint of the proposed Regulated Activities and its impacts on the environment is relatively small. Using the PER stakeholder definition, Santos has identified the following groups as the relevant stakeholders whose rights or activities may be directly affected by the environmental impacts or environmental risks of the proposed activities:

- Host Pastoralist – Rallen Australia Pty Ltd
 - Native Title parties and stakeholders – facilitation via their representatives:
 - Northern Land Council (NLC)
 - Top End (Default PBC) Aboriginal Corporation
 - Nurrdalindi Aboriginal Corporation.
- Government agencies/other interested parties:
 - Department of Logistics and Infrastructure
 - Power and Water Corporation
 - Roper Gulf Regional Council
 - Telstra.

Santos has undertaken the following engagement activities to inform the development of this EMP:

- A Beetaloo Appraisal Activity Information Pack provided to all identified stakeholders listed above.
 - Provided to each stakeholder between 20th-26th June 2025.
 - Allowed 4 weeks response period to formally respond to the information pack.
- An on-country meeting, coordinated by the NLC for all relevant Native Title holders, held 30 September 2025.
- Regular meetings with the NLC and the host pastoralist.
- Feedback from stakeholders which has directly shaped the EMP are:
- Revision of infrastructure layouts: Relocation of the access track to accommodate pastoral operations.
- Cultural Heritage protection clarification: Santos is confident that it has met its obligations to manage potential cultural heritage risks for the proposed activities in accordance with the PER and that a CHMA is not an obligation associated with the work sought to be authorised under this EMP. Further, current cultural heritage protection mechanisms for exploration and appraisal activities, including the Regulated Activities proposed by this EMP, are defined and covered in the existing 2012 Cooperations and Exploration Agreement. Santos is however also committed to collaborating with the NLC and to consider developing a CHMA with relevant parties in the future.

- Enhanced commitments: Inclusion of a management commitment to maintain Telstra (Amplitel) infrastructure access.

These amendments demonstrate that engagement outcomes have been appropriately considered, assessed, and integrated into the final EMP to address stakeholder concerns and regulatory expectations. Further detail is provided in Section 5 of this EMP.

1. Introduction

1.1. Scope of this EMP

In the NT, an EMP is required to be prepared by proponents of a petroleum project and details how environmental risks and impacts will be managed throughout the project's life, demonstrating that these will be reduced to a level that is ALARP and acceptable. This EMP has been prepared by Santos in accordance with the Code. Table 6 provides a brief outline of the content of each section of this document, in line with Regulation 9 of the PER, and requirements in Schedule 1.

Table 6: Overview of EMP content

Section	Title	Content
ES	Executive summary	Provides a concise overview of this EMP.
1	Introduction	- Defines the purpose of the proposed Regulated Activities. - Defines the scope of the EMP. - Nominates the Interest Holder.
2	Relevant legislation and other requirements	- Identifies and describes relevance of any legislation applicable to this EMP relevant to the protection of the environment. - Identifies additional approvals and agreements to be attained before commencing the proposed Regulated Activities. - Assesses requirements in accordance with the EP Act (NT).
3	Regulated Activity description	- Describes the Regulated Activities, including the location of the Project Area, general details of the construction and layout, and an outline of operations, and proposed timetable). - As the proposed Regulated Activities involve HFS, details of the chemicals proposed to be used in drilling and stimulation activities.
4	Existing environment	- Describes the existing environment that be affected by the proposed Regulated Activities, including particular values and sensitivities that may exist. - Details any uncertainties or lack of understanding in relation to the environment.
5	Stakeholder engagement	- Provides information and evidence of stakeholder engagement that has been undertaken to support preparation of the EMP and information about future stakeholder engagement. - Provides a summary of the feedback.
6	Environmental impact and risk assessment	- Outlines all impacts and environmental risks of the Regulated Activities and the assessment of those impacts and risks (including a description of the process used to assess the impacts and risks) and the risk mitigation strategies that will be implemented. - Specifies the environmental outcomes / performance standards of the Regulated Activities. - Demonstrates residual environmental risk is ALARP and acceptable. - Describes any uncertainty or lack of understanding in relation to the environment. - Cumulative effects of those impacts.
7	Management plans	Management plans that have been developed to manage impacts associated with the Regulated Activities.

8	Implementation strategy	• Outlines application of Santos Limited's Management System and relevant management strategies (including details of systems, monitoring and testing, and personnel) and an emergency contingency plan, known as the Emergency Response Plan. • Confirms environmental outcomes and performance standards Santos aims to achieve. • Arrangements for recording, monitoring and reporting information about the Regulated Activities. • Arrangements for notifications and reporting requirements.
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1.2. Purpose of the proposed Regulated Activities

Early exploration efforts of the Beetaloo Basin commenced in the 1980s, initially targeting conventional oil and gas within the Roper and McArthur Groups. In the 2000s, attention shifted towards unconventional resources, particularly shale gas. The Middle Velkerri Formation (Amungee Member) emerged as a significant target due to its rich organic content and favourable geological characteristics.

Within EP 161, Santos conducted the tenure's first significant 2D seismic survey in 2013, acquiring approximately 497 km of data. Mount Brown-1 was drilled in 2014 at the centre (deepest part) of the EP 161 depocenter, which was followed by the Marambulligan-1 stratigraphic well in 2016. After the lifting of the hydraulic fracturing moratorium, Mount Brown-1 underwent fracture stimulation and flow testing in late 2019. The well demonstrated promising gas flows, and a 'Declaration of Discovery' was issued in 2020.

In 2021, a 2-well horizontal campaign was completed to further test the B-Shale in the Mount Brown area (Mount Brown-2H/ST1, Mount Brown-3H/ST1). In 2024, positive drilling results across the basin and within EP 161 lead Santos to advance its seismic coverage in the Jibera South and Newcastle South areas.

Santos proposes to continue petroleum exploration activities on EP 161. The Beetaloo Appraisal Pilot will assess the prospectivity of a longer-term commercial shale gas development within the EP 161 permit area, that could potentially deliver significant economic growth, job creation and energy security for the NT.

A key objective for the proposed Regulated Activities is to demonstrate that shale gas development can be undertaken in safe, sustainable and reliable manner, with minimal impact on the environment, and in a way that is acceptable to the communities alongside which it operates.

1.3. Nomination of the interest holder

Santos QNT Pty Ltd (Santos) and Tamboran Resources Ltd (Tamboran) are the interest holders in EP 161. For the purpose of this EMP, Santos QNT Pty Ltd (Santos) as the Operator will be wholly responsible for the undertaking of the Regulated Activities and implementation of the management measures set out in this EMP. The details of the interest holders' nominated liaison are provided in Table 7.

Table 7: Operator contact details

Operator details	Operator Liaison contact person
Name: Santos QNT Pty Ltd (Santos)	Name: Matthew Mitchell
Address: 60 Flinders Street, Adelaide, SA, 5000	Position: Development Lead NT
Telephone: 08 81 16 5000	Company: Santos QNT Pty Ltd
ACN: 083 077 196	Address: Level 22, Santos Place, 32 Turbot Street, Brisbane, QLD

2. Relevant legislation and other requirements

2.1. Legislation requirements

A summary of legislation and approval requirements and the Interest Holder's actions and intent for each are provided in Table 8.

Table 8: Summary of legislation and approval requirements

Name	Requirements	How the interest holder meets the requirement	Administrator
Commonwealth			
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	- Under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) an action will require approval from the minister if the action has, will have, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES). - Proponents are responsible for determining whether a proposed action is likely to have a significant impact on a MNES. - To support this obligation, the Commonwealth provides publicly available EPBC Act self-assessment tools and guidance that companies may use during project planning and environmental assessment.	Santos has completed a self-assessment under the EPBC Act to determine whether the Regulated Activities are likely to have a significant impact on MNES. The self-assessment concluded that the proposed Regulated Activities are not likely to result in a significant impact on MNES.	Department of Climate Change, Energy, the Environment and Water (DCCEEW)
<i>Aboriginal and Torres Strait Heritage Protection Act 1984</i>	The Act protects areas and objects in Australia that are of particular significance to Aboriginals in accordance with Aboriginal tradition. The Act allows the Commonwealth Environment Minister, on the application of an Aboriginal person or group of persons, to make a declaration to protect an area, object or class of objects from a threat of injury or desecration. There are not specific legal requirements that must be assessed as part of this proposal in regard to this Act, however Traditional Owners may apply for a declaration by the Federal Minister in the event that areas or objects of traditional significance could be disturbed and/or damaged.	The project has not been deemed to have a significant impact in regard to federal legislation and therefore it is not anticipated that this act will apply.	DCCEEW
<i>National Greenhouse and Energy Reporting Act 2007</i>	- A national framework for reporting and disseminating company information about greenhouse gas emissions, energy production, energy consumption and other information otherwise specified under the legislation. - Companies that meet certain thresholds must register under the framework and report their emissions, energy consumption and consumption each year. This data informs national policy and program development. - One of the key statutory instruments for regulating Australia's emissions in line with its NDCs under the Paris Agreement is the	The Interest Holder will work with Santos Ltd being the controlling corporation and relevant reporting entity under the NGER Act for the purposes of its compliance with applicable emissions reporting requirements under the National Greenhouse and Energy Reporting Scheme (NGER). Although not projected to do so, should emissions exceed relevant thresholds under the Safeguard Mechanism (being a zero GHG emissions baseline for a shale gas extraction facility), Santos will meet its obligations	The Clean Energy Regulator (CER)

	<i>National Greenhouse and Energy Reporting (NGER) (Safeguard Mechanism) Rule 2015</i> (Cth) (the Safeguard Mechanism), made under the NGER Act and administered by the Clean Energy Regulator. The Safeguard Mechanism was developed to ensure Australia's largest industrial Greenhouse Gas (GHG) emitters keep their net emissions below an emissions limit (a baseline). The Safeguard Mechanism currently applies to facilities that emit more than 100,000 tonnes CO₂-e per annum and requires annual emissions to be reported against a designated emissions 'baseline'. In line with the NT's commitment to implementation of recommendation 9.8 of the Scientific Inquiry into Hydraulic Fracturing in the NT projects extracting or exploring shale gas, including those in the Beetaloo sub-Basin are required to have net-zero Scope 1 emissions.	under the Safeguard Mechanism to offset the Scope 1 emissions to a net zero position as required including the potential surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs).	
<i>Native Title Act 1993</i>	- This Act provides a legal framework for the recognition and protection of native title rights for Aboriginal and Torres Strait Islander peoples where those rights haven't been extinguished by government action. The Act establishes processes for recognising native title, resolving claims, validating past government actions, and managing future developments on land where native title exists or may exist, including ensuring that the right to negotiation with native title claimants and any expedited procedure for consultation are complied with. - The Act requires proponents to engage with Native Title parties (for this EMP it is the Northern Land Council) to form agreements before activities can proceed.	- A 'Co-operation and Exploration Agreement - Exploration Permit Application EP(A)161' was signed 4 April 2012 which provides for the consent to the grant of EP 161 and the ability for Santos to conduct exploration activities, subject to certain conditions. This Agreement was negotiated pursuant to s31 of the <i>Native Title Act 1993</i>. - The counterparty to this agreement is the "Native Title Parties" defined more particularly as "those Aboriginals who have or claim Native Title in the Application Area as at the date of this Deed including the Custodians of Sacred Sites or Sacred Objects wholly or partly within the Application Area" and "The Northern Land Council".	The Attorney-General's Department
Northern Territory			
<i>Petroleum Act 1984</i>	- This Act is the principal legislation dealing with petroleum tenure, exploration and production activities onshore and in inland waters of the NT. - The Act provides a legal framework to undertake exploration for petroleum and to develop petroleum production so that the optimum value of the resource is returned to the NT. - A petroleum exploration permit is required to explore for hydrocarbons, including when found in connection with helium. The Act also requires compensation to be paid to native title holders and	- Exploration permit EP 161 has been obtained. - The Interest Holder is the registered holder of the exploration permit EP 161. - Operations for the drilling of a well or for a seismic survey cannot commence unless notice is given to the Minister and the Minister's approval is obtained.	DLPE Department of Mining and Energy (DME) Department of Treasury and Finance (DTF)

	owners and occupiers of land with a registered interest in the land where petroleum activity is proposed. The Act is supported by the <i>Petroleum Regulations 2020</i> and the <i>Schedule of Onshore Petroleum Exploration and Production Requirements 2012</i>.	This appraisal is covered by a Co-Operation and Exploration Agreement (2012) with the NLC (and others).	
<i>Petroleum Regulations 2020</i>	- The Regulations requires a land access agreement before conducting regulated petroleum operations. - The rules governing access by an interest holder to Pastoral Leases (granted under the <i>Pastoral Land Act 1992</i>) are set out in the <i>Land Access Petroleum Regulations 2020 Guideline</i>.	- A Land Access Agreement (LAA) is in place – number LAA0022*, approved 4 October 2023. - Existing Land Access and Compensation Agreement (LACA) is in place for ongoing work at Mount Brown and Inacumba locations and water monitoring bore construction and sampling.	DME
<i>Petroleum (Environment) Regulations 2016</i>	- The PER ensures the regulated activity has an approved EMP, which satisfies the approval criteria set out in Regulation 9. The activity is a regulated activity under the PER with regulated activity defined in Regulation 5. - The PER at Regulation 5A sets out that decisions are subject to the principles of ecologically sustainable development. - The PER includes notification requirements for recordable and reportable incidents - The Regulations requires that an EMP be submitted to the Minister for approval, describe what an EMP must contain to meet approval criteria, and require proponents to undertake stakeholder engagement during preparation of an EMP. Furthermore, the PER states an EMP must be developed in accordance with the Code. - The Regulation requires that notification by the Interest Holder be made to the Minister and owner and occupier of the land before the proposed date of commencement of construction or drilling.	- This EMP has been developed in accordance with the approval criteria set out in regulation9, being that an EMP: - Includes all information required by Schedule 1. - Is appropriate for the nature and scale of the regulated activity to which it relates. - Demonstrates that the activity will be carried out in a manner by which the environmental impacts and environmental risks of the activity will be reduced to a level that is ALARP and acceptable. - Includes an authority certificate in relation to the land on which the activity will be carried out. - This EMP considers the principles of ecologically sustainable development. - The EMP identifies the incident and reporting requirement which are to be undertaken in accordance with the PER. - the EMP has been submitted to the Minister for assessment and approval. - Stakeholder engagement has been undertaken and is described in Section 5.	DLPE

<i>Bushfires Management Act 2016</i>	- This Act provides for the protection of life, property and the environment through the mitigation, management and suppression of bushfires, and for related purposes. - The Act requires operators to manage fire risk to protect people, property and the environment during petroleum operations.	- Addressed through the Santos Bushfire Management Plan (Appendix B), including bushfire preventative and response measures. Santos utilised the NT <i>Government's Bushfire Management Planning Guide: Onshore Petroleum Projects</i> (2020) to prepare the Fire Management Plan. - Annual fire mapping with Northern Australia Fire Information (NAFI) to monitor changes in fire frequency as required by the Code.	Northern Territory Fire and Emergency Service
<i>Environment Protection Act 2019 and Environment Protection Regulations 2020</i>	This Act and Regulation require a proponent to refer a proposed action to the Northern Territory Environment Protection Authority (NT EPA) that has the potential to have a significant impact on the environment.	- Refer to Section 2.5. - Santos has assessed the proposed Regulated Activities using the pre-referral screening tool in the NT EPA's Referring a proposal to the NT EPA: <i>Environmental Impact Assessment Guidance for Proponents</i> (2025). It has been determined that the proposed Regulated Activities are unlikely to have a significant impact on the environment.	NT EPA DLPE
<i>Territory Parks and Wildlife Conservation Act 2014</i>	- Makes provision for the establishment of Territory Parks and other Parks and Reserves and the study, protection, conservation and sustainable utilisation of wildlife. It sets aside areas of the NT as parks and conservation areas that may not be developed. Flora and fauna can also be declared as threatened species under the Act. - The Act requires petroleum projects to identify, assess and manage potential impacts on protected flora, fauna and habitats with the project area. It is an offence to take, interfere with, or destroy any listed species or their habitat without authorisation.	Desktop assessments and field surveys have identified no occurrences of threatened species or sensitive habitats likely to be significantly affected by the proposed disturbance. The clearing footprint has been designed to avoid areas of known environmental or conservation value, and standard mitigation measures will be implemented to minimise impacts such as dust, erosion, and habitat loss. Based on these findings, the project does not anticipate any significant impact on species or ecological communities protected under this Act.	Department of Tourism and Hospitality (DTH)
<i>Weeds Management Act 2001</i>	- Aims to prevent the spread of weeds throughout the NT, ensuring the management of weeds is an integral component of land management. If a weed is declared, all landholders, land managers and land users (including interest holders) must comply with the declaration classification. - The Act requires operators to prevent, control and manage the spread of declared weeds within their project areas.	Santos will comply with the requirements of this Act through the implementation of weed prevention, detection, and eradication controls as detailed in the Weed Management Plan (Appendix C). An overview of the Weed Management Plan is outlined in Section 6 and 7.	DLPE

<i>Waste Management and Pollution Control Act 1998)</i>	- The Act aims to protect, and where practicable, restore and enhance the quality of the NT environment; encourage ESD; and facilitate the implementation of National Environmental Performance Measures established by the National Environment Protection Council. It is designed to prevent contamination of the surrounding environment, including soil, air, and water, and imposes a general environmental duty on conducting an activity or action that causes or is likely to cause pollution resulting in environmental harm, or that generates or is likely to generate waste and a general duty to notify of incidents causing or threatening to cause pollution. - The disposal of listed waste and discharge of water to the environment requires a licence under the Act. - The WMPC Act does not apply within the petroleum permit area, however, any offsite disposal will require compliance with this Act.	- Santos does not propose to dispose of listed waste to the environment. - Licensed contractors may be engaged for the removal and disposal of listed waste outside the petroleum permit area, in accordance with the WMPC Act. - Management of wastes produced as part of the activities are addressed in Appendix O (Risk Assessment).	DLPE
<i>Water Act 1992 and Water Regulations 1992</i>	- This Act provides for the investigation, allocation, control, protection, management and administration of water resources in the NT. The Act prohibits waste to come in contact with water or water to be polluted unless under authorisation. - The Act requires Interest Holders to obtain a Water Extraction Licence (WEL) prior to the extraction of any groundwater. - The WEL (and any subsequent amendments or new licences) governs the activities scale and methodologies and activities will be delivered in accordance with current limits and conditions. - The Act governs the installation of bores by requiring that any person drilling, constructing, or altering a bore must hold a licence or permit issued by the Controller of Water Resources, ensuring that groundwater extraction and bore construction are conducted sustainably and in accordance with approved standards.	- WEL GRF10280 authorises the extraction of 193.5 ML/year from the Gum Ridge Formation and was reissued on 6 December 2023 for a period of 10 years (expires 31 December 2033). - Santos proposes to seek authorisation to extract up to 750 ML/year in total to support proposed Regulated Activities. Santos will not extract more water than it is authorised to and in strict accordance with WEL requirements. - WEL amendments will be sought as required including for Santos to construct up to 10 groundwater bores at each well pad.. Authorisation to construct any new bores (permit for bore work) will also be obtained in accordance with section 57 of the <i>Water Act 1992</i>. - No surface water take is proposed. - No wastewater release to surface water is proposed. - No waste or wastewater will be disposed of underground.	DLPE
<i>Work Health and Safety (National Uniform Legislation) Act 2011</i> <i>Work Health and Safety (National Uniform</i>	The WHS Act is part of the nationally harmonised work health and safety laws, which aim to provide all workers in Australia with the same standard of health and safety protection regardless of the work they do or where they work. It requires workers and workplaces to implement the national health and safety framework.	Santos will maintain an accessible register of hazardous chemicals, safety data sheets (SDS) and appropriate procedures and controls to prevent worker exposure to hazards.	NT WorkSafe, Department of the Attorney-General and Justice

<i>Legislation) Regulation 2011</i>	This includes hazardous chemical assessments, a hazardous chemical register, access to safety data sheets, labelling and the use, handling, generation, and storage of hazardous chemicals at a workplace. • All chemicals used or stored on site must be managed in accordance with relevant Act requirements. • An Emergency Response Plan (ERP) must be in place to address potential incidents such as chemical spills, fires, or leaks, outlining clear notification procedures, containment measures, and first-aid or evacuation protocols. • The Act imposes duties under the WHS Act to require the elimination or minimisation of health and safety risks as far as reasonably practicable. • The Act requires notification of notifiable incidents and preservation of incident sites.	• Santos will notify NT WorkSafe if required under the legislation. • Emergency Response Plan (Appendix M) and Section 8.5 (Incident reporting) provide information on how Santos fulfil its obligations under this Act.	
<i>Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2010 and Transport of Dangerous Goods by Road and Rail (National Uniform Regulation) Regulations 2011</i>	• Requires implementing all required signage, spill management, reporting, and licencing requirements for chemical transportation during drilling activity. • Road vehicles must be licenced, and the drivers must hold a dangerous goods driver's licence to transport dangerous goods over a certain volume or weight (Regulations, Part 15). • Notification of incident resulting in dangerous situation required.	• Section 6 (Environmental risk and impact assessment) and 8.5 (Incident reporting) of the EMP, and the Spill Management Plan (Appendix E) provide further information of the management of dangerous goods.	NT WorkSafe, Department of the Attorney-General and Justice
<i>Heritage Act 2011 and Heritage Regulations 2012</i>	• The Act establishes the Heritage Council and the NT Heritage Register and requires the avoidance of impacts on heritage places and objects. It sets the process by which places become heritage places, allows for interim protection of places and sets out the requirements for getting permission to do work to heritage places and allows for fines and imprisonment for offences against the Act. Work approval is required to carry out works on a heritage place or object. • Requires that any new archaeological site, object or heritage place discovered during activities must be reported as soon as practicable to the Heritage Branch.	• Any new sites or finds identified while carrying out the Regulated Activities will be reported to the CEO of the Heritage Council under the Heritage Act 2011 (Section 6.1 and 6.6). • Prior to and during the Regulated Activities, a cultural heritage management procedure will be implemented to ensure appropriate identification, protection and management of cultural heritage values. • Further information is provided in Section 4.3.14.	DLPE
<i>Radiation Protection Act 2004</i>	• The Act manages radiation for the protection of people and the environment • It governs the use, storage, transport and disposal of radioactive materials and equipment.	• Section 6 and the Wastewater Management Plan (WMP) (Appendix F) manages the drilling by-products and produced fluids prior to on-site or off-site disposal.	Department of Health (DoH)

	The Act will be considered in the event that naturally occurring radioactive material is intersected and requires management.	Assessment of the potential accumulation of NORM in well equipment at the time of well suspension or decommissioning in accordance with the Monitoring Program (Section 8.6)	
<i>Northern Territory Aboriginal Sacred Sites Act 1989</i>	The Act establishes the AAPA as the body responsible for overseeing the protection of sacred sites in the NT. The AAPA provides process requirements for avoidance of sacred sites and/or entry onto sacred sites and requires the issue of Authority Certificates, which indemnify the holder against prosecution under the Act for damage to sacred sites in the certificate area, provided works or use has occurred in accordance with the conditions of the Authority Certificate.	- AAPA Authority Certificates have been obtained (Section 4.3.14) - Prior to and during the Regulated Activities, access to land and the management of cultural heritage will be undertaken in accordance with established Indigenous access and cultural heritage management processes. - Further information is provided in Section 4.3.14 (Cultural Environment), the Heritage Assessment (Appendix L) and the Risk Assessment (Appendix O). - Santos and the Northern Land Council are parties to a Cooperation and Exploration Agreement. Multiple consultations and sacred site avoidance surveys completed to date. - All activities proposed in this EMP will be undertaken in accordance with an AAPA Authority Certificate or Authority Certificate Variation. - The AAPA Authority Certificates relating to EP 161 to date are: - Seismic Survey – C2013/142 - Construction of 3 Wells, VSP, Seismic lines – C2014/053; varied C2019/043 (Exploration Wells, Well Development and 2D Seismic Survey – Northern Region) - Water Bores for Environment Monitoring – C2018/102 - varied in C2018/105 - Exploration Wells, Well Development & 2D Seismic Survey – Southern Region) - C2020/011. - C2020/011 is the current certificate relevant to these appraisal activities which was issued on 20 February 2020.	AAPA

<i>Public and Environmental Health Act 2011, and Public and Environment Health Regulations 2014</i>	- This Act makes provision to protect and promote the health of individuals and communities in the Territory, and to monitor, assess and control environmental conditions, factors and factors and agents, facilities and equipment and activities, services and products that impact on, or may impact on, public and environmental health. - Other relevant regulations under the Act include Public Health (General Sanitation, Mosquito Prevention, Rat Exclusion and Prevention) Regulations. - Wastewater treatment systems are subject to requirements of the Act. Sewerage plants need to meet the NT Code of Practice for Small On-site Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent.	Santos aligns its operation to ensure that the wastewater treatment systems meet the requirements of the Act and Regulations and that the sewage treatment plants are managed in accordance with Department of Health <i>Code of Practice for Wastewater Management</i>.	DoH
<i>Dangerous Goods Act 1998 (NT)</i>	Ensures the safe handling, storage and transport of dangerous goods.	The SMS will be implemented during the course of the Regulated Activities to ensure the safe handling of dangerous goods.	NT WorkSafe, Department of the Attorney-General and Justice
Other Approval Requirements			
<i>Code of Practice: Onshore Petroleum Activities in the Northern Territory 2025 (NT) (the Code)</i>	The Code applies to all activities involved in both conventional and unconventional oil and gas exploration, appraisal, development, production and ancillary works in the NT. And provides the minimum standards which must be adhered to. The Code addresses the management of environmental risk and environmental impacts associated with the conduct of Regulated Activities. It provides mandatory requirements that must be adhered to, and preferred requirements that should be followed unless a viable alternative can be justified.	- Section 3 of the EMP sets out site selection, activity description of the proposal. - The mitigation and management of the environmental factors and objectives are presented in Section 6 (Environmental Risk and Impact Assessment), following the description of the risk assessment process. Appendix O includes references to the relevant sections of the Code for each risk source to ensure compliance with the Code.	DLPE
<i>Code of Practice: Well Integrity 2025 (CoA - Well Integrity)</i>	- Sets out mandatory standards and best practice requirements for the design, construction, operation, maintenance, and abandonment of petroleum wells in the NT. - The CoA - Well Integrity applies to ensure that all wells are engineered, constructed, and managed to prevent leaks, protect groundwater and surface water resources, and maintain long-term well integrity. - It requires that: - Well barriers are properly designed, verified, and tested.	Santos will develop a Well Operations Management Plan (WOMP) that will be submitted to the Department of Mining and Energy, NT for approval.	DME

	- That risks to human health, safety, and the environment are minimised. - That detailed records and monitoring are maintained throughout the well's lifecycle. • Compliance with this Code is requirement under the PER 2016		
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2.2. Agreement and approvals

Santos will ensure that all necessary agreements and approvals are in place before the commencement of any part of the Regulated Activities proposed under this EMP (Table 9). All works will be undertaken according to the terms and conditions stipulated in relevant approvals and agreements.

Table 9: Agreements and approvals

Agreement / approval	Overview/status
Native Title Co-operation and Exploration Agreement (CEA)	Native Title Agreement negotiated in 2012 pursuant to section 31 of the <i>Native Title Act 1993</i> (Cth). Initial Grantee party Tamboran Resources, with Santos assigned the Grantee rights and obligations for same in acquiring 75% interest in EP 161. The CEA supports the EMP in that it provides evidence that stakeholder engagement and cultural considerations have been properly addressed as required under the <i>Native Title Act 1993</i> and relevant land access requirements.
Land Access and Compensation Agreement	The Interest Holder has a land access agreement in place with the affected party that permits the Interest Holder to undertake the proposed activities outlined in the EMP. This demonstrates that Santos has secured lawful access for the proposed activities and ancillary infrastructure and has considered the pastoralists rights and potential impacts in its assessment.
Water Extraction Licence	WEL GRF10280 for 193.5 ML / annum is currently held. WEL amendments will be sought as required including for Santos to construct up to 10 groundwater bores at each well pad. Santos will also submit an application for a new WEL to increase this to a total of 750 ML/annum to support proposed activities. Assessment of groundwater drawdown, the spatial extent of drawdown, and potential impacts on nearby groundwater users and groundwater-dependent values associated with extraction of up to 750 ML/year will be undertaken as part of the new WEL application and assessment process. The WEL assessment will be completed in accordance with NT regulatory requirements under the <i>NT Water Act 1992</i> and the <i>Georgina Wiso Water Allocation Plan 2023–2031</i> (NTG, 2023), which applies to groundwater within the Cambrian Limestone Aquifer (CLA) in the Daly Roper Beetaloo Water Control District.
Well Operations Management Plan	Santos will submit a WOMP, in relation to the well activities proposed in the EMP, to DME for approval. A WOMP and EMP are complementary regulatory documents that are both required for petroleum activities in the NT. Both of these are required to be approved prior to drilling activities commencing.
AAPA Certificate	All activities proposed in this EMP will be undertaken in accordance with an AAPA Authority Certificate or Authority Certificate Variation. The relevant AAPA Authority Certificate for the appraisal activities is C2020/011 issued on 20 February 2020. An AAPA certificate that covers all areas of the activities is a prerequisite for regulatory approval to demonstrate that cultural heritage obligations have been met.

2.3. Relevant guidelines

This EMP has been prepared in consideration of the following environmental standards, guidelines, and codes of practice:

- NT EPA Environmental Factors and Objectives (NT EPA, 2025)
- Land Clearing Guidelines – Northern Territory Planning Scheme (DEPWS, 2021, 2024)
- Onshore Petroleum Annual Environmental Performance Report Guideline (DEPWS, 2023)
- Environmental Factor Guidance: Atmospheric Processes, Greenhouse Gas Emissions (NT EPA, 2025)
- Environmental Factor Guidance: Cultural Heritage – Draft (NT EPA, 2022)

- Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-basin (NT DENR, 2018)
- Code of Practice for Wastewater Management NT 2020
- NT Planning Scheme Clearing Guidelines
- Santos Management System (SMS)
- Australian Petroleum and Exploration Association's (APPEA) Code of Environment Practice 2008 (APPEA, 2008)
- Minimum Construction Requirements for Water Bores in Australia, 4th Edition (National Uniform Drillers Licensing Committee, 2020)
- *National Environment Protection Council Act 1994* (National Environment Protection [Assessment of Site Contamination] Measure 1999).

2.4. Ecologically sustainable development

Ecologically sustainable development (ESD) is defined in the EP Act as development that improves the total quality of human life, both now and in the future in a way that:

- Maintains the ecological processes on which all life depends.
- Recognises the need for development to be equitable between current and future generations.

The principles of ESD, as referenced in the *Petroleum Act 1984* (NT), are set out in Sections 18-24 of the EP Act, and are a requirement of the Code, Section 1. In determining whether to approve an EMP, the Minister must consider and apply those principles.

In preparation of the EMP, the below points were considered regarding ESD principles:

- The proposed Regulated Activities comprises small scale appraisal activities which will assess the prospectivity of future commercial natural gas resources in the Beetaloo Basin.
- The well pads have been designed to utilise existing access tracks as much as practicable or along previously disturbed areas such as fence lines.
- Of the 37 environmental risks identified in relation to the proposed Regulated Activities, 16 were assessed as very low, and 21 as low. No risks were identified as having a rating of medium or higher. All identified risks have been assessed and reduced to ALARP and acceptable (relevant to the principles set out in ss 19 and 21 of the EP Act).
- Mitigation measures will be in place to prevent or minimise any impact on threatened species (relevant to the principles set out in ss 23).
- Third-party, suitably qualified consultants were engaged to design site-specific ecological, weed and cultural surveys to inform a detailed description of the environment and site-specific risk controls (relevant to the principles set out in ss 20, 23 and 26 of the EP Act).
- Third-party, suitably qualified consultants were engaged to create site-specific erosion and sediment control plans, surface water and groundwater monitoring and WWMP (Appendix F) (relevant to the principles set out in ss 19, 22, 23 and 26 of the EP Act).
- Site-specific plans (bushfire, weed, spill, wastewater, methane and rehabilitation) have been created, all of which are underpinned by a contingency (emergency response) plan to prevent and mitigate foreseeable risks and respond to an unwanted event if one was to occur (relevant to principles set out in ss 19, 21, 25, 26 and 27 of the EP Act).
- Stakeholders (including Traditional Owners and Pastoralists) that may be affected by the Regulated Activities have been identified and engaged (relevant to the principles set out at ss 18, 20, 21 and 22 of the EP Act).

- The operator has strategies in place to achieve their local spend policy that includes engaging local businesses, facilities, suppliers and employment of local / regional people (relevant to the principle set out at ss 21 of the EP Act).
- The area utilised will be rehabilitated at the cessation of all approved Regulated Activities, along with areas previously used for the Interest Holders exploration activity in the Project Area at the cost of the interest holders (relevant to the principles set out at ss 18,19,21 and 23 of the EP Act).

2.5. Referral under NT legislation

2.5.1. Referral under the Environment Protection Act 2019 (NT) (EP Act)

Under the EP Act, proposed actions that may have a significant impact on the environment are required to be referred to the NT EPA for assessment. The Interest Holder has assessed the Regulated Activities using the pre-referral screening tool in the NT EPA's *Referring a proposal to the NT EPA: Environmental Impact Assessment Guidance for Proponents (2025)*.

The pre-referral screening assessment took into consideration the following aspects of the proposed Regulated Activities:

- There is no anticipated impact on the variety and integrity of distinctive physical landforms. The Project Area is comprised of relatively flat terrain and the proposed Regulated Activities do not involve activities that will significantly alter surface water flows or increase land erosion.
- Land and soil will be protected through the implementation of site-specific erosion and sediment control, weed management, spill, wastewater, rehabilitation and contingency (emergency) management plans.
- Terrestrial habitats will be avoided through the utilisation of an ecologist during site selection and avoidance of areas of significant habitats. A fauna spotter will be onsite at the time of clearing activities to further mitigate any potential impacts from the Regulated Activities.
- The water required for the Regulated Activities will be sourced from up to 10 water bores at each well pad. These water bores will be located more than one km away from, and will not impact water supply from, any water supply bores operated by other users, including those for domestic or stock consumption. Surface waters will not be impacted and there are no streams or surface water bodies mapped within 4 km of either well pad.
- Protection of groundwater quality can be achieved by adhering to the CoP-Well Integrity and *Minimum Construction Requirements for Water Bores in Australia – Fourth Edition 2025*. These standards ensure the necessary barriers are in place to ensure long term protection of water quality in beneficial use aquifers.
- Drilling pits and above-ground open-topped treatment tanks will have freeboard levels maintained and monitored to significantly reduce the risk of overtopping during extreme rainfall events.
- Above-ground tanks will have secondary containment compliant with A.3.8 of the Code and telemetry to allow for remote monitoring when no operations are active onsite.
- The workforce required for the Regulated Activities will be sourced from a local workforce where available and practicable to do so, otherwise interstate/national resources will be used.
- An AAPA Authority Certificate has been granted, and this EMP includes measurement criteria (Section 6.7) to ensure compliance with the resulting conditions. A cultural heritage survey has been conducted that concluded that significant early historical sites are unlikely to be present near the proposed access tracks or well pads.
- Santos has considered the *Environmental Factor Guidance: Atmospheric Processes – Greenhouse Gas Emissions* published by the NT EPA in August 2025 and the emissions thresholds set out therein as guidance for when to consider NT EPA referral based on GHG emissions. Santos has determined that referral is not required based on GHG emissions for the Regulated Activities. Scope 1 emissions are estimated to remain below 100,000 t CO₂-e in any financial year and the overall scope 1 emissions

estimates (approximately 276,896 t CO₂-e over a 5–6 year period) reflect the short-term duration of the Project (Section 3.15.5). Emissions will be monitored and recorded in accordance with Section 3.15.8 to track performance against forecasts. Should emissions exceed relevant thresholds under the Safeguard Mechanism (being a zero GHG emissions baseline for a shale gas extraction facility), Santos will meet its obligations under the Safeguard Mechanism to offset the Scope 1 emissions to a net zero position as required including the potential surrender of Australian Carbon Credit Units (ACCUs) or Safeguard Mechanism Credits (SMCs). Scope 1 emissions will be reported as per the requirements of the NGER Act and managed in accordance with the Code to ensure compliance with NT and national policies.

- The beneficial reuse of appraisal gas is outside the scope of this EMP and would be subject to a separate regulatory assessment and approval process. If opportunities for beneficial use of appraisal gas (such as gas to market or power generation) are available at the commencement of operations, GHG emissions from flaring associated with proposed Regulated Activities are expected to be lower than the estimates presented in Section 3.15, Tables 35 and 36.
- The Regulated Activities will be conducted approximately 3.7 km away (Jibera South) and 12.5km (Newcastle South) from the nearest sensitive noise receptor. A noise assessment has been completed, which shows compliance with the *NT Noise Management Framework Guideline, 2018*.
- During the Regulated Activities, the health and safety of personnel will be protected through the implementation of appropriate safety protocols, which will conform with the SMS. In addition, the environmental protection measures set out in this EMP will be implemented, which will also conform with the SMS.

Based on a detailed assessment, Santos has determined that the Regulated Activities are unlikely to have a significant impact on the environment.

3. Regulated Activities description

3.1. Overview of proposed Regulated Activities

This EMP covers the installation of up to 12 new petroleum appraisal wells (up to 3 wells to be drilled per year, over 4 years) at two separate well pads within EP 161. The EMP provides a comprehensive description of Santos' proposed approach to identifying, assessing, and managing the potential environmental impacts and risks associated with the proposed Regulated Activities, which include:

- **Clearing and earthworks for two new well pad locations** – The clearing and construction to create 2 new well pads and ancillary infrastructure (as listed below) at well pad locations referred to as Jibera South and Newcastle South.
- **Drilling** – Up to 12 appraisal wells, being either vertical or horizontal well types, distributed across the Jibera South and Newcastle South well pads.
- **Operating, testing, maintenance and decommissioning** – Up to 12 installed wells distributed across Jibera South and Newcastle South well pads.
- **Hydraulic fracture stimulation (HFS)** – Up to 12 appraisal wells with an average of 60 stages of HFS for horizontal wells and 4 stages for verticals.
- **Wastewater management** – Each well pad will include evaporation tanks, storage tanks, drilling sumps, cutting pits and any transfer infrastructure within the well pad. This also includes recycling, transportation, and disposal of these wastes (unless otherwise approved for reuse or burial).
- **Ancillary infrastructure and activities** – Infrastructure and activities required to support the appraisal activities includes:
 - Water supply bores – up to 10 bores installed at each well pad
 - Clean water storage – onsite tanks or dams
 - Groundwater monitoring bores – Impact and control bores (included as part of total new bores proposed to be installed)
 - Borrow pits
 - Production testing
 - Airstrip operations
 - Office, workshop and laydowns
 - Bulk chemical storage and handling
 - Installation and operation of camps at each the Jibera South and Newcastle South well pads
 - Traffic Management.
 - Flaring – a routine activity during the well testing phase and will be managed in accordance with the EMP flaring controls and applicable regulatory requirements.

This EMP also includes previously authorised and ongoing Regulated Activities within EP 161. The inclusion of these activities is to allow Santos to continue to undertake these activities, but operate under a single, contemporary EMP whilst ceasing to operate under the existing EMPs. A list of the existing EMPs for EP 161, and the activity approved under each, is provided in Table 11 and Section 3.14.

A breakdown of the Regulated Activities, activity status, environmental performance standards, and outcomes and obligations are provided in Appendix A. Upon approval of this EMP, Santos will submit a regulation 14 letter to the Department of Land, Planning and Environment (DLPE) to close-out the below EMPs in accordance with the regulations.

To the extent that there is simultaneous operation of this EMP and the previously approved EMPs in respect of ongoing Regulated Activities as set out in Table 2, this EMP incorporates and replaces the environmental management requirements of the previously approved EMPs in respect of those activities. It is intended that approval of this EMP under regulation 11 of the PER will have the effect that this EMP will prevail to the extent of any inconsistency with the previously approved EMPs, including during any transitional period in which this EMP

and the previously approved EMPs remain simultaneously in force. Following approval, Santos will engage with DLPE to formalise the close-out of the previously approved EMPs by way of notice under Regulation 14 of the PER.

Table 10 and Table 11 summarise the components of the Regulated Activities to be carried out under this EMP. Further detail on previously approved Regulated Activities to be carried out under this EMP is provided in Section 3.14.

Table 10: Key components of the activities covered by this EMP

Overview	Units	Unit of measure
Exploration Permit	EP 161	
Total area of EP	1,050,870	ha
Total project area	429 ⁷	ha
Total area of surface disturbance (including existing disturbed areas)	87.34 ⁸	ha
Total area of remnant vegetation disturbance	46.9 ⁹	ha
Rehabilitation commenced from previous EMP Activities	121.9 ¹⁰	ha
Total number of new wells under this EMP (to be delivered over 5 years)	12	Maximum number of wells over the EMP period
Anticipated wells delivered per year	Up to 3	wells
Groundwater		
Water Extraction Licence (WEL)	The Interest Holder intends to apply for an increased allocation to ensure consistency with the appraisal works proposed in this EMP. Activities will commence under its existing WEL and operate within the requirements of this allocation until an increase volume is approved.	
Extraction Licence - existing	193.5	ML /year
Extraction Licence – target	750	ML / year
Number of bores for extraction	Up to 10	Per well pad
Estimated total groundwater usage	2,350	ML
Potable water		
Potable water usage	4	ML / year
Produced fluid/flowback		
Anticipated flowback rate based on previous appraisal campaigns	10%	Of injected stimulation water
Anticipated flowback volume	14-28	ML per well
Maximum storage requirements per 3 well yearly campaign	Up to 108	ML

⁷ Project Area includes previous 2D Seismic and Ground Gravity program previously disturbed area of 125 ha, Mount Browns and Inacumba project area of 99.4 ha and the new Jibera South, Newcastle South project area of 204.59 ha.

⁸ This is a total disturbance area which includes both pre-disturbed and new remnant vegetation areas as per Table 13.

⁹ Total area of 46.9 ha of remnant vegetation will be cleared as part of this project, which will be rehabilitated.

¹⁰ Rehabilitation that commenced as part of the 2D Seismic and Ground Gravity program.

Tank size	Between 7-13.5	ML
Number of tanks	- Up to 8 x 13.5 ML (4 each well pad), or - Up to 16 x 7 ML (8 on each well pad), or - A mixture of tank sizes ranging from 7 ML to 13.5 ML	ML
Anticipated volume of open tanks for evaporation	13.5 ML	Per well pad
Potential evaporation	0.35 (open tanks) or 0.25 (closed tanks)	ML / month
Traffic movements		
Average traffic movements – during active drilling and HFS operations	30 light vehicles (LVs) 15 heavy vehicles (HVs)	Vehicles per day
Average traffic movements – during other operations	5 LVs 2 HVs	Vehicles per day
Emissions		
Total Scope 1 greenhouse gas emissions ¹¹	276,896	t-CO ₂ -e

¹¹ The proposed Regulated Activities do not have any Scope 2 emissions

Table 11: Previously approved EMPs for EP 161

Approved EMP	EMP Name	Approved	Activities approved	Status
STO7-4: 2D Seismic and Ground Gravity Survey Program	EP 161 2D Seismic and Ground Gravity Survey Program	September 2024	2D seismic and survey – approximately 240 km of seismic lines & 10 km of connection lines.	Completed
			Rehabilitation of up to 240 km of seismic lines and 10 km of connection lines.	Ongoing
STO2-7: McArthur Basin Drilling Program <i>(responsibility for rehabilitation activities was transferred to STO1-4 in accordance with Condition 2 of the relevant EMP's Statement of Reasons (SOR))</i>	McArthur Basin 2019 Drilling Program Revised and added program in STO 2-7 (Inacumba program cancelled)	21 February 2021	Drilling of Mount Brown-1 (formerly Tanumbirini-1).	Completed
			Marmbulligan - 1 stratigraphic Core hole Program.	Completed
			Drilling of water bores in Mount Brown (formerly Tanumbirini) North.	Completed
			Drilling of water bores at Mount Brown (formerly Tanumbirini) South and Inacumba North and South.	Completed / Cancelled
			Drilling of Inacumba-1 pilot well.	Cancelled
			Plug and decommission of the deepest section of the Inacumba-1 pilot well.	Cancelled
			DFIT of Mount Brown-1 (formerly Tanumbirini-1).	Complete
			Drilling of Mount Brown-2H (formerly Tanumbirini-2H) well.	Complete
			Well integrity monitoring.	Ongoing
			Evaluation of Inacumba-1/1 H and Mount Brown-2H (formerly Tanumbirini-2H) (including mudlogging, wireline/LWD, coring).	Ongoing
			Suspension and/or plugging and decommissioning of Mount Brown (formerly Tanumbirini-2H) and Inacumba-1/1 H.	Ongoing
			Drilling of Mount Brown (formerly Tanumbirini)-3H well.	Complete
			Drilling of Inacumba-2H well.	Complete
			Evaluation of Inacumba-2H and Mount Brown (formerly Tanumbirini)-3H (including mudlogging, wireline/LWD, and coring).	Ongoing
			Suspension and/or plugging and decommissioning of Inacumba-2H and Mount Brown (formerly Tanumbirini)-3H.	Cancelled / Ongoing

3.2. Site selection

3.2.1. Geological and geophysical assessment

Santos has carried out exploration and appraisal activities in EP 161 since 2013, including 2D seismic surveys, water bore drilling and monitoring programs, and the drilling, testing, and hydraulic fracturing of vertical and horizontal wells.

These activities, integrated with desktop assessments of pre-existing and emerging geological surveys, seismic data acquisition, and well logs, have informed Santos' understanding of the geological and geophysical conditions of the area. Completed exploration activities across the Beetaloo East Basin (seismic acquisition and drilling) relative to EP 161 are presented in Figure 3 and Figure 4, with key wells identified.

Both Jibera South and Newcastle South sites are located within the recently acquired 2D seismic area, which will be utilised to assist well design and operating procedures.

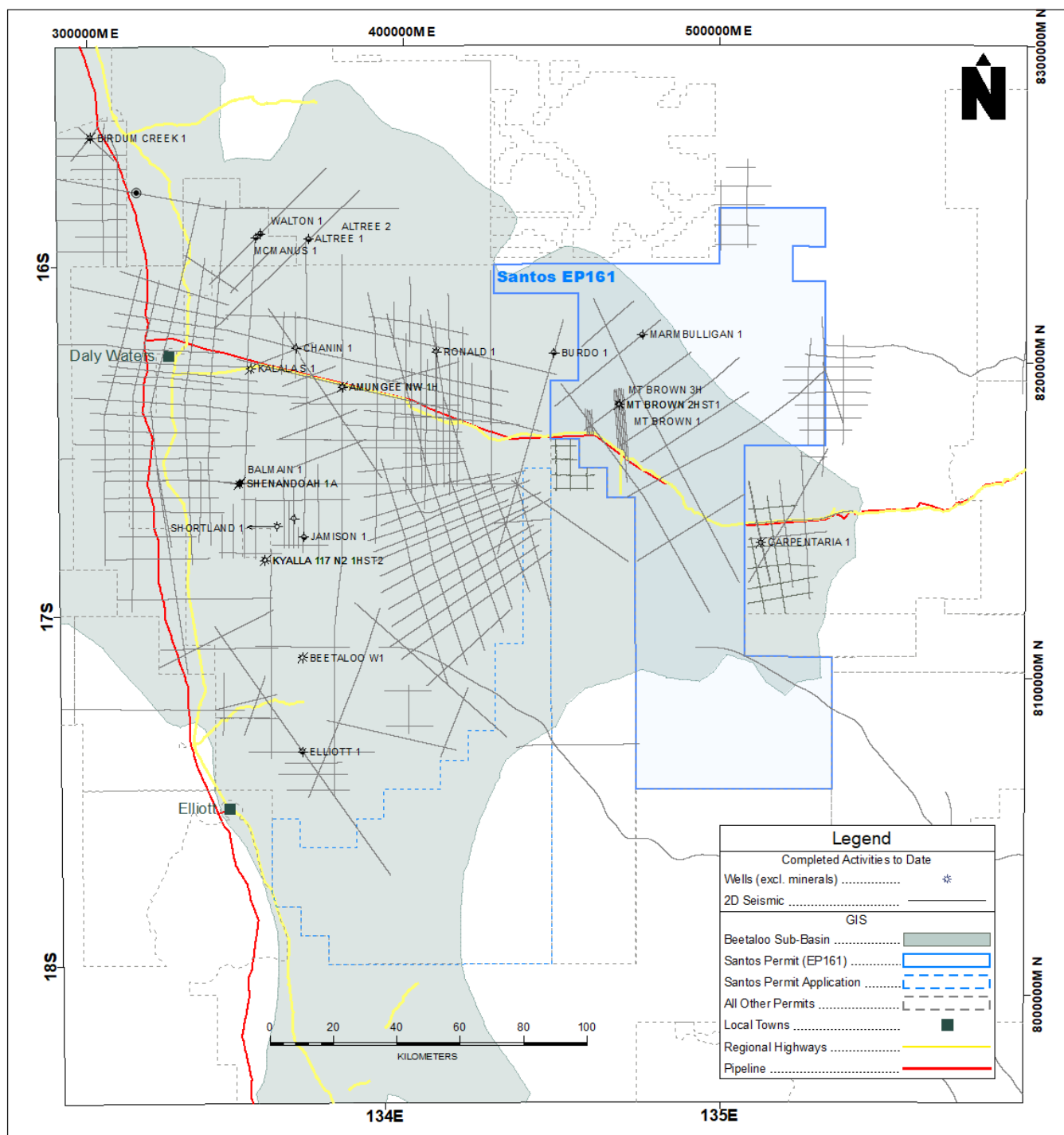


Figure 3: Completed geological and geophysical assessments across the Beetaloo Basin (with key wells identified and shallow mineral wells excluded)

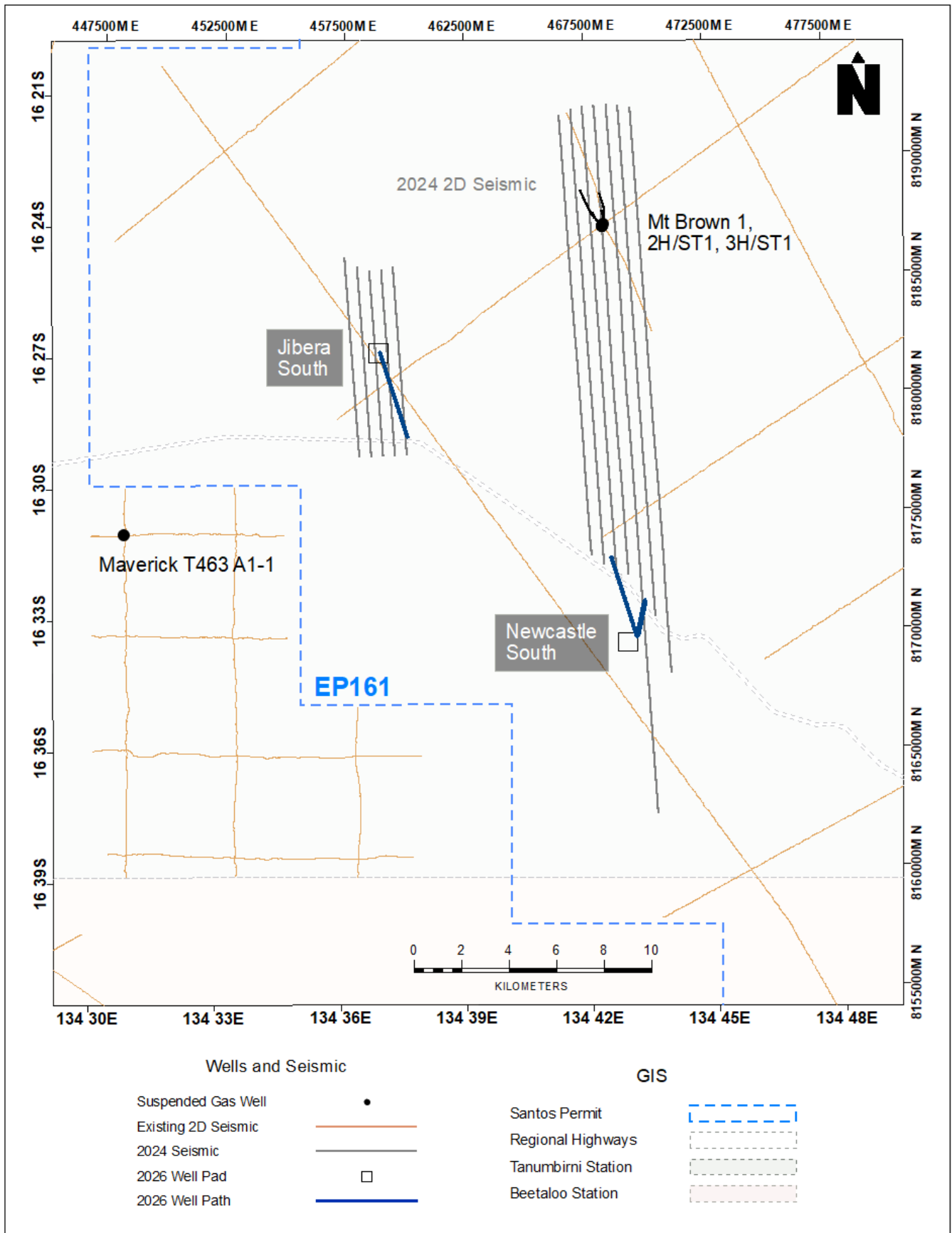


Figure 4: Santos EP 161 recent 2D seismic activities

3.2.2. Site accessibility and existing infrastructure

Site accessibility and existing access track infrastructure was considered during site selection. Important factors included:

- Minimise clearing for new access tracks through the use of existing access tracks where feasible.
- Maximise distance from existing pastoral lease homesteads and water infrastructure, including water bores.

Notwithstanding the subsurface location requirements, the following justifies the preferred and proposed well pad locations:

- Jibera South has a new 6 km access track which proposes to run along the edge of existing paddocks and previously cleared fence lines. The new route has been selected in consultation with the pastoralist to minimise the activities interaction with the farming operations.
- Newcastle South utilises an existing access track, with a short 0.6 km access track to connect the existing track with the well pad.
- Both well pads have been located greater than one km from existing, active water bores (as per the Code CI A3.2.2 (d)), with the closest bores being:
 - Approximately 3 km north-west from the Jibera South well pad location (RN038179).
 - Approximately 4 km south from the Newcastle South well pad location (RN031244).
 - Various historic bores are located in closer proximity to the east of the proposed well pad, however these are not used for domestic or stock water supply, with:
 - Power and Water Corporation bores (RN29302 and RN29303) have been used for earthing and are not active water bores providing domestic or stock water.
 - Pastoralist Bore (RN005864) – believed abandoned located less than one km east from the anticipated Newcastle South well pad. Previous hydrocensus could not identify installed bore or any bore infrastructure.
 - On ground investigations have been unable to locate any infrastructure at these 3 bores at, or within close vicinity of GPS locations. This supports that these bores are abandoned and have been decommissioned.

3.2.3. Pastoralist engagement

Santos currently holds a valid land access agreement (LAA) with the Pastoralist of EP 161. Within this agreement, various 2 km by 2 km (400 ha) investigation areas were identified and deemed appropriate by the pastoralist lease holder for exploration activities.

Through the processes above, and in line with the LAA, Santos has located its proposed well pads within identified investigation areas.

3.2.4. Environmental values

3.2.4.1 Selection criteria used for well pad locations

Santos has undertaken an analysis of all available desktop, field and modelling data available for the final locations of the Jibera South and Newcastle South well pads. The results of the outcomes of this analysis in regard to the well pad siting is presented in Table 12.

Table 12: Selection criteria for well pad location

Well Pad	<1 in 100 Year Flood	Slope (%)	Approx. Distance to Closest Bore (km)	Visible from Public Roads	Closest Stream Order	Distance to Closest Stream (km)	Distance to Closest Dwelling (km)	Other Gas Wells (km)
Jibera South	No	<1%	3	No	1	6	3.7	>10
Newcastle South	No	<1%	4	No	1	4.5	>10	>10

Various environmental values have been assessed in the siting of the well pads. In line with the Code of Practice, cl A.3.1, the following values have been assessed in Table 13.

Table 13: Environmental values informing site selection

Environmental value	Approach
Suitability of site	- Flood modelling has been undertaken with 1% Annual Exceedance Probability (AEP) inundation and velocity mapped for the whole investigation area. Both well pads (and as such key infrastructure for appraisal activities) have been located outside a 1% AEP flood event. - Both Jibera South and Newcastle South are relatively flat, with <1% fall over the site. This has been confirmed via LiDAR and a cut fill plan completed (Appendix P). - The sites are not in close proximity to a watercourse, with: - Jibera South 6 km from the nearest stream order 1 intermittent stream. - Newcastle South 4.5 km from the nearest stream order 1 intermittent stream. - The proposed well pad is located more than 2 km from any existing petroleum resource. The previously drilled Mount Brown-1 well is situated approximately 11 km north-east of Jibera South, while the approved Inacumba well pad lies about 13.9 km east of Newcastle South.
Erosion and sediment control	The site is relatively flat, and outside of high flow areas. The access tracks have been located in areas away from inundation, however are subject to some flooding. Velocity mapping of these areas has been undertaken and these access tracks will be appropriately designed to manage any inundation and velocities to minimise risk of erosion.
Sensitive receptors	As per the Code cl A.3.1 (f), the well pads have been located greater than 2 km from a sensitive receiver, with the existing habitable dwelling (Tanumbirini Station) being approximately 3.5 km east of Jibera South. A noise assessment (as per the Code Cl A.3.3) has been undertaken showing that compliance can be achieved during the HFS activity (highest noise producing activity).
Wildlife movement and biodiversity protection	Site scouting was undertaken concurrently with an ecologist in December 2024. This survey informed the final placement of the well pad and associated access tracks and borrow pits. The final disturbance area can be further optimised if needed to avoid mature and hollow bearing trees. Additionally, the size of the well pad has reduced from 64 ha to 15 ha through optimisation of operational design.
Weeds	No Weeds of National Significance (WoNS) are known to inhabit the investigation areas associated with this appraisal scope
Cultural Heritage	Both sites have been located clear of any areas identified under the AAPA Authority Certificate. Additionally, an archaeologist and Traditional Owners participated in the site scouting activities completed in December 2024. This information was used to confirm the final location of the well pads, access tracks and borrow pits

3.2.5. Emergency response planning

The location was reviewed against fire risk, availability of site resources, accessibility for emergency services and escape routes available in the event of an emergency. Both Jibera South and Newcastle South have been located in proximity to previously cleared access tracks, and Jibera South near previously cleared farmland and the pastoralist homestead (including airstrip). Both sites are also situated a short distance to the Carpentaria Highway, of which provides a reliable route in the event of any emergency. The wellsite operations will have an emergency response plan in place with field based medic and emergency aviation medivac support arrangements.

3.3. Proposed locations

The proposed well pads will be approximately 15 ha each in size with additional disturbance for ancillary areas for access roads, borrow pits and groundwater bores.

The proposed footprint has been categorised into two types, a Project Area and disturbance footprint:

- The Project Area refers to the broader area assessed, within which the disturbance footprint will be contained. The Project Area has been defined to allow flexibility for the final well pad, borrow pit placement and access track locations. As the design of both well pads progresses, the disturbance footprint may shift slightly within the Project Area as part of the refinement of the final layout.
- The disturbance footprint is the maximum footprint required for clearing and earthworks for the Regulated Activities. This will remain within the Project Area. The final disturbance footprint will not exceed the maximum disturbance area as defined in Table 14.

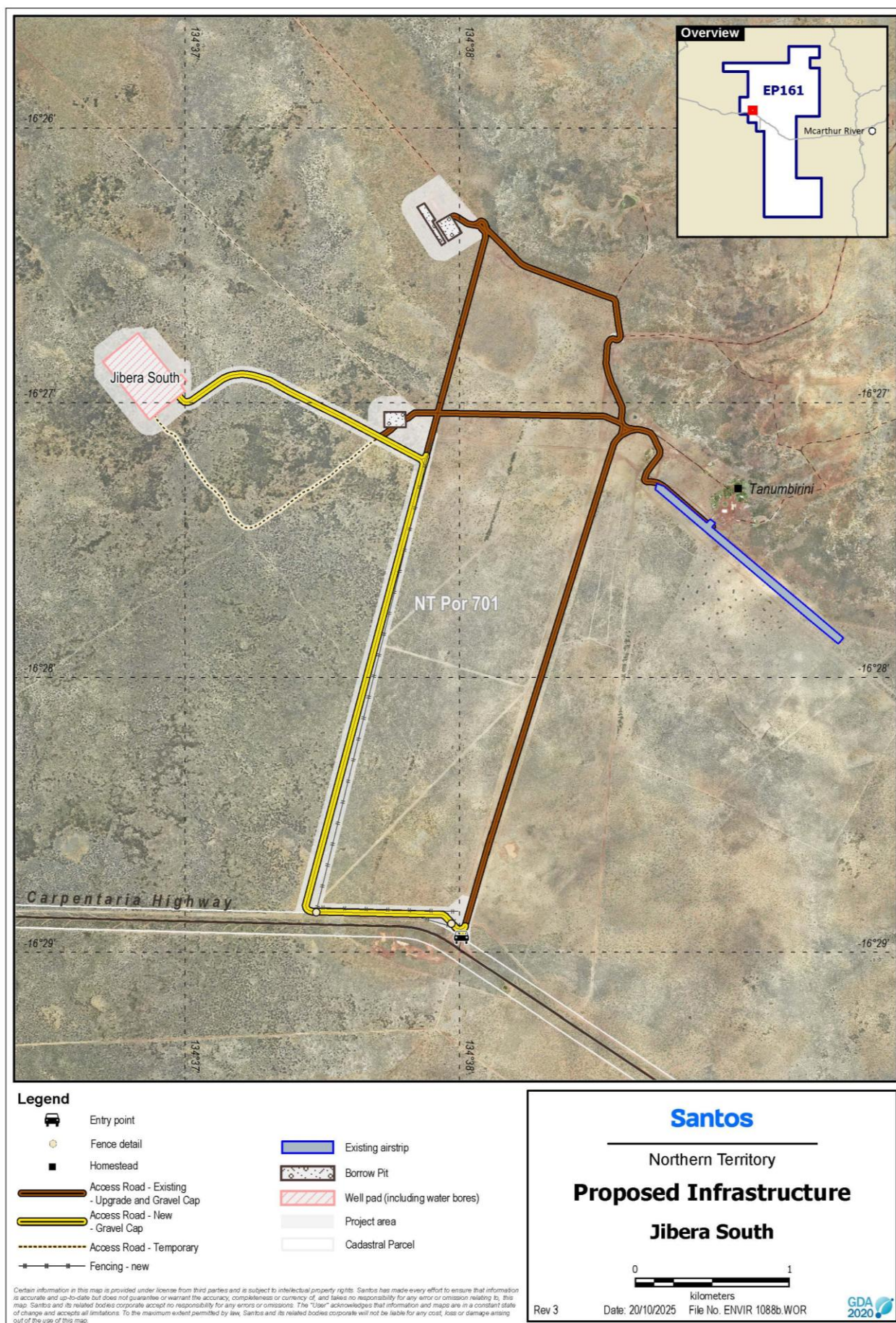


Figure 5: Jibera South proposed infrastructure locations

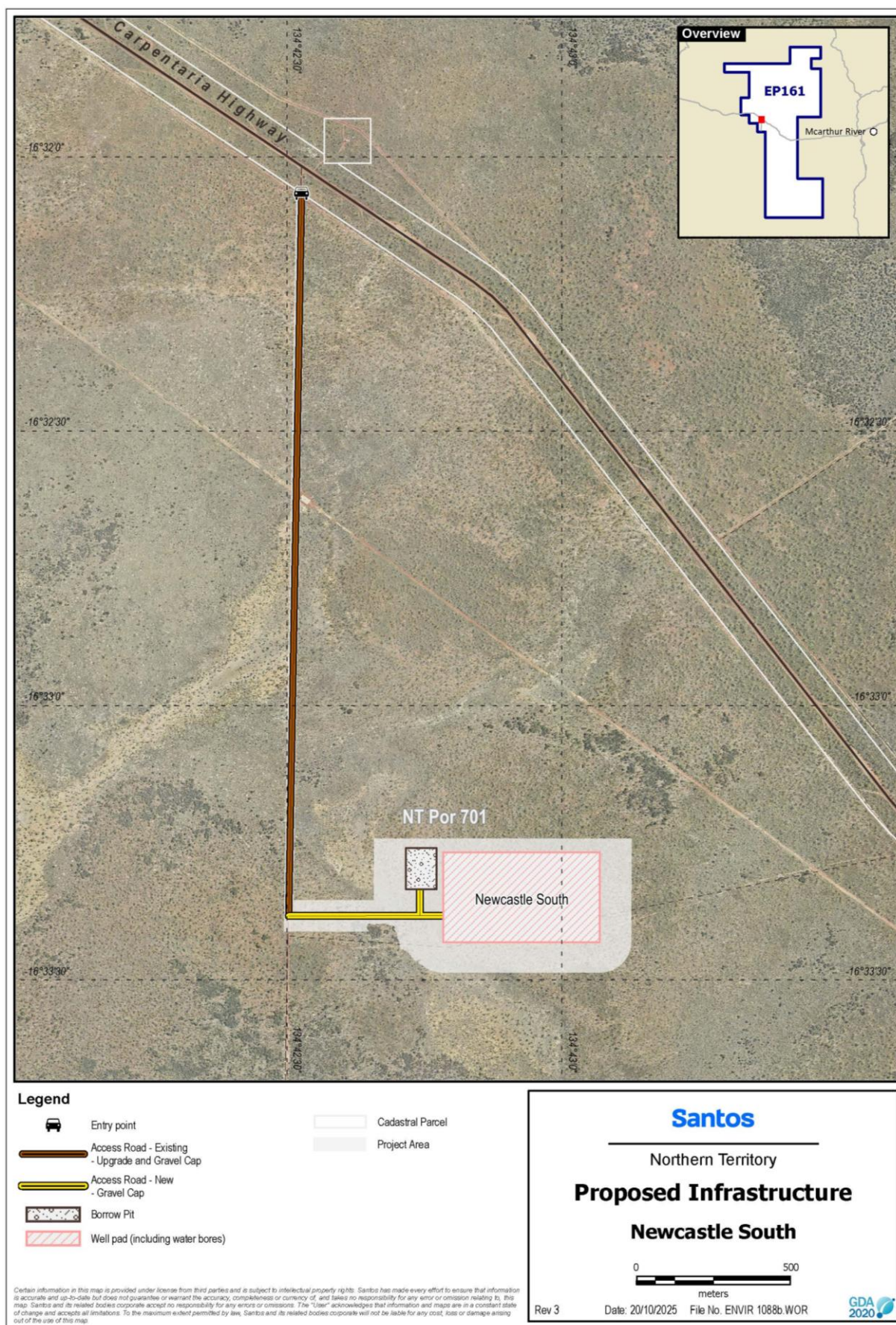


Figure 6: Newcastle South proposed infrastructure locations

3.3.1. Disturbance footprint

The Regulated Activities will involve new vegetation clearing and earthworks at both Jibera South and Newcastle South to enable the construction of well pads, access tracks, groundwater bore infrastructure and borrow pits.

The Project Area contains areas of pre-existing disturbance for a range of infrastructure unrelated to Regulated Activities e.g. cleared land included disturbed tracks, roads, cattle grazing paddocks and fence lines.

Proposed Regulated Activities will prioritise utilisation of existing infrastructure in consultation with relevant stakeholders to minimise new disturbance. Where existing infrastructure is utilised, it will typically require minimal additional disturbance i.e. it will primarily involve maintenance and grading of existing tracks and the airstrip.

The extent and type of disturbance associated with the proposed Regulated Activities are summarised in Table 14 below.

Table 14: Total disturbance breakdown (across both well pads)

Footprint feature	Area within disturbance footprint (ha)		
	Jibera South	Newcastle South	Total
New remnant vegetation disturbance - Well pads, borrow pits, groundwater monitoring areas and new access tracks.	26.99	19.91	46.9
Pre-disturbed areas for Jibera South and Newcastle South (cleared land included disturbed tracks, roads, cattle grazing paddocks and fence lines) – not to be rehabilitated.	37.29	3.15	40.44
Total disturbance footprint	64.28	23.06	87.34

3.4. Well pad layout

The well pads will include a drilling pad, casing storage, cutting pits, laydown areas, water and fluid storage tank areas and other ancillary infrastructure. See Figure 7 and Figure 8 for an example of a well pad, or Appendix P for a more detailed well pad layout. The well pad will include space for:

- Hardstand for drilling, completions and HFS operations
- Water management (tanks, clean-water dams)
- Drill cutting pits and drill fluid sumps
- Water bores (final location may vary, however will be located within the project area as shown within Figure 5 and Figure 6)
- Campsite
- Laydown and HFS material storage areas
- Office and maintenance facilities
- Fence line and firebreak
- A flare (location identified in Appendix P)
- Parking area
- Contingent activity expansion area.

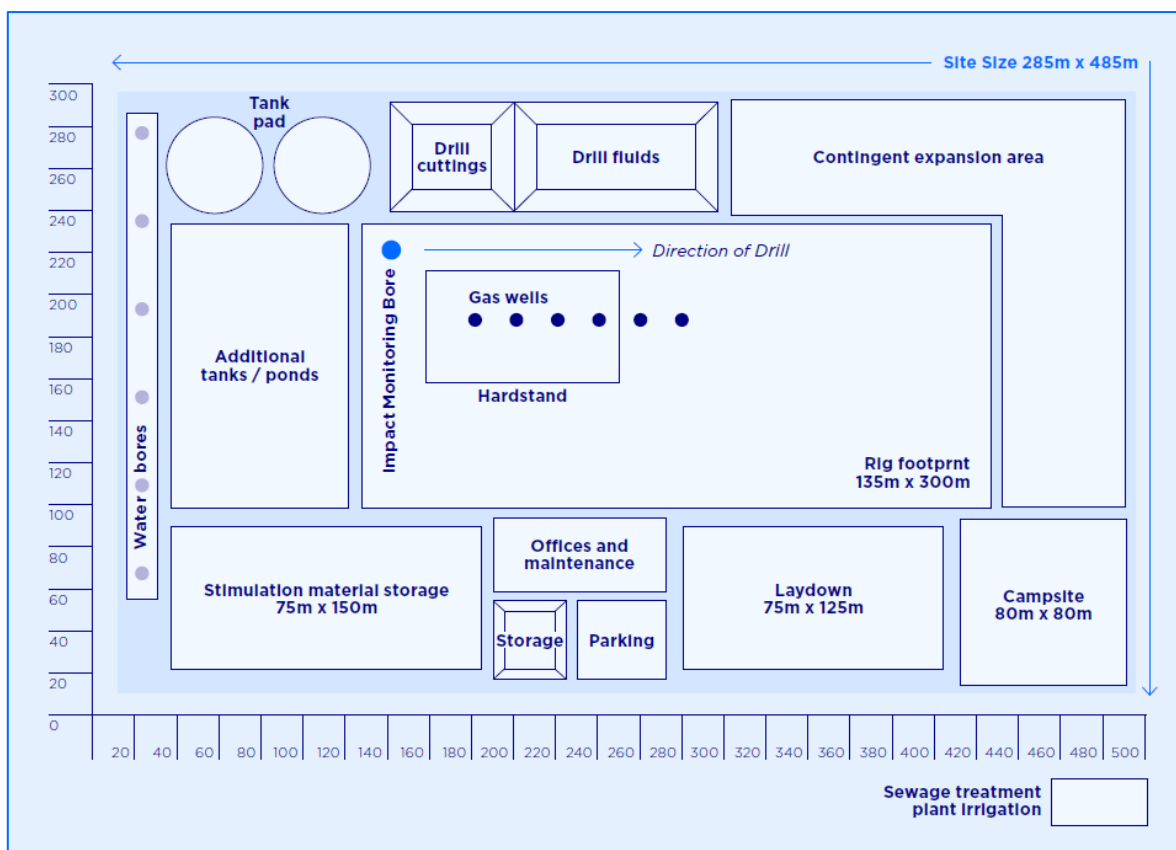


Figure 7: Indicative well layout for both Jibera South and Newcastle South well pads



Figure 8: Mount Brown well pad during drilling operations

3.5. Timing and personnel requirements of the proposed Regulated Activities

An indicative project schedule and personnel requirements for one appraisal well (per operation), as part of the proposed Regulated Activities is provided in Table 15.

Table 15: Indicative project schedule (2026/27)

Activity	Estimated duration	Personnel required*
Mobilisation of civil equipment	1 week	10
Civil works	2 – 4 weeks	10
Demobilisation of civil equipment	1 week	3
Mobilisation of drilling equipment	2 weeks	20 – 50
Drilling and well evaluation	4 – 8 weeks (per well)	35 – 65
Demobilisation of drilling equipment	2 – 4 weeks	30 – 60
Mobilisation of HFS and production testing	2 weeks	20 – 30
HFS	3 – 6 weeks (per well)	35 – 80
Demobilisation of HFS equipment	2 weeks	20 – 30
Well completion	2 weeks	10 – 15
Production testing	30 days per wells up to 3 wells	5 – 10
Well surveillance (long term build up test)	2 years	0 – 2
Well suspension and/or decommissioning	4 weeks	15 – 30
Rehabilitation post well suspension	1 – 2 weeks	5 – 15
Rehabilitation post-decommissioning of wells	2 – 4 weeks	5 – 20

* Up to 105 personnel are expected to be concurrently onsite at one time. The numbers listed are estimates based on specific activities; however, due to the staggered scheduling of activities across both sites, there may be additional personnel onsite beyond those indicated for each specific activity.

The anticipated 5 year delivery schedule of up to 12 appraisal wells is provided in Figure 9 which is indicative in terms of activities, sequence and timings and may differ throughout the appraisal process to that presented below.

The final delivery schedule for the Regulated Activities described in this EMP is subject to various key considerations, including findings from initial appraisal wells, commercial decisions, Interest Holder priorities and land access arrangements.

Updates on the schedule will be regularly provided to DLPE. The schedule presented below shows activities being delivered over various seasons and concurrently with other activities. This has been applied so that all scenarios have been assessed as part of this impact assessment.

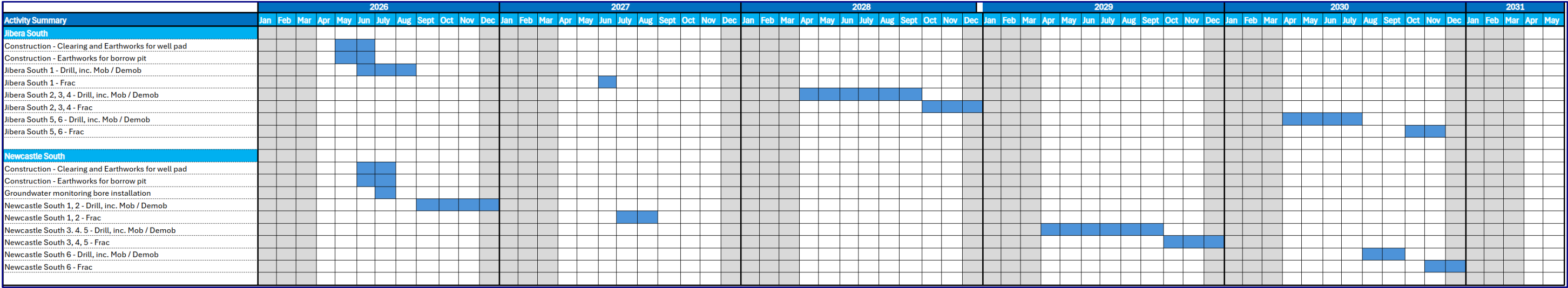


Figure 9: Indicative schedule of appraisal activities over 5 years

3.6. Clearing and earthworks

The clearing and earthworks required for the Regulated Activities include the construction and upgrading of access tracks, creation and extraction of material from borrow pits, development of well pads, and installation of water bores, storage areas, raw water dams, and campsites, along with associated earthworks to maintain existing and approved infrastructure.

These activities will involve vegetation clearing, surface grading, placement of capping material for access tracks and pad foundations to ensure safe and efficient site operations. Each well pad will be designed to minimise environmental disturbance by utilising previously cleared or disturbed areas where practicable and by restricting the extent of clearing to the smallest area necessary to accommodate drilling and ancillary activities.

3.6.1. Civil equipment

The equipment forecast for each well pad is shown in Table 16. This equipment will be utilised across both sites, with all civil works being completed at one pad, before mobilisation to the next. Well pad creation will be one of the first activities to commence and it is anticipated that both pads will be formed in close succession.

Table 16: Anticipated construction equipment for civil construction

Aspect of work	Anticipated construction equipment*
General Services	• Small excavator (<10t), bob cats / Skid steer, tipper (~8T) • General craneage and trucking fleet. • Telehandler • Light 4WD vehicles / ATVs • Water carts • Lighting.
Clearing	• Excavators • Dozers.
Civil / Bulk Earthworks	• Excavators • Dozers • Scrapers • Rollers • Haulage trucks.
Grading / Pad Creation / Road works	• Graders • Rollers • Water Carts • Haulage trucks.
Storage (Cellar, Conductor, Water)	• Excavators • Concrete truck • Telehandler • Groundwater Tanks • Auger Drilling Equipment.
Groundwater Bore installation	• Drill Rig • Pumps (sized appropriately to WEL requirements).
Rehabilitation	• Excavators • Dozers • Graders • Water Carts.

Equipment	• Site office and crib huts • Flex drive pumps • Generator (power).
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**Final equipment will be subject to contractors' methodology and requirements; this list may change as delivery methodologies mature.*

3.6.2. Access tracks

Vegetation will be cleared for new access tracks and stockpiled or mulched for rehabilitation purposes. To avoid further clearing and if feasible, cleared vegetation will be stockpiled in a naturally clear area where one is available in the immediate vicinity. Impacts to trees of significance or environmentally sensitive flora or fauna will be minimised as much as practicable, and the clearing of large trees will be avoided wherever possible.

A maximum extent of clearing for new access tracks for both well pads is estimated to be 13.1 ha, with each track being cleared to a width of 10 metres (m). A 2m road shoulder will be installed to accommodate spoon drains. The access tracks will be gravelled and regularly maintained to ensure continued access to each site. Although the standard road corridor will be 10m wide, the maximum disturbance footprint may extend up to 20m in certain areas. This additional width allows for erosion and sediment control (ESC), stormwater drainage, and other water management requirements. These wider corridors would be site-specific and typically located in areas with significant drainage needs.

While a 20 m corridor represents the maximum potential disturbance, efforts will be made to maintain a 10m width wherever possible. It is expected that further reductions in the disturbance footprint will be achieved during the delivery phase when siting of infrastructure is finalised.

Access tracks will be constructed to NTG Pastoral Access Road 3 standards shown in Figure 10. A 2 m wide road shoulder will be installed to accommodate spoon drains.

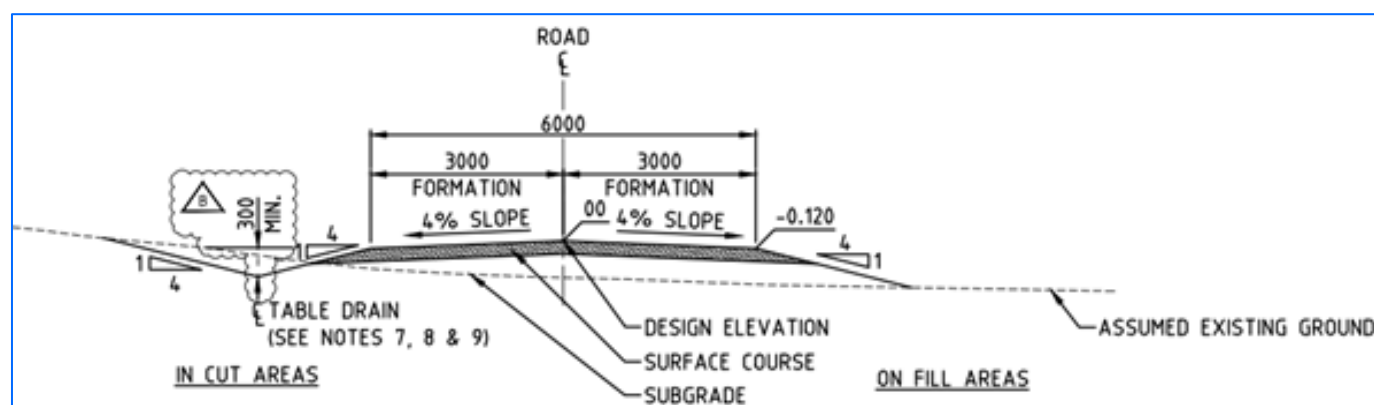


Figure 10: Typical road cross-section (Class C)

As shown in Figure 5 and Figure 6, approximately 64% (Jibera South) and 81% (Newcastle South) of the required access tracks for proposed Regulated Activities are existing and these tracks will be maintained and upgraded where necessary. New access tracks will have topsoil stripped and stored in an appropriate area, free of overland flow. Access tracks will be formed and compacted using on-site materials sourced from approved borrow pits.

3.6.2.1 Jibera South access road

The Jibera South well pad will require the installation of a new access track, while utilising other existing tracks for site and borrow pit access. The access tracks have a total distance of 17 km and use 9 km of the existing landowner access tracks. 2 km of existing access tracks were constructed by Santos for access to the 2 existing water bores, within the proposed Jibera South well pad project area (as approved under the Water bore monitoring program EMP in 2018). This access track is to be utilised for ad hoc deliveries and access during the site mobilisation phase. Once the new access track is constructed, this track will be reinstated. The 6 km of new access track has been located in consultation with the landowner and positioned to avoid interference with farming operations. The route passes through previously cleared agricultural paddocks and follows existing fence lines for much of its length.

The proposed access tracks are described as follows:

- 6 km of new access track.
- 2 km existing access track installed for existing water bores – this existing access track will be used for initial ad hoc use and early works site mobilisation, otherwise rehabbed.
- 9 km of landowner access tracks. All 9 km to be used intermittently for sourcing materials (during construction of the well pad, access roads and for ongoing maintenance) and as an alternative access in the event the newly constructed track is inaccessible, or access to the airstrip for crew. The existing intersection off the Carpentaria Highway will be used, with the new access track diverting west along the fence line.

Figure 5 illustrates the proposed new tracks, existing maintenance-only tracks, and tracks proposed for rehabilitation.

3.6.2.2 Newcastle South access road

Newcastle South will utilise the existing access track for approximately 2.5 km, with a new track cleared and constructed into the new well pad to the east. The new access track will be approximately 590 m long, required to site the new well pad outside of potential flood inundation areas. The proposed new and existing maintenance-only tracks are shown in Figure 6.

3.6.3. Clearing and earthworks – well pad

The indicative well pad locations are shown in Figure 4, Figure 5 and Figure 6, and indicative well pad layout is shown in Figure 7 which shows the draft placement of all supporting aspects required to deliver the appraisal scope.

The well pad will be cleared and constructed to provide a safe and efficient workplace for drilling, completions and hydraulic fracturing stimulation activities. Works at each new well pad will include the following:

- Clearing the well pad.
- Use of gravel / fill material for well pad construction/capping and hardstand.
- Constructing lined pits for the storage of drilling by-products (both fluids and cuttings). Alternative dams may be constructed for the storage of clean groundwater.
- Construction of tank pad with a compacted base and overland flow diversion bund. The overland flow diversion bund will be constructed to a secondary containment standard. Refer to Appendix F for above-ground tank secondary containment specifications.
- Construction of up to 10 new water bores per each well pad.
- Installing a well cellar and conductor (outer wellbore casing) as required.
- Fencing the perimeter to prevent livestock and personnel entry.
- Clearing vegetation for firebreaks.
- Installing erosion and sediment control devices and diversion bunds/berms.

An additional buffer area has been included to account for any deviations that may be necessary due to items identified during clearing and earthworks. It is not expected that this buffer area will be required to be cleared but is included as a contingency. The proposed Regulated Activities will not exceed the disturbance limits as identified in Table 14.

3.6.3.1 Clearing and earthworks

The well pad will be cleared of vegetation and soil will be stripped and windrowed along the edge of the well pad as per the *Erosion and Sediment Control Plan (ESCP)* (Appendix G). Topsoil will be stockpiled onsite in windrows up to 2m in height. Diversion berms/drains will be installed as per the ESCP to provide a clean water diversion around the well pad and to prevent significant water run-on.

The well pad will be compacted using on-site material as far as practicable, and gravel/fill will be used and sourced from approved borrow pits. This material will be used for well pad construction, capping and or

hardstand. Pits will be constructed using bulldozers and excavators, with overland flow diversion bund/berms consolidated with watering and compaction.

The well pad will be designed with a minimum slope of 1% (except the well hardstand, which is designed to be relatively flat) so rainfall collected on the well pad will runoff from the compacted area in a controlled manner. Stormwater on the well pad will drain toward Type 3 sediment controls constructed in accordance with the ESCP (Appendix G).

Fire breaks will be constructed and maintained in line with the *Bushfire Management Plan* (Appendix B).

The Tank Pads will have low point drains to allow the collection of stormwater and in the unlikely event of a leak from the tank, the fluid will be collected and either pumped back into the tank or disposed to a licenced facility and any spills managed in accordance with the *Spill Management Plan* (Appendix E). Wastewater storage areas will have bunds constructed to divert stormwater runoff and contain fluids within the defined areas.

The cuttings pit will be lined with High-Density Polyethylene (HDPE) or other material that meets the requirements of the Code.

Clearing and earthworks activities will also be undertaken to support ancillary works outlined in Section 3. These activities will occur within the defined project areas identified in this EMP and will contribute to the overall disturbance footprint. All clearing and earthworks will be conducted in accordance with environmental management measures to minimise soil disturbance, erosion, and impacts to native vegetation.

Fencing will be erected around the perimeter of the well pad to prevent accidental entry into the site by livestock and large native fauna. Fauna escape ramps and gateways will be installed in any constructed onsite clean water storage dams within each well pad.

3.7. Drilling

3.7.1. Basis for well design

The basis for gas well design (BfWD) serves as the foundational framework which guides the planning, construction and operation of gas wells. It is the first step in appraisal activities, and it ensures that the well is designed to safely and efficiently extract hydrocarbons while considering geological, operational, environmental and economic factors. The Beetaloo Appraisal Pilot scope has been informed by recently acquired seismic data, water bore drilling logs and the results of the Mount Brown 1, 2H & 3H extended production testing that Santos recently completed.

The BfWD begins by defining the wells objectives (for this campaign it is for the appraisal of the Amungee Member within the Velkerrie Formation) and identifies the specifics of the well type, be it vertical, deviated or horizontal. It also establishes the expected operational lifespan of the well.

Geological and reservoir data are integral to the BfWD, detailing the target formation depth, pressure, temperature and fluid properties. Assessing the pore pressure and fracture gradients informs casing and drilling fluid design, while understanding reservoir behaviour, which may change over the well's life.

Wellbore design is another critical component, specifying sizes, grades and depths of casing strings and production tubing. Cementing programs are outlined to ensure zonal isolation and well integrity. Completion design determines the type of completion (open hole, perforated, or slotted liner) and hydraulic fracturing stimulation methodology, to enhance the permeability in low-permeability reservoirs (such as those of the target shale layers of this campaign).

The BfWD also addresses pressure and flow considerations, identifying maximum and minimum expected pressures during drilling, completion and production. It estimates expected gas and water production rates and specifies anticipated pressures at the wellhead during various operational phases. This is important to ensure that the assumptions regarding wastewater management and onsite methodologies are supported by sound engineering principles that inform the overall design.

Safety and environmental considerations are paramount in the BfWD. It includes blowout prevention measures and pressure control systems, assessing potential environmental risks, and defines appropriate barriers to mitigate risks.

The BfWD is a dynamic document that evolves as new data becomes available and as the project progresses through different phases. It serves as a reference point for all engineering disciplines involved and to inform environmental impact assessments.

Section 3 of the CoP – Well Integrity requires the Interest Holder to be able to demonstrate that the basis of design for all wells and well activities allow for the identification of all foreseeable well integrity risks and sources of uncertainty. This will be included within the *Beetaloo Appraisal Pilot Well Operations Management Plan* (WOMP), to be approved by the Department of Mining and Energy.

For the purposes of this EMP, Table 17 is an overview of drilling and stimulation activities that are proposed, and the general descriptions of each aspect that has been applied within the well design.

Table 17: Well design and anticipated aspect descriptions

Aspect of BfWD	Jibera South and Newcastle South
Scope of gas wells	Appraisal and Production testing
Target Formation	Amungee Member 'A', 'B', 'LB' and 'C' Shale
Shoe Depth (m TVDGL*)	~3400 TD (+/- 200 m TVD)
Well head spacing	Between 10 – 60 m
Horizontal Lateral spacing	Between 200 – 500 m
Horizontal Length	Up to 3500 m
Hydraulic Stimulation	Between 20-75 stages

*True Vertical Depth referenced to Ground Level (TVDGL)

An indicative well design showing well vertical depths, horizontal laterals and potential target formations is shown in Figure 11 which depicts the target formations of laterals that are proposed under this EMP. Only one lateral will occur per well, and will be in either the A, B or C shale formations.

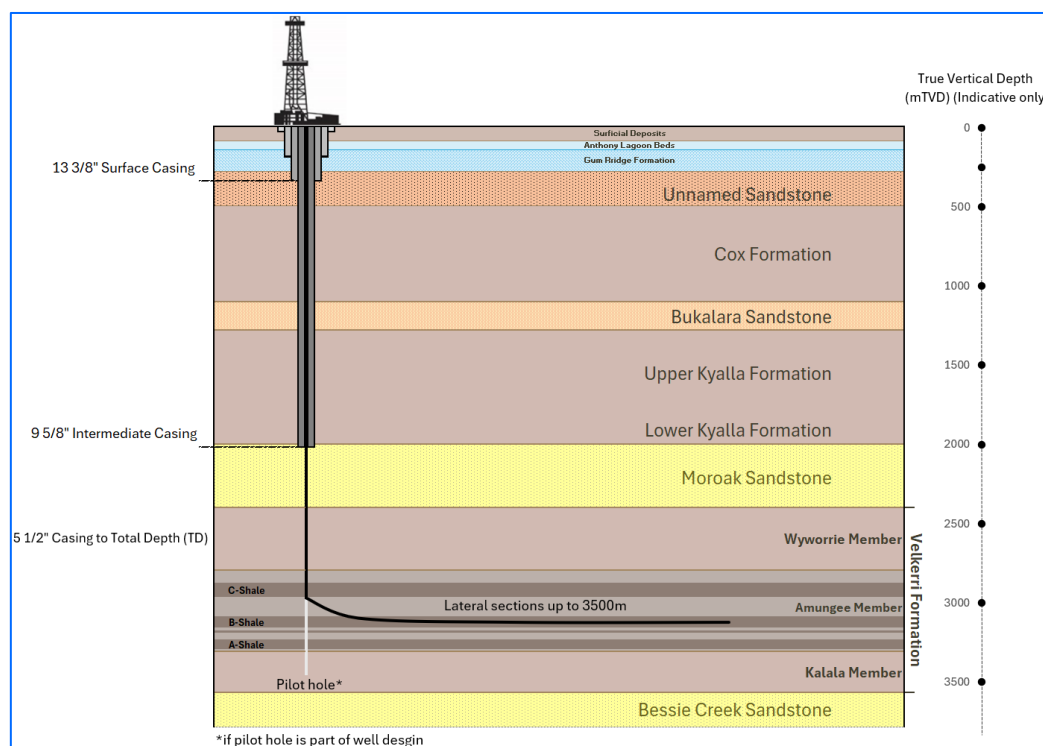


Figure 11: Indicative well design at Jibera South and Newcastle South

3.7.2. Well design – casing sections

To ensure casing integrity, Santos has developed detailed specifications for well casings and well completion materials. The casing materials are specifically rated to handle hydraulic stimulation treatments at Velkerri Member depths and pressures. Parameters such as yield and burst pressures are specified and tri-axial load modelling are performed to ensure that the well's integrity is maintained during the high treatment pressures applied during hydraulic fracture stimulation and for the lifecycle of the well.

3.7.2.1. Casing configuration and function

Santos wells are designed with multiple sections of casing that become sequentially smaller in diameter as the well is drilled deeper. The advantages for installing multiple sections of casing include borehole stability, isolation of non-targeted formations, and well control (containment of gas and artesian flow of groundwater).

3.7.2.2. Casing installation sequence

This is followed by drilling a series of sequentially deeper boreholes for installation of the various casing pipes as follows: conductor casing, surface casing, intermediate casing (if necessary), and the production casing as shown in Figure 12 and Table 18. Specific considerations for each of these casing strings are presented below. It is important to note that the shallow portions of the well have multiple concentric strings of steel casing installed.

Table 18: Well design and anticipated casing methodology

Casing type	Size (inches)	Depth (m TVDGL)	Geology comment
Shallow conductor	30	12	Surficial cover.
Conductor	18-5/8	140-160	Cased across the Anthony Lagoon beds (where present).
Surface	13-3/8	310-350	Cased across Gum Ridge Formation, seated in unnamed Cambrian Sandstone.
Intermediate	9-5/8	1,800-2,000	Shoe located at the bottom of the Kyalla Formation just above the Moroak Sandstone Formation.
Production	5-1/2	3,200-3,400	In target shale. This also includes the horizontal lateral up to ~3,500m.

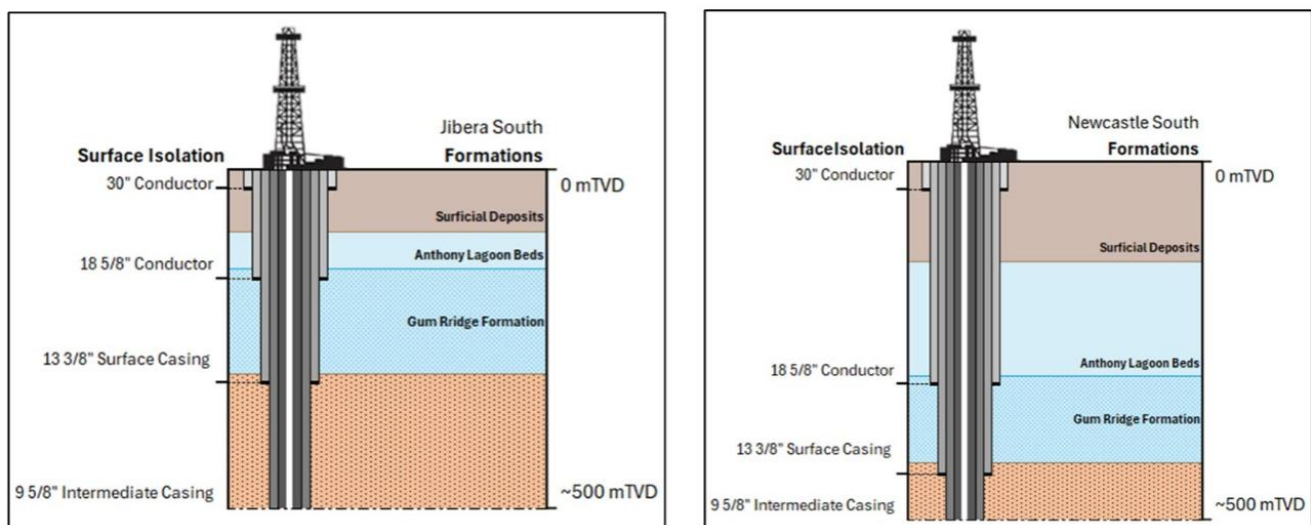


Figure 12: Well design casing methodology through aquifers at Jibera South and Newcastle South

3.7.2.3. Conductor casing

The conductor casing stabilises the surface sediments from the drilling of subsequent drilling phases (i.e. it prevents the loose soils from caving into the borehole) and is cemented into place to ensure an appropriately robust seal (up to ground level). The conductor casing can also serve to isolate the surface water and perched aquifers. For both Jibera South and Newcastle South this is planned to be installed across the Anthony Lagoon Formation if present.

3.7.2.4. Surface casing

The surface casing is installed to protect shallow formations (weathered or unconsolidated rock layers) and to stabilise the well from the later drilling phases of deeper section of the borehole. This portion of the well can extend from the conductor casing up to 1000 m depth. The casing pipe is also cemented into place to ensure an appropriately robust seal, with cementing taking place from bottom to top to ensure an effective seal. The surface casing is designed to achieve the Code requirements for isolating groundwater and to contain pressures that might occur during the subsequent drilling process. The surface casing will be installed to isolate the Gum Ridge Formation.

3.7.2.5. Intermediate casing

An intermediate casing pipe may be installed to isolate deeper aquifer systems (if present), for example the Bukalara Sandstone may be cased off to reduce the risk of impact to this layer. As with the shallower casing strings, this casing pipe is also cemented into place to ensure an appropriately robust seal, with cementing taking place from bottom to top to ensure an effective seal.

3.7.2.6. Production casing

After the production hole is drilled and logged, the production casing pipe is lowered to the total depth of the borehole (including horizontal laterals) and cemented in place (vertical pilot well total depth typically 10 to 20 m below the base of the lowermost hydrocarbon-bearing unit, but ideally not penetrating the underlying aquifer systems (if present)). The pilot hole will be isolated with cement. At both Jibera South and Newcastle south this is not anticipated, as the Velkerri Formation (an interlaminated mudstone and siltstone) is anticipated to provide an impermeable layer between the lowest drill point and the potentially underlying Bessy Creek Sandstone partial aquifer.

The purpose of the production casing is to provide the final isolation between the hydrocarbon reservoirs and all other overlying formations, and for containing and pumping the various fluids used to hydraulically stimulate the target zones from the surface into the producing formation without affecting the shallower layers penetrated by the well. During the appraisal phase of the well, its most important function is internally containing the produced hydrocarbons.

3.7.2.7. Cementing and integrity testing

The production casing pipe is cemented, from bottom to inside the previous casing (and sometimes to surface), to achieve robust and effective isolation of the well from the various subsurface layers (aquifers and aquitards alike).

Prior to perforating and stimulation operations, the production well casing is pressure tested. This test is conducted at a pressure that is greater than what is expected during hydraulic stimulation and operations, to ensure that the casing integrity is adequate. Diagnostic tools are run to establish that the cement integrity is satisfactory for the completion and operational conditions designed for the life of the well. Remedial cementing operations are implemented if there is evidence of inadequate cement integrity required for hydraulic stimulation operations. Figure 12 shown above displays the well design, incorporating multiple layers of casing strings, effectively isolates the Anthony Lagoon Bed Formation, Gum Ridge Formation, and other subsurface formations from one another. This approach is considered best practice mitigation for drilling through aquifers and other formations to access deep gas reserves.

Figure 12 displays that the well design, incorporating multiple layers of casing strings, effectively isolates the Anthony Lagoon Bed Formation, Gum Ridge Formation, and other subsurface formations from one another. This

approach is considered best practice mitigation for drilling through aquifers and other formations to access deep gas reserves.

3.7.3. Drilling equipment

Once the civil works for the formation of the well pad and access tracks is complete, a drill rig and supporting equipment will be mobilised to site. The equipment forecast for each well pad are shown in Table 19. This equipment will be used across both sites, or concurrently on each pad, depending on the selected campaign methodology.

Table 19: Anticipated drilling and completions machinery and equipment

Aspect of work	Anticipated drilling equipment*
General Services	• Small excavator (<10 ton), bob cats / Skid steer, tipper (~8 ton). • General craneage and trucking fleet. • Telehandler • Light 4WD vehicles / ATVs • Water carts • Lighting • Fuel trucks.
Drilling	• Drill rig • Rig floor • Mast or derrick • Blowout preventer (BOP) system • Catwalk • Spill mats • Water Bore drill rig • Water pumps.
Storage (Pipe rack / casing)	• Excavators • Concrete truck • Telehandler • Groundwater Tanks • Auger Drilling Equipment.
Installation of Water Management and Fluid system	• Telehandler • General craneage and trucking fleet. • Rig fluid system, including shakers, mud treatment system, pipes and drill string. • Evaporation
Operation support	• Site Office and crib huts • Workshop • 2 inch flex drive pumps • Generator (power) – diesel • Storage trailers, dangerous goods and hazardous chemical storage containers.

*Final equipment will be subject to contractors' methodology and processes. This list may change as delivery methodologies mature.

3.7.4. Drilling overview

3.7.4.1 Jibera South appraisal wells

The proposed Jibera South vertical (and/or pilot) and subsequent Jibera South horizontal wells will appraise the western flank of the eastern extension of the Beetaloo Basin, approximately 11 km south-west of the existing Mount Brown well pad.

The pilot has been proposed as a vertical well that will reach an approximate total depth (TD) of 3,350 metre true vertical depth (mTVD), before being plugged back with cement to a kick-off point (KOP) to facilitate the subsequent drilling of the horizontal wells towards the north-west or south-east, from the vertical pilot hole. Table 20 outlines the expected formations and depths that will be intersected, with a brief description of the general lithology of each formation/member and presented in Figure 13.

The B Shale unit of the Amungee Member of the Velkerri Formation is the anticipated target for horizontal drilling, however a decision to target the A Shale, B Shale, Lower B Shale or C Shale will be finalised following evaluation of the vertical pilot hole. The proposed horizontal wells have been planned to be approximately 10 to 50 m apart at surface i.e., wellhead to wellhead, and the lateral sections planned to be approximately 200 – 500 m apart. The horizontals may target separate shale intervals and be vertically separated with a minimum spacing of approximately 50 mTVD. After being completed with casing/tubing, the wells will also be monitored with pressure gauges to detect communication during operations. The preferred direction for the proposed horizontal will be drilled using real-time Logging While Drilling (LWD) tools to remain in the optimum target zone defined by the pilot well. The horizontal wells are conceptually planned to reach a total depth of approximately 2,900-3,300 mTVD.

The interval targeted by the horizontal section of the well will be confirmed once the results of the vertical pilot well are known, but the shallowest possible target is considered to be the Amungee Member C Shale. The top of this unit is prognosed to be intersected at 2,916 mTVD in the vertical pilot well. The deepest aquifer at this location, based on offset well data (including water bores), is expected to be the Gum Ridge Formation aquifer. The base of this unit is prognosed to be intersected at 425 mTVD. Therefore, an offset of approximately 2,400 m is expected between the base of the deepest aquifer and the top of the shallowest primary target of the horizontal section of the well. This significantly exceeds the minimum offset, of more than 600 m, between top target zone and base aquifer as mandated by the Code.

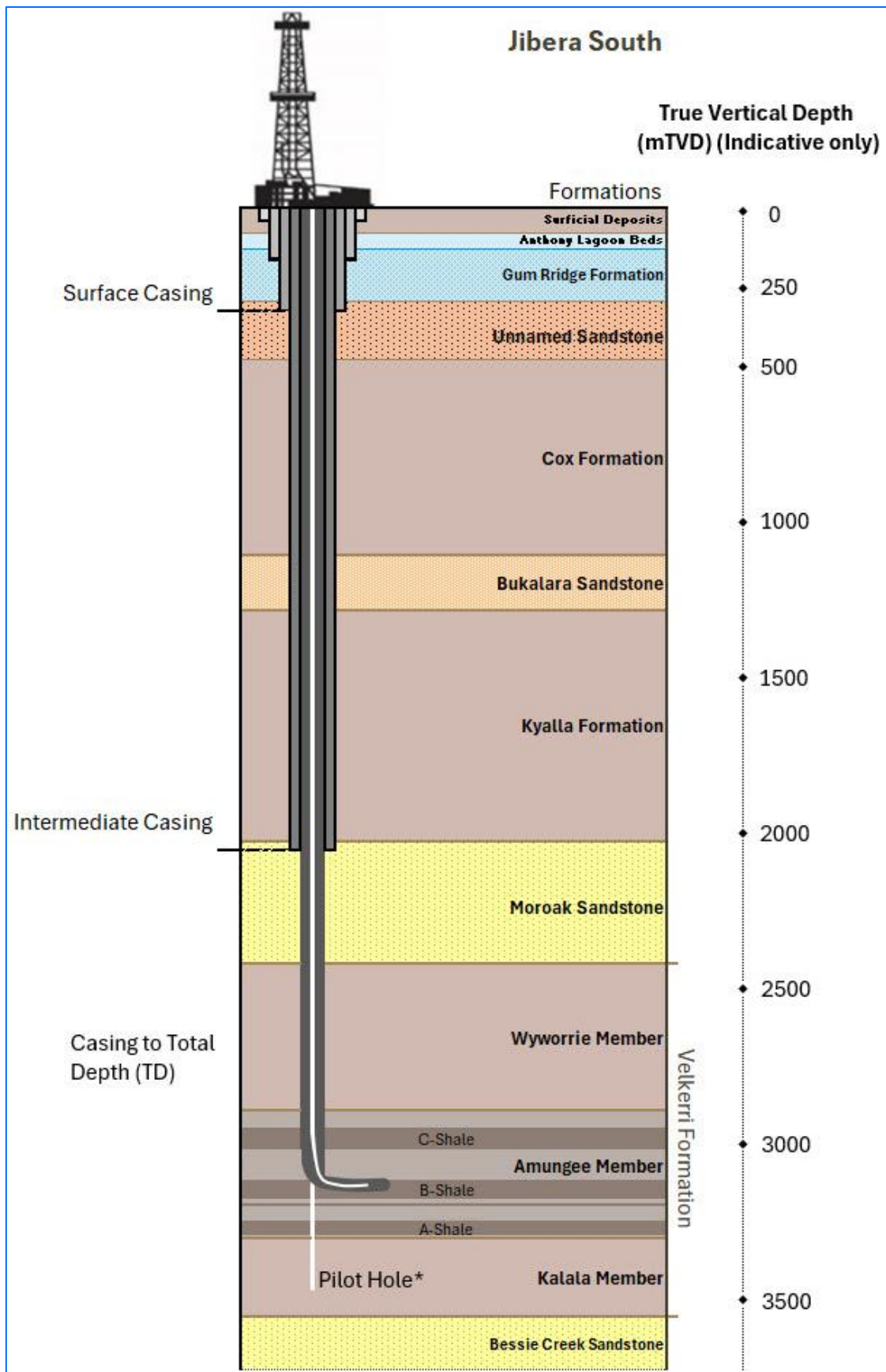


Figure 13: Schematic diagram illustrating offset between top of target interval and base of shallowest aquifer at Jibera South location

Table 20: Jibera South prognosed formation depths

Formation		Depth (m-TVD)	Depth (m-TVDSS)	Description	
Rig Height		0	242.59	Location of rig rotary table above ground level.	
Surficial Deposits		9	233.59	Claystone, siltstone and minor sandstone.	
Anthony Lagoon Beds		145	98	Regional Aquifer. Sandstone, siltstone and Dolomitic limestones.	
Gum Ridge Formation		305	-62	Regional Aquifer. Minor grey brecciated limestone, pink to pale brown cryptalgal laminate.	
Un-named Sandstone		425	-182	Fine to very coarse grained, friable quartz to lithic sandstone with minor shale beds and basal pebbly sandstone to conglomerate.	
Cox Formation		490	-247	Thinly interbedded siltstone, laminated siltstone to claystone and very fine-grained sandstone.	
Bukalara Sandstone		1,126	-884	White, light grey to brown, fine- to coarse-grained quartz sandstone with lesser fine-grained micaceous sandstone.	
Upper Kyalla		1,281	-1,039	Interbedded siltstone, mudstone and very fine grained quartz sandstone.	
Lower Kyalla		1,713	-1,471	Fine- to coarse-grained quartz sandstone, with interbedded siltstone, mudstone.	
Moroak Sandstone		2,013	-1,771	Medium to fine quartz sandstone.	
Velkerri Formation	Wyworrie Member		2,407	-2,164	Interbedded and interlaminated mudstone and siltstone.
	Amungee Member		2,853	-2,164	Thinly interbedded, dark grey to brown-black organic rich-to-poor claystone, pale grey siltstone and rare, light grey fine grained sandstone.
	Amungee Mbr	C Shale	2,916	-2,674	Organic-rich carbonaceous with varying clay content shale.
		B Shale	3,117	-2,874	Organic-rich carbonaceous with varying clay content shale.
		A Shale	3,269	-3,026	Organic-rich carbonaceous with varying clay content shale.
	Kalala Member		3,279	-3,036	Interlaminated grey-green to dark grey, variably carbonaceous claystone and pale grey siltstone, minor fine-grained light grey sandstone .

3.7.4.2 Newcastle South exploration wells

The proposed Newcastle South vertical (and/or pilot) and subsequent Newcastle South horizontal wells will appraise the southern flank of the eastern extension of the Beetaloo Basin approximately 17 km south-west of the existing Mount Brown well pad. Table 21 outlines the expected formations and depths that will be intersected with a brief description of the general lithology of each formation/member, and these are illustrated in Figure 14.

The proposed horizontal wells have been planned to be approximately 10 to 50 m apart at surface and the lateral sections planned to be 300-500 m apart. The horizontals will target separate shale intervals and be also vertically separated with a minimum spacing of approximately 50 m TVD. After being completed with casing/tubing, the wells will also be monitored with pressure gauges to detect communication during operations. The horizontal wells

will be directionally drilled to remain in the optimum zone of the selected A, B, Lower B or C Shale intervals using real-time logging while drill tools. Mount Brown-1 source rock analysis for core and cutting samples have been used to confirm TOC and calibrate petrophysical models for future data acquisition and indicates that the proposed horizontal exploration wells should intersect highly mature Velkerri shale intervals with an expected dry gas composition i.e. primarily methane. The horizontal wells are currently planned to reach a total depth of 2880-3240 m TVD.

The interval targeted by the horizontal section of the well will be confirmed once the results of the vertical pilot well are known, but the shallowest possible target is considered to be the Amungee Member C Shale (of the Velkerri Formation). The top of this unit is prognosed to be intersected at 2,880 m TVD. The deepest aquifer expected at this location is the Gum Ridge Formation. The base of this unit is prognosed to be intersected at 258 m TVD. Therefore, a minimum offset of 2,600 m is expected between the base of the deepest aquifer and the top of the primary target of the horizontal section of the well. This significantly exceeds the minimum offset, of more than 600 m, between top target zone and base aquifer as mandated by the Code.

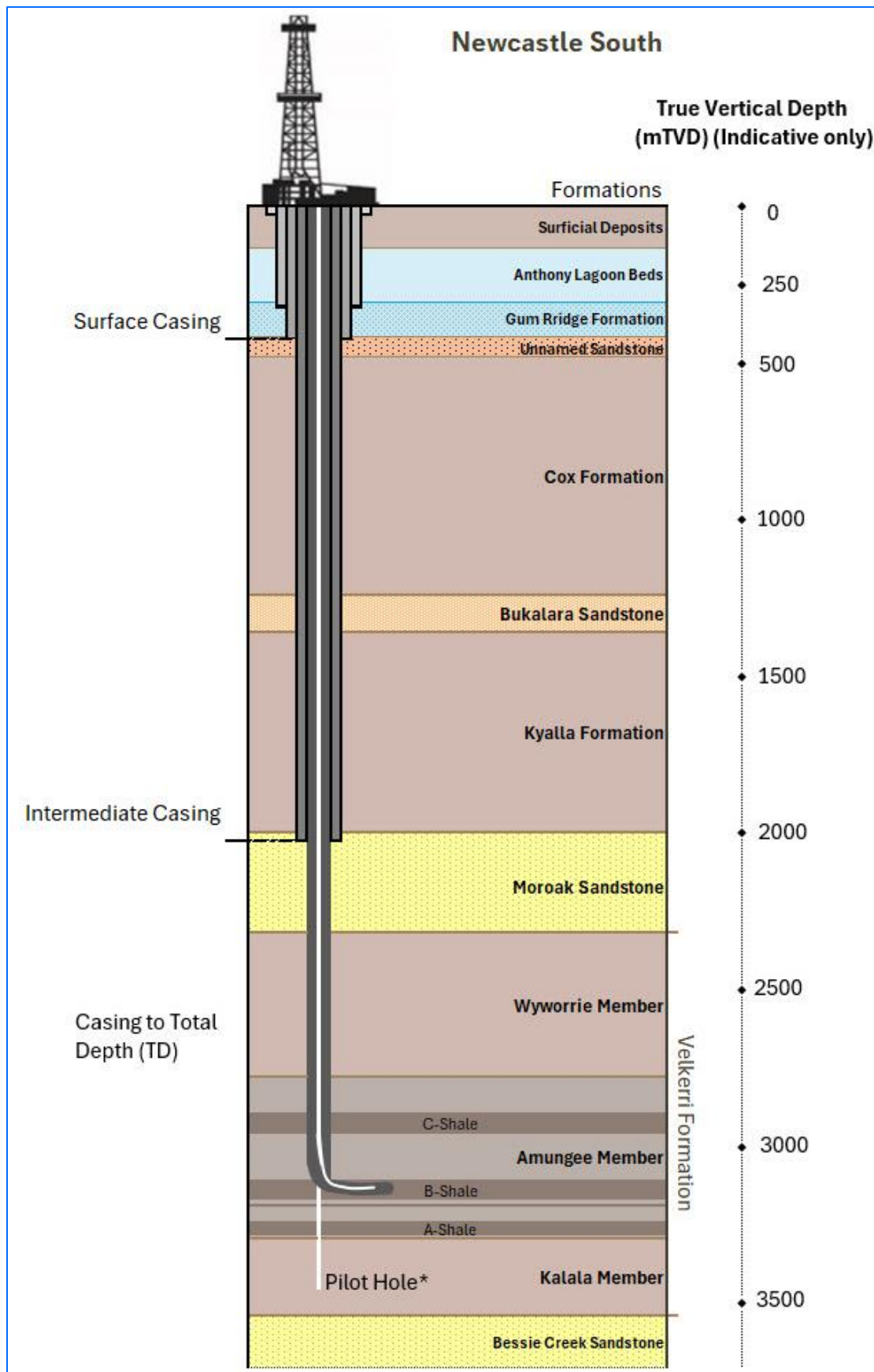


Figure 14: Schematic diagram illustrating offset between top of target interval and base of shallowest aquifer at Newcastle South location

Table 21: Newcastle South exploration wells prognosed formation depths

Formation		Depth (m-TVD)	Depth (m-TVDSS)	Description	
Rig Height		0	245	Location of rig rotary table above ground level.	
Surficial Deposits		9	236	Claystone, siltstone and minor sandstone.	
Anthony Lagoon Beds		92	153	Regional Aquifer. Sandstone, siltstone and Dolomitic limestones.	
Gum Ridge Formation		138	107	Regional Aquifer. Minor grey brecciated limestone, pink to pale brown cryptalgal laminate.	
Un-named Sandstone		258	-13	Fine to very coarse grained, friable quartz to lithic sandstone with minor shale beds and basal pebbly sandstone to conglomerate.	
Cox Formation		478	-233	Thinly interbedded siltstone, laminated siltstone to claystone and very fine-grained sandstone.	
Bukalara Sandstone		1,240	-995	White, light grey to brown, fine-to-coarse grained quartz sandstone with lesser fine grained micaceous sandstone.	
Upper Kyalla		1,355	-1,110	Interbedded siltstone, mudstone and very fine grained quartz sandstone.	
Lower Kyalla		1,701	-1,456	Fine- to coarse-grained quartz sandstone, with interbedded siltstone, mudstone.	
Moroak Sandstone		2,001	-1,756	Medium to fine quartz sandstone.	
Velkerri Formation	Wyworrie Mbr		2,322	-2,077	Alternating, interbedded and interlaminated mudstone and siltstone.
	Amungee Mbr		2,821	-2,576	Thinly interbedded, dark grey to brown-black organic-rich to -poor claystone, pale grey siltstone and rare, light grey fine-grained sandstone.
	Amungee Mbr	C Shale	2,884	-2,639	Organic-rich carbonaceous with varying clay content shale.
		B Shale	3,086	-2,841	Primary Target - Organic-rich carbonaceous with varying clay content shale.
		A Shale	3,228	-2,983	Organic shale with varying clay content and potentially favourable brittleness properties.
	Kalala Mbr		3,238	-2,993	Interlaminated mudstone and siltstone.

3.7.5. Drilling fluids and process

Drilling fluids are used to fill the wellbore and provide primary well control by exerting a hydrostatic pressure at the bottom of the hole which is in excess of formation pressure. Drilling fluids are also the primary means for transporting drilling cuttings to the surface, preserving wellbore stability and providing cooling and lubrication to the drill bit and drill string during drilling. Fluid volumes required for each drilling operation are dependent on the well depth, casing design and formations to be drilled through.

Drilling mud plays a crucial role in maintaining well control, ensuring formation stability, lubricating the drill, regulating its temperature, and transporting cuttings to the surface. The fluid system typically comprises water

mixed with a bentonite for viscosity, and a sodium, calcium, or potassium-based salt to prevent formation swelling. Additional chemicals may be required, depending on the particular requirements of a formation and any site-specific drilling conditions encountered.

Detailed information about the chemicals used during drilling is provided in the *Chemical Risk Assessment* (Appendix D) which includes the Safety Data Sheets (SDS) and relevant hazard assessment as required by CoP – Well Integrity. It is not necessary to use all these additives for every hole and specific additives are selected for each well.

3.7.6. Drilling through aquifers and shallow loss zones

It is recognised that drilling through aquifers¹⁷ presents a potential risk to groundwater quality, however, this risk will be managed to a level that is ALARP. The following control measures will be implemented to mitigate potential impacts:

- Well design and construction to isolate aquifers.
- Groundwater monitoring bores, both control and impact monitoring bores, are to be located in accordance with the *Groundwater and Surface Water Monitoring Plan* (Appendix I) to monitor for changes in groundwater quality.
- Drilling fluid should be captured and recycled for reuse as much as practicable.
- When drilling through local beneficial use aquifers and until these aquifers are isolated by a minimum of 2 verified barriers, then:
 - Only air, water or water-based drilling fluids are permitted to be used.
 - Chemicals or other substances that could leave a residual toxic effect in the aquifer will not be added to the drilling fluid.
 - Non-toxic water-based drilling fluid systems will be utilised, such as bio-degradable guar gum / Xanthan gum (or similar).

Santos has previously used blind drilling with non-toxic drilling fluids (including inhibition sweeps) and water through aquifers, in line with the Code, during past appraisal campaigns. This approach has proven to be effective, as evidenced by offset well control and impact monitoring records confirming that all activities were conducted within compliance requirements.

3.7.6.1 Drilling sumps

Drilling fluids, including cuttings, muds, and cement returns, will be collected and directed to the drilling sump at each site for recovery and reuse (where possible). The drilling sump will be designed to accommodate multiple wells so that sufficient capacity is maintained to meet operational needs, including significant rain events and requirements as per the WWMP (Appendix F). Additionally, waste drilling fluids may be transferred to onsite wastewater tanks or sumps to provide extra storage capacity, ensuring compliance with freeboard requirements. These measures are implemented to prevent overflows and to manage the volume of fluids effectively during drilling operations.

Sumps will be managed in accordance with the WWMP (Appendix F) and *Spill Management Plan* (Appendix E).

3.7.7. Drilling and completions

3.7.7.1 Drilling and completions

Completions are undertaken after the well has been drilled and cased. Completion operations may include:

- Cementing and/or remedial cementing

¹⁷ An aquifer is as defined within the Code – a body of rock that is sufficiently permeable to conduct groundwater and currently supplying, or potentially being able to supply, water for environmental, cultural or consumptive (stock or domestic) uses, as determined by the Northern Territory Government.

- Cleaning out the casing
- Running production logging tools, static gradients
- Running tubulars
- Setting packers
- Perforating
- Acidizing or other stimulation activities to enhance hydrocarbon flow
- Production or injection testing.

The majority of Santos wells completed are cased to their total depth and perforated through the casing in the targeted formations.

3.7.7.2 Drilling and completion design

A completion design is prepared by the engineering team based on:

- Rock cuttings and/or borehole core retrieved from drilling of the well hole.
- Information gained from geophysical logging of the borehole.
- The regional geological model; reservoir analysis.
- Fluid type to be produced or injected.
- The history of nearby wells.
- Consideration of technical / physical limitations of equipment.

Historical problems encountered in the area (lost returns, irregular hole erosion, poor hole cleaning, poor cement displacement etc.) are considered during the design process.

These scenarios are modelled through industry best practice to determine design loads for collapse, burst and tensile failures. The results of this tubing stress analysis (which incorporate pressures exerted during the hydraulic stimulation process) direct the selection of tubing grade and weight.

3.7.7.3 Remedial cement

If the casing bond log from the primary cement job typically executed during the drilling phase identifies issues with the integrity of the cement, further evaluation is undertaken. If it is determined that the loss of integrity poses an unacceptable risk, remedial cementing works will be undertaken. This is managed by the WOMP.

Remedial cementing may also be used to isolate or shut-off sections of the wellbore, or perforations where appraisal is no longer required or the produced fluids have become undesirable. This can be in the form of cement plugs, cement squeezes or cement circulations.

Remedial cementing is undertaken using a cementing pump truck, tanks holding cementing fluids and a bulk dry cement truck. The cement is mixed on location and pumped according to the program specific to the well issue.

3.8. Operation, testing, maintenance and decommissioning

3.8.1. Operation

The proposed well operations will involve the appraisal and testing of the drilled well to evaluate its reservoir characteristics, productivity, and potential for future development. Activities may include the installation of surface and downhole equipment, flow testing, sampling, and data acquisition to assess formation properties and fluid composition. Operations will be conducted within the established well lease area using existing infrastructure where practicable.

3.8.2. Well evaluations

Appraisal testing involves a series of activities, including production testing, to evaluate the commercial viability of a gas resource. Production testing is a necessary part of the initial appraisal phase, as it provides essential information about the behaviour and performance of gas reservoirs. The data collected is used to estimate recoverable reserves, forecast production potential, and inform the design of any future wells and facilities.

This includes an Initial Production (IP) flow test of up to 30 days per well (IP30), limited to 3 horizontal wells only. Production testing during the appraisal phase allows the company to better understand reservoir performance and supports informed decision-making regarding the potential scale, timing, and viability of any future development.

Well testing is required to generate the appraisal data necessary to support future commercial and financial considerations assessment of the resource. Beneficial reuse is not included within the scope of this EMP and would be subject to separate regulatory assessment and approval.

The company is investigating options available for beneficial use with studies underway to assess the various options in terms of technical, environmental, and economic feasibility. This includes consideration of infrastructure, regulatory, and land access requirements.

Beneficial use of appraisal gas requires additional regulatory approvals including assessment under the *Petroleum Act 1984* and the PER 2016. Beneficial use of appraisal gas must be incorporated within an approved EMP that specifically addresses the handling, processing, and transport of gas for use or sale.

As the appraisal activities will occur on land subject to Native Title rights and interests, the beneficial use also requires the consent of the Native Title holders under the *Native Title Act 1993* (Cth). This ensures that any physical works or gas transport associated with the beneficial use are lawfully undertaken and properly negotiated with Traditional Owners.

3.8.2.1 Open hole evaluation, logging and testing

Well evaluation activities including mudlogging, Logging While Drilling (LWD), wireline logging, formation testing, core acquisition, fluid sampling, open hole formation integrity testing (i.e. leak-off tests, formation integrity tests, or diagnostic fracture injectivity tests) and other standard oilfield evaluation techniques as deemed appropriate. Drill core and/or cutting samples will be collected for geological assessment and analysis and wireline logs will be acquired over the open hole section as per Santos and NT Government requirements.

3.8.2.2 Diagnostic fracture injection test

Diagnostic Fracture Injection Tests (DFITs) may be undertaken. These cased-hole DFITs assess the geochemical and reservoir properties of the target formations to inform their suitability and capacity for potential gas extraction.

3.8.3. Flaring and venting during drilling and testing operations

During drilling and well testing activities, in addition to undertaking planned IP30 tests, flaring and venting may be required to safely manage gas encountered while establishing well integrity, confirming reservoir characteristics, and conducting short-duration function or flow tests. Flaring may occur as part of routine drilling and testing operations and also in non-routine circumstances to maintain well control, ensure safe operations, or respond to abnormal conditions. These non-routine activities are distinct from extended production testing and may also occur where required to collect essential reservoir data.

Flaring involves the controlled combustion of gas at a purpose-built flare stack. Non-routine flaring may occur during:

- Initial well clean-up to remove drilling fluids, cuttings, or formation debris.
- Short-duration flow checks to confirm well performance or equipment functionality.
- Safety-related situations where controlled combustion is required to reduce pressure or eliminate combustible gas.
- Any other temporary circumstances where beneficial use of the gas is not feasible or practicable.

Flaring is undertaken in accordance with safety and operational procedures to ensure stable combustion and to minimise emissions and off-site impacts. Combustion efficiency is maximised through appropriate flare design, ignition systems and monitoring. Flare combustion efficiency will be monitored indirectly through measured gas flow rates and engineering calculations that apply accepted flare efficiency assumptions, to verify that the assumed combustion efficiency is being achieved under operating conditions. Non-routine flaring durations are kept as short as practicable and are limited to the minimum periods required to support safe and compliant drilling and testing activities.

Venting may occur where the release of small quantities of gas is required for pressure equalisation or equipment function testing and where flaring is not technically feasible (e.g., insufficient gas volume for sustained combustion). Venting may include:

- Low-volume gas releases associated with well-control equipment testing.
- Gas bled from pressure control systems.
- Traces of gas released during well clean-up where the composition or flow rate does not support flaring.

Venting is minimised to the greatest extent practicable, and operational practices prioritise non-routine flaring over venting wherever safe and feasible. Gas releases are monitored and recorded to meet regulatory requirements.

3.8.3.1 Phase separator

Separators have the ability to effectively segregate hydrocarbons and water in order to optimise the flowing conditions and clean-up the well. After separation, the water or flowback is stored as described in Section 3.11. The gas is sent through to a flare stack where it is flared on location and any liquid hydrocarbon (oil / condensate) is stored in onsite storage tanks.

The separator controls which substance is sent to the flare stack. Pneumatic level controllers in the water and oil compartments control the fluid levels within the separator, preventing liquids from getting high enough and being released through the gas outlet (flare line). When the separator is operated, only natural gas will be flared. An enclosed storage tank will be on site and downstream of the separator oil outlet. An oil vacuum truck or equivalent is traditionally used for the transport, disposal or potential sale of condensate (if required). Figure 15 provides an example of a separator.



Figure 15: Separator package installed on a multiple well pad in Cooper Basin

3.8.3.2 Flare stack

A flare is used for the controlled release and combustion of gas such as well testing, pipe flaring and well clean-up. A horizontal flare pit surrounded by an earthen berm is proposed to be utilised as the flaring design for this Project. The flare pit will be constructed as an excavation in the ground, with the gas discharge pipe discharged horizontally into the pit. The surrounding berm (minimum 3 m high) will act as a physical barrier and will reduce both radiant heat and noise reaching surrounding areas. Final flare pit dimensions, orientation and equipment will be confirmed during detailed design and contractor selection.

The flare design will utilise an auto-ignition system (AIS) to ensure continuous ignition and is designed to achieve a combustion efficiency of 98%. Combustion efficiency will be monitored through measured gas flow rates and engineering calculations.

Preliminary radiant heat modelling has been undertaken in accordance with API 521 to assess vegetation fire risk and the vegetation-free exclusion zone. The modelling applies a standard flare radiation approach consistent with API 521, in which radiant heat intensity at a receptor is calculated based on heat release from combustion, the fraction of heat radiated by the flame, atmospheric transmission and the distance from the flame radiant epicentre. The assessment assumes a horizontal flare pit and berm configuration, maximum operating conditions, partial shielding by the berm, and allowance for wind-induced flame deflection. Potential mechanisms beyond radiant heat, including exposure duration, hot particulates and burning droplets were also considered.

For vegetation fire risk, a total heat flux of 9 kW/m² was adopted as the maximum continuous radiant heat exposure that light dried vegetation may be exposed to. Allowing approximately 1 kW/m² for solar radiation, the flare is therefore limited to 8 kW/m² at the nearest vegetation edge.

The assessment also identifies that ignition risk is influenced not only by radiant heat intensity, but also by exposure duration and other potential ignition mechanisms, including burning droplets, hot particulates and ignition of wind-blown material that may subsequently settle in adjacent dry fuels. On this basis, the modelling and flare layout have been used together to define a conservative vegetation setback and sterile area around the flare pit. A minimum 30 m vegetation-free exclusion zone will be established around the flare pit by clearing the soil surface of flammable materials and vegetation. This 30 m clearance is the minimum fuel-free area; however, the final vegetation setback will be confirmed by radiant heat modelling for the selected flare pit geometry, berm arrangement and operating conditions to ensure that the radiant heat contribution from the flare does not exceed 8 kW/m² at the nearest vegetation edge.

This approach is consistent with other NT EMPs, where a minimum sterile or low-fuel area is maintained around flaring infrastructure and the final setback is then established and verified through flare design and validation modelling to demonstrate that vegetation fire risk has been reduced to ALARP.

The assessment also considered thermal radiation guidance for personnel and exclusion zone design. API 521 Table 12 sets out recommended design thermal radiation levels for personnel, noting that shielding and/or special protective apparel should be considered where personnel may be exposed to greater than 6.31 kW/m². In this EMP, API 521 is therefore used to inform broader flare pit layout, personnel protection and exclusion zone design, while the vegetation criterion remains the assessment-specific 8 kW/m² flare contribution at the nearest vegetation edge.

3.8.4. Well suspension or abandoned

After drilling and evaluating the well, a decision will be made to either run and cement the production casing and suspend the well or plug and abandon the well.

As part of the well suspension process, temporary well barriers will be installed in accordance with Santos WOMP and relevant COP – Well integrity requirements. A Well Integrity Monitoring Plan (WIMP) will also be developed for any suspended well to ensure ongoing monitoring of the wellbore barriers.

When plugging and decommissioning a well, the following considerations are applied:

- Isolate all formations that have hydrocarbon shows.
- Isolate aquifers.
- Set plugs:
 - Across intermediate casing shoe (if present).
 - To minimise the potential for cross flow between aquifer systems and hydrocarbon bearing intervals as defined in the Code.
- Set plugs across surface casing shoe.
- Set a final plug at surface after removing the surface casing bowl and erect a well identification sign.

Figure 16 presents an example of the placement of a decommissioning plug. This is further discussed and approved within the WOMP as required by the Code.

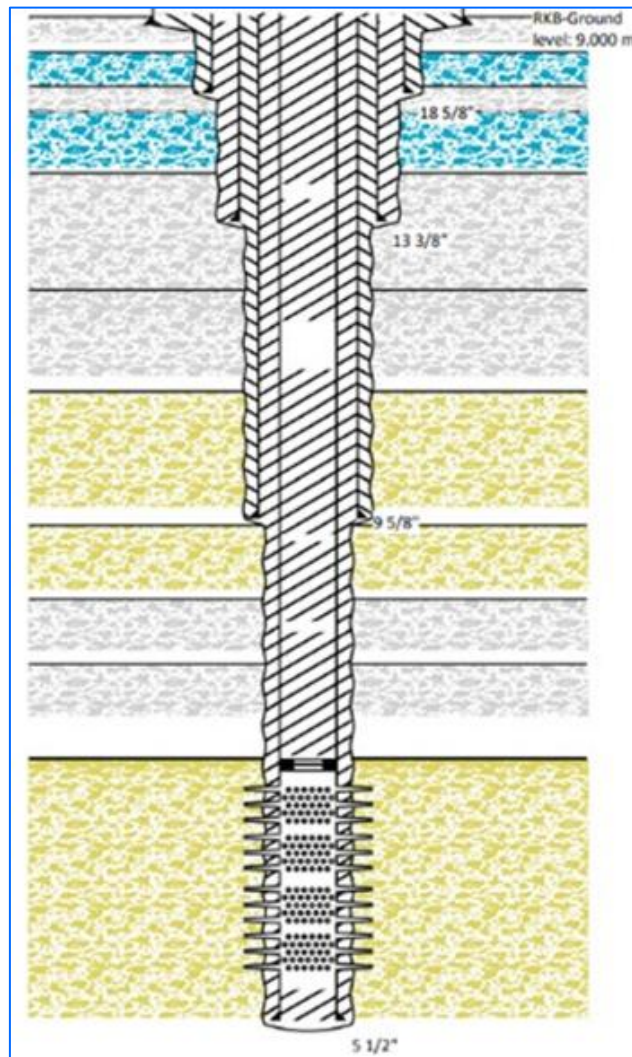


Figure 16: Example of a cement plug showing aquifer isolation

3.8.5. Wellheads

A wellhead system is installed which includes all equipment on the surface that supports the various pipe strings, seals off the well and controls the paths and flow of reservoir fluids. The type of wellhead installed, and metallurgy selected, is based on the conditions in the individual well. In some instances, a simple assembly to support the weight of the tubing in the well is enough while other wells may need a high pressure well head to control formation pressure, or use of alloys to mitigate corrosion from formation fluids.

Wellheads have at least one casing head and casing hanger and will usually have a tubing head and tubing hanger and a Christmas tree (refer Figure 17).

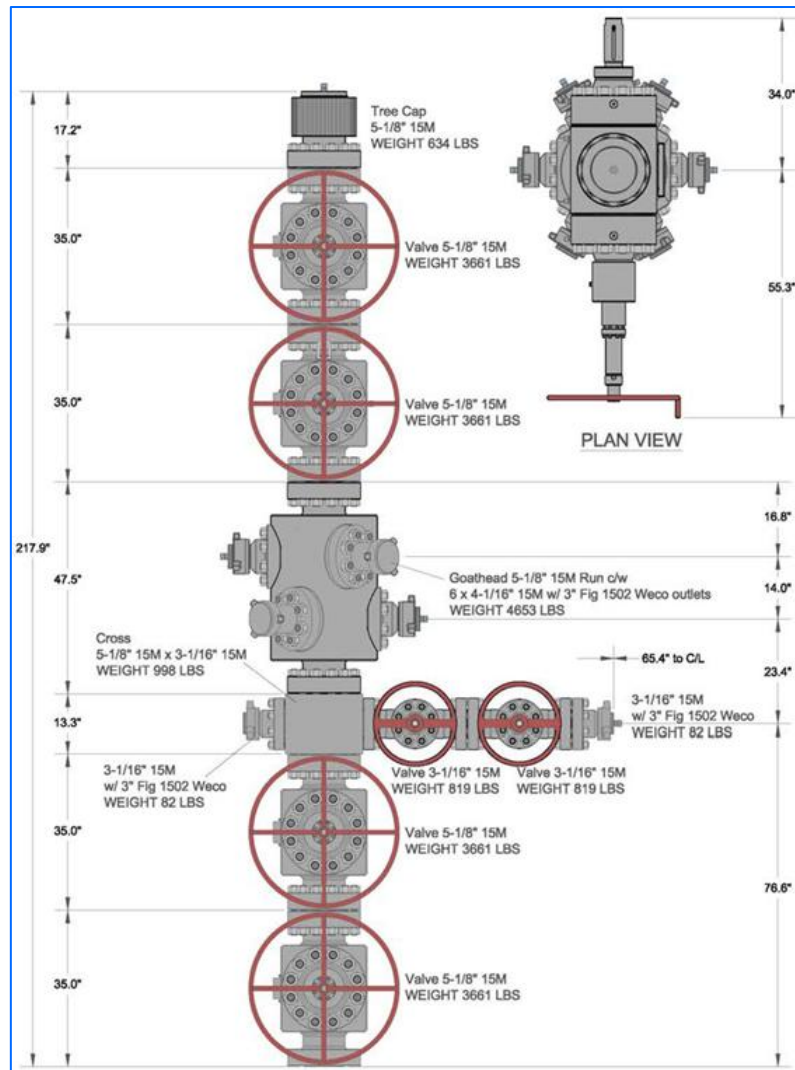


Figure 17: Typical wellhead configuration

3.9. Hydraulic fracture stimulation

HFS is not part of the drilling process but is a completion technique applied after the well is drilled. The intent of HFS is to place highly conductive channels into the reservoir (illustrated in Figure 18) to increase the flow capacity of the well and increase the production of natural gas.

HFS involves the injection of hydraulic fracturing fluids (water, sand/proppant and minor chemical additives) at high pressure into a cased wellbore, and it is usually conducted over a number of intervals along the production zone of the well. This technique is commonly used in low permeability reservoirs that cannot otherwise sustain economic production, such as shale.

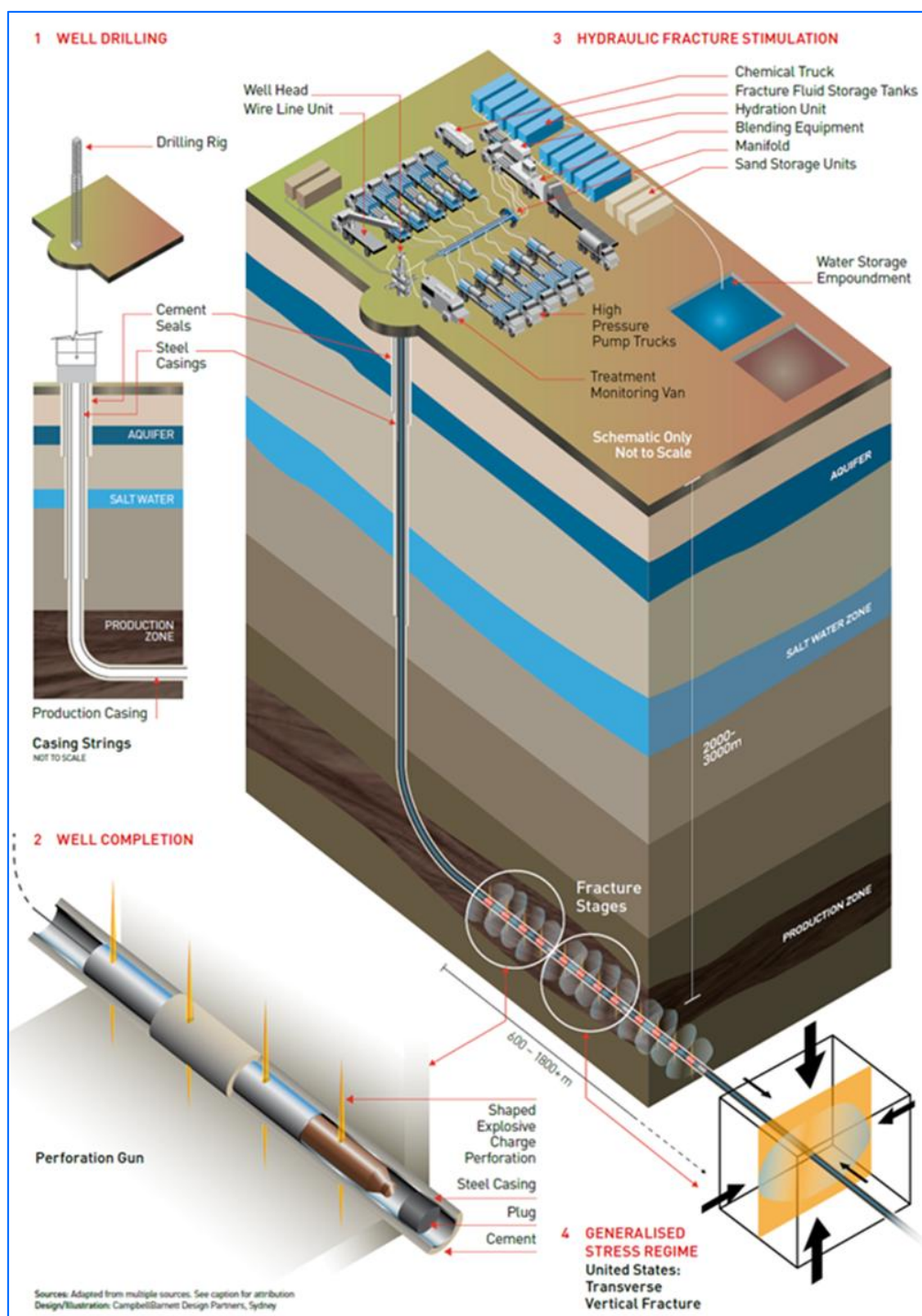


Figure 18: Illustration of multistage fracture stages in a horizontal well

3.9.1. HFS equipment

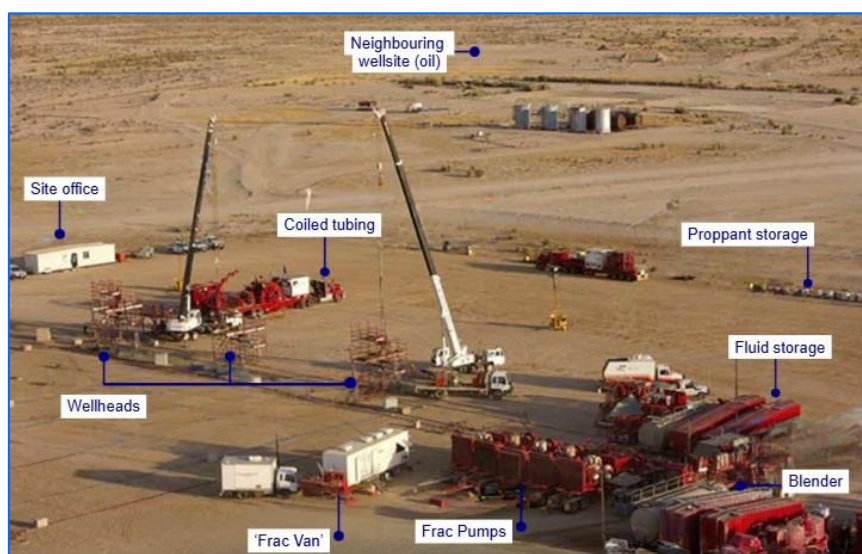
Once the drilling activity is complete and relevant depths and well integrity achieved, the HFS equipment will be mobilised to site. The equipment forecast for each well pad for HFS activities is provided in Table 22. This equipment will be used across both sites or concurrently on each pad, depending on the selected campaign methodology.

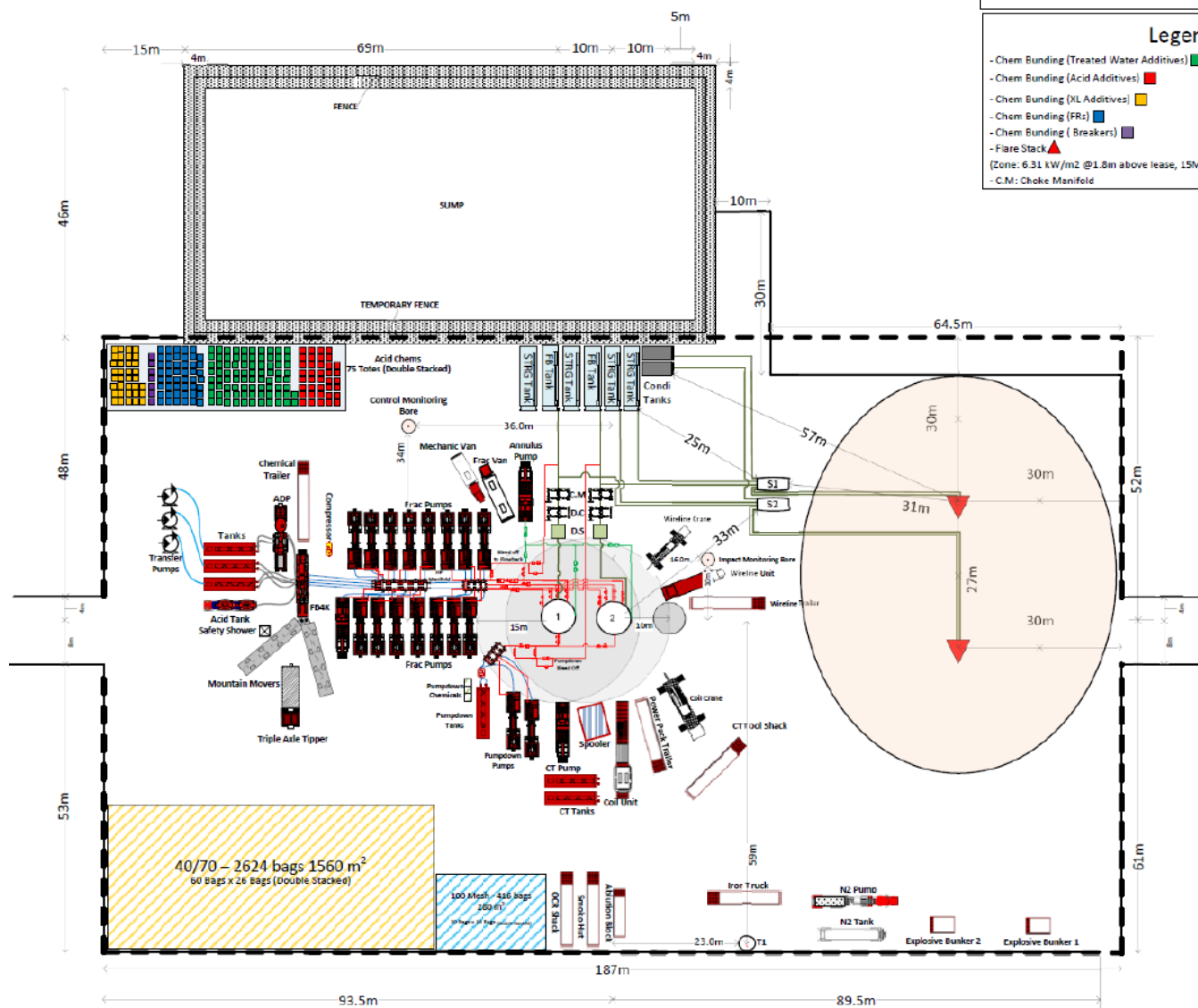
Table 22: Anticipated HFS equipment

Aspect of work	Anticipated construction equipment
General Services	• Small excavator (<10t), bob cats / Skid steer, tipper (~8T) • General craneage and trucking fleet. • Telehandler • Light 4WD vehicles / ATVs • Water carts • Lighting • Fuel trucks.
HFS	• Blenders • Sand trailer unit • High pressure pumps – up to 30 • Coiled tubing unit • Control unit • Proppant and Chemical Storage Area.
Storage (Groundwater / Wastewater)	• Large, above ground storage tanks – groundwater • Large, above ground storage tanks – flowback.
Installation of Water Management and Fluid system	• Telehandler • General craneage and trucking fleet.
Operation support	• Site Office and crib huts • Workshop • Generator (power) – diesel • Storage trailers, dangerous goods and hazardous chemical storage containers.

3.9.2. HFS set up and layout

This process has been extensively used in the industry since 1947. Santos Ltd has successfully used this technique on wells in the Cooper Basin for over 50 years and is currently performing the process in many basins around Australia. An indicative equipment layout is shown at Figure 20. A photo from a 3 well pad location in the Cooper Basin (with mark-up of major equipment on location during the hydraulic fracturing operation) is shown in Figure 19.


Figure 19: HFS equipment in a 3 well location (pad) in the Cooper Basin



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3.9.3. HFS process

The stimulation process involves pumping water, a specific blend of chemical additives and a propping agent such as sand or ceramic beads down the well at sufficient pressure to create a fracture in the target formation. Proppant keeps the fractures open once the pump pressure is released, which thereby improves the productive potential of the well. A fracture created in deep shale reservoirs will propagate laterally from the well in a vertical plane. Common dimensional terminology for the created fracture includes fracture half length (x_f), fracture height (h_f) and propped width (w_f), as below in Figure 21.

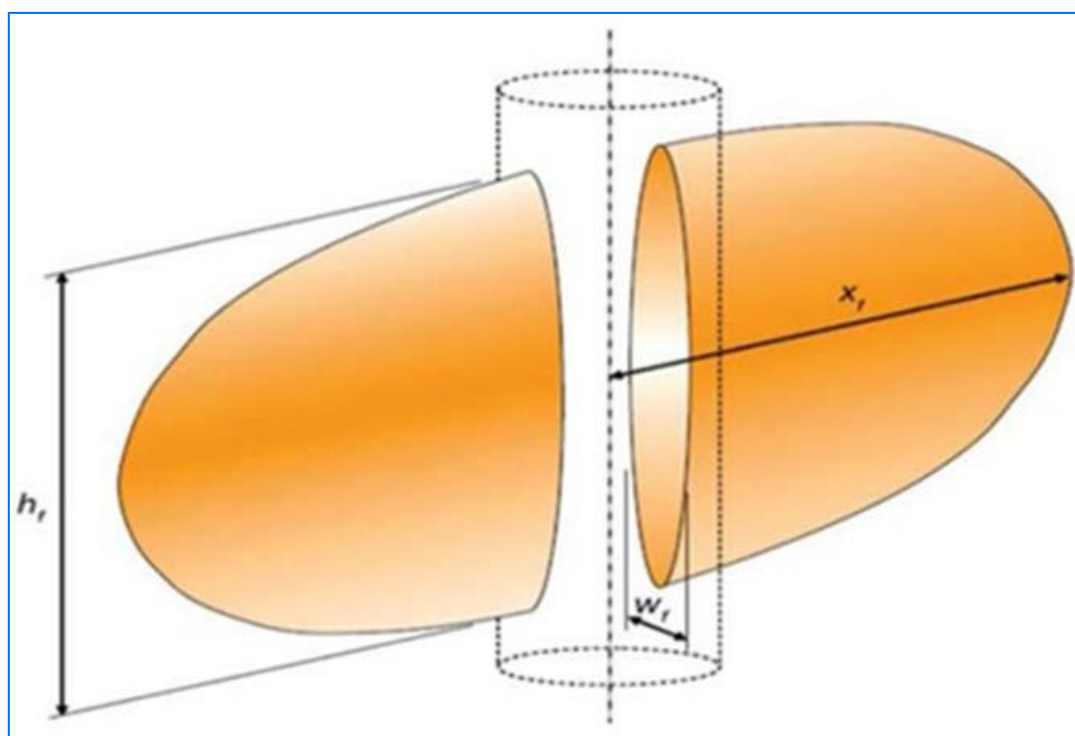


Figure 21: Conceptualised shape of hydraulic fracture (Source: Economides & Martin, 2007)

3.9.4. HFS design considerations

Open-hole and cased-hole logging provides information required for the hydraulic stimulation design process, including rock stress and lithological parameters. This data is processed using industry accredited stimulation software to develop an optimal design. The basis of well specific hydraulic fracture design is to create a fracture within the target formation that will produce hydrocarbon through the number of required fractures. This is achieved by modelling fracture length, fracture conductivity, and fracture height for each created fracture as depicted in Figure 22 below. Several considerations influence the final design for each treatment, including:

- Depth and thickness of the formation target.
- Lithology of formation target and bounding layers.
- Minimum and maximum horizontal stress across all layers (target and bounding).
- Thickness of the seals above and below the target reservoir formation.
- Porosity and permeability of the formation.
- Pore fluid saturations (percentage of formation pore volume occupied by hydrocarbons or water).
- Pore fluid properties (e.g., density, water salinity).
- Well performance data, including flow rates, formation pressure and produced fluid properties.
- Formation boundaries (as identified from offset wells, log data, cuttings data, and/or seismic data).
- Bulk rock density, elastic properties and compressibility.
- Natural fracture networks.

- Stress field analysis to determine the maximum principle stress direction and the minimum principal stress direction.

The completion design process accommodates detailed analysis of these parameters to specify a hydraulic stimulation design that provides containment within the target formation. The treatment design models can predict the fracture geometry, including fracture length and height based on the geomechanical rock properties. The models do not predict the fracture orientation, however Santos holds regional stress information that is used to predict the fracture orientation across the basins.

Further, there is occasional use of microseismic sensing and other diagnostic techniques to monitor fracture orientation within the industry. Santos has experience with these technologies and may consider additional controls as required. These are all used to keep the HFS profile within target formations as far as reasonably practicable.

Ground motion accelerometers will be used to provide continuous recordings of ground motion and real-time assessment of peak ground acceleration as an indicator of induced seismicity and to supporting implementation of the Traffic Light System as per Section 2.4 of the *NT Induced Seismicity Management Plan Guideline 2025*. Consistent with this guideline, at least two accelerometers will be used for each common drilling well pad location area, no closer than 500 m and no further than 2 km from the pad. The accelerometers will be positioned away from operational or other mechanical noise sources where practicable and installed to manufacturers' specifications. Monitoring will commence at least two days prior to hydraulic fracture stimulation, continue for the duration of operations including flowback, and continue for 30 days after completion.

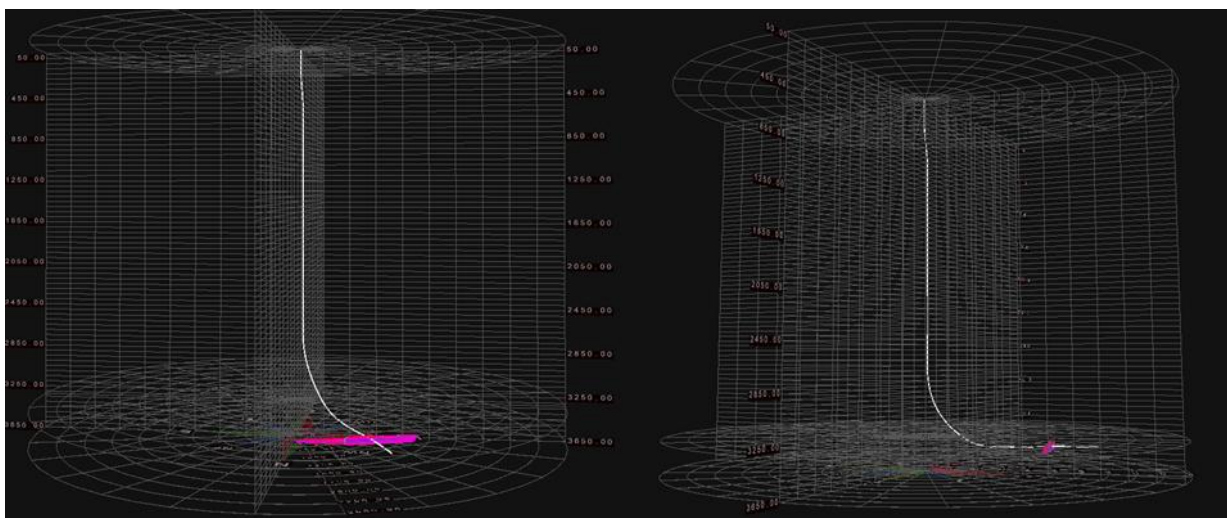


Figure 22: Modelled 3D view output from industry accredited stimulation software for a horizontal well shale hydraulic fracture at >3,000mTVD

3.9.5. Flowback and well testing

After fracture stimulation has been completed, flowback activities will be conducted to produce the fracturing fluid while removing the isolation plugs that were set during the fracturing operations. Coiled tubing may be used to remove these plugs, to ensure the wellbore is cleaned of proppant, and nitrogen to assist fluid recovery if necessary.

Subject to a successful reservoir outcome (continuous well appraisal (production) rates), each of the first 3 wells may be flow tested for a period of up to 30 days to appraise the commerciality of the well and gas resource (henceforth referred to as an 'IP 30 test'). During any flowback that has potential to return formation fluids, flow will be directed through a separator to capture fluids and separate gas to be flared or transported for beneficial use. IP 30 tests (using a flare to dispose of gas) will only occur where there is no ability to transport the appraisal gas. Beneficially using appraisal gas requires separate additional regulatory approvals, which Santos is currently progressing.

Once the injection process is complete, the internal pressure of the rock formation causes fluid to return or "flowback" to the surface through the well. This fluid, henceforth referred to as 'flowback fluid', contains the low

concentrations of the products of the injected fluids plus naturally occurring geogenic compounds (i.e. material or substances that are mobilised through the process that must also be considered for potential health or environmental impact).

Based on offset well experience, total fluid recovery is expected to be approximately 10 to 20% of HFS water. The flowback fluid is typically temporarily stored in tanks before reuse, evaporation or disposal. This is variable across different fields and Santos' recent Mount Brown appraisals resulted with approximately 10% of HFS water recovered.

The recovered fluids produced during the initial clean-up phase (following stimulation activities) are stored in flowback tanks, which will be stored in double lined or doubled walled storage tanks. Where produced water or flowback fluid is being treated in open tanks, transfer to above ground enclosed storage tanks will be undertaken at least 8 hours in advance of a predicted significant rainfall event (as per C.7.1.1 of the Code and as defined within the WWMP – Appendix F).

For a full description of the wastewater management associated with the production of flowback fluid refer to the WWMP – Appendix F.

3.9.6. Hours of operation

During operations, Regulated Activities such as HFS and flaring will run 24 hours a day and can create noise and light nuisance, particularly in otherwise quiet and remote rural or pastoral areas. The use of heavy machinery, high-pressure pumps, generators, and transport vehicles generates continuous noise that can disrupt local communities, wildlife, and pastoral activities, especially during nighttime operations.

In addition, powerful floodlights used to ensure safety during night shifts contribute to light pollution, which can interfere with the natural day-night cycle for both people and animals. These disturbances can affect the wellbeing of nearby residents and Indigenous communities, and may impact nocturnal wildlife behaviour, including movement, feeding, and breeding patterns.

To support the impact assessment of the Project, a preliminary noise assessment has been conducted to determine potential impacts on sensitive receivers. This assessment and further details on noise management are presented in Section 3.12.12.

3.10. Waste management

Waste will be managed in line with the internationally recognised waste management hierarchy, with the aim of achieving the best practicable environmental outcomes. The remoteness of the Project Area and the relatively small volumes of some waste streams influence the waste management approaches available. As a result, waste management will follow the hierarchy principles set out below:

1. Avoid – avoid producing waste in the first place / avoid waste by incorporating design measures.
2. Reduce – reduce the amount of waste created or substitute a less resource intensive product / service.
3. Reuse – reuse a waste / use more than once.
4. Recycle – recover resources from a waste.
5. Treat – bring the waste back into use through treatment or to make quality suitable for disposal.
6. Disposal of waste if there is no viable alternative.

Waste generation associated with the Project is expected to be minor (less than approximately 5 t per year over the operational life of the facility). Any listed wastes generated by the Project, as defined under Schedule 2 of the *Waste Management and Pollution Control (Administration) Regulations 1998*, will be removed from the site and transported to an appropriately licensed facility for recycling or disposal, in accordance with NT EPA requirements and *National Waste Policy 2018*.

Waste transfer certificates will be retained and provided to DLPE upon request. Table 23 provides an overview of the waste management practices for expected for this project.

Table 23: Waste and disposal methods

Activity	Disposal Method
Food waste, paper & plastic	Disposal: Collected in designated waste receptacles and back-loaded for disposal at an approved landfill facility.
Glass and cans	Recycling: Separated at source and collected for transport to an approved off-site recycling facility.
Scrap metals	Recycling: Stored in designated skips and transferred to an approved metal recycling facility.
Chemical bags and cardboard packaging materials	Recycling: Compacted at the rig site and transported to a licensed recycling facility.
Used chemical and fuel drums	Recycling: Managed in designated storage areas and transported to an approved recycling facility.
Chemical wastes / residual chemicals	Reuse or disposal: Where practicable, residual chemicals will be reused between programs. Surplus or waste chemicals will be stored in approved containers and either returned to the supplier, recycled, or disposed of at an appropriately licensed facility.
Timber pallets (skids)	Recycling: Collected and transported to an approved facility for reuse or recycling.
Vehicle tyres	Disposal: Removed from site and disposed of at an approved landfill or tyre management facility.
Oily rags, oil contaminated materials, filters and hydrocarbon waste	Recycling or disposal: Collected in suitable, clearly labelled containers and transported to an approved facility for recycling or disposal, depending on material type and contamination.
Sewage, grey and stormwater	Treatment and disposal: - Santos will utilise a suitably qualified third-party contractor to design, install and operate the irrigation system in accordance with the <i>Code of Practice for Wastewater Management</i> (2020). - Greywater and sewage to be treated on site using an approved portable treatment system, consistent with Department of Health requirements for small on-site sewage and sullage systems defined under the <i>Code of Practice for Wastewater Management</i> (2020). - Treated effluent will be irrigated within a designated, fenced area with existing vegetation retained. Designated irrigation areas will not require vegetation clearing, and they will be fenced to exclude livestock access. The sizing of irrigation areas will be determined in accordance with the requirements of the <i>Code of Practice for Wastewater Management</i> (2020) i.e. with consideration of hydraulic load and equivalent persons. Santos will utilise a suitably qualified third-party contractor to design, install and operate the irrigation system in accordance with the <i>Code of Practice for Wastewater Management</i> (2020). Sludge will be removed from site and disposed of at a suitably licensed facility. - Uncontaminated stormwater will be tested in accordance with Section 3.12.4 to determine its disposal approach (reuse, disposed off-site, discharged, etc.).

3.11. Wastewater management

3.11.1. Wastewater generation

The Project will generate various streams of drilling and produced wastewater. Table 24 provides a summary of each activity's sources of these wastewaters.

Table 24: Wastewater streams

Activity – waste resource	Waste type
Drilling	Drilling fluids Cuttings Cement returns
Ancillary activities to Hydraulic Fracturing	Residual drilling and completion fluids
HFS	Produced fluid Drilling and completions fluids produced back from formation
Production Testing	Flowback

3.11.2. Flowback fluid volume

It is anticipated that each well will produce up to 10% flowback fluid with a typical volume of up to 20 ML of flowback fluid for an approximately 60 stage fracture stimulation process.

If the number of stages is reduced, the volume of hydraulic stimulation fluid will also reduce. If monitoring shows the flowback fluid volume may exceed total storage capacity for enclosed tanks, there are numerous options to ensure flowback can safely continue, whilst adhering to the requirements under the Code of Practice. Options include fitting covers to wastewater tanks to reduce rainwater ingress and increase available enclosed storage capacity during the wet season, adding additional tanks (which may be open- or closed-topped depending on the final configuration), and choking back well(s) to reduce flowback fluid rate.

If additional tanks are required they shall be constructed as per above ground enclosed tanks Code requirements, but the total number of tanks will not exceed the maximum number of tanks stated in Table 10 of the EMP. In the absence of sufficient storage, wells will be choked back or shut-in to reduce flowback fluid rate to an acceptable level.

The majority (75% of encountered volume of flowback) is expected to be generated in the first 4 months of the well test. The predicted maximum volume of flowback stored at each of the sites is approximately 54 ML. This figure includes flowback from up to 3 wells at one site per year. This is therefore considered a conservative assessment and applied to ensure appropriate capacity for onsite storage is available. This would require up to 4 x 13.5 ML tanks at each well pad, or 8 x 7 ML tanks, or a mixture of different sized tanks to fulfill a conservative flowback demand. Tanks may be open or closed-topped, subject to supplier availability and the final vendor configuration, and any of the approved wastewater storage tanks may be fitted with covers where required to manage wet season operations. An example of above ground water storage tanks is provided in Figure 23.



Figure 23: Example of above ground water storage tanks

3.11.3. Flowback fluid management

Flowback fluid volumes will be recorded (either via inspections during active operations or via telemetry if no active operations are occurring) to ensure there is sufficient water storage to continue forecasted flowback operations. In absence of sufficient storage, wells will be choked back or shut-in to reduce flowback fluid rate to ALARP.

Flowback will be held in above-ground enclosed tanks at all times, other than in the following circumstances:

- It is being prepared for reuse or disposal (on-site or off-site).
- It is being evaporated via onsite evaporation tanks to manage volumes.

Priority will be given to the reuse of flowback fluid during HFS activities.

Onsite open top tanks will maintain at the commencement of the season, a minimum freeboard level capable of handling a 1:1,000 year AEP wet or dry season event. Off-site disposal of flowback fluid will be reduced through on-site disposal via evaporation tanks, except during times of heavy rainfall.

To maintain risk associated with flowback fluid management to ALARP, a minimum freeboard will be maintained for on-site wastewater storages in accordance with the WWMP (Appendix F). A minimum freeboard of 1.1 m will be applied to open-top tanks, pits and sumps during the wet season, and a minimum freeboard of 0.5 m will be applied to open-top tanks during the dry season. Wastewater tanks may also be fitted with covers during the wet season to limit rainwater ingress and preserve available storage capacity; where tanks are closed-topped, a minimum freeboard of 0.5 m will still be maintained in accordance with the WWMP. These freeboard levels are designed to manage the 90-day critical rainfall period associated with a 1:1000-year rainfall event, as assessed in Appendix B of the WWMP (Appendix F). During exceptionally heavy rainfall, these freeboard levels may be temporarily exceeded (i.e. the freeboard is being used as intended as a mitigation measure). Santos will reinstate the appropriate seasonal freeboard as soon as reasonably practicable following any rainfall event that exceeds this threshold in accordance with the WWMP (Appendix F).

Closed-topped tanks are not intended for the capture or storage of rainwater or stormwater and are designed to minimise rainwater ingress to a level that is ALARP. Any stormwater temporarily retained on the tank roof (e.g. in the roof creases or ridges) will not come into contact with wastewater contained within the tank, and will be managed as stormwater as per Section 3.12.4.

An onsite water management crew will be available to ensure continuity of service when active stimulation is occurring during drilling, stimulation and the proposed testing period. Monitoring will be reduced to telemetric and remote monitoring outside of these periods, or if the well has been suspended or plugged.

3.11.4. Wastewater reuse and recycling

The beneficial use of wastewater for dust suppression or construction use has been successfully and widely employed in other jurisdictions. While this application does not seek approval for such reuse, Santos will continue

to investigate opportunities to apply the principles of the waste management hierarchy in future operations, consistent with the Code. In doing so, Santos remains committed to supporting the objectives of the *National Waste Policy 2018* by seeking practical and responsible ways to manage wastewater streams in accordance with the waste management hierarchy, being:

1. Avoid – eliminate or substitute activities that generate wastewater.
2. Reduce – minimise wastewater generation as part of a process or activity.
3. Reuse – apply wastewater for the same or alternative petroleum activities without, or with minimal, treatment.
4. Recycle – beneficially reuse wastewater for another purpose without, or with minimal, treatment.
5. Treat – process wastewater to improve its quality for reuse or disposal.
6. Dispose – final option where no other beneficial management is feasible.

3.11.4.1. Flowback disposal

Flowback will be managed using two primary disposal methods – evaporation and recycling. Residual flowback liquids (after treatment and recycling / re-use) that are unsuitable for use, and evaporation brines will be transported to a licenced interstate disposal facility (e.g., Hydrea Tenant Creek, Pure Environmental Jackson, Queensland or alternative approved locations) with the appropriate interstate waste transport consignment authority as per the *National Environmental Protection Measure (NEPM)* as implemented under the *NT Waste Management and Pollution Control Act 1998*.

3.11.4.1.1 Evaporation

Evaporation rates have been estimated using conservative planning assumptions informed by previously observed evaporation rates for comparable wastewater storage arrangements in EP 161. On this basis, indicative evaporation rates of up to 0.35 ML per month for open tanks and 0.25 ML per month for enclosed tanks have been applied for storage and water balance planning. The lower evaporation rate for enclosed tanks reflects the reduced exposed surface area, with evaporation occurring via vents that allow hydrocarbons in the flowback fluid to be safely released rather than retained beneath the cover. Actual storage levels and available freeboard will be monitored throughout operations, and wastewater volumes will be managed in accordance with the WWMP to ensure the required freeboard is maintained regardless of the assumed evaporation rate.

3.11.4.1.2 Recycling

Flowback fluids will, where practicable, be reused as make-up water for stimulation activities. Flowback, raw groundwater and stimulation chemicals will be combined within an on-site storage tank prior to downhole injection. As flowback fluids are expected to be saline, blending with raw groundwater will be undertaken to reduce electrical conductivity to suitable levels before reuse. Monitoring of flowback fluids is described in Section 5.6.1 of Appendix F, with sampling and analysis results used to inform decisions regarding reuse, recycling or disposal.

3.11.5. Drilling fluid and cuttings

The following section provides an overview of the management of drilling returns, including waste drilling fluids, muds, cuttings and cement returns.

3.11.5.1 Sumps

All drilling returns, including fluids, cuttings, muds and cement returns, will be directed to the inground drilling sumps on each well pad. Separate sumps for fluids and cuttings will be constructed. The drilling sumps will be designed to accommodate the drilling of multiple wells.

The drilling sump(s) will include engineered pits (rolled and compacted), lined with an impermeable membrane in accordance with Section C.4.1.2 of the Code¹⁸ for inground pits. Coletanche™ waterproof geomembrane (or equivalent) may be utilised. In some circumstances, a conventional HDPE liner may be used. Where a HDPE (or alternative) liner is used, the liner specification shall meet or exceed the Code.

The sumps will be operated with sufficient freeboard available to accommodate the total rainfall anticipated for the dry and wet season, based on a 1:1,000-year AEP for the duration the sump is in operation as described with the WWMP (Appendix F).

3.11.5.2 Volume of drilling solids and liquids

Drilling solids will be separated from the drilling fluids via solids control equipment (e.g., shale shakers) on the drilling tanks/pits. The drilling solids/cuttings/fluid will be transferred to the drilling sumps for storage, where practical fluid recycling will occur after settling of solids in the drilling sumps. An indicative estimate of drilling solids and fluid volumes per well has been summarised in Table 25.

Table 25: Indicative volume of drilling solids and liquids

Material	Per Well (m ³)	Estimate for well pad (m ³)
Drilling Solids / Cuttings	600	2,400
Drilling Fluids	600	2,400

3.11.5.3 Drilling returns and sump management

Drilling returns including fluids, cuttings, muds, and cement returns will be directed to the inground drilling sumps on each well pad. Separate sumps for fluids and cuttings are planned to be constructed as depicted in the well pad layout figures in *Engineering Drawings* (Appendix P).

The drilling sumps have been designed to store up to 2,400m³ of material, which is the anticipated upper volume for up to 3 wells drilled in one campaign on one well pad. Each sump will be excavated to the required depth with indicative surface area dimensions presented in Appendix P. The sumps will be designed to accommodate the upper volume and the minimum freeboard of 1.1 m for each sump.

3.11.5.4 Sump treatment and volume reduction

Evaporation is the main mechanism used to reduce the volume down to as low as possible. The residual concentrated liquid waste will either be evaporated or blended into the burial material (as per the burial methodology identified in the WWMP (Appendix F)).

Drill cuttings and residue liquid will be evaporated as much as possible and disposed of to land, via the certified burial method within the WWMP (Appendix F). Recycling and re-use of all solids waste should be maximised, to minimise volume of waste that must be disposed of on-site.

3.11.5.5 Burial pits and on-site disposal

Purpose-built burial pits are proposed at the Jibera South and Newcastle South well pads and will be located within the final well pad disturbance footprint in locations selected based on operational requirements. Each burial pit will measure approximately 1,500 m² in area and extend to a depth of approximately 3 m below final grade.

The burial areas will be located outside the 1% AEP inundation extent. The assessment methodology for determining the suitability of drill cuttings for on-site disposal is provided in the WWMP (Appendix F).

¹⁸ The permeability of less than 10⁻⁹ m/s tested in accordance with AS 1289.6.7.2 and with resistance to tearing >0.5kN (ASTM D 4073); static puncture >0.5kN (ASTM D 4833) and tensile strength >20 kN/m (ASTM D 7275).

If the material is unsuitable for on-site disposal, the material will be transported off-site and disposed of at a licenced facility. Off-site disposal will be undertaken in accordance with the *NT Waste Management and Pollution Control Act 1998*.

3.11.5.6 Timing of disposal activities

Drilling material may either be disposed of during operations (i.e. between the drilling of each appraisal well to accommodate storage volume requirements) or upon completion of drilling / well testing operations (with the potential for on-site storage of material in accordance with Section C.4.1.2 of the Code).

3.11.6. Volume of domestic wastewater

The camp will generate effluent from day-to-day activities of the temporary accommodation for up to 105 workers and ancillary activities. It is assumed that each worker requires 200 litres per day, based on operational experience from previous camp set ups. Grey water and sewage treated on-site in an approved, portable treatment system accordance with Department of Health *Code of Practice for Wastewater Management (2020)*. Sewage treated will be surface irrigated to a dedicated, fenced area which will be determined once final layout is defined by the approved contractor. The sizing of irrigation areas will be determined in accordance with the requirements of the *Code of Practice for Wastewater Management (2020)* i.e. with consideration of equivalent persons.

Santos will utilise a suitably qualified third-party contractor to design, install and operate the irrigation system in accordance with the *Code of Practice for Wastewater Management (2020)*.

3.12. Ancillary infrastructure and activities

3.12.1. Water use

As discussed in Section 3.11.4, water recycling will be utilised where possible for stimulation activities. An additional WEL will be required under the *Water Act 1992* to meet the maximum water demand of these two well pads. It is anticipated that the scope of works in this EMP will require a WEL of up to 750 ML per year. Additionally, Santos will also investigate to acquire alternative water allocations from other petroleum users in line with those licence conditions in the event that unforeseen water requirements are experienced.

The indicative schedule presented in Table 26 outlines the anticipated combined annual water use associated with proposed Regulated Activities. Santos intends to submit an amendment application (or a new application, if required) to the current WEL to increase the existing allocation from 193.5 ML to 750 ML. The Project is expected to involve the drilling and HFS of up to 3 appraisal wells in any year, over the 5-year period. During years when drilling and HFS are not occurring, water use will be minimal, and will be limited to access track and well pad maintenance, and camp supply.

The scope of previous EMPs that require water use comprise site rehabilitation and monitoring activities. Accordingly, water use associated with maintaining previously approved activities will be restricted to dust suppression and/or minor civil works. This includes intervention activities with rehabilitation monitoring areas or water use associated with decommissioning works, should these be required.

Accordingly, total annual water use will not exceed the proposed licensed extraction volume of 750 ML (or 193.5 ML until approval of the amendment is granted). To fulfil the water demand requirements of hydraulic fracturing stimulation and subject to approval under the *Water Act 1992*, up to 10 water bores may be installed on, or near each well pad.

Table 26: Indicative water extraction and activity schedule

Water Year (May 1- Apr 30)	Planned Activity	Max. annual water use (ML)*
-------------------------------	------------------	------------------------------

2026 / 27	Camp, dust suppression, civils, and drilling and completions (D&C)	306
2027 / 28	Camp, dust suppression and HFS on 3 horizontal wells ¹⁹	412
2028 / 29	Camp, dust suppression, D&C and HFS on 3 horizontal wells	596
2029 / 30	Camp, dust suppression, D&C and HFS on 3 horizontal wells	571
2030 / 31	Camp, dust suppression, D&C and HFS on 3 horizontal wells	571

**Water use based off current annual period of May1-April 30 each year.*

Figure 24 presents an indicative schedule of well appraisal activities over the five-year campaign, and use required for the monitoring maintenance required as part of previous EMP scope of works. The accompanying water balance provides a graphical representation based on a conservative estimate of fluid recovery, assuming a 10% return of injected water for the Jibera South and Newcastle South wells. The detailed water balance is based on HFS of 60 stages, flowback fluid volumes (ML / month), recycling, and the proposed conservative management approach involving trucking and limited onsite reuse.

¹⁹ Only minor D&C is planned 2027 / 28 as most of the HFS activity is to occur in 2026 / 27.

Activity Summary	2026												2027												2028												2029												2030												2031																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Figure 24: Indicative water balance model for the Beetaloo Basin Appraisal Pilot campaign

3.12.2. Groundwater bores

It is anticipated that up to 10 new groundwater bores per well pad (inclusive of monitoring bores) will be required to meet the anticipated water demand and monitoring requirements. The water bores are proposed to be located on or directly adjacent to the well pad to minimise environmental disturbance. If this is not possible due to well pad infrastructure constraints, the water bores may be located adjacent to the well pad access road. A 2 ha area has been conservatively accounted for in the total disturbance area of the proposed Regulated Activities for the water bores. The water bores will be placed in compliance with the Code.

The target aquifer depth for water extraction for the proposed water bores is greater than 100 m below ground level (mbgl). The recorded groundwater levels across Santos' Project Areas range from approximately 60 to 120 mbgl (AECOM, 2025).

No impacts to potential GDEs are anticipated due to proposed water extraction from these water bores. This is because there is a significant vertical separation and geological barriers between the target aquifer for water extraction and the shallow perched groundwater system that is interpreted to support GDEs in the Project Area (refer to Section 4.3.10 for further discussion on GDEs).

Assessment of groundwater drawdown, the spatial extent of drawdown, and potential impacts on nearby groundwater users and groundwater-dependent values associated with extraction of up to 750 ML/year will be undertaken as part of the WEL. This assessment will be completed in accordance with Northern Territory regulatory requirements under the *NT Water Act (1992)* and the *Georgina Wiso Water Allocation Plan 2023–2031* (NTG, 2023), which applies to groundwater within the CLA in the Daly Roper Beetaloo Water Control District.

Ongoing monitoring of water extraction will comprise monthly flow meter readings from each water during operations or otherwise as required by the WEL.

3.12.3. Freshwater lines

If required, freshwater lines from water bores to water storage areas would be run above ground, along the surface. Freshwater lines would be used if more efficient than trucking for the site transportation of groundwater.

The length of freshwater lines and location cannot be determined until operational parameters are encountered. These freshwater lines will be located within the well pad or water bore footprint extents, and no additional clearing extents have been allowed. Leaks from any installed freshwater lines will be mitigated through regular maintenance and detected during installation and testing, surveillance and via the WEL water volume recording bore monitoring. Leaks will be repaired as soon as practical after detection.

3.12.4. Surface water reuse and onsite disposal

The Newcastle South and Jibera South well pads will be operated in a way that minimises the volume of stormwater captured, prevents contamination of stormwater and any overland runoff within the disturbed footprint will be managed in accordance with the *Site Erosion and Sediment Management Plan* (Appendix G). Given the various sumps, pits and other areas that may retain stormwater, this section discusses suitable water quality requirements prior to any reuse or discharge from the well pads.

Rainfall runoff is typically characterised by low salinity, slightly acidic, and may include elevated total suspended solids. Any stormwater that has not been contaminated may be discharged offsite provided it meets the stormwater release criteria specified in Table 27. This includes water such as clean rainfall runoff or perched water (e.g. on pit or tank covers) that has not come into contact with contaminants. Only rainfall that is contaminant free and has been collected in clean tanks, sumps and pits may be reused on site.

Records of total volume of water (including stormwater) and wastewater re-used or discharged during drilling/stimulation works or for other purposes will be tracked in accordance with Clause C.6.1(a)(v) of the Code. Further details are provided in Section 8.6.

Table 27: Stormwater release limits

Monitoring parameter	Release Limit
Electrical conductivity	1,300 µS/cm
pH	5.2 to 9 pH units
Visible hydrocarbons, sheens, foaming, or discolouration	No visible oil, grease, or other hydrocarbons No visible foams caused by surfactants and detergents No visible abnormal discolouration

3.12.5. Well pad material requirements

Approximate capping volumes and site cut fill of the well pad is provided below in Table 28.

Table 28: Estimated disturbance area and gravel volume requirements

Activity / Area	Area (m²)	Topsoil Volume (m³)	Gravel Volume (m³)
Jibera South			
Hardstand & Rig / HFS Footprint	29,700	2,970	4,500
Campsite	6,400	6,40	1,000
Laydown area	9,375	938	1,500
Water Tank Pads	62,736	6,274	9,500
New Access Tracks	29,000	2,900	1,700
Upgrading of Existing Access Tracks	66,000	NA	6,600
Total estimated material required from Jibera South Borrow Pits		24,800	
Newcastle South			
Hardstand & Rig / HFS Footprint	29,700	2,970	4,500
Campsite	6,400	6,40	1,000
Laydown area	9,375	938	1,500
Water Tank Pads	62,736	6,274	9,500
New Access Tracks	5,900	590	400
Upgrading of Existing Access Tracks	15,000	NA	1,500
Total estimated material required from Newcastle South Borrow Pits		18,400	

3.12.6. Borrow pits

The proposed infrastructure construction for the proposed Jibera South and Newcastle South pad will require approximately 43,200 cubic metres (m³) of clay/gravel select fill across both sites.

The select fill is proposed to be sourced from pits located near Jibera South, and an area located near Newcastle South, as displayed in Figure 5 and Figure 6.

Anticipated material volumes include:

- Approximately 24,800 m³ of fill from the 3 borrow pits located near Jibera South; and
- Newcastle South is anticipated to require a smaller volume of approximately 18,400 m³ of fill from a borrow pit located near Newcastle South.

If suitable fill is not available from the Newcastle South location, borrow pits at Jibera South may be used to supply material to Newcastle South for well pad construction.

4 borrow pits of 2 ha have been proposed as part of this EMP.

The project will seek to minimise the establishment of new borrow pits by:

- Excavating borrow pits deeper where practical to maximise material recovery; and
- New borrow pits will only be utilised if the approved borrow pit areas are exhausted or do not contain suitable fill material.

Borrow pits will be excavated progressively and managed to minimise erosion and sediment release. Excavation and design parameters include:

- Maximum excavation depth of approximately 4 m below natural surface level;
- Borrow pits will be up to 2 ha in size, typically in the order of 120 m wide and 165 m long; and
- Batter slopes will be constructed at approximately 6H:1V where practicable, with a maximum batter steepness of 3H:1V.

Final borrow pit dimensions and excavation profiles will be confirmed during detailed design and field set-out based on material suitability, geotechnical conditions and construction requirements.

Erosion and sediment controls will be implemented in accordance with the ESCP (refer to Appendix G).

In the event that all 4 proposed borrow pits cannot supply sufficient or suitable fill material for well pad construction and activities, the previously used borrow pit on Mount Brown (as previously approved under the McArthur Basin Civil and Seismic Program EMP) may also be used to supply fill.

An image of a typical borrow pit from other Santos Ltd operations in the Cooper Basin is provided in Figure 25.



Figure 25: Example of a typical operational borrow pit located within the Cooper Basin

3.12.7. Airstrip

The landowner airstrip adjacent the Tanumbirini Homestead may be used for crew changes and emergency response evacuations. The 1,400 m length airstrip is a dry weather strip and contains no lighting and is regularly used to deliver landowner mail and other irregular private aircraft. The location of the airstrip is shown on Figure 5.

The airstrip surface is unsealed and requires annual maintenance to control termite mound growth, repair erosion and remove vegetation which has emerged following the wet season. Santos will assume responsibility for this maintenance when it is in active use to support the Project (in accordance with the land access agreement).

Proposed works at the airstrip include maintenance grading and rolling of the entire runway, parking areas and signal areas to restore the surface and repair any minor erosion following the wet season. In addition, regular maintenance watering may be required on the airstrip access and runway to maintain the surface and control dust. All proposed maintenance works will be limited to the cleared airstrip footprint and no new clearing will be required.

3.12.8. Office, workshop and laydowns

Supporting infrastructure for the appraisal well activities will include a designated office, workshop, and laydown areas within each well pad.

- The office area will provide space for site management and operational coordination, typically housed in temporary transportable buildings.
- The workshop area will be used for the storage, maintenance, and minor repair of tools and equipment required for well operations, ensuring that all activities are undertaken safely and efficiently.
- The laydown area will accommodate the temporary storage of materials, consumables, and equipment awaiting use, allowing for safe and orderly site logistics.

All areas will be located on level, compacted ground with appropriate drainage and containment measures to prevent environmental impacts.

3.12.9. Bulk chemical storage

Bulk chemicals and hydrocarbons required for appraisal well operations will be stored in designated, clearly marked areas within the well lease. Storage arrangements will be designed to prevent spills, runoff, cross-contamination, and uncontrolled releases. materials will be managed in accordance with relevant Australian Standards and regulatory requirements.

Hazardous chemical storage and handling areas will incorporate secondary containment (e.g. bunding or compliant storage containers), spill kits, and appropriate signage to support safe handling and storage. A full suite of assessed chemicals is detailed in Appendix D.

3.12.10. Accommodation camps

Temporary camps (where Santos is likely to utilise a suitably qualified third-party contractor) will be established at both the Jibera South and Newcastle South well pads, each designed to accommodate up to 105 workers. Both camps may operate simultaneously, depending on project needs and scheduling. The size of each camp will be scaled according to the activities underway. If either camp cannot house the required number of personnel, overflow accommodation may be provided at the existing, approved camp at the Mount Brown well pad.

The camps will include:

- Accommodation
- Workshop to allow for vehicle maintenance
- Ablutions and sewage treatment plant
- Kitchen and mess
- Freezer unit
- Site office
- Generator and diesel storage
- Potable water tank.

All camps will have their own sewage treatment plant. Treated water will be dispersed via drainage or sprinkler systems away from the camp to a designated irrigation area in accordance with Department of Health requirements under the *Code of Practice for Wastewater Management* (2020).

Designated irrigation areas will not require vegetation clearing, and they will be fenced to exclude livestock access. The sizing of irrigation areas will be determined in accordance with the requirements of the *Code of Practice for Wastewater Management* (2020) i.e. with consideration of equivalent persons. Santos will utilise a suitably qualified third-party contractor to design, install and operate the irrigation system in accordance with the *Code of Practice for Wastewater Management* (2020).

A smaller temporary camp may be required during the flowback management period and other ancillary activities. This camp will be located within the same well pad footprint as the original camp or another area already disturbed.

3.12.11. Traffic management

Mobilisation to the project area is primarily via the Stuart Highway and Carpentaria Highway. These Highways have a 110 – 130 km per hour posted speed limit. The Stuart Highway is a 2-way road with a sealed wide of 7m and unsealed or grassed shoulders. The Carpentaria Highway at the time of writing this EMP is undergoing an upgrade, which includes widening and lifting to improve flood immunity in and around the Project Area.

The anticipated traffic volumes for the project are:

- Approximately 45 traffic movements (15 heavy vehicles and 30 light vehicles) expected per day during peak activities at each site (both heavy and light vehicle traffic).
- Majority of traffic movements expected to be local, i.e. between camp and well site.

Due to the anticipated vehicle types and traffic numbers, the intersection at the Newcastle South access track/Carpentaria Highway is anticipated to require upgrading. The Department of Logistics and Infrastructure (DLI) is currently undertaking works on the Carpentaria Highway and it is anticipated this will be incorporated as part of those works, as this access track is used by various users. In the event that this intersection is not upgraded, Santos will secure a 'Permit to Work Within NT Government Road Reserves' through the DLI to undertake these upgrades.

This upgrade is anticipated to be consistent with Santos' previously approved Traffic Management Plan and upgrade of the Tanumbirini Homestead entrance (previous improvements undertaken by Santos for other approved activities within EP 161) and intersection with the Carpentaria Highway. Santos will engage with DLI and secure all required approvals including those under the *NT's Planning Scheme 2020* as required.

3.12.12. Noise management

Noise impacts from the Project have been assessed for the nearest sensitive receivers in accordance with the *NT Noise Management Framework Guideline* (2018). Activities assessed included site preparation, drilling operations, HFS, well testing and flaring, production operations and maintenance, and decommissioning. The nearest sensitive receiver to the project is Tanumbirini Station, located 3.7 km east of Jibera South. Two receivers were modelled to represent the most affected locations within Tanumbirini Station:

- Receiver R01, located approximately 3,880 m east of the subject facility.
- Receiver R02, located approximately 3,740 m east-southeast of the subject facility.

Figure 26 below shows the general location of the homestead and the proximity to Jibera South. Newcastle South is substantially further from any identified sensitive receiver (approximately 12.5 km) and is therefore not expected to result in material off-site noise impacts.



Figure 26: Nearest sensitive receivers to Jibera South

The applicable noise criteria for a rural residential receiver are summarised in Table 29. The minimum assumed rural rating background noise levels prescribed by the *NT Noise Management Framework Guideline* were adopted as the conservative basis for assessment. In accordance with the *NT Noise Management Framework Guideline*, both the project intrusiveness noise level and the amenity noise level were considered in the assessment. For the rural residential receivers assessed for this project, the intrusiveness criterion is more stringent than the amenity criterion for the day, evening and night periods. Accordingly, the controlling project-specific assigned noise levels are 40 dB(A) during the day and 35 dB(A) during the evening and night.

Table 29: Minimum assumed RBLs and project intrusiveness noise levels - rural area

Time of Day	Minimum assumed rating background noise level (dB[A])	Minimum project intrusiveness noise levels (LAeq, 15min dB[A])	Recommended maximum assigned amenity noise level (dB[A])
Day	35	40	50
Evening	30	35	45
Night	30	35	40

An assessment was undertaken to model noise impacts resulting from site preparation, drilling operations, HFS, well testing and flaring, production operations and maintenance, and decommissioning. Sound propagation calculations were undertaken using CadnaA Version 2024 and the Concawe method. Conservative noise-enhancing environmental and meteorological conditions were adopted to represent worst-case scenarios for sound propagation, including:

- Downwind (source to receiver) wind conditions up to 2 m/s.
- Stable night-time temperature inversion conditions that can increase sound propagation.
- Relative humidity input to the model was approximately 75%.
- Temperature of 10°C.
- Conservative ground absorption assumptions (0.0 for roads/water bodies and 0.6 elsewhere).

- Vegetation was conservatively assumed to provide minimal attenuation (i.e. the propagation modelling assumed clearing and limited shielding from vegetation along the source-receiver path).

Two existing homestead generators are present at Tanumbirini Station and contribute to the local acoustic environment. The homestead generators have been considered as part of the existing noise environment at the nearest sensitive receivers, with one unit assumed to run continuously as the primary source of electricity for the homestead and the second unit acting as standby.

Source noise levels were derived from measurements, theoretical calculations, manufacturer information and previous studies on similar equipment. Major equipment within each assessed scenario was assumed to operate concurrently on a conservative worst-case basis. Noise emissions for the homestead gensets were based on best available information, including the known generator size and configuration, the location of the generators within an enclosed shed near the residence area, photos of the unit, and reference data for comparable 100 kVA generators.

The assessed operational scenarios and key modelling inputs adopted for each are summarised in Table 30.

Table 30: Major equipment and operating assumptions used in the HFS acoustic assessment

Scenario	Major equipment	Assumptions / notes used for modelling
Site preparation	• 2 × dozers. • 1 × excavator. • 2 × dump trucks. • 1 × roller. • 1 × water truck.	• Site preparation activities assumed to include clearing, grading, cut and fill, compaction, and internal haulage. • Equipment source levels derived from typical plant construction equipment data.
Drilling operations	• Typical large drilling rig (similar to Ensign #34), including carrier, mud pumps, generators, compressors and crane.	• Continuous 24-hour operation. • Combined noise emission level adopted to represent worst-case normal drilling operations, with engines operating at maximum output. • Rig configuration and mitigation measures can materially influence noise emissions; therefore, this dataset represents a conservative high-output scenario.
HFS	• 30 × 2000 hhp pumps. • 1 × 600 hhp unit. • 3 × blenders. • Ancillary generator, loaders and cranes operating concurrently.	• 24-hour operations. • Assuming 3–4 fracs/day average, approx. 20 days for ~70 fracs on the pad. • Equipment source levels derived from best available information for comparable fracturing equipment, including measured data from analogous hydraulic fracturing operations and reference data for similar units.
Well testing and flaring	• 1 x horizontal flare pit operating at a P50 flow rate of 24 MMscf/d. • 2 x diesel-driven generators. • 1 x compressor. • 4 x light towers.	• Flare pit surrounded by a 3 m earthen berm. • Equipment source levels derived from manufacturer specifications and field measurements from similar equipment operating under maximum load.
Production operations and maintenance	• Representative production equipment including compression units, electric motors, air coolers/fans, water transfer pumps, auxiliary power generation units, and well-level prime movers.	• Model assumes one generator set, one screw compressor, and 12 wells, with each well equipped with a 22 kW motor, consistent with typical operating conditions,

Decommissioning	Workover/service rig and supporting equipment, including pumps, generators, lighting plants and service vehicles.	Assumed to be consistent with typical plug and abandonment operations.
Existing homestead generator	2 x 100 kVA gensets (one running, one standby) located in an enclosed shed	Assumed typical noise emissions based on best available information (including photos/reference data for comparable 100 kVA gensets).

The predicted facility sound pressure levels and predicted cumulative sound pressure levels for the assessed scenarios at the sensitive receivers are summarised in Table 31. The predicted noise levels are assessed against the minimum project intrusiveness night-time noise level of 35 dB(A), which is the most stringent applicable threshold; accordingly, where compliance with the night-time threshold is achieved, compliance with the daytime threshold is also achieved.

Table 31: Predicted noise levels at the nearest sensitive receivers

Receiver	Minimum Project Intrusiveness Noise Level (L _{Aeq,15min} dB[A]) ²⁰	Minimum Assumed Rating Background Noise Level (RBL) (dB[A])	Facility SPL (dB[A])	Compliance with Minimum Project Intrusiveness Noise Level?
HFS				
Receiver R01	35	30	32.1	Yes
Receiver R02	35	30	33.4	Yes
Site Preparation				
Receiver R01	35	30	20.3	Yes
Receiver R02	35	30	21.4	Yes
Drilling operations				
Receiver R01	35	30	14.9	Yes
Receiver R02	35	30	16.0	Yes
Well Testing & Flaring Operations				
Receiver R01	35	30	31.9	Yes
Receiver R02	35	30	33.1	Yes
Production operations and maintenance				
Receiver R01	35	30	10.3	Yes

²⁰ Based on the minimum assumed night-time project intrusiveness noise level for a rural area in accordance with the NT Noise Management Framework Guideline (2018).

Receiver R02	35	30	11.6	Yes
Decommissioning				
Receiver R01	35	30	14.9	Yes
Receiver R02	35	30	16.0	Yes

As shown in Table 31, all assessed well pad activities are predicted to comply with the project-specific assigned evening/night-time noise level of 35 dB(A) at both receivers. The highest noise generating activity was HFS, which resulted in predicted facility sound pressure levels of 32.1 dB(A) at R01 and 33.4 dB(A) at R02, which comply with the minimum project intrusiveness night-time noise level of 35 dB(A). Well testing and flaring is predicted to represent the next highest-noise phase, with sound pressure levels of 31.9 dB(A) at R01 and 33.1 dB(A) at R02. Site preparation, drilling operations, production operations and maintenance, and decommissioning are all predicted to result in lower sound pressure levels at the sensitive receivers.

The assessment also indicates that the homestead generator remains the dominant contributor to the residential acoustic environment at Tanumbirini Station when operating. In comparison, the proposed well pad activities in each phase contribute only insignificant or minor cumulative impacts at the nearby receivers.

Based on the assessment, all Project activities are predicted to comply with the applicable *NT Noise Management Framework Guideline* criteria at the nearest sensitive receivers under conservative worst-case operating assumptions. On this basis, the proposed controls are considered adequate to manage potential noise impacts to ALARP and acceptable levels. Any substantiated noise complaints will be investigated and further mitigation will be implemented if required.

3.13. Other operational characteristics and requirements

3.13.1. Civil engineering activity

An overview of remaining civil engineering activity to be covered by the Beetaloo Appraisal Pilot EMP includes:

- Civil work will be required for ongoing maintenance of roads, campsite, laydowns areas and wellsite. This consists of grading, watering (coursed from bores) and minor patching.
- Borrow pits as approved under the McArthur Basin Civil and Seismic Program EMP will continue to be utilised for civil works as required.
- Existing water bores constructed will continue to be used and water stored as required. This could be in tanks or in a constructed dam for storage and use.
- The reprofiling of constructed access tracks and lease pads to service Mount Brown and Inacumba will continue, until rehabilitation occurs.

3.13.2. Chemical use

A detailed *Chemical Risk Assessment* for all proposed chemicals in the drilling and hydraulic fracturing stimulation activities is provided in Appendix D. A tier assessment was conducted using a screening of the potential health and ecological hazards that should be considered for potential exposure to the drilling and hydraulic fluids during transportation, undertaking the activities (including storage), and subsequent treatment and disposal of fluids and flowback. The tier assessment includes the following steps:

- Tier 1 – Identify chemicals of low human health and ecological concern that do not require additional chemical risk assessment in the tier assessment process nor additional management controls beyond standard proposed and regulatory imposed controls.
- Tier 2 – Chemical additives that are not identified as a low human health and ecological concern and therefore require additional risk assessment to characterise potential risks (and potentially the need for

additional management controls). This is done using a quantitative evaluation of the risks based on the potential complete exposure pathways and the Tier 1 assessment.

This assessment evaluated potential hazards associated with drilling fluid, cementing and hydraulic fracturing chemicals and the potential for exposures to human and environmental receptors and for potentially hazardous chemicals, where exposure pathways are complete, quantified potential risks. A tiered assessment was conducted on the compiled hydraulic fracturing fluid systems using screening of the potential human health and ecological hazards that should be considered for potential exposure to the hydraulic fracturing fluids during transportation, hydraulic fracturing activities (including storage), and subsequent treatment and disposal of flowback.

The outcome of the Tier 1 assessment identified the chemicals of low human health and environmental concern. The outcome of the Tier 2 assessment did not identify unacceptable exposures for workers or to avian species.

A tiered assessment was also conducted on the drilling fluid chemicals using a screening of potential human health and ecological hazards that should be considered for potential exposure to the drilling fluids and cuttings during transportation, drilling operations, and recycling and disposal of drilling mud and cuttings.

Based on the outcomes of these assessments, no further management controls are considered necessary.

A full list of the chemicals proposed for drilling and stimulation activities on EP 161 can be found in the *Chemical Risk Assessment* (Appendix D).

3.13.3. Rehabilitation

For both new and existing wells, the following activities will be undertaken following well suspension or when the well is no longer required:

- Removal of fencing.
- Back filling of pits and sumps.
- Water bore holdings to be drained of liquids.
- Lightly scarifying or rolling all disturbed areas to break up consolidated surfaces.
- Spreading of stockpiled topsoil material and trees, shrubs and grasses across the lease pad and areas not needed for future monitoring and maintenance.
- Ripping and spreading of stockpiled vegetation at the water bore site to promote revegetation.
- Removal of fencing and water bore pumps from water bores. Any reusable materials and pumps to be delivered to the landholder, otherwise decommissioned in accordance with the licence.
- Repair or reinstate any landholder infrastructure damaged due to civil activities.
- The Interest Holder will inspect and maintain areas being progressively rehabilitated in line with the *Rehabilitation Management Plan* (Appendix K).

Following completion of the final inspection to determine compliant rehabilitation, Santos will submit the final Environmental Reports to DLPE along with the application to release the long-term Rehabilitation Security. In accordance with the *Rehabilitation Plan Guide for Surface Disturbance: Onshore Petroleum Exploration 2020* the final rehabilitation assessment and endorsement will be conducted by an appropriately qualified third party.

Rehabilitation and decommissioning by Santos may not occur where agreement with the Pastoral Lease Holder or another third party, and approval by government is obtained, to transfer ownership of an asset to the Pastoral Lease Holder or another third party.

Requirements arising from previous EMPs (STO1-4, STO2-7, and STO7-4) will be incorporated into the Beetaloo Appraisal Pilot EMP for civil and seismic rehabilitation, consistent with the relevant Plan on a Page(s) presented in Appendix K.

3.14. Previously approved Regulated Activities incorporated into the Beetaloo Appraisal Pilot EMP

As described within the executive summary and throughout Section 3, it is proposed that Regulated Activities currently underway on EP 161 be incorporated into this EMP. The description of the Regulated Activities from previously approved EMPs are provided below in Table 32. This table relates to ongoing works associated with the previously approved Regulated Activities.

Table 32: Summary of previously approved Regulated Activities incorporated into this EMP

Scope definition	EMP reference	Activity description
Well integrity monitoring.	McArthur Basin Drilling Program (STO2-7)	Section 8.6.1 and 8.6.2
Evaluation of Inacumba-1/1H, Mount Brown-2H, Inacumba-2H and Mount Brown-3H (including mudlogging, wireline/LWD, DFIT, and coring).		To be addressed as outlined in Section 3.8.2
Suspension and/or plugging and decommissioning of Mount Brown-2H, Mount Brown-3H, Inacumba-1/1H, and Inacumba-2H		To be addressed as outlined in Section 3.8.4
Rehabilitation of the Mount Brown-1, Mount Brown-2H, Mount Brown-3H, Inacumba-1/1H, and Inacumba-2H	McArthur Basin Civil and Seismic Program (STO1-4)	Section 3.13
Civil engineering activity - maintenance of roads and access tracks, areas, campsites, and tank pads.		
Rehabilitation of a 10 km 2D seismic line.		
The reprofiling of access tracks and lease pads. Use of existing borrow pits.		
Rehabilitation of 240km of seismic lines and 10km of connection lines).	EP 161 2D Seismic and Ground Gravity Survey Program (STO7-4)	

Table 33 provides a consolidated summary of existing infrastructure, including the location, type of infrastructure, individual disturbance areas, as well as bore numbers or references where applicable. This table captures infrastructure that will be reused, maintained and monitored, or rehabilitated under this EMP.

Table 33: Consolidated EP 161 existing infrastructure

Infrastructure name	Disturbance total (ha)	Center location (GDA 2020 latitude / longitude, decimal degrees)
Borrow Pit	1.67	16.517838 / 134.827342
Borrow Pit	3.56	16.432342 / 134.659601
Borrow Pit	0.83	16.398359 / 134.706518
Inacumba south bore pad	0.58	16.562248 / 134.770576
Inacumba well pad (laydown, camp, access track)	11.68	16.515606 / 134.841869
Mt Brown well pad	12.3	16.399965 / 134.704587
Jibera Waterbore pad and access track	0.56	16.448842 / 134.616063

10 km 2D seismic line.	5.02	16.400758 / 134.704946
Infrastructure name	Reference	Location (GDA 2020 latitude / longitude, decimal degrees)
Inacumba south 1 control bore (GRF)	RN040932	16.562428 / 134.771166
Inacumba 1 supply bore (GRF)	RN040939	16.517107 / 134.842340
Inacumba 1 control bore (GRF)	RN040931	16.517181 / 134.842535
Inacumba 1 control bore (BS)	RN041242	16.516994 / 134.842964
Inacumba 1 impact bore (BS)	RN041243	16.516147 / 134.842133
Inacumba 1 impact bore (GRF)	RN040935	16.516077 / 134.842184
Tanumbirini 2 control bore	RN040930	16.400037 / 124.703546
Tanumbirini 2 impact bore (GRF)	RN040936	16.399528 / 134.703407
Tanumbirini 3 Control Bore (GRF)	RN040937	16.448773 / 134.616257
Tanumbirini 3 Control Bore (ALB)	RN040938	16.448809 / 134.616343
Santos bore	RN038580	16.399672 / 134.704839

A summary of the ongoing, previously approved Regulated Activities is provided below. The locations and disturbance footprints associated with all ongoing EP 161 activities are shown in Figure 27.

The combined previous EMP total project areas and disturbance footprints are as per Table 34. This represents disturbance of 0.0125% the total area of EP 161. When combined with the proposed additional disturbance of 46.9 ha of native vegetation, the cumulative footprint is not considered to have a significant impact.

Table 34: Previous project disturbance areas and project areas to be incorporated into this EMP

Activity description	Disturbance area (ha)	Project Area (ha)
McArthur Basin Civil and Seismic Program	36.2	99.4
EP 161 2D Seismic and Ground Gravity Survey Program	121.9	125 ²¹
McArthur Basin 2019 Drilling Program	Contained within existing disturbance	
Total	153.05	224.4

²¹ The 2D Seismic and Ground Gravity Survey Program has been complete and is in the rehabilitation phase of the project.

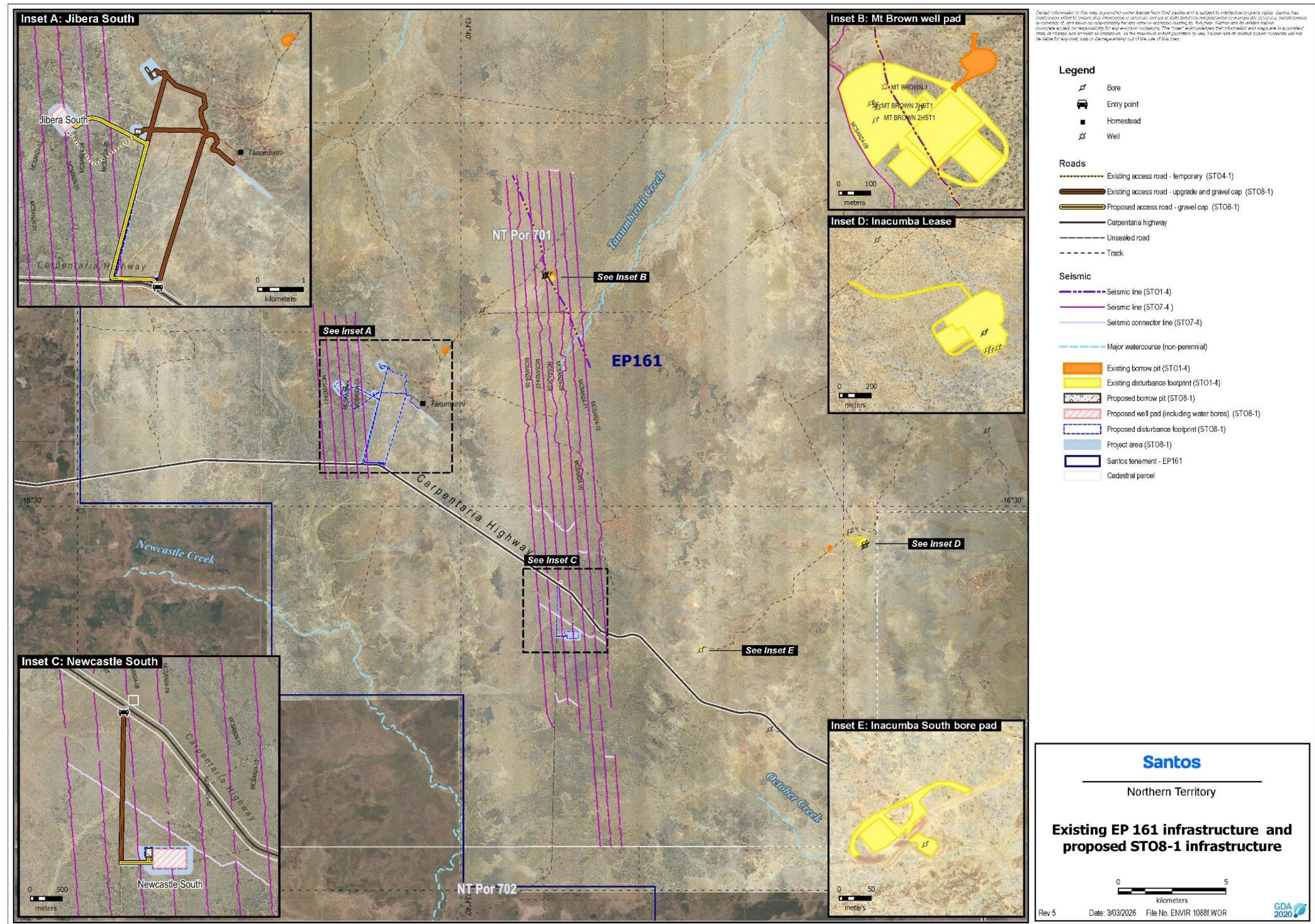


Figure 27: Proposed and previously approved Regulated Activities to be incorporated into this EMP

3.15. Greenhouse gas emissions

3.15.1. National policy context

The Australian Government has adopted a national target of net-zero greenhouse gas emissions by 2050, supported by a suite of regulatory measures to drive emissions reductions across major industrial sectors. Central to this framework is the Safeguard Mechanism, which places a baseline emissions number on covered Scope 1 emissions from Australian facilities emitting greater than 100,000 t CO₂-e in a financial year. Baselines are designed to decline over time in line with Australia's emissions reduction trajectory. The mechanism operates under the *National Greenhouse and Energy Reporting Act 2007* and is administered by the Clean Energy Regulator, with policy oversight jointly overseen by the DCCEEW.

Amendments introduced in 2023 require that new shale gas extraction facilities covered by the Safeguard Mechanism (i.e. Scope 1 covered emissions greater than 100 kilotonnes (kt) CO₂-e), including those within the Beetaloo Basin, are assigned a baseline emissions number of zero requiring all covered Scope 1 emissions to be offset to a net-zero position. This approach is consistent with Australian Government commitments made in collaboration with the Northern Territory to implement Recommendation 9.8 of the *Scientific Inquiry into Hydraulic Fracturing in the Northern Territory*. (Department of Climate Change, Energy, the Environment and Water [DCCEEW], Safeguard Mechanism Overview, 2025).

For the purposes of the Safeguard Mechanism, a facility is a shale gas extraction facility if:

- The activity, or the series of activities, that constitutes the facility is or includes the extraction of gas from a geological formation by means of processes, that include hydraulic fracturing; and
- More than 90% of the gas extracted from the geological formation is shale gas; and
- Emissions from the extraction and use of gas from the geological formation (i.e. lifecycle emissions) would likely exceed 100 million tonnes of carbon dioxide equivalence in total if the formation were fully exploited.

A facility is also a shale gas extraction facility if:

- The activity or series of activities that constitutes the facility is the exploration of a geological formation that contains shale gas; and
- Processes that include hydraulic fracturing would be needed to extract gas from the formation; and
- Emissions from the extraction and use of gas (includes scope 1, 2 & 3 emissions) from the geological formation would likely exceed 100 million tonnes of carbon dioxide equivalence in total if the formation were fully exploited.

3.15.2. Overview of emission sources

GHG emissions associated with the proposed Regulated Activities primarily relate to construction, drilling, stimulation, and well testing. Majority of total emissions are associated with diesel combustion and flaring activities due to undertaking an Initial Production (IP) flow test for 30 days.

Flaring of produced hydrocarbons is a necessary component of exploration and appraisal operations, as it enables the evaluation of reservoir performance and the commercial viability of the resource. As part of proposed Regulated Activities, an IP flow test of up to 30 days per well is proposed, limited to 3 horizontal wells only. Well testing will be required to obtain appraisal data to underpin future financial decisions regarding the sale of appraisal gas. Beneficial use is not included in the scope of this EMP and is subject to further regulatory approvals.

Emissions estimates have been prepared using a conservative success-case scenario, which assumes that all wells are successful, hydrocarbons are produced at commercially observable rates, and all planned activities are completed at each well. Under this conservative scenario, GHG emissions are expected to peak during periods of intensive well testing. If beneficial use of appraisal gas (e.g. gas-to-market or power generation) is available at the commencement of operations, GHG flare emissions associated with the proposed Regulated Activities are expected to be lower than the estimates provided in Table 35 and Table 36.

3.15.3. Emissions framework and scopes

The applicable emissions reporting framework for the Beetaloo Appraisal Pilot EMP is Australia's NGER scheme. Under Australia's NGER reporting framework, greenhouse gas emissions are categorised using Scope 1, Scope 2 and Scope 3, consistent with international greenhouse gas accounting frameworks. Greenhouse gas emissions are defined as follows:

- Scope 1 GHG emissions are direct GHG emissions that occur from sources that are owned or controlled by the reporting company.
- Scope 2 GHG emissions are indirect GHG emissions from the generation of purchased or acquired electricity, steam, heating or cooling consumed by the reporting company, from sources that are not owned or controlled by the reporting company.

Scope 3 GHG emissions are indirect GHG emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions, from sources that are not owned or controlled by the reporting company. Scope 3 emissions are not required to be reported under NGER. The anticipated Scope 1 GHG emissions associated with the proposed Regulated Activities encompass all direct emissions expected to occur during the five-year appraisal campaign. These include emissions arising from well stimulation, well testing, and associated operational activities.

Scope 1 emissions sources for the Beetaloo Appraisal Pilot include:

- Fugitive emissions (losses of containment, management of produced water and disposal of drill cuttings),
- Vegetation clearing,
- Flaring and venting (well clean up, safety or other initial testing requirements), and
- Diesel fuel use.

There are no Scope 2 emissions anticipated as part of these Regulated Activities. Scope 3 emissions (being emissions from upstream suppliers and downstream users) are not included in this EMP as they are not required to be reported under the NGER framework and occur outside Santos' (and Santos Ltd's, being the controlling corporation and reporting entity under the NGER Act) operational control.

3.15.4. Methodology for calculating emissions estimates

GHG emission estimates were calculated using fuel consumption and operational activities data, including the type and quantity of fuel used by drilling rigs during operations. Emissions have predominantly been estimated using the project activity data multiplied by relevant Method 1 emissions factors prescribed by the *NGER (Measurement) Determination 2008* (Cth). The American Petroleum Institute (API) 'Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry (August 2009)' has also been used to estimate emissions from well completions.

3.15.5. Emissions estimates

Estimated GHG emissions for Santos EP 161 activities are summarised below. A breakdown of annual Scope 1 emissions by financial year is provided in Table 35, followed by a summary of total Scope 1 emissions over the 5-year appraisal campaign by emission source in Table 36. Overall emissions totals reflect the short-term duration of the project and associated activities. In the event emissions exceed relevant thresholds, Santos will meet its obligations under the Safeguard Mechanism to offset the Scope 1 emissions to a net-zero position as required.

Table 35: Predicted greenhouse gas emissions breakdown per financial year

Financial year	Estimated gross Scope 1 emissions (t CO ₂ -e)
2025 / 26	9,830
2026 / 27	49,612
2027 / 28	96,324
2028 / 29	43,281

2029 / 30	43,281
2030 / 31	34,567
Total	276,896

Table 36: Greenhouse gas emissions sources over the total 5-6 year campaign

Emission source	Project activity	Estimated emissions (t CO ₂ -e)	Emissions estimate methodology and assumption
Scope 1 emissions			
Vegetation clearing	46.9 ha	4,653	Estimated emissions are based off the NT Department of Lands, Planning and Environment NR Maps online 'Carbon Emissions Calculator'. The emissions estimate assumes 46.9 ha of vegetation clearing. Access via https://nrmaps.nt.gov.au/carbon/carbon.html .
Diesel combustion – civil construction	457 kL	992	Diesel estimates multiplied by emission factor from <i>NGER (Measurement) Determination 2008</i>: Division 2.4.2 Method 1 emissions of carbon dioxide, methane and nitrous oxide from liquid fuels other than petroleum-based oils or greases, section 2.41 Method 1—emissions of carbon dioxide, methane and nitrous oxide and Schedule 1, Part 3—Fuel combustion—liquid fuels and certain petroleum-based products for stationary energy purposes, Item 40: • Energy Content Factor (GJ/kL) 38.6 • CO₂ Factor 69.9 kg CO₂-e/ GJ of diesel • CH₄ Factor 0.1 kg CO₂-e/ GJ of diesel • N₂O Factor 0.2 kg CO₂-e/ GJ of diesel
Diesel combustion – drilling	15,598 kL	32,191	
Diesel combustion – well stimulation	41,001 kL	103,882	
Diesel combustion – completion	507 kL	366	
Diesel combustion – camp	301 kL	725	
Fugitives - Flowback / Produced water	2,040 ML	17,994	The emissions for produced water are estimated in accordance with the <i>NGER (Measurement) Determination 2008</i>, Division 3.3.6D, section 3.73NA Method 1—produced water (other than emissions that are vented or flared) where cuttings volumes are converted to litres. Emissions are calculated as megalitres x methane emission factor (EF) x adjusted share of methane as detailed below: • EF CH₄: 7.99 t CO₂-e / ML produced water • Measured share methane (0.9185) / default share carbon dioxide (0.832)
Fugitives - Drill cuttings	800 m ³ per well	85	
Fugitives - Ongoing Well Operation / Suspension	30 kt	447	The fugitive emissions for onshore natural gas production are estimated in accordance with the <i>NGER (Measurement) Determination 2008</i>, Subdivision 3.3.6.A.1—Onshore natural gas production, other than emissions that are vented or flared—wellheads, section 3.73A Method 1—onshore natural gas production, other than emissions that are vented or flared— wellheads. Emissions are calculated as the tonnes gas produced x emissions factors (EF) x adjusted share methane and carbon dioxide, as detailed below: • EF CO₂: 0.0000026 t CO₂-e / tonnes gas throughput • EF CH₄: 0.00132 t CO₂-e / tonnes gas throughput • Measured share methane (0.9185) / default share methane (0.98)

Emission source	Project activity	Estimated emissions (t CO ₂ -e)	Emissions estimate methodology and assumption
			Measured share carbon dioxide (0.0842) / default share carbon dioxide (0.02).
Non-routine flaring / Venting	2 completion days per well	17,405	The emissions associated with venting from well completions are estimated using the American Petroleum Institute (API) Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry (2009), Table 5-23 Production Segment CH₄ Emission Factors for Maintenance and Turnaround Activities. Emissions are calculated as total completion days x methane emissions factor x methane global warming potential (GWP), as detailed below: 25.9 tonnes of methane per completion day (API Table 5-23) - GWP methane: 28 (regulation 2.02, NGER Regulations 2008) Estimates based off a conservative approach of venting emissions. Flaring will be preferred over venting, therefore the total emissions for 12 wells could include both activities.
Well testing – flared natural gas emissions	1,342 MMscf	98,155	The emissions for well flaring are estimated in accordance with the <i>NGER (Measurement) Determination 2008</i>, Subdivision 3.3.2.2—Oil or gas exploration and development (emissions that are flared), section 3.44 Method 1—oil or gas exploration and development. Emissions are calculated as tonnes gas flared x emissions factors (EF), as detailed below based on estimated production rates (forecasted P50 success) for 3 test wells: - EF CO₂: 2.69 t CO₂-e / tonnes gas flared - EF CH₄: 0.56 t CO₂-e / tonnes gas flared - EF N₂O: 0.021 t CO₂-e / tonnes gas flared
Total over 5 years		276,896	

3.15.6. Emissions governance and compliance

The Safeguard Mechanism under the NGER Act requires Australian facilities with covered emissions exceeding 100,000 t CO₂-e per year to keep their emissions at or below the applicable baseline emissions number.

Under section 10(2) of the *NGER (Safeguard Mechanism) Rule 2015*, where a facility is classified as a shale gas extraction facility, the baseline emissions number is zero.

Should covered emissions exceed the applicable Safeguard baseline in any financial year, Santos will comply with Safeguard Mechanism requirements, including the surrender of Australian Carbon Credit Units (ACCUs) and/or Safeguard Mechanism Credit Units (SMCs), as required under the NGER framework.

Scope 1 and 2 emissions are reported annually to the Clean Energy Regulator by 31 October in accordance with NGER compliance reporting requirements.

3.15.7. Operational controls

If beneficial use of appraisal gas (e.g. gas-to-market or power generation) is not available at the commencement of operations, GHG emissions will be managed through strict operational limits, and application of the emissions mitigation hierarchy. The proposed Regulated Activities will implement the requirements of the Code and implement a *Methane Emissions Management Plan* (Appendix H), in addition to the following controls to limit emissions:

- Flaring duration limits: production testing via flaring will be restricted to a maximum of 30 days per well.
- Well limits: testing will be limited to 3 appraisal wells only.

- Purpose limitation: flaring will be undertaken solely for appraisal testing purposes to assess reservoir deliverability and commercial potential. A 30-day test period is considered industry standard for obtaining reliable appraisal data.

These limits ensure that emissions from flaring are minimised while still enabling the technical objectives of the appraisal program to be met.

3.15.8. Emissions monitoring and forecasting

GHG emissions will be monitored and recorded as part of annual NT reporting requirements, including under the NGER scheme, allowing ongoing comparison against forecasts and early identification of any deviation from expected emissions profiles.

4. Existing environment

This section describes the physical, biological, cultural and socio-economic environment that may be affected by the Project and identifies particular values and sensitivities of the environment that may be affected by the activity (referred as the 'Project Area'). The existing environment has been described using the Environmental Factors and Objectives described in *NT EPA Environmental Factors and Objectives* (2025). The information has been sourced using Santos's data, publicly available information, the Australian Government Protected Matters Search Tool (PMST) and *NT NRM Report (Ecology Assessment Report – Appendix J)*.

4.1. Physical environment

4.1.1. Climate

The climate of the Beetaloo area can be described as arid to semi-arid, with rainfall decreasing in frequency and quantity from north to south. The climate is monsoon influenced and has a distinctive wet and dry season. The wet season occurs in summer, between October and March and is characterised by hot and wet conditions. The dry season occurs during the winter months between May and August and is characterised by mild days and cool nights. September and April are transitional months, with occasional rainfall. Approximately 90% of the rainfall occurs during the wet season, and annual totals show moderate variability from year to year.

There is a pronounced north-south rainfall gradient through the region, with mean annual rainfall of around 1,200 millimetres (mm) in the north and around 500 mm in the south (DEPWS, 2022). The maximum rainfall for the permit areas occurs in January and February, coinciding with the northern Australian annual monsoon event and average monthly rainfall is very low in the dry season (between May and October) (BoM, 2025; DEPWS, 2022).

EP 161 is located between the Daly Waters Airstrip weather station (Station #014626) and the McArthur River Mine Airport weather station (Station #014704). A third weather station (Station #014628) is situated within the exploration permit area at Tanumbirini Station.

The majority of annual rainfall occurs in January and February, with January being the wettest month at Tanumbirini Station, where an average of 205.6 mm was recorded between 1970 and 2024. July and August are the driest months across all 3 weather stations. However, during the dry season, Tanumbirini Station consistently receives more rainfall on average than either the Daly Waters or McArthur River Mine weather stations (Table 37).

Table 37: Monthly average rainfall

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daly Waters Rainfall (mm)	166.0	188.1	110.0	21.0	6.1	2.8	2.7	0.3	2.3	21.3	53.9	115.6
McArthur River Mine Rainfall (mm)	212.6	178.9	149.5	30.6	6.6	1.5	2.5	0.3	4.4	19.8	61.6	125.6

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tanumbirini Rainfall (mm)	205.6	184.2	123.0	23.4	2.2	4.7	3.2	1.2	5.5	22.2	50.9	122.0

The average annual rainfall experienced in the region (which includes the BoM data from Daly Waters Airstrip, station number 14626) is shown in Table 38. In 2024, the Daly Waters Airstrip weather station recorded its highest total annual rainfall on record, with 1,353.6 mm.

While annual rainfall patterns vary between the 3 weather stations, the overall mean annual rainfall increases towards the coast. The average rainfall at Tanumbirini Station is more closely aligned with that of Daly Waters Airstrip than with McArthur River Mine Airport (Table 38).

Table 38: Annual rainfall 2016 - 2024

Year	Daly Waters annual rainfall (mm)	McArthur River Mine annual rainfall (mm)	Tanumbirini annual rainfall (mm)
2016	608	535	646
2017	866	923	909
2018	752	900	958
2019	277	470	230
2020	951	1,293	925
2021	679	791	595
2022	561	645	458
2023	762	653	780
2024	1,354	1,157	-
Annual Mean	690	802.1	719.5

The minimum and maximum mean daily temperatures in Daly Waters are slightly less than McArthur River Mine throughout the year. The highest temperatures for both areas are experienced in November, with temperatures of 38.2 degrees Celsius and 38.7 degrees Celsius respectively. The lowest temperatures are experienced in July, with an average daily temperature between 12.0 degrees Celsius and 12.7 degrees Celsius at both stations. The average temperature increases closer to the coast (BoM 2025).

Average maximum and minimum temperatures are also high in the wet season and lower in the dry season, with slightly greater extremes of temperature in the southern part of the region (Table 39). At Daly Waters, annual monthly maximum temperatures range between 29.0 degrees Celsius (June) and 38.2 degrees Celsius (November), and minimums between 11.9 degrees Celsius (July) and 24.2 degrees Celsius (December) (DEPWS, 2022).

Table 39: Long-term average temperature (BoM Station No. 014704)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean Max (°C)	36.0	35.4	35.4	34.9	32.4	30.1	30.2	32.3	35.5	38.1	38.7	37.8
Mean Min (°C)	25.1	24.8	23.6	20.8	16.7	12.9	12.3	13.6	17.4	21.4	24.2	25.1

4.1.2. Topography

Tanumbirini Station is situated on the north-eastern boundary of the Beetaloo Basin, approximately 250-280m above sea level at the Carpentaria Highway (Fulton & Knapton 2015). The station is situated on a drainage divide

that separates inland drainage of the Sturt Plateau from the northeast flowing streams that lead into the Gulf of Carpentaria.

To the west and south-west lie the gently undulating plains of the Sturt Plateau, while to the north and east, toward the Gulf of Carpentaria, are laterite plains. These laterite plains are formed by lateritic capping over Cretaceous-aged sedimentary rocks. The undulating terrain is further characterised by scattered low, steep hills and dissected plateaux developed on exposed Proterozoic and Palaeozoic sedimentary rocks (Fulton & Knapton, 2015). The Project Area occurs within a topographic zone classified as laterite plains that predominantly slope in a south and south-westerly direction. The proposed locations of both well pads are flat, with LiDAR confirming less than a 1% fall across both sites.

4.1.3. Land use and sensitive receptors

Approximate separation distances between the proposed disturbance footprint for Jibera South and Newcastle South to the nearest environmental and sensitive receptors are summarised in Table 40 and depicted in Figure 28.

Table 40: Disturbance footprint environmental and community receptors

Receptor	Distance from Well Pad	
	Jibera South	Newcastle South
Nearest active bore	3.2 km (Northwest – RN038179)	3.9 km (South – RN31244)
Nearest homestead – Tanumbirini	3.7 km (200 m from nearest access track)	13 km north-west
Nearest Community – Daly Waters	133 km west	144 km west
Stuart Highway	133 km west	144 km west
Carpentaria Highway	3.3 km south	0.8 km north-east
Lake Woods	187 km south-west	187 km south-west
Nearest ephemeral watercourse	6 km north-east	4.5 km east
Bullwaddy Conservation Reserve	37.5 km west	44 km west
Aquatic ecosystems refugia	18 km south – Newcastle creek waterhole	9 km south west - Newcastle creek waterhole

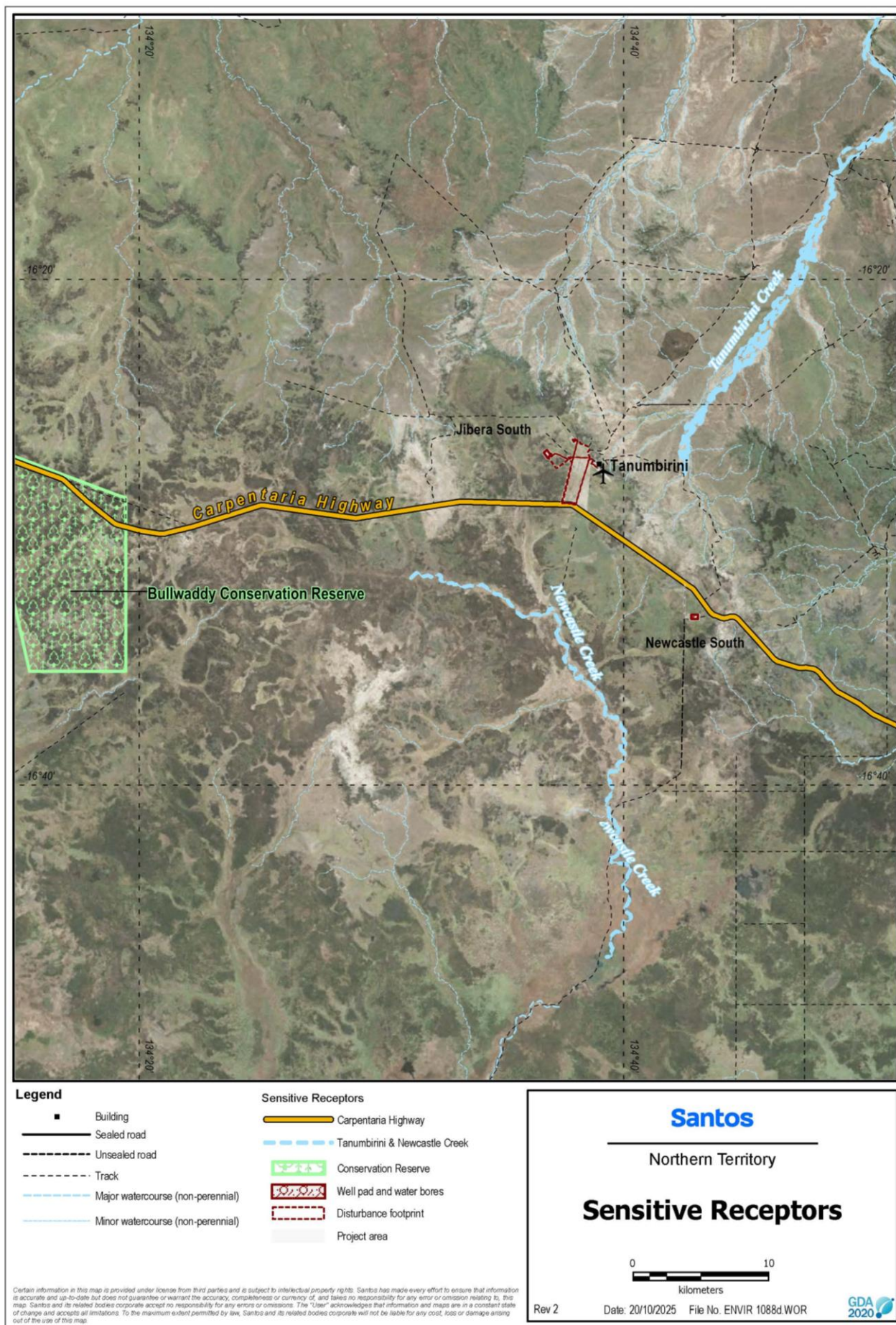


Figure 28: Nearby sensitive receiver

4.1.4. Geology

The geology containing the Study areas within EP 161, comprises stacked sedimentary basins ranging in age from Cretaceous to Mesoproterozoic. The geology of the Beetaloo Basin region includes:

- The Cretaceous Carpentaria Basin
- The Cambrian Georgina Basin
- The Neoproterozoic Kiana Group
- The Mesoproterozoic Beetaloo Basin.

These stratigraphic units are summarised in Table 41.

Table 41: Beetaloo Basin region stratigraphy

Era	Period	Group	Formation
Mesozoic	Cretaceous	N / A	Walker River Yirrkala
Palaeozoic	Cambrian	Barkly	Anthony Lagoon Gum Ridge Antrim Plateau Volcanics unnamed Cambrian Sandstone
Neoproterozoic	Cryogenian	Kiana	Cox Bukalara Sandstone
Mesoproterozoic	Ectasian	Roper	Kyalla Moroak Sandstone Velkerri
		Maiwok subgroup	Bessie Creek Sandstone Corcoran

4.1.4.1 Carpentaria Basin

The Carpentaria Basin lies beneath the Gulf of Carpentaria and extends onshore in the north-western portion of Queensland and the north-eastern portion of the NT. The Basin is mapped between Katherine and Elliott in the NT. The entire Basin covers an area of approximately 680,000 km squared.

The Basin comprises predominantly sandstone rich rock units deposited during sea level highs from the Late Jurassic to Mid Cretaceous. The Basin overlies a heterogeneous Proterozoic basement. It comprises fluvial sandstone, minor siltstone, and conglomerate successions, within a thick mudstone sequence that were deposited when shallow marine to fluvial conditions prevailed across the Basin.

In the NT, the Carpentaria Basin contains a condensed unnamed section of Cretaceous sandstone, comprising quartz sandstone and conglomerate, sandy claystone and siltstone, and was previously called the 'Mullaman Beds'. The Australian Stratigraphy database indicates the Mullaman Beds has been replaced by:

- Walker River Formation - Variably ferruginous and clayey, medium-grained sandstone; some fine to coarse-grained sandstone; massive claystone and siltstone; minor conglomerate and breccia; marine fauna including pelecypods and ammonites (associated with the manganese ore at Groote Eylandt).
- Yirrkala Formation - White to pale grey, fine to very coarse-grained sandstone with massive to thick planar beds, trough cross beds, rare chert pebbles and plant fossils (associated with the bauxite at Gove).

4.1.4.2 Georgina Basin

The Georgina Basin is a large (around 330,000 km squared) intracratonic sedimentary basin in central and northern Australia, lying mostly within the NT and partly within Queensland. Within the Study areas, the Beetaloo

Basin is overlain by the Georgina Basin. The Basin deposition comprises up to 4 km of marine and non-marine sedimentary rocks, which comprises sequences of dolostone, limestone, shale, sandstone and siltstone.

The Georgina Basin includes widespread basalts (Antrim Plateau Volcanics) and a thick limestone sequence that forms the Cambrian Limestone Aquifer (CLA), comprising the Anthony Lagoon Formation (ALF) and the Gum Ridge Formation (GRF). The limestone in the CLA is commonly fractured and cavernous and hosts a significant water supply aquifer in the region.

The ALF is a distinctive maroon dolomitic-siliciclastic siltstone interbedded with pale grey dolostone, with nodular and bedded evaporite and siliceous (chert) concretions. Dolomitic sandstone-siltstone interbeds and beds of quartz sandstone are present.

The GRF conformably underlies the Anthony Lagoon Beds and comprises grey, partially dolomitised massive, ribbon, bioclast, lithoclast and minor onkoid limestone, minor cryptomicrobial dololaminite and grey siliciclastic mudstone.

The Antrim Plateau Volcanics comprises massive and amygdaloidal tholeiitic basalt and basalt breccia and is commonly capped by ferricrete. The dominant flood basalt flows include minor sandstone and chert interbeds. It consists of 20 to 60m thick lava flows, mostly fine basalt with conspicuous vesicular flow tops, and less commonly plagioclase-phyric basalt.

The unnamed Cambrian sandstone disconformably or unconformably underlies Antrim Plateau Volcanics. This unnamed Cambrian sandstone, identified using gamma logs, is often absent. In some areas, this unnamed Cambrian sandstone directly underlies the CLA.

4.1.4.3 Kiana group

The Cox Formation comprises very fine to fine-grained, usually micaceous sandstone, thinly interbedded with micaceous siltstone and shale, overlain by finely laminated siltstone and shale. The Hayfield Mudstone (obsolete), which was identified as a regional, thick, organic-poor shale and siltstone, has been incorporated into the Cox Formation.

The Bukalara Sandstone resulted from high-energy shoreline to shallow-marine deposition, which disconformably or unconformably underlies Antrim Plateau Volcanics. This unit comprises fine to very coarse grained, cross bedded, friable quartz to lithic sandstone with minor shale beds and basal pebbly sandstone to conglomerate and contains trace fossils.

Jamison Sandstone (obsolete), comprising quartz sandstone, was abandoned in favour of Bukalara Sandstone in 2023. Redefined as part of Bukalara Sandstone, Kiana Group overlies Roper Group and underlies 'Hayfield Mudstone' (Cox Formation).

4.1.4.4 Roper group

The Beetaloo Basin consists of a series of sedimentary deposits and includes Proterozoic Roper Group sediments. Petroleum reservoir units within the Roper Group include the Velkerri Formation and the Moroak Sandstone.

Kyalla Formation (formation within the Maiwok Subgroup of the Roper Group) comprises interbedded siltstone, mudstone and very fine-grained quartz sandstone, and underlain by Moroak Sandstone.

The Moroak Sandstone comprises flaggy to blocky, medium- to fine-grained quartz sandstone with minor quartz granule-rich coarse-grained sandstone, conglomerate and siltstone interbeds.

The Velkerri Formation represents the primary unconventional gas target in the Beetaloo basin, although small hydrocarbons intersections have been encountered in other formations within the Roper Group. The Velkerri Formation consists of the Kalala, Amungee, and Wyworrie members. The Amungee Member shales are the target of the proposed Santos EP 161 shale gas exploration activities. The Velkerri Formation is underlain conformably by the Bessie Creek Sandstone.

The Bessie Creek Sandstone is included in Maiwok Subgroup of Roper Group. It comprises fine-to-medium grained clean quartz sandstone, mudstone partings and thin intraclast-rich intervals.

The Bessie Creek Sandstone conformably overlies the Corcoran Formation. The lower part of this formation comprises red to brown ferruginous sandstone, siltstone, mudstone, conglomerate and pisolitic ironstone. The upper part comprises laminated green-grey to black mudstone and siltstone, minor fine sandstone.

4.1.5. Hydrogeology

The major regional groundwater system within the Beetaloo Basin occurs within the CLA. The CLA is a vast multi layered aquifer which occurs within the top 20 to 400 m of the natural surface (DEPWS, 2022). The CLA is subdivided into:

- The upper CLA, which comprises the ALF, is characterised by siltstone interbedded with thin, karstic limestone and dolomite sequences. It is mapped at thicknesses of up to 200 m.
- The lower CLA, which includes the GRF, consists predominantly of fractured and karstic limestone and dolomite. It can reach thicknesses of up to 400 m and may sub crop in areas where the upper CLA is absent. The GRF, within the lower CLA, is identified as the primary water bearing unit occurring within the Study areas.

The CLA is the only aquifer present in the Project Area. Earlier interpretations by Santos and the Northern Territory Geological Survey (NTG) identified the 'Inacumba Aquifer' as a separate hydrostratigraphic unit. However, subsequent regional hydrogeological assessments have determined that the Inacumba Aquifer forms part of the Lower CLA and is not a distinct aquifer.

Accordingly, the term 'Inacumba Aquifer' is no longer used in current hydrogeological interpretations. This interpretation is consistent with that of the Strategic Regional Environmental Baseline Assessment (SREBA, 2022). No other geological formations in the Project Area are classified as aquifers.

The Mesoproterozoic shale units targeted by unconventional gas exploration (i.e., the Velkerri Formation) are significantly deeper in most areas and are separated from the CLA by one or more aquitards (DEPWS 2022). Within the Study area, a separation depth of around 2,800 m is reported between the CLA (Gum Ridge Formation) and the target gas bearing units of the Velkerri Formation.

The CLA does not outcrop within EP 161 and is overlain by generally unsaturated, siltstone and claystone rich Cretaceous-aged deposits of the Carpentaria Basin. These deposits have been observed to be greater than 80m thick in bores drilled in the vicinity of EP 161. The north-eastern portion of EP 161 is outside of the spatial extent of the CLA and is characterized by Proterozoic-aged geology.

Regional characteristics of the CLA are described below:

- Groundwater level: 32 to 123 mbgl, with deeper levels observed toward the south-western basin margin (Fulton, 2018).
- Flow direction: Regional groundwater in the GRF flows north-west toward Mataranka (Figure 29 and Figure 30).
- Discharge: The aquifer discharges into the Roper River approximately 100 km north-west of the Beetaloo Basin, supporting important groundwater-dependent ecosystems.
- Gradient: Flow gradients are extremely flat, with little change in elevation over long distances.
- Recharge: Recharge to the GRF is primarily conceptualised to occur via seepage from seasonal creeks where they intersect outcrops, potentially through dolines located within creek beds. During large rainfall events, runoff into streams and the filling of endorheic lakes can also contribute to recharge where these surface water features are in direct contact with outcropping formations.

The groundwater flow pattern for the CLA is provided in .

4.1.6. Groundwater and availability and quality

There are 23 registered bores within 5 km of the disturbance footprint, with 21 bores recorded to be completed within the GRF and 2 within GRF or ALF. These bores have recorded water levels ranging from 74 to 185 mbgl.

Bores identified within the Study areas had a reported purpose of monitoring (4), petroleum water bore (4), production (12) and unknown (3).

Groundwater quality in the CLA is typically good with electrical conductivity (EC) in the CLA ranging from 1170 – 2,260 $\mu\text{S}/\text{cm}$ (average of 1,580 $\mu\text{S}/\text{cm}$) and a neutral pH (6.3 - 7.3) (Fulton 2018). Santos has established groundwater monitoring bores at the Mount Brown-1/2H location and Inacumba-1/1H location. The groundwater from these bores is fresh, ranging between 800-1000 milligrams per litre Total Dissolved Solids (TDS). Groundwater quality of the Anthony Lagoon and Gum Ridge is provided in Table 42. Groundwater bore locations in the vicinity of the Project Area are provided in Figure 31.

Table 42: Groundwater quality of Beetaloo Basin aquifers²³

Aquifer	No. of samples	Conductivity ($\mu\text{S}/\text{cm}$)	Lab pH (mean)	Major ion concentration (mg/L) *					
				Na	Ca	Mg	HCO ₃	SO ₄	Cl
Gum Ridge	144	350-3,000 (1,390)	7.5	2-440 (130)	16-200 (86)	11-116 (53)	56-680 (440)	6-650 (150)	2-6,209 (160)
Anthony Lagoon	86	670-6,470 (1,590)	7.6	9-380 (150)	12-300 (88)	25-134 (57)	86-530 (330)	18-980 (230)	16-570 (210)

*mean concentration in brackets

²³ Source: Fulton and Knapp 2015, Tickell and Bruwer 2017

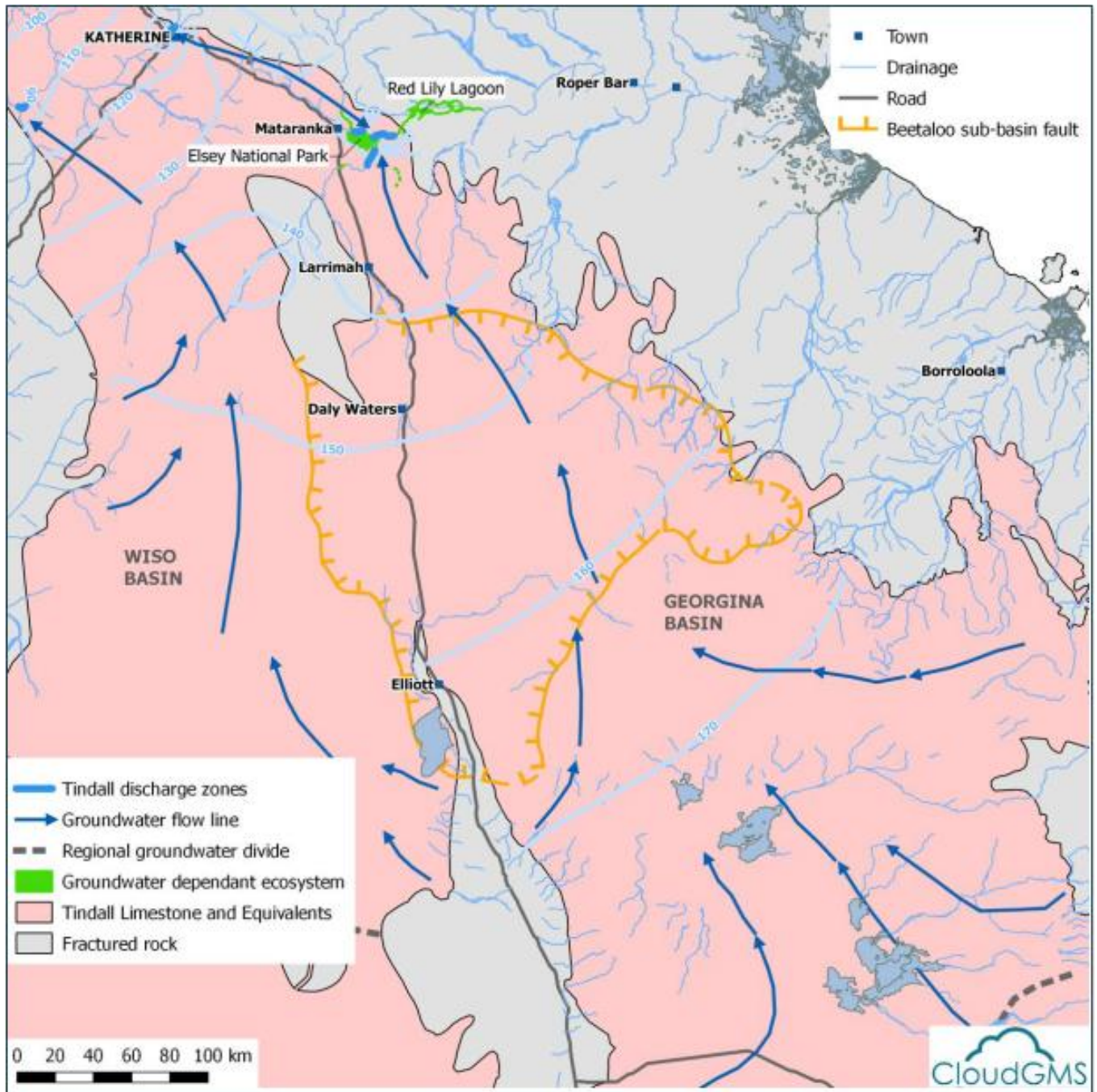


Figure 29: CLA groundwater flow pattern

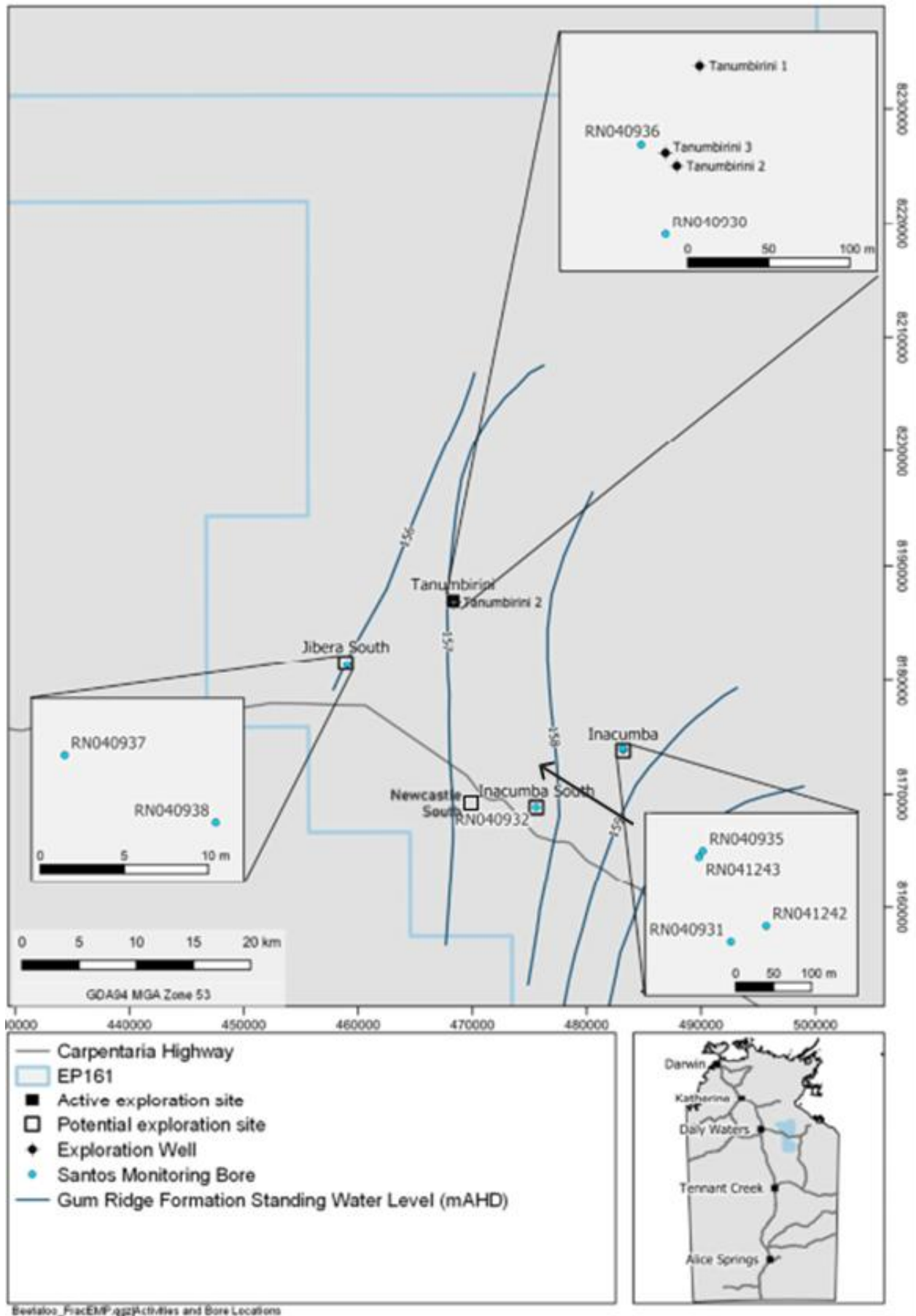


Figure 30: EP161 Gum Ridge Formation Standing Water Level (Source: RDM Hydro, 2024)

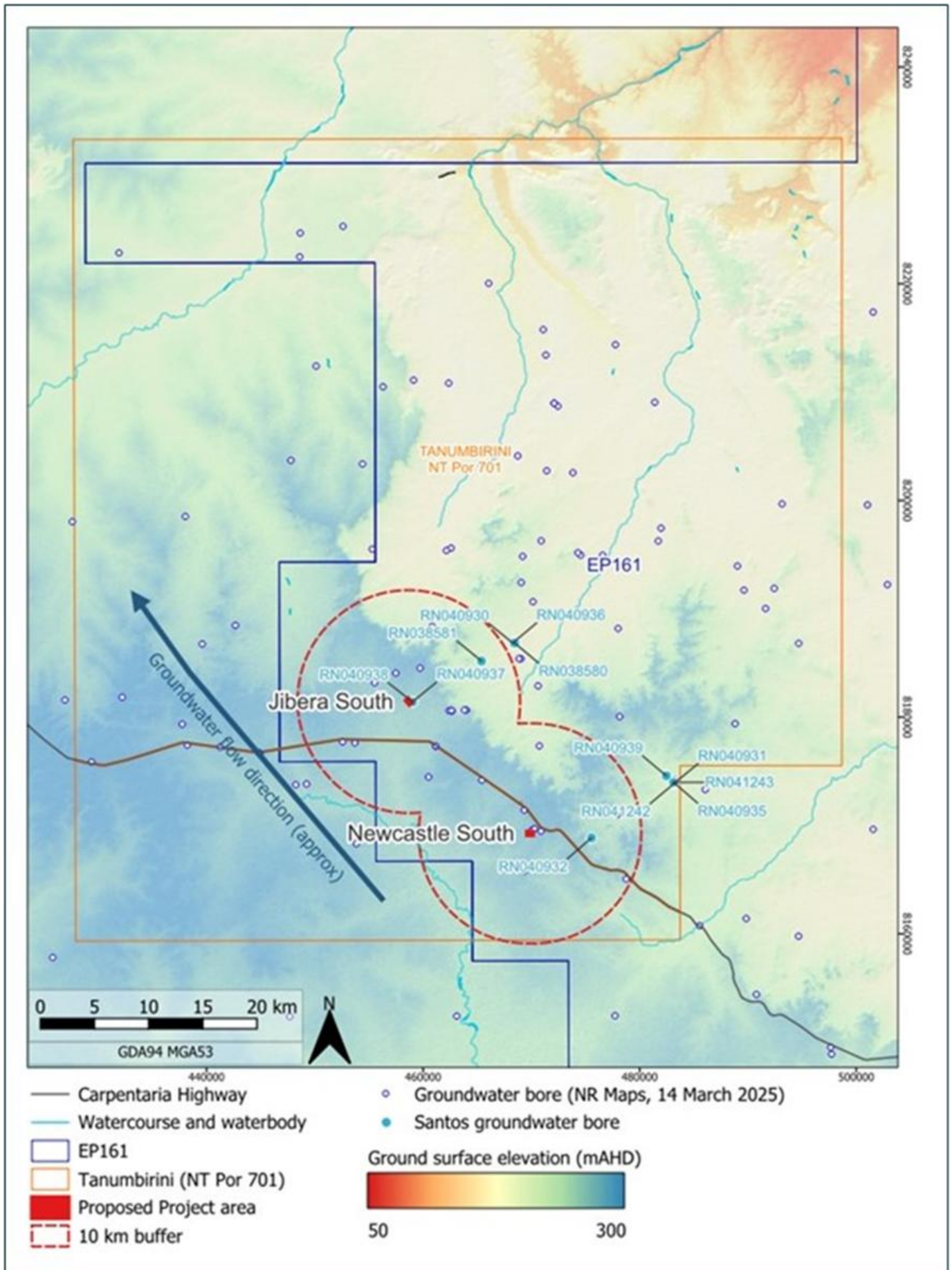


Figure 31: Groundwater bores in the vicinity of the Project Area

4.1.7. Soils

The Australian Soil Classification map was used to determine soil types within the Disturbance Area (Searle, 2021). Most of the area for both Jibera South and Newcastle South was mapped as containing Kandosols, with Vertosol scattered around access tracks. Kandosols are typically red to brown in colour, have a sandy to loamy texture and are well drained and permeable. This soil type is widespread across the Top End, Sturt Plateau, Tennant Creen and Central Australia (DLRM, 2023).

Soil erosion susceptibility varies throughout the permit area, dependent upon soil types, slope and extent of ground disturbance. Apart from the erosive impact of climatic conditions, soil erosion is influenced mainly by the inherent properties of the soils and the processes which occurred during the formation of the landscapes.

4.1.8. Land systems

Land systems are defined because of their distinct differences from the surrounding areas and by the recurring pattern of geology, topography, soils and vegetation. Land system mapping for the disturbance footprint is derived from the following 2 data sets:

- Land Systems of the Southern Part of the NT
- Land Systems of the Northern Part of the NT (DLRM, 2023).

Most of the disturbance footprint occurs within the Beetaloo Land System, which is classified as lateritic plains and rises. This land system is characterised by plains and rises associated with deeply weathered Land Systems. These are summarised in Table 43.

Table 43: Land system details within EP 161

Land system	Landform	Soil descriptions	Vegetation description
Beetaloo	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils.	Not Applicable.	Information not available.
Creswell	Erosionally stable, gently undulating plains and rises on ferruginised Lower Cretaceous sediments (laterite).	Leptic Rudosols, Leptic Tenosols, Red and Yellow Kandosols.	Mid-high open woodland of <i>Corymbia dichromophloia</i> , <i>C. bleeseri</i> , <i>Eucalyptus tetrodonta</i> , <i>Erythrophleum chlorostachys</i> with isolated stands of <i>Acacia shirleyi</i> on crests over <i>Chrysopogon fallax</i> , <i>Plectrachne pungens</i> , <i>Sorghum plumosum</i> .
Inacumba	Gently undulating rises and undulating plains to low hills on ferruginised Lower Cretaceous sediments (laterite) and weathered sandstones.	Leptic Rudosols and shallow Ferric Brown Kandosols.	Mid-high open woodland of <i>Corymbia dichromophloia</i> , <i>Eucalyptus miniata</i> , <i>E. tetrodonta</i> , <i>C. ferruginea</i> , <i>E. leucophloia</i> with isolated stands of <i>Acacia shirleyi</i> on steeper slopes over <i>Eriachne</i> spp, <i>Chrysopogon fallax</i> , <i>Plectrachne pungens</i> .

4.1.9. Air quality

SREBA Beetaloo Environmental Health Baseline Report on air quality (GHD, 2024) reveals that the dust rate at nearby monitoring stations of the disturbance footprint such as Bullawaddy and Daly Waters is within the adopted objective level (4 g/me/month) (GHD, 2022). Concentrations of nitrous oxide (NO₂), sulphur dioxide (SO₂) and hydrogen sulphide (H₂S) were also well below the annual criterion at 2 monitoring stations as is described in Table 44.

Table 44: Summary of air quality data from the SREBA Environmental Health Baseline Report (GHD, 2024)

Pollutant	Annual criterion	Bullwaddy*	Daly Waters*
Nitrogen dioxide (NO ₂)	31 (µg/m ³)	3.1	3
Sulphur dioxide (SO ₂)	57(µg/m ³)	1	2
Hydrogen sulphide (H ₂ S)	0.5 µg/sample	<0.5	
Aldehydes (formaldehyde)	54(µg/m ³)	0.91	0.9
Benzene	10 (µg/m ³)	0.04	0.04
Toluene	411 (µg/m ³)	0.1	0.08
Xylene	947 (µg/m ³)	0.39	0.37
Dust (October 2022)	4 g/m ² /month	1.00	0.40

* Maximum recording over the 12-month monitoring period between September 2022 to September 2023.

Results from the baseline study show that in general areas to the north around Manbulloo and Mataranka experienced higher PM₁₀ and PM_{2.5} concentrations than areas to the south, likely due to the increased bushfire activity that occurred during the investigation period. Dust deposition was below the adopted standard throughout the monitoring period for all locations, except for one monthly exceedance in Mataranka. Gas sampling indicated that concentrations of NO₂, SO₂, H₂S, formaldehyde and BTX were below the adopted standards throughout the monitoring period at all locations.

4.2. Surface water, hydrology and hydraulics

4.2.1. Surface water

The SREBA Beetaloo Georgina Basin Water Management Area mapping reveal that the Project Area occurs on the edge of the Limmen Bight Basin (Figure 32). Limmen Bight Basin is part of the Limen River Catchment, and flows towards the eastern coastline of the NT, approximately 190 km north-east of the disturbance footprint.

The highest flows for these rivers occur during the wet season, predominantly due to cyclones and monsoonal rainfall. In contrast to these larger rivers, smaller braided streams and drainage lines such as the Tanumbirini Creek and October Creek to the north, and Newcastle Creek to the south are largely ephemeral. Ephemeral rivers and streams are subject to short flow duration and high turbidity.

There is also a range of small wetlands associated with springs, sinkholes and minor depressions in the generally flat landscape. Riparian zones of these rivers and wetlands are generally in fair to good condition, affected mostly by livestock, feral animals and weeds.

Across the Project Area there are no creeks that will be directly impacted by the Project. There are some minor streams nearby to the Project Area, in which there may be indirect impacts due to changes in water volume, direction and speed. Nearby waterways are described in Table 45 below.

Table 45: Waterways near the disturbance footprint

Project well pad	Catchment	Waterway type	Distance (km)
Jibera South	Limmen Bight Basin	Intermittent stream (stream order 1)	6.0 km
Newcastle South	Limmen Bight Basin	Intermittent stream (stream order 1)	4.5 km

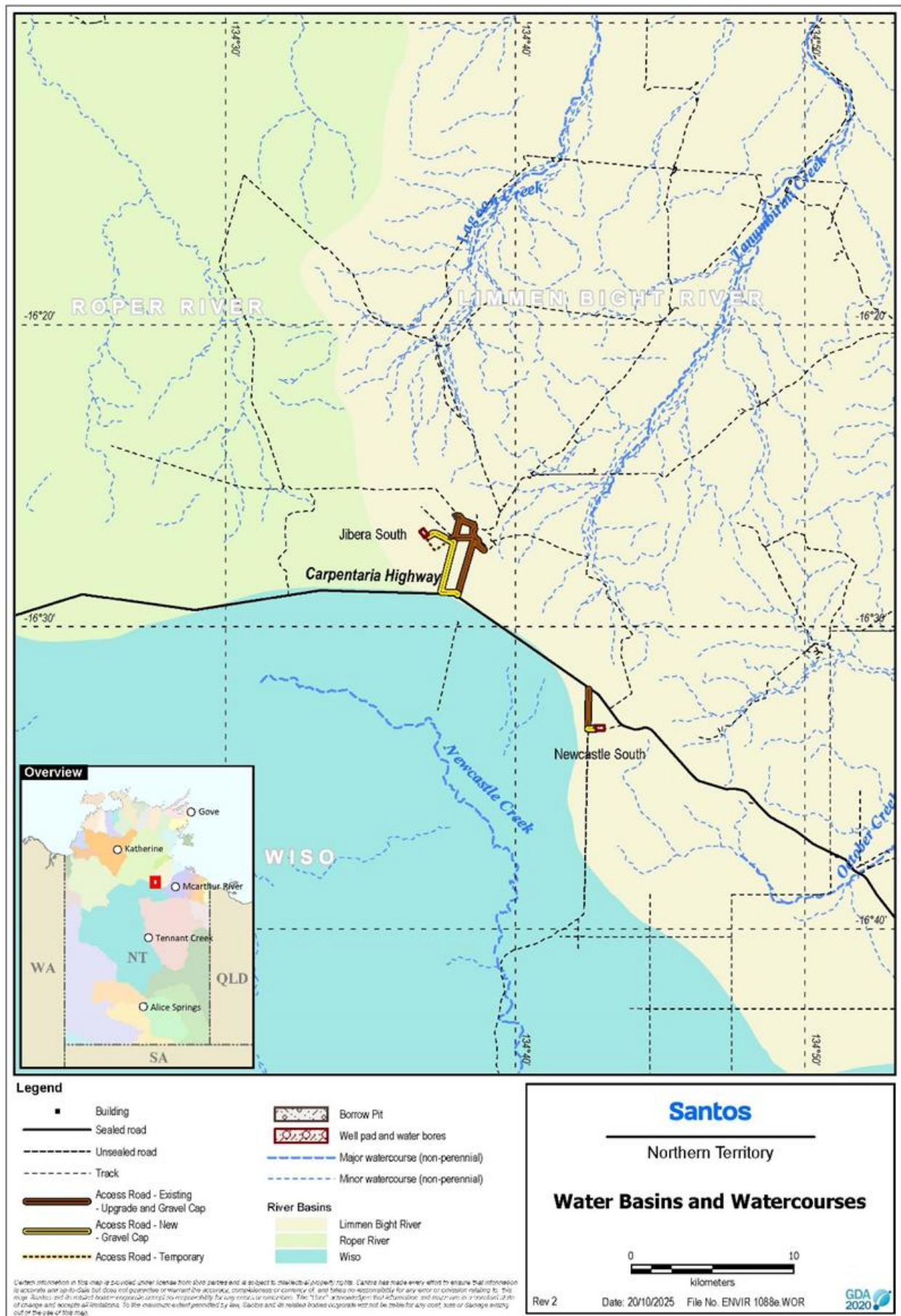


Figure 32: Water basins and watercourses

4.2.2. Flood modelling and hydraulics

Flood modelling was undertaken for AEPs of 1 in 10, 1 in 50, and 1 in 100 years. These probabilities represent the likelihood that a specific rainfall total, accumulated over a set duration, will be exceeded in any given year. The modelling aimed to identify and map areas of inundation and flow velocity associated with these events.

The flood modelling was based on a hydrologically LiDAR digital elevation model and were validated by ground survey pickup points.

4.2.2.1 Jibera South and Newcastle South results

The results of the flood modelling indicate that both the Jibera South and Newcastle South wells pad would not be subject to flooding in a 1% AEP flood event. Some minor flooding would be experienced on access tracks, with small sections flooding up to a depth of 0.3 – 0.4 m during a 1% AEP event. However, the well pad and supporting infrastructure areas, including the camp, tank pads and laydown areas remain largely unaffected by a 1% AEP flood event.

Given the 1% AEP immunity shown from the modelling of each well pad, velocity is not considered a concern for well operations. The access track extents however which are subject to flooding experience the following;

- Jibera South – Velocities along the new proposed access track does experience a small less than 100m section in which velocities are modelled at 0.5 to 0.75 m/s. Larger sections of access track will experience lower flows around the 0.25 – 0.5 m/s.
- Newcastle South – the proposed new access track has been located outside modelled flood extents. The existing access track does experience high velocities in the range of 1.0-1.5m/s

The 1% AEP flood extent and velocities at the Jibera South and Newcastle South locations are shown in Figure 33 to Figure 36. These events show the most change out of the events modelled.

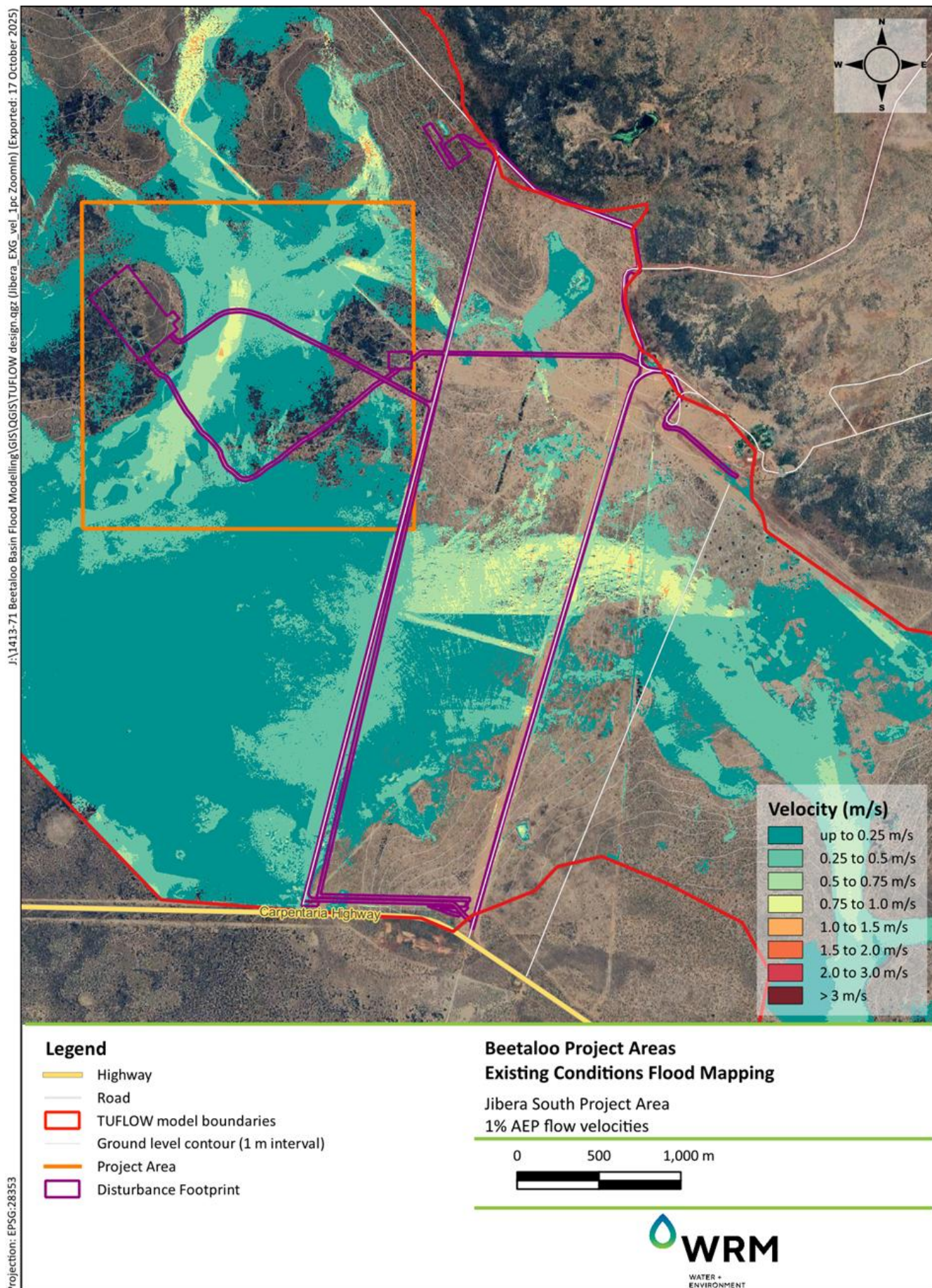


Figure 33: 1% AEP flow velocities at Jibera South

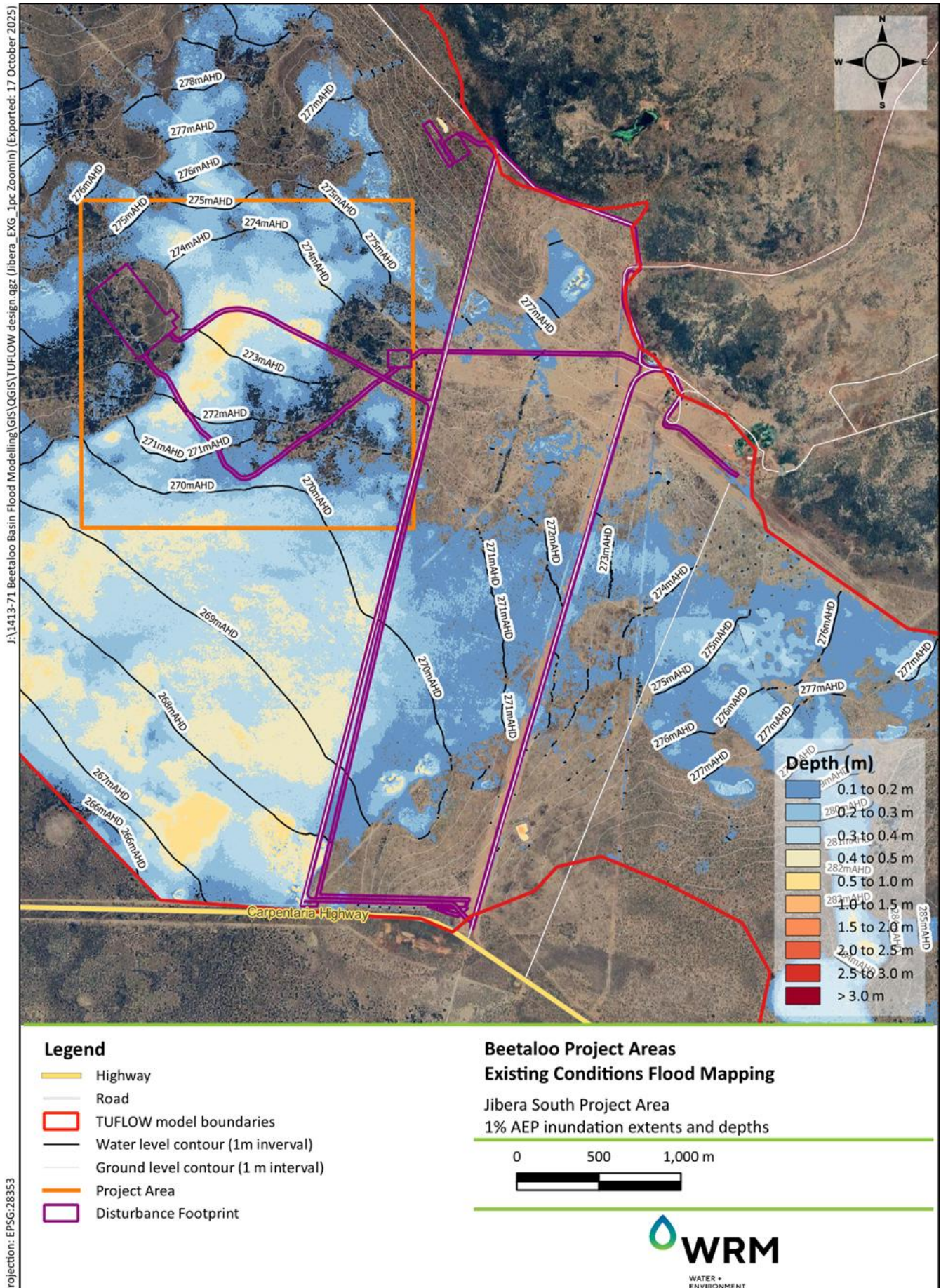


Figure 34: 1% AEP flood inundation areas at Jibera South

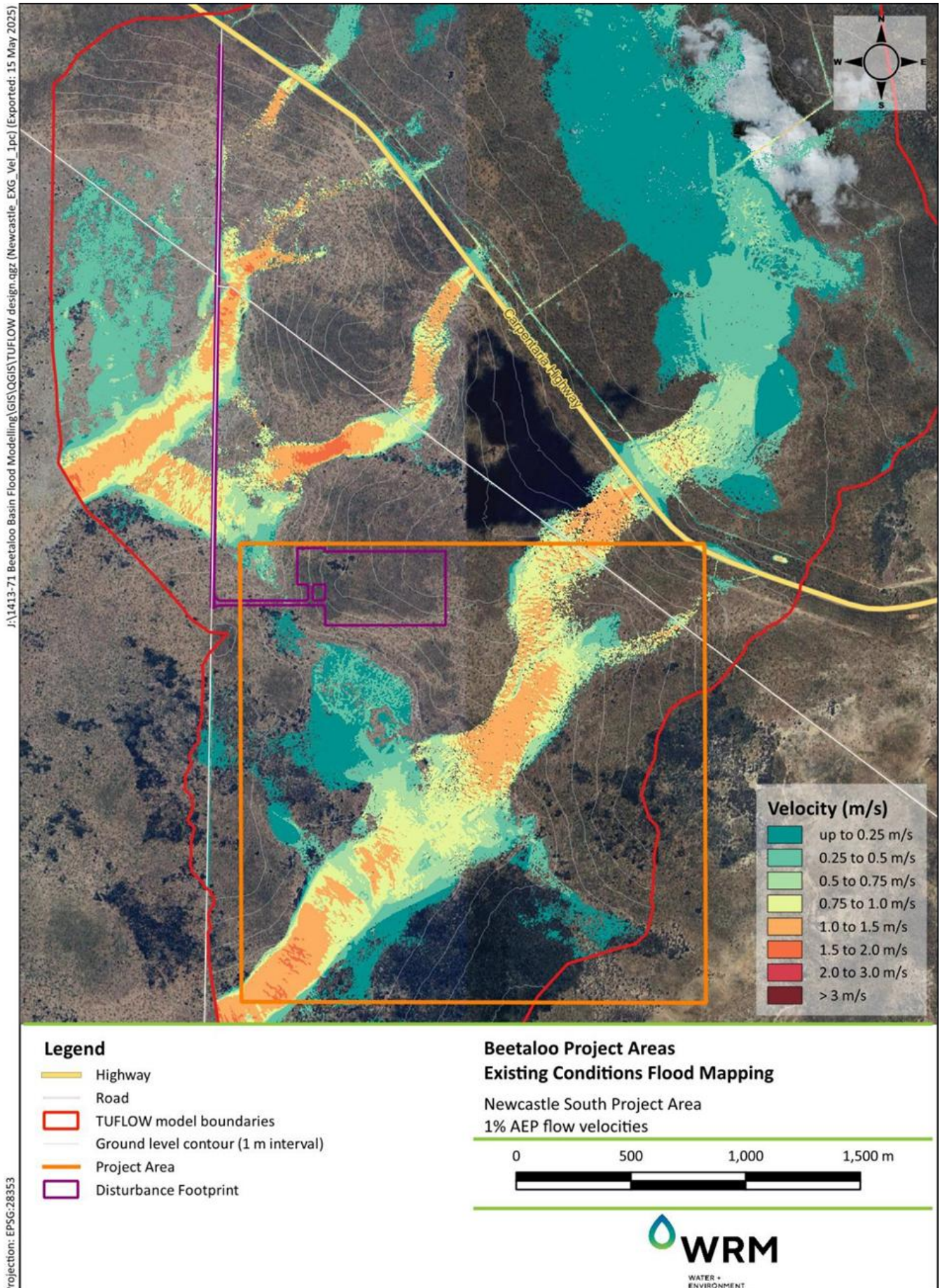


Figure 35: 1% AEP velocities at Newcastle South

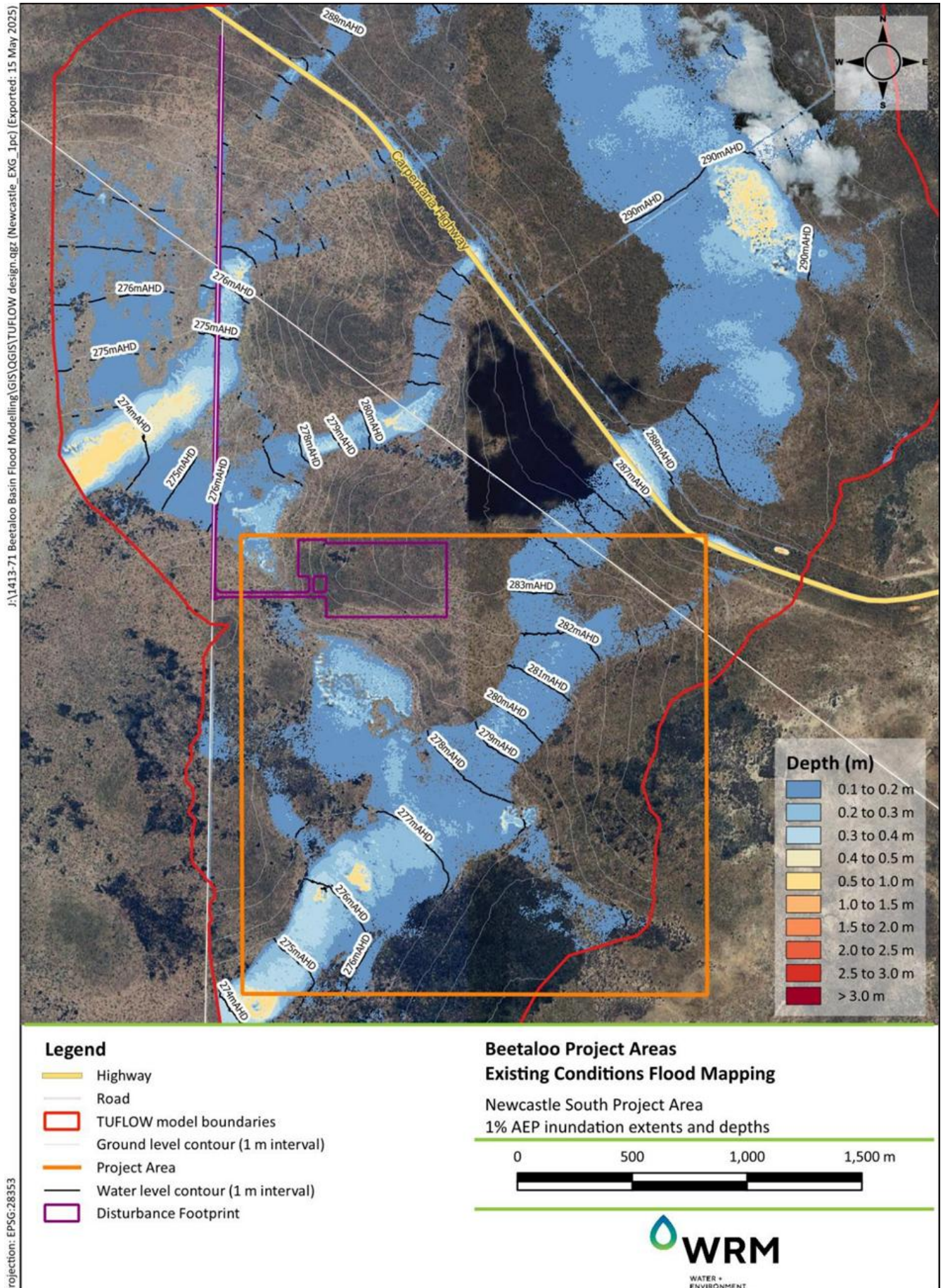


Figure 36: 1% AEP flood inundation areas at Newcastle South

4.3. Natural environment

4.3.1. Bioregions

The Interim Biogeographic Regionalisation of Australia (IBRA) classifies the Project Area mostly occurring within the Sturt Plateau Bioregion, and a smaller part of the Project Area occurring within the Gulf Fall and Uplands Bioregion.

The Sturt Plateau Bioregion comprises undulating plains on sandstone, with predominantly neutral sandy red and yellow earth soils. Dominant vegetation is eucalypt woodland (dominated by variable-barked bloodwood *Eucalyptus dichromophloia*) with spinifex understorey, as well as extensive areas of Lancewood (*Acacia shirleyi*), Bullwaddy (*Macropteranthes kekwickii*) vegetation association and associated fauna, including the spectacled hare-wallaby (*Lagorchestes conspicillatus*). Land condition in the bioregion is moderate to good but threatened by impacts from weeds, feral animals, pastoralism and changed fire regimes (Baker et al., 2005).

The Gulf Fall and Uplands bioregion comprises undulating terrain with scattered low, steep hills on Proterozoic and Palaeozoic sedimentary rocks, often overlain by lateralised Tertiary material. Soils are mostly skeletal or shallow sands. Two types of woodland predominate vegetation: Darwin stringybark (*Eucalyptus tetradonta*) and variable-barked bloodwood (*Corymbia dichromophloia*) with spinifex understorey and northern box (*Eucalyptus tectifica*) with tussock grass understorey (Baker et al., 2005).

4.3.2. Vegetation communities

Nine vegetation communities were identified within the Project Area. A total of 15 vegetation sites and 2 check sites were surveyed, identifying 5 vegetation communities within Jibera South and 6 communities within Newcastle South. Vegetation communities are reported below in Table 46 and a map of vegetation community boundaries within the Project Area is shown in Figure 37 and Figure 38.

The area of each vegetation community within the Project Area are detailed in Table 47. Further information can be found in the *Ecology Assessment Report* (Appendix J).

None of the vegetation communities identified comprise sensitive or significant vegetation types, as defined in the *Land Clearing Guideline 2024*. No threatened Ecological Communities were recorded within the Project Area.

Table 46: Vegetation community descriptions

Vegetation community	Description	Photo
1a	<i>Corymbia dichromophloia</i> , <i>Eucalyptus leucophloia</i> , <i>Erythrophleum chlorostachys</i> , mid high open woodland.	
1b	<i>Corymbia dichromophloia</i> , <i>Eucalyptus leucophloia</i> , <i>Erythrophleum chlorostachys</i> , mid high open woodland, over <i>Acacia calligera</i> , low shrubland.	
1d	<i>Corymbia dichromophloia</i> , <i>Erythrophleum chlorostachys</i> , <i>Eucalyptus tectifica</i> , mid high open woodland.	

Vegetation community	Description	Photo
2a	<i>Acacia shirleyi</i> , <i>Corymbia dichromophloia</i> , ± <i>Corymbia terminalis</i> , mid high woodland over <i>Macropteranthes kekwickii</i> mid high open shrubland.	
2b	<i>Eucalyptus leucophloia</i> , <i>Macropteranthes kekwickii</i> ± <i>Acacia shirleyi</i> , mid high woodland.	
3	<i>Eucalyptus chlorophylla</i> , mid high open woodland.	
4a	<i>Eucalyptus leucophloia</i> , <i>Corymbia terminalis</i> , <i>Acacia shirleyi</i> , mid high open woodland, over <i>Macropteranthes kekwickii</i> , <i>Melaleuca viridiflora</i> , <i>Melaleuca citrolens</i> , mid high open shrubland.	

Vegetation community	Description	Photo
4b	<i>Melaleuca citrolens</i> , <i>Macropteranthes kekwickii</i> , <i>Eucalyptus tectifica</i> , mid high open woodland, over <i>Melaleuca citrolens</i> , <i>Terminalia volucris</i> , <i>Melaleuca viridiflora</i> , mid high open shrubland.	
5	<i>Eucalyptus microtheca</i> , <i>Eucalyptus pruinosa</i> , mid high open woodland, over <i>Melaleuca viridiflora</i> , <i>Melaleuca citrolens</i> , <i>Vachellia ditricha</i> , mid high open shrubland.	
6	Historically cleared resprout (Borrow Pit outside investigation area) - <i>Erythrophleum chlorostachys</i> , low open woodland.	

Table 47: Ground-truth vegetation communities mapped within the disturbance footprint and Project Area

Vegetation Community		Disturbance footprint (ha)		Project Area (ha)	
		Jibera South	Newcastle South	Jibera South	Newcastle South
1a	<i>Corymbia dichromophloia</i> , <i>Eucalyptus leucophloia</i> , <i>Erythrophleum hlorostachys</i> , mid high open woodland.	2.72	2.38	12.68	9.37
1b	<i>Corymbia dichromophloia</i> , <i>Eucalyptus leucophloia</i> , <i>Erythrophleum chlorostachys</i> , mid high open woodland, over <i>Acacia calligera</i> , low shrubland.	5.59	16.86	10.36	23.08
1d	<i>Corymbia dichromophloia</i> , <i>Erythrophleum chlorostachys</i> , <i>Eucalyptus tectifca</i> , mid high open woodland.	0	0	0	0.13
2a	<i>Acacia shirleyi</i> , <i>Corymbia dichromophloia</i> , ± <i>C. terminalis</i> , mid high woodland over <i>Macropteranthes kekwickii</i> mid high open shrubland.	0	0.50	0	2.68
2b	<i>Eucalyptus leucophloia</i> , <i>Macropteranthes kekwickii</i> ± <i>Acacia shirleyi</i> , mid high woodland.	14.92	0	34.30	0
3	<i>Eucalyptus chlorophylla</i> , mid high open woodland.	1.55	0	5.46	0
4a	<i>Eucalyptus leucophloia</i> , <i>Corymbia terminalis</i> , <i>Acacia shirleyi</i> , mid high open woodland, over <i>Macropteranthes kekwickii</i> , <i>Melaleuca viridiflora</i> , <i>M. citrolens</i> , mid high open shrubland.	0.70	0	1.61	0
4b	<i>Melaleuca citrolens</i> , <i>Macropteranthes kekwickii</i> , <i>Eucalyptus tectifca</i> , mid high open woodland, over <i>Melaleuca citrolens</i> , <i>Terminalia volucris</i> , <i>Melaleuca viridiflora</i> , mid high open shrubland.	1.50	0	9.07	0
5	<i>Eucalyptus microtheca</i> , <i>E. pruinosa</i> , mid high open woodland, over <i>Melaleuca viridiflora</i> , <i>M. citrolens</i> , <i>Vachellia ditricha</i> , mid high open shrubland.	0	0.16	0	1.90
6	Historically cleared, non-remnant, or modified	37.02	3.15	75.10	3.14
No data	No data collected	0.28	0.01	12.26	3.45
Total		64.28	23.06	160.84	43.75
Combine total		87.34		204.59	

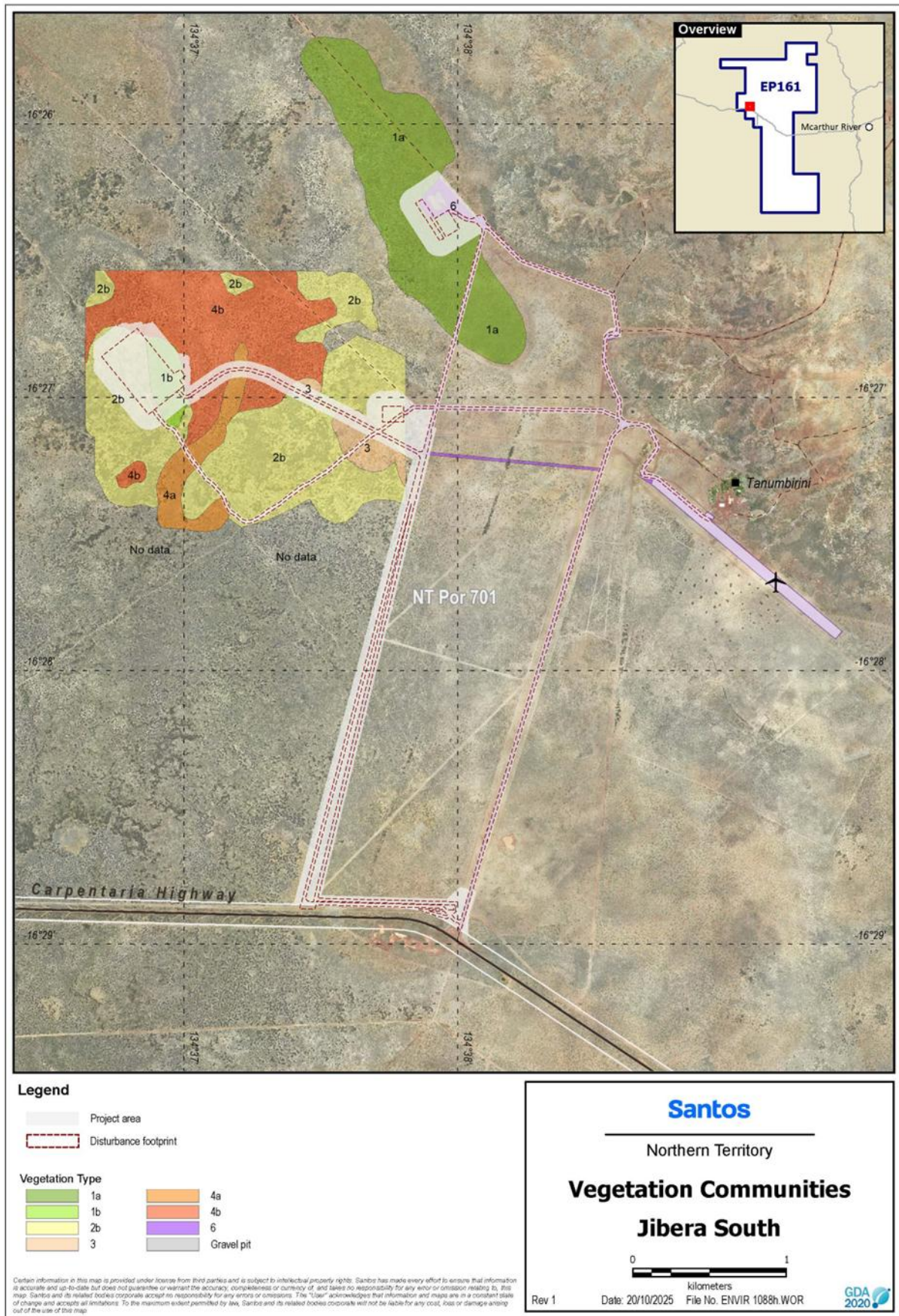


Figure 37: Vegetation communities at Jibera South

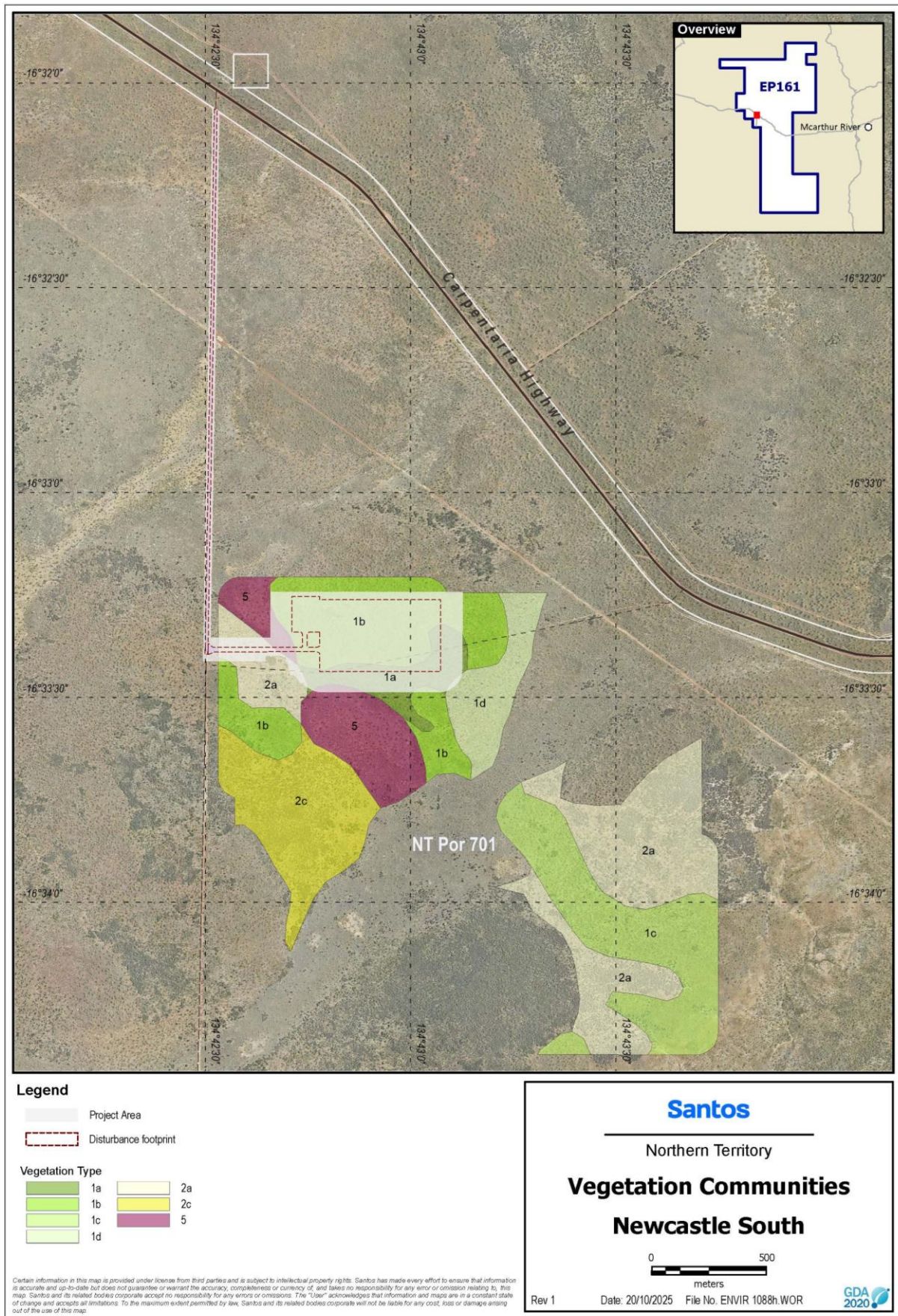


Figure 38: Vegetation communities in Newcastle South

4.3.3. Significant vegetation

Significant or sensitive vegetation communities are described in the *NT Land Clearing Guidelines 2024*. Significant vegetation communities are those that are distinct and limited in extent or support important ecological values and include vine thicket, closed forest or riparian vegetation, mangroves, monsoon vines forest, sand-sheet heath and vegetation containing large trees with hollows suitable for fauna. Sensitive vegetation is a term applied to ecosystems easily impacted by neighbouring or adjacent land uses or management. Riparian vegetation occurs along freshwater waterways (ephemeral or permanent). It covers a relatively small land area and provides unique habitat features and dry season refuge for a range of native fauna species.

The proposed clearing and disturbance extent has been located away from any waterways and any significant riparian vegetation. No riparian vegetation will be disturbed as part of the 2 new well pad sites.

4.3.4. Flora

Desktop analysis of flora in the region was undertaken to inform the likelihood of occurrence of threatened and significant flora in the Project Area. The desktop analysis indicates that no threatened flora species under the EPBC Act occur in the Project Area footprint. This was confirmed through the field surveys where no threatened flora or threatened vegetation communities were recorded. The following criteria were used in the assessment to identify the likelihood of occurrence for threatened species:

- Known – Species was positively identified and recorded in the disturbance footprint during the field surveys; or previous, reliable records occur within the disturbance area.
- Likely – Species was not recorded during the field surveys or previously, however there are reliable records within the nearby surrounding area and suitable habitat exists in the disturbance footprint.
- Possible – Species was not recorded during the field surveys or previously, however reliable records occur in the surrounding area and/or habitat in the disturbance footprint is marginal or degraded.
- Unlikely – Habitat in the disturbance footprint may be marginally suitable, however, species was not recorded during the field surveys, and no known records of the species exist within the surrounding area.
- 2 records of *Ipomoea argillicola* (in the NT Flora Atlas) occur within the Bullwaddy Conservation reserve approximately 33 km from Jibera South and 45 km from Newcastle South. Given the distance, these are not considered to occur at this location.

The survey undertaken in December 2024 did record 42 individual flora species. The full list of flora species recorded in the desktop review and field survey is within the *Ecology Assessment Report* (Appendix J).

A Desktop search using DCCEEW Protected Matters Search Tool (PMST) and DLPE Natural Resource maps produced a list of potential regulated species that may occur. Additionally, the NT Flora Atlas and SREBA surveys were also reviewed. As a result, no threatened flora species are deemed likely to occur within the project area.

4.3.5. Weeds

The Weeds of National Significance (WoNS) list, compiled by the Commonwealth government, provides a national standard for ranking the impact of individual pest weed species. Under the *Weed Management Act 2001*, weeds can be declared as:

- Class A – to be eradicated.
- Class B – growth and spread to be controlled.
- Class C – not to be introduced into the NT (All declared weeds are automatically class C weeds).
- Class D – prevent spread by action of persons.

The Katherine Regional Weeds Strategy 2021-2026 provides a strategic approach to reduce the adverse impact of weeds in the Katherine Region (DEPWS, 2021a). The plan includes a list of weed species that require priority management. The 9 priority weed species are listed in Table 48. If located, the EMP requires the Weed Management Branch to be contacted for identification and disposal.

Table 48: Priority weed species identified for the Katherine Region (DEPWS, 2021a)

Scientific name	Common name	Declaration
<i>Vachellia nilotica</i>	Prickly acacia	Class A
<i>Prosopis</i> spp.	Mesquite	Class A
<i>Parthenium hysterophorus</i>	Parthenium	Class A, WoNS
<i>Mimosa pigra</i>	Mimosa	Class A
<i>Cryptostegia grandiflora</i>	Rubber vine	Class A, WoNS
<i>Salvinia molesta</i>	Salvinia	Class B
<i>Cylindropuntia</i> spp.	Rope cactus	Class A
<i>Hyparrhenia rufa</i>	Thatch grass	Class A
<i>Sporobolus</i> spp.	Giant rats tail grass	Not Declared

The Tennant Creek Regional Weeds Strategy and Katherine Regional Weeds Strategy also identifies 3 alert weed species that potentially occur (Table 49). Alert weeds have been identified as the principal threatening weeds to specific regions of the NT. Weed species records and associated management responses are documented in the Weed Management Plan (Appendix C), with weed control activities continuing in accordance with both the Plan and the Code of Practice.

Table 49: Alert weed species in the Katherine and Tennant Creek regions (DEPWS, 2021b, 2021a)

Scientific name	Common name	Declaration
<i>Themeda quadrivalvis</i>	Grader grass	Class B and C
<i>Parthenium hysterophorus</i>	Parthenium	Class A and C, WoNS
<i>Chromolaena odorata</i>	Siam weed	Class C

4.3.5.1. Weed surveys

Previous surveys of EP 161 have recorded hyptis and rubber bush (*Calotropis procera*) (Santos, 2018). In addition, a range of grassy weeds are known to occur along road corridors throughout the region. This includes buffel grass and Gamba grass, which can alter fire regimes and impact biodiversity.

Baseline weed surveys undertaken as part of this EMP's ecology assessments in December 2024 focused on the proposed disturbance areas. These surveys recorded a low number and density of weed species. Only a single weed species (*Mesosphaerum suaveolens*, commonly known as hyptis) was identified within the proposed disturbance footprint at the Jibera South well pad, as shown in Figure 39. No weed species were recorded within the Newcastle South disturbance area during the baseline surveys, as illustrated in Figure 40.

Annual weed surveys conducted in July 2025 covered all existing EP 161 activity areas. During these surveys, several weed species were observed in the vicinity of the proposed Jibera South well pad, while no weeds were identified within the proposed Newcastle South disturbance footprint (Figure 41).

Although no weeds were identified within the Newcastle South disturbance area during field surveys, hyptis has been recorded in previous ecological assessments, surrounding activity areas and is mapped on NR Maps in close proximity to the Newcastle South area.

Further information on the full range of weed species recorded across Santos EP 161, together with applicable control and management measures, is provided in the *Weed Management Plan* (WMP) (Appendix C). Weed management will continue to be implemented in accordance with the WMP and the Code of Practice.

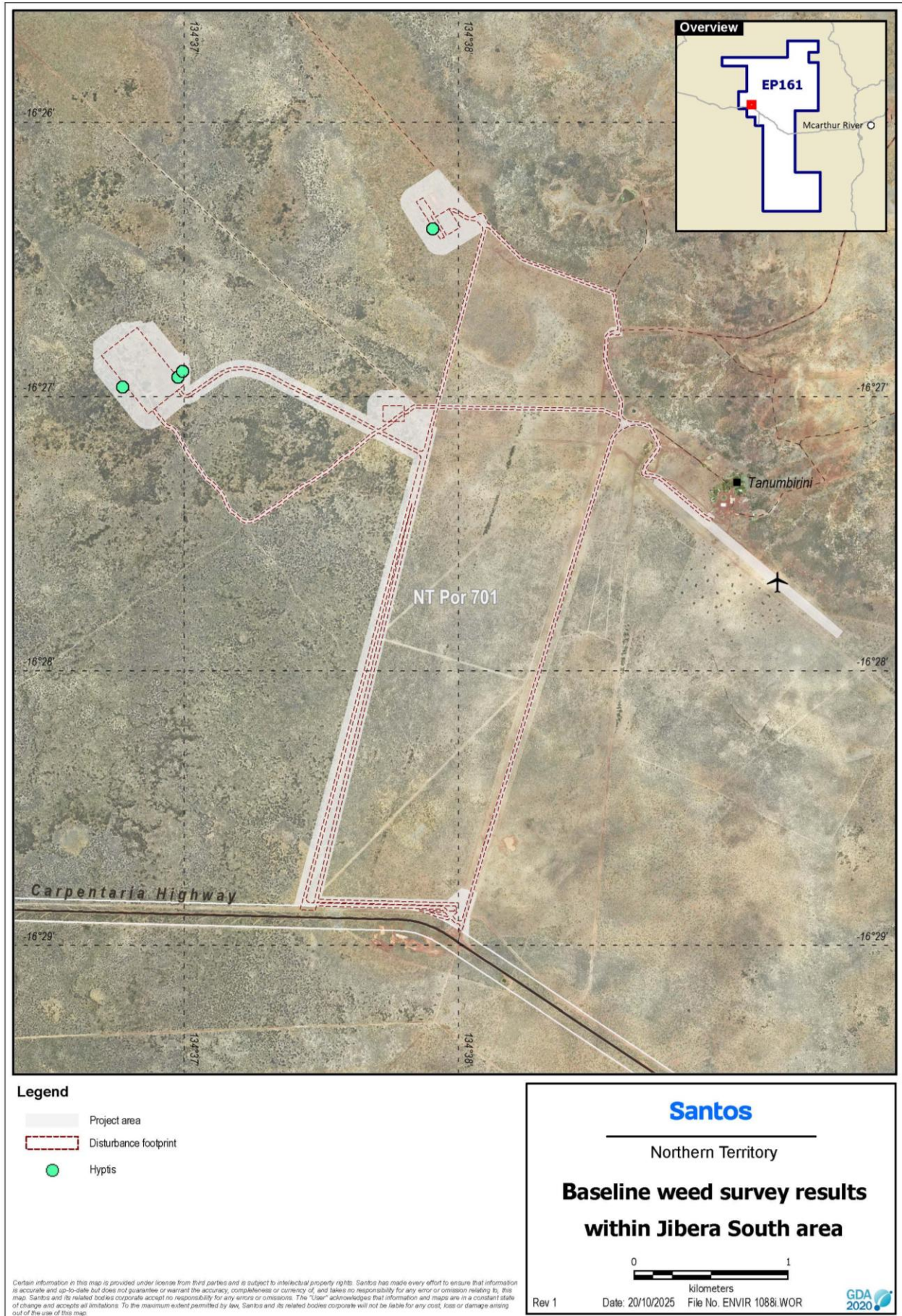


Figure 39: Baseline weed survey results within Jibera South area (December 2024)

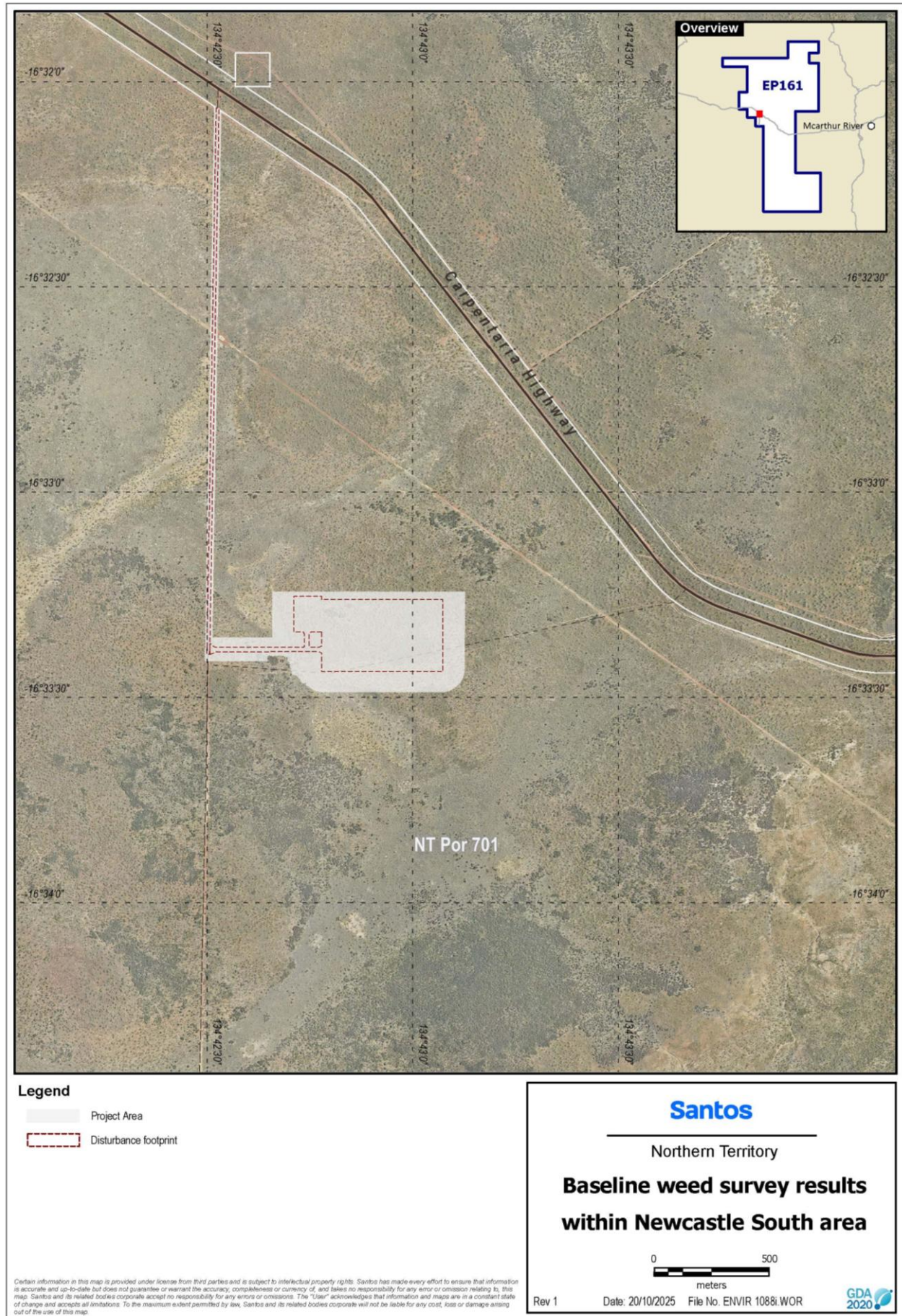


Figure 40: Baseline weed survey results within Newcastle South area (December 2024)

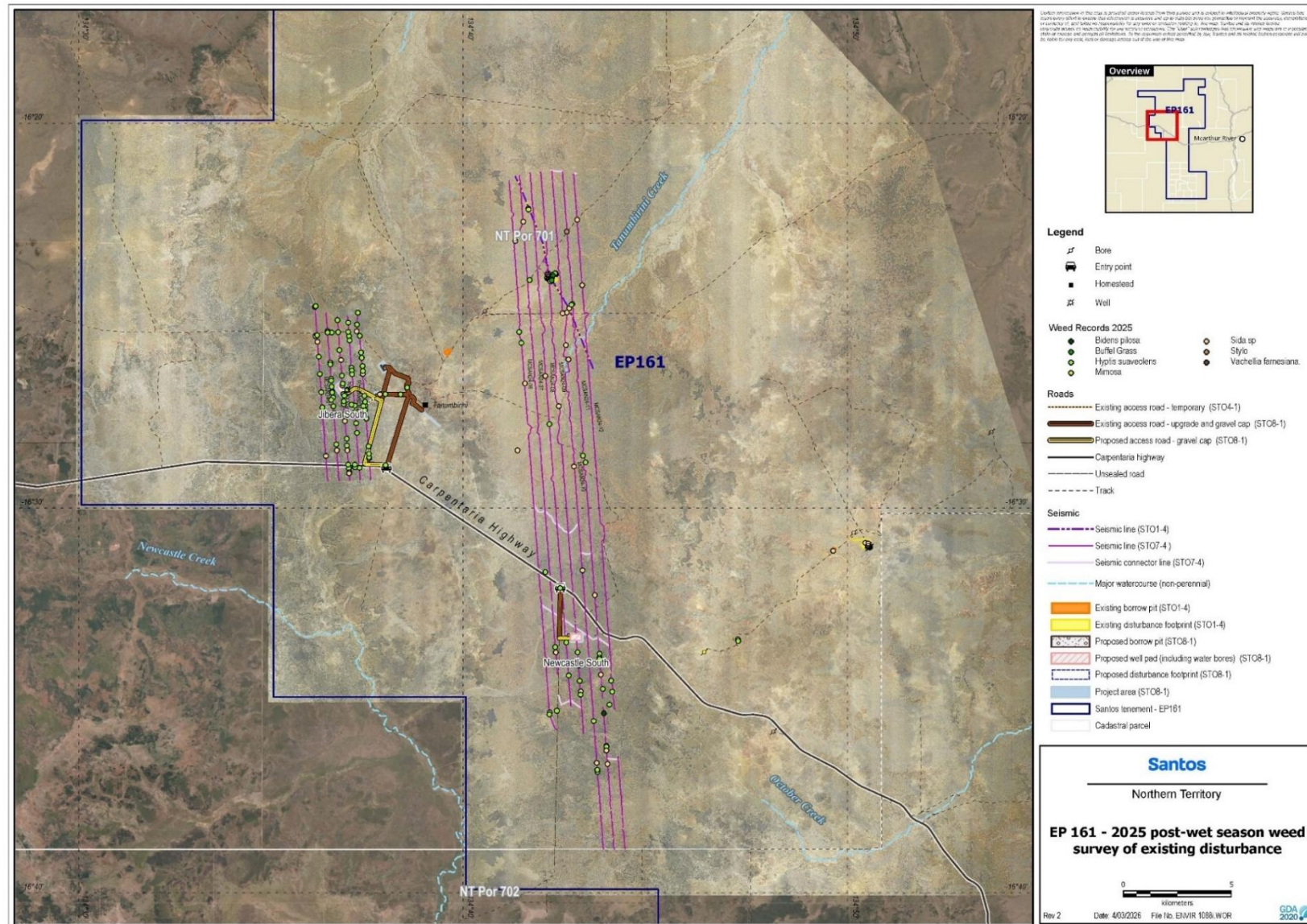


Figure 41: EP 161 Annual weed survey results (July 2025)

4.3.6. Conservation areas

There are no national or world heritage places, Commonwealth land, heritage places, reserves or critical habitat areas listed under the EPBC Act located within or adjacent to the exploration area.

The Bullwaddy Conservation Reserve is approximately 30 km west of Jibera South and approximately 40 to 45 km west of Newcastle South. The Reserve was declared in 2000 under the TPWC Act and is approximately 11,500 ha in area. It represents the only declared conservation area within the Sturt Plateau region to protect Lancewood/Bullwaddy vegetation communities. Less than 3% of this vegetation community is reserved nationally (Parks and Wildlife Commission, 2005). The most significant values of the reserve are the flora communities, and the fauna associated with this habitat. This includes the spectacled hare-wallaby (*Lagorchestes conspicillatus*), northern nailtail wallaby (*Onychogalea unguifera*) and the giant frog (*Cyclorana australis*). It is also a valuable area for research on the ecology of Bullwaddy (*Macropteranthes kekwickii*), particularly the effects of fire (Parks and Wildlife Commission, 2005).

Limmen National Park is situated approximately 80 to 95 km east of Jibera South and Newcastle South.

Lake Woods occurs approximately 80 km south of the Jibera South and Newcastle South. This large ephemeral wetland is situated on the western edge of the Barkly Tableland, about 220 km north of Tennant Creek. Lake Wood spans approximately 350 km² and includes the lower reaches of Newcastle Creek. It is primarily fed by surface inflow by Newcastle Creek from a large catchment to the northeast.

During major flooding events, the lake can expand to between 850 km² and 1000 km² (Harrison et al., 2009). During the period of inundation, Lake Woods supports over 100,000 waterbirds including internationally significant numbers of plumed whistling-duck (*Dendrocygna eytoni*). Numerous bird species nest and feed in the diverse wetland habitat, and the conservation group 'Birdlife International' nominated Lake Woods as an 'Important Bird Area' (IBA). The lake also includes the largest area of lignum swamp in the NT and in tropical Australia (Harrison et al., 2009).

4.3.6.1 Fauna habitat

The disturbance footprint primarily comprises open woodland consisting of mixed Eucalyptus/Corymbia species with a mixed tussock grass understorey. Often, scattered stands of Lancewood/Bullwaddy communities also occur across the proposed sites and individuals of both species are dispersed throughout. In the wider landscape, including proposed access tracks, additional habitat types include those associated with drainage lines, grasslands / floodplains and *Acacia* sp. shrublands.

Eucalyptus/Corymbia sp. Woodland provides habitat for a range of species. The proposed sites contained shrubs and native grasses, which included numerous species suitable for granivorous birds (seed eaters). Dense leaf litter and numerous logs provide suitable refuge and foraging sites for fauna such as reptiles. Although most of the species found in this vegetation type are widespread in the tropical savannas of the NT, some such as the threatened northern shrike-tit (*Falcunculus whitei*) are rare and known to utilise this habitat (Ward, 2008), however they were not found on site. Many of the sites have a high density of hollow-bearing trees that provide important habitat for many fauna species.

4.3.6.2 Listed fauna

A desktop analysis of fauna in the region was conducted using the DCCEEW PMST, DLPE Natural Resource maps and records from the NT Government Fauna Atlas database to inform the likelihood of occurrence of threatened and other significant fauna in the Project Area. The following criteria were used in the assessment to identify the likelihood of occurrence for threatened species:

- Known – Species was positively identified and recorded in the disturbance footprint during the field surveys; or previous, reliable records occur within the disturbance area.
- Likely – Species was not recorded during the field surveys or previously, however there are reliable records within the nearby surrounding area and suitable habitat exists in the disturbance footprint.
- Possible – Species was not recorded during the field surveys or previously, however reliable records occur in the surrounding area and/or habitat in the disturbance footprint is marginal or degraded.

- Unlikely – Habitat in the disturbance footprint may be marginally suitable, however, species was not recorded during the field surveys, and no known records of the species exist within the surrounding.

The search results indicate the potential presence of 24 fauna species listed as threatened under the EPBC Act and/or the TPWC Act. These included 11 birds, 6 mammals, 6 reptiles and one shark²⁴.

A likelihood of occurrence assessment was performed, based on an understanding of habitat within the Project Area, records in the vicinity and distributional data. Results of the likelihood of occurrence assessment for species that are known, possible or likely to occur in the project area are presented in Table 50, with the complete assessment presented in Appendix J. 6 species were identified as possible to occur within the Project Area, and the Gouldian finch is considered likely to occur.

Table 50: Summary of likelihood of occurrence assessment within the disturbance footprint - possible, likely or known threatened fauna

Species name	Common name	EPBC Act; TPWC Act	Likelihood of occurrence
<i>Chloebeia gouldiae</i>	Gouldian finch	EN; VU	Likely
<i>Erythrorhynchus radiatus</i>	Red goshawk	EN; VU	Possible
<i>Falco hypoleucos</i>	Grey falcon	VU; VU	Possible
<i>Falcunculus whitei</i>	Northern shrike-tit	VU; NT	Possible
<i>Acanthophis hawkei</i>	Plains death adder	VU; VU	Possible
<i>Tiliqua scincoides intermedia</i>	Northern blue-tongue skink	CE;	Possible
<i>Varanus panoptes</i>	Yellow-spotted monitor	VU	Possible

4.3.7. Listed migratory and marine species

The EPBC Protected Matters database indicated the potential presence of 12 migratory species and 17 marine species²⁴ within 50 km of the Project Area. Of these species, one is considered likely to occur and one possibly to occur within the Project Area (see Table 51) below for summary of likelihood of occurrence assessment for species that are known, possible or likely to occur within the Project Area. The Project Area does not have wetland areas and is not considered to be suitable habitat for wetland species. The Project Area does not contain critical habitat for any migratory or marine listed species.

Table 51: Summary of migratory species likelihood of occurrence assessment - possible, likely and known to occur within the Project Area

Scientific name	Common name	EPBC Act; TWPC Act	Likelihood of occurrence
<i>Apus pacificus</i>	Fork-tailed swift	Migratory, Marine	Known
<i>Cuculus optatus</i>	Oriental cuckoo	Migratory	Possible

4.3.8. Pest species

Feral animals known to occur within the region include:

- Pig (*Sus scrofa*)
- Wild dog (*Canis lupus familiaris*)
- Feral cat (*Felis catus*)

²⁴ The PMST identified a shark and other marine species during desktop assessments associated with the Regulated Activities. Santos has conducted appropriate validation and assessments of these species and determined that they are unlikely to occur in this location.

- Cane toad (*Rhinella marina*)
- Horse (*Equus caballus*)
- Donkey (*Equus asinus*)
- Water buffalo (*Bubalus bubalis*)
- Camel (*Camelus dromedarius*)
- Black rat (*Rattus rattus*)
- Domestic cattle (*Bos Taurus*).

During the December 2024 field survey, evidence of current cattle grazing or grazing within the last one to 2 years was recorded at most assessed sites.

Cane toads are known to be present in the Project Area and the Commonwealth DCCEEW recognises this species as a 'key threatening process' related to their impacts on biodiversity through predation, competition, land degradation and poisoning. In the NT, cane toads have been implicated in the decline of several reptile species such as the plains death adder (*Acanthophis hawkei*), mulga snake (*Pseudechis australis*), monitors and northern blue-tongue skinks (Catling et al., 1999; Pearson et al., 2013; Price-Rees et al., 2010).

Pest predators such as cats likely occur within the Project Area, though their abundance is difficult to assess due to their cryptic nature. Introduced predators such as cats can impact many vertebrates (Dickman, 2009). One of the primary concerns of introduced predators are the impacts on reptiles and ground-dwelling birds.

There is potential for pest species to be attracted to the Project Area due to increased site activities. Inappropriate dumping of rubbish or artificial water sources on site can attract feral animals.

4.3.9. Aquatic ecosystems

Mapping of SREBA Beetaloo aquatic ecosystems undertaken by the NT Government indicates that the Project Area can be classified as terrestrial aquatic ecosystems. Within the Beetaloo Basin, the mapping identified 1,061,555 ha of surface water ecosystems, covering approximately 12% of the study area. Most were floodplain systems, followed by palustrine, riverine, and lacustrine systems. Additionally, 22 spring locations were identified (Young et al., 2022).

4.3.10. Groundwater dependent ecosystems

A search of the NT SREBA dataset was undertaken for GDEs occurring within a 5 km radius of the Newcastle South and Jibera South well pads. Based on the SREBA Beetaloo GDE mapping, the following GDEs (consisting of groundwater dependent vegetation communities i.e. deep-rooted vegetation communities) are mapped to occur:

- within a 5 km radius of the Newcastle South well pad:
 - Melaleuca forests (springs, river channels), a high-confidence permanent GDE.
 - Riparian woodland (ephemeral streams), a low to moderate confidence seasonal GDE.
 - *Corymbia bella* woodland on alluvial plains, a moderate confidence seasonal GDE.
- within a 5 km radius of the Jibera South well pad:
 - Melaleuca forests (springs, river channels), a high-confidence permanent GDE.
 - Riparian woodland (ephemeral streams), a low to moderate confidence seasonal GDE.
 - *Corymbia bella* woodland on alluvial plains, a moderate confidence seasonal GDE.

The above mentioned GDEs are interpreted to be supported by a shallow perched (isolated) groundwater system, associated with alluvial deposits rather than the underlying CLA. Recorded shallow groundwater levels across Santos' project areas range from approximately 60 to 120 mbgl (AECOM, 2025). Within Santos' project areas, the top of the CLA occurs at depths greater than 100 mbgl. This substantial vertical separation between the CLA and the near-surface and surface ecological receptors (as identified in the SREBA Beetaloo GDE mapping) indicates that hydraulic connectivity between the CLA and the mapped GDEs is unlikely. Accordingly, even if present,

potential impacts to GDEs from proposed Regulated Activities are assessed to be negligible. Regardless, the negligible risks are identified and managed in accordance with Appendix O.

Other deeper groundwater units (e.g. the Moroak Sandstone and Bessie Creek Sandstone) are not considered sensitive due to their depth and/or hypersaline water quality and are located beyond the GDE range in the Project Area.

4.3.11. Stygofauna

Stygofauna surveys using eDNA have been undertaken in the Beetaloo Basin in August and October of 2019 (Rees et al., 2020), and during May 2021 and October 2022 (Humphreys et al., 2022). These surveys involved sampling across several bores in the region, including 4 bores within 50 km of the Project Area. The results of stygofauna surveys at these bores are summarised in Table 52.

The surveys undertaken recorded no stygofauna within the Project Area, with the nearest known record being at bore RN006329, approximately 17 km south-east of the Newcastle South well pad. Given the absence of detections within the Project Area and the considerable distance to the nearest confirmed occurrence, the presence of stygofauna within the Project Area is considered unlikely.

This conclusion is further supported by the hydrogeological context of the area. Stygofauna are typically associated with specific aquifer conditions, such as stable water chemistry, low disturbance, and suitable pore spaces (Edgar, 2024).

Operational water demand is predicted to result in a temporary aquifer drawdown of approximately 1 m. This magnitude of drawdown is minor and is expected to result in a negligible reduction in available subterranean habitat.

Accordingly, potential impacts to stygofauna are assessed as negligible. Even if stygofauna are present within the Project Area (despite the absence of recorded detections), the predicted drawdown is unlikely to materially alter groundwater-dependent habitat conditions. Further, the confined aquifer ensures that water levels remain above the stygofauna zone of influence, preventing any alteration to groundwater conditions that may potentially impact this fauna (AECOM, 2025). Regardless, the negligible risks are identified and managed in accordance with Appendix O.

Table 52: Stygofauna survey results

Bore	Distance from Project Area	Results
RN006329	17 km southeast of Newcastle South.	Taxon recorded: <i>Parisia unguis</i> .
RN029025	Less than 1 km from Jibera South.	No stygofauna detected.
RN041141	44 km west of Jibera South.	Taxon recorded: <i>Parisia unguis</i> .
RN042218	42 km southeast of Newcastle South.	No stygofauna detected.

4.3.12. Springs

Where natural groundwater discharge occurs at surface, a permanent or non-permanent (ephemeral) saturation of ground at the surface may be manifest as a spring. As part of the study area investigations, 19 springs have been identified within the broader EP 161. No springs have been identified within the Project Area.

The closest mapped spring, Stone Spring, is located approximately 45 km north of the Jibera South well pad. Stone Spring is situated in 'Hot Springs Valley' located on Tanumbirini Station. Hot Spring Valley contains a series of springs that likely relate to outcropping of the Roper Group Mesoproterozoic formations. More specifically, the Moroak and Bessie Creek Sandstone formations (within the Roper Group Mesoproterozoic formations) are believed to supply the Hot Springs Valley springs (CSIRO, 2025).

The Hot Springs Valley springs and Roper Group sandstone units are assessed to not be negatively impacted by the proposed Regulated Activities. This is because the formations that likely supply the Hot Springs Valley springs

are located at substantially deeper or shallower depths to the formation Santos is targeting for gas production (that being the Velkerri Formation). More specifically, the Bessie Creek and Moroak Sandstone formations are located at greater than 300 m below, and greater than 500 m above, the Velkerri Formation, respectively.

The Bessie Creek and Moroak Sandstone formations are also vertically separated from the target shale gas formation by extensive and low permeability aquitards of the Velkerri Formation. HFS-induced changes in permeability will be confined to the immediate stimulation zone, with the remaining Velkerri Formation's integrity remaining intact to prevent the migration of pressure or HFS fluids. Additionally, any permeability changes from HFS are expected to be confined to the immediate stimulation zone, and the intervening target formation (Velkerri Formation) acts as an aquitard that limits transmission of pressure changes over long distances.

Furthermore, established well integrity standards protect water-bearing formations intersected by wells. Consequently, due to this geological vertical isolation and a ~45km horizontal separation distance (i.e. the closest spring (Stone Spring) is located approximately 45 km north of the Jibera South well pad), no impact to the Roper Group sandstone units that may be connected to the springs are anticipated (AECOM, 2025).

4.3.13. Fire

Fire is a natural occurrence in most Australian ecosystems and plays an important ecological role. Fire is generally excluded from Mitchell grasslands by pastoral management to maintain forage throughout the dry season (HLA-Envirosciences, 2005). Fire is more frequent in the Eucalypt and Acacia woodlands situated within the Sturt Plateau bioregion.

Historical fire data was acquired from the North Australian Fire Information (NAFI) site and queried for the Project Area. Ten-year fire data (2014 to 2024) shows that Jibera South has been burnt one to 3 times in the last 10 years. Newcastle South has had one occurrence over the last 10 years. Presentation of NAFI fire history data for Santos activities in EP 161 is presented in Figure 42.

Generally, high intensity fires in the area are most likely to occur during the dry season (June to September), while wet season fires (October to May) are likely to be patchy and lower intensity, depending on the state of curing of the fuel load. The impacts of hot fires can impact flora and fauna species and reduce habitat quality. Research suggests that hot fires may impact fauna diversity and in particular diurnal reptiles (Legge, S. et al., 2008). Fire management is set out in the *Bushfire Management Plan* (Appendix B).

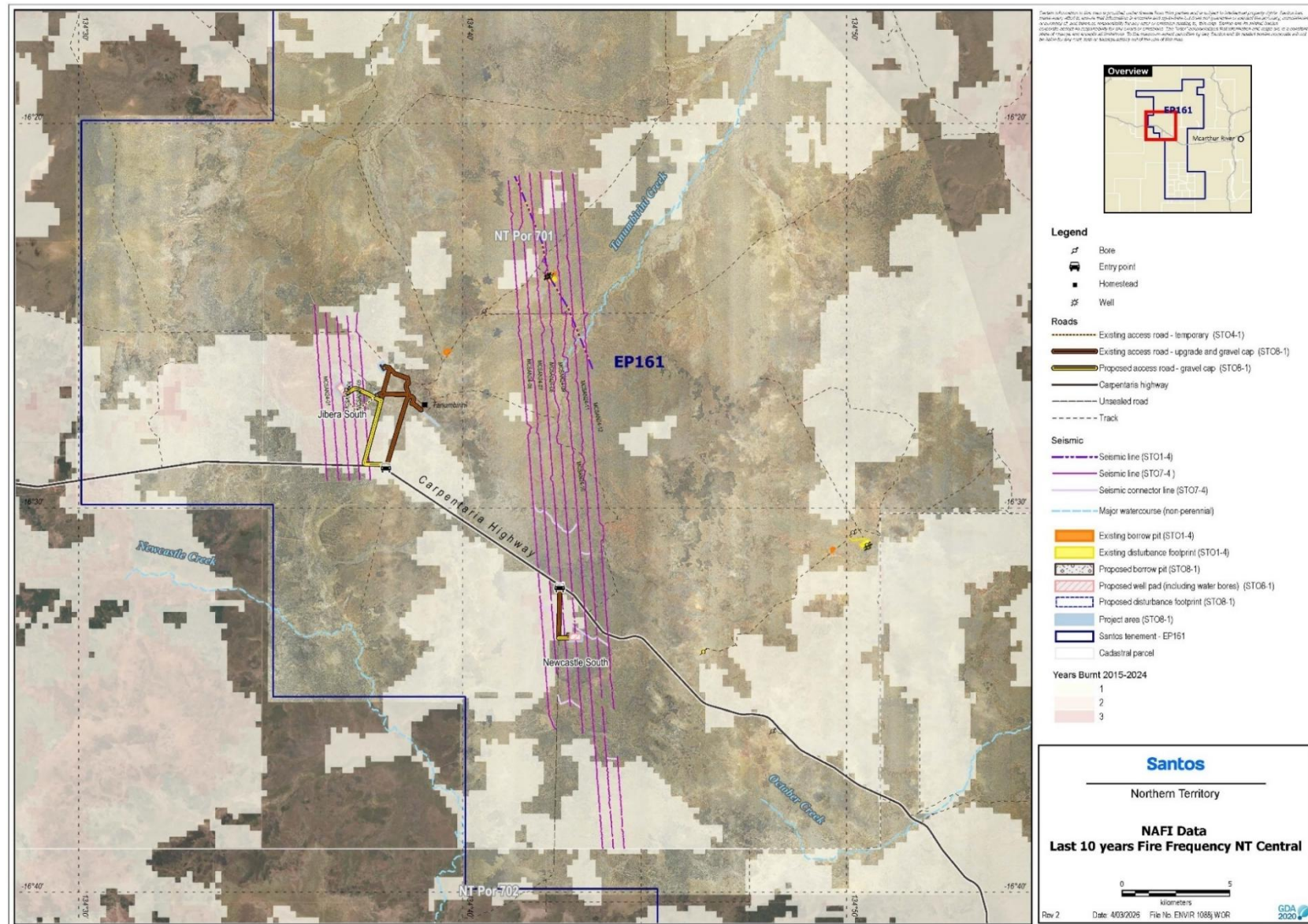


Figure 42: Santos EP 161 activities and fire frequency over the last ten years

4.3.14. Cultural heritage

All works have been sited to avoid impacts to any identified heritage values, and to minimise impacts to areas of heritage sensitivity. Cultural heritage considerations have informed the design, siting, and mitigation measures for proposed Regulated Activities.

4.3.14.1 Desktop searches and reporting

A search of the PMST database in the Environmental Assessment Report (Appendix J) showed there are no World Heritage List (WHL), National Heritage List (NHL), Commonwealth Heritage List (CHL) or Register of the National Estate (RNE) heritage places within the Project Area.

In addition, as part of a recent *Cultural Heritage Assessment* (Appendix L), a search of the Northern Territory Heritage Register (NTHR) was conducted on 17 October 2025, and no recorded NT heritage items or places are present in the Project Area. A full list of the desktop assessment and searches undertaken can be found in section 2.2 of Appendix L.

To ensure there are no archaeological artefacts or sites of significance that will be impacted by proposed Regulated Activities, an independent archaeologist was contracted by Santos to survey the Project Area. The final report is attached in Appendix L and confirmed there are no sites of archaeological or heritage significance that will be impacted by the proposal. If sites were found, they would be reported to the NT Heritage Branch, as is required under Section 114 of the *Heritage Act 2011* (NT).

4.3.14.2 Cultural heritage assessment findings

The key findings of this *Cultural Heritage Assessment* (Appendix L) are:

- Known Aboriginal archaeological sites are limited to 2 artefact scatters, [REDACTED]
[REDACTED]
[REDACTED]
- AAPA certificates provided by Santos show one Restricted Work Area (RWA) is present within the October Creek North Investigation Area. No Regulated Activities are proposed in this area.
- The archaeological potential of the Study Area is low due to a paucity of water, suitable stone for tool manufacture, and other raw materials. Any sites which do exist are likely to be isolated artefacts or low-density artefact scatters reflecting transitory use of the landscape.
- The field surveys for Request Areas 1 and 2A, access tracks and borrow pit expansions within the Jibera South and Newcastle South Investigation Areas identified:
 - No historical heritage sites.
 - No Aboriginal archaeological sites.
 - Several Aboriginal resource plants which are common to the area.
- Traditional Owner representatives indicated that:
 - Survey effort was satisfactory in all proposed works areas.
 - The locations selected were suitable for construction.
 - No management measures were required for the resource plants.
- There are no impacts to known cultural heritage sites or AAPA sites based on the current disturbance footprint and CDZ, provided avoidance and mitigation requirements for CHAS01 are implemented.
- While the field survey did not identify any sites, there is some potential for unrecorded sites to exist in un-surveyed areas.

4.3.14.3 Cultural heritage management measures

On the basis of the above findings, the following cultural heritage management recommendations were made for the proposed Regulated Activities in the *Cultural Heritage Assessment* (Appendix L) :

- **Recommendation 1 – Avoid all heritage impacts**
 - Activities should be designed to avoid impacts to all cultural heritage sites.
- **Recommendation 2 – Additional permitting and approvals**
 - If impacts to any archaeological site cannot be avoided, including any unexpected finds not identified during this assessment, an Application to Carry Out Work should be prepared in consultation with Traditional Owners and the NT Heritage Branch.
- **Recommendation 3 – CHAS01 site extents**
 - The Project should avoid impact to CHAS01. No works (including vegetation removal, ground disturbance and vehicle or machinery movement), are permitted within the CHAS01 site extent or within a five metre buffer of the site. If works must occur in this area, recommendation two should be followed.
- **Recommendation 4 – CHAS01 buffer zone**
 - A 50metre cultural heritage buffer zone should be established around CHAS01. This buffer zone may exclude the disturbance footprint of the existing road and should be:
 - Established using high visibility ground markers (e.g. bunting and staking) visible to personnel on foot and operating vehicles and machinery.
 - Erected prior to work commencing, and maintained during the proposed activities.
 - Mapped in the EMP, and management requirements included in the EMP and inductions delivered to all site personnel.
 - No works should occur in the CHAS01 buffer zone. If works in the CHAS01 buffer zone cannot be avoided, Traditional Owners should undertake an archaeological clearance of the area prior to ground disturbance. Any works within the existing heavily disturbed areas (i.e. existing highway and access track) may proceed without any further assessment or implementation of any further management measures.
- **Recommendation 5 – Design changes**
 - Siting of the Project has been informed by survey results and predictive modelling and is considered low risk. Any changes to siting should be informed by the desktop assessment, predictive modelling and survey results.
- **Recommendation 6 – Provision of report to NT Heritage Branch**
 - A copy of this report should be provided to the NT Heritage Branch.
- **Recommendation 7 – AAPA Certificates**
 - The Project works should be carried out in accordance with the conditions of all relevant AAPA Certificates, including Authority Certificate C2020/011. Authority Certificates are a requirement for all regulated activities under the Petroleum (Environment) Regulations Act 2016 (NT) before Ministerial approval of an Environmental Management Plan for that activity. Santos should consult with AAPA regarding any changes to the Project or any Project works that are not included in any Authority Certificate issued for the Study Area.
- **Recommendation 8 – Management process**
 - Santos should ensure its existing cultural heritage management protocols meet legislative and NT Heritage Branch requirements and comply with all the conditions.
- **Recommendation 9 – Cultural Heritage Management Plan**
 - A Project CHMP is not required under the Draft Environmental factor guidance: Culture and heritage (2022) as no significant impacts to cultural heritage have been identified. However, Santos can consider developing such a document as recommended by Heritage Branch and Northern Land Council.
- **Recommendation 10 – Unexpected finds**

- *The Santos Limited Unexpected Heritage Finds Stop Work Procedure should be implemented for the duration of proposed works, noting the potential for unidentified cultural heritage within the Study Area. Any finds should be documented (described and photographed, and their coordinates captured with GPS), and records sent to the NT Heritage Branch and the NLC. The NLC has emphasised the importance of involving Traditional Owners in decisions about cultural heritage management measures, including new finds.*
- **Recommendation 11 – Site Inductions**
 - *Site inductions provided to all site personnel should outline any relevant cultural heritage no-go zones and the unexpected finds procedure.*
- **Recommendation 12 – Ongoing Access**
 - *Santos should ensure that required access to land subject to native title determination, including land that Traditional Owners must access to protect sacred sites, will be maintained throughout the Project, as per Section 4 of the Draft Environmental factor guidance: Culture and heritage (2022). Santos may reasonably restrict access due to Workplace Health and Safety requirements if appraisal, construction and operations have commenced.*

In response

Santos has considered the NLC's request to negotiate a Cultural Heritage Management Agreement (CHMA) (Section 5.4.2) and the Heritage Branch's recommendation regarding a consolidated Cultural Heritage Management Plan (CHMP). Santos considers that a standalone CHMA or CHMP is not required, given the limited activities proposed in this EMP, the minor nature of the potential environmental impacts associated with the activities and, in particular, the fact that the activities will not cause any significant impacts to cultural heritage. The following circumstances are also relevant to determining whether a CHMA or consolidated CHMP is a reasonable requirement to mitigate a perceived environmental risk:

- The cultural heritage assessments were undertaken consistent with the existing 2012 Cooperation and Exploration Agreement in consultation with the NLC and Traditional Owners, for identification of risks and risk mitigations for the proposed appraisal activities.
- The existing 2012 Cooperation and Exploration Agreement provides a robust framework for cultural heritage protection during exploration and appraisal phases.
- The current management measures, described above are commensurate with the activity's scale.
- Access will be maintained for Traditional Owners throughout the proposed Regulated Activities, subject to workplace health and safety requirements.

4.3.14.4 Cultural Heritage Management Plan

Santos acknowledges the NT Heritage Branch's recommendation regarding the potential benefits of a consolidated CHMP for future large-scale or complex developments on EP 161 and remains open to engaging with the Heritage Branch, NLC and Traditional Owners on this matter in the context of future proposals.

4.3.14.5 Future activities and further assessment

This EMP is strictly limited to the currently defined pads, tracks, and associated infrastructure assessed as part of the proposed Regulated Activities. Should Santos propose future expansion into unassessed areas of Jibera South, Newcastle South, October Creek North, or any other areas of EP 161, further archaeological and cultural heritage surveys would be required. Any such expansion would be subject to a new or revised EMP under the PER 2016, at which time additional heritage assessment requirements would be addressed.

4.3.14.6 Sacred sites and AAPA

Areas of significance for sacred sites as defined by the *Northern Territory Aboriginal Sacred Sites Act 1989* (NT) is considered through the process of securing an Authority Certificate from the Aboriginal Areas Protection Authority (AAPA). This process aims to prevent damage to, and interference with sacred sites, by identifying and setting out the conditions for entering and working on the land.

AAPA Authority Certificate C2014/053, Reference: 2013/2250 was granted in 2014 for the construction of up to 3 wells along with associated facilities and Vertical Source Profiling (VSP) seismic activities within EP 161. The

areas covered by AAPA Authority Certificate C2014/053 include the Mount Brown-1/2H and Inacumba-1/1H locations. However, although the existing Authority Certificate does allow for further exploration drilling and associated activities, all activity approvals requested under this EMP are proposed to be supported by an AAPA Authority Certificate C2019/043, as a variation to C2014/053. Most relevant to the current Project Area, is the issue of AAPA Authority Certificate C2020/011, specifically expanding the scope of cover to further exploration wells, well development and 2D seismic survey.

The C2020/011 certificate authorises activities for petroleum exploration inclusive of those listed within Section 3 of this EMP. The current activities are located outside of the identified restricted works areas and the terms of conditions of the AAPA Authority Certificates are incorporated into project planning.

4.4. Socioeconomic environment

There is a range of current land uses within the area including conservation, tourism, oil and gas exploration and pastoral activities.

The EP 161 lease overlays 2 Local Government Areas; Barkly Regional Council to the south, and Roper Gulf Regional Council to the north.

The Barkly Regional Council covers an area of 323,514 km² and has a population of approximately 7,531. The Barkly Regional Council includes the Barkly Tablelands, numerous Aboriginal land trusts and pastoral properties.

The Roper Gulf Regional Council covers an area of 186,000 km² and has a population of approximately 6,121. The region comprises 16 towns and communities of varying sizes, as well as major roadhouses, 22 outstations, and 50 pastoral properties.

The local area remains generally undeveloped in terms of infrastructure and roads. Major infrastructure within EP 161 includes the Carpentaria Highway and the Daly Waters to McArthur River gas pipeline, which run parallel with one another east-west through the southern half of the tenement. The McArthur River Mine is located approximately 100 km east of the Project Area.

The Carpentaria Highway is frequented as a tourist route in the dry season, both as a route to destinations around the Gulf of Carpentaria, and as a link between the NT and Queensland.

4.4.1. Settlements

The closest towns to the Project Area are Daly Waters (approximately 130 km to the west) and Borroloola (approximately 180 km to the east). The closest significant population centre is Katherine located approximately 350 km to the north-west.

5. Stakeholder engagement

5.1. Purpose and objectives

Santos' approach to stakeholder engagement proactively focuses on building respectful relationships with stakeholders. The Interest Holder seeks to ensure that stakeholders are fully informed of on-ground works through regular communication and consultation. The Interest Holder recognises that stakeholder engagement is integral to achieving its objectives.

Santos seeks to establish and maintain enduring and mutually beneficial relationships with the communities where it operates; ensuring that Santos' activities generate positive economic and social benefits for these communities.

The SMS details the requirements for appropriate communication and consultation mechanisms to achieve the above objectives. The standard includes requirements to establish and maintain communication links with employees, contractors and external stakeholders, including local communities, government agencies and other organisations. The SMS will be employed throughout this project.

A stakeholder engagement log documenting engagement associated with the Regulated Activities is attached at Appendix N.

Stakeholder engagement has been conducted in accordance with Regulation 7(2) of the PER.

5.2. Stakeholder identification

Regulation 7 (3) of the PER defines a Stakeholder as:

- A person or body whose rights or activities may be directly affected by the environmental impacts or environmental risks of the regulated activity proposed to be carried out; or
- An agent or representative or a person or body mentioned in the point above.

Using this definition, Santos has undertaken the following searches to identify stakeholders relevant to the Beetaloo Appraisal Pilot EMP:

- Review of relevant Santos and Santos Ltd database searches.
- Review of previously approved Santos EMPs for EP 161.
- Review of other interest holders identified in previously completed EMPs within the Beetaloo Basin.
- Desktop search of Spatial Territory Resource Information Kit for Exploration (STRIKE) - Department of Mines and Energy.
- Desktop search of Northern Territory's Natural Resource Maps – Department of Lands, Planning and Environment.
- Sacred site searches protected under relevant legislation and the parties involved in such agreements.
- Desktop search of Native Title determinations and claims available online.
- Previous Santos experience within EP 161.

The results from these enquiries have identified the following relevant stakeholders whose rights or activities may be directly affected by the environmental impacts or environmental risks of the Regulated Activities:

- Landholders, landowners and land occupiers (host pastoralist) - Rallen Australia Pty Ltd (Tanumbirini Station)
 - Native Title parties and stakeholders – facilitation via their representative bodies:
 - Northern Land Council (NLC)
 - Top End (Default PBC) Aboriginal Corporation
 - Nurrdalindi Aboriginal Corporation.
- Government Agencies / other interested parties –
 - Department of Logistics and Infrastructure (DLI) (owner of roads including Carpentaria Highway)
 - Power and Water Corporation (owner of third party pipeline)
 - Roper Gulf Regional Council (representative for local communities, land use and economic development within the region)
 - Telstra / Amplitel (owner / operator of a communications tower).

Santos has undertaken extensive steps to initiate stakeholder engagement and consult with pastoralists, Traditional Owners, and other interested parties whose rights or activities may be directly affected by the environmental impacts or environmental risks of the Regulated Activities.

5.2.1. Pastoralist engagement

Santos respects the established relationships with pastoralists across the Beetaloo Sub-basin, including within EP 161, which have been built through undertaking Regulated Activities in the area since 2013.

The Regulated Activities are located on Tanumbirini Station, which is the subject of a pastoral lease managed by Rallen Australia Pty Ltd. As the primary landholder and operational pastoralist, Rallen Australia was directly

engaged as a key stakeholder for this EMP. Engagement with the landholder has focused on maintaining safe coexistence between pastoral operations and petroleum activities, ensuring that land use requirements, livestock management practices, and infrastructure needs are understood and accommodated within the EMP. A current Land Access Agreement is in place with Rallen Australia Pty Ltd for the Regulated Activities.

Further details on Santos' engagement with Rallen Australia regarding the Regulated Activities are available in Section 5.3, Table 55 and *Stakeholder Engagement Log* (Appendix N).

5.2.2. Traditional owner(s) engagement

Santos regularly engages with the Traditional Owners across EP 161. The below section summarises the traditional owners and their agent or representative that are considered a stakeholder for this EMP. Further details on Santos' engagement with Traditional Owners regarding Regulated Activities are available in Section 5.3, and Table 55, and *Stakeholder Engagement Log* (Appendix N).

The Native Title Act 1993 (Cth) (NT Act) recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and custom. The NT Act allows for the making of ILUAs, which are voluntary agreements with Native Title Holders about the use and management of areas of land and/or waters.

5.2.2.1 Native Title determinations

5 Native Title determinations under the NT Act overlap EP 161. These define the holders of non-exclusive native title rights and interests over several areas of EP 161. The Native Title holders relevant to EP 161 are made up of many estate groups, their spouses and members of neighbouring estate groups. Membership of the estate groups is determined by patrilineal descent, or a person's mother, father's mother or mother's mother or having been a member of the group by reason of patrilineal descent or if a person has been adopted and incorporated into such a descent relationship. Collectively, these persons belong to the Alawa People. Native Title rights and interests are customary and ceremonial in nature and coexist with other land rights. This connection to EP 161 is relevant to the identification of whom is a stakeholder under the PER, wherever the Native Title holder's rights or activities may be directly affected by the environmental impacts and risks of the Project.

The determinations that overlap the Project Area for the Beetaloo Basin Appraisal Pilot EMP, are NTD33/2012 and NTD27/2010, as outlined in Table 53. In addition, the NLC, discussed below at Section 5.2.2, has also assisted with the identification of potentially affected Traditional Owners and Native Title holders.

Table 53: Determinations NTD33/2012 and NTD27/2010 estate groups

Native Title determination	Native Title holders	Relevant prescribed body corporate
NTD33/2012 (Tanumbirini Pastoral Lease)	(a) the Gyal Ambulya estate group; (b) the Gyal Muynmin estate group; (c) the Budal Labanga estate group; (d) the Murrungun Baluganda estate group, being the persons descended from the one apical ancestor, a late unnamed Aboriginal man; (e) the Mambali Ngubayin estate group; and (f) the Mambali Wungurrindjirr estate group; and (i) subject to the rights and interests of the abovementioned estate group members: (ii) members of estate groups from neighbouring estates; and (iii) spouses of the estate group members.	The Top End (Default PBC/CLA) Aboriginal Corporation RNTBC (TED PBC) was determined as the Prescribed Body Corporate for this determination on 27 October 2016.
NTD27/2010 (Beetaloo Pastoral Lease)	(a) the Karranjini group; (b) the Bamarnganja group; (c) the Warranangu group; (d) the Pinda (OT Downs) group;	The Top End (Default PBC/CLA) Aboriginal Corporation RNTBC (TED PBC) was determined as the Prescribed Body Corporate

	(e) the Lija/Muwartpi group. and (i) subject to the rights and interests of the abovementioned estate group members: (ii) members of estate groups from neighbouring estates; and (iii) spouses of the estate group members.	for this determination on 12 March 2015.
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5.2.2.2 Top End Default Prescribed Body Corporate

As set out in Table 53 above, the Top End Default Prescribed Body Corporate (TED PBC) is the relevant Prescribed Body Corporate in respect of each of the Native Title determinations relating to areas where the environmental impacts or risks of the proposed Regulated Activities may directly affect Native Title holders' rights or activities. The TED PBC was incorporated to perform the role of the registered native title body corporate for native title determinations as requested by the relevant Native Title holders. It has a role under the NT Act to manage and protect the determined native title rights and interests. As such, it is considered to be a representative body within the meaning of 'stakeholder' under regulation 7(3)(b) of the PER. Therefore, Santos have engaged with the TED PBC (as the relevant Registered Aboriginal and Torres Strait Islander Body for the area of EP 161) as individual stakeholders, facilitated via the Northern Land Council (NLC).

5.2.2.3 Northern Land Council

Santos have engaged with the NLC. The NLC is a 'stakeholder' pursuant to regulation 7(3)(b) of the PER, due to its role as a Recognised Aboriginal and Torres Strait Islander Body (RATSIB) under s 203AD of the NT Act.

The NLC is also the relevant Aboriginal Land Council established under the *Aboriginal Land Rights (Northern Territory) Act of 1976* (Cth) (ALR Act). The ALR Act provides for the establishment of Aboriginal Land Councils in the territory, with functions that include protecting the interests of Traditional Owners of, and other Aboriginals interested in, 'Aboriginal land' (as defined in section 3 of the ALR Act) in the area of the relevant Land Council. The functions of a Land Council also include ascertaining and expressing the wishes and the opinion of Aboriginals living in the area of the Land Council as to the management of such Aboriginal land in that area. For EP 161, the NLC is the relevant Land Council (being one of 4 Aboriginal Land Councils in the NT). The NLC has previously worked with Santos and other Santos Ltd entities in various contexts, including to facilitate consultation/engagement with Native Title holders for previous EMPs.

The NLC's status, knowledge and functions as a Land Council under the ALR Act and as a RATSIB makes it a reliable source of information about, and access to, Native Title holders and Traditional Owners whose rights or activities may be directly affected by the environmental impacts or environmental risks of the Project. Santos has engaged with the NLC to facilitate required engagement, such as the distribution of the information packs and coordination of the on-country meeting that was held on the 30th September 2025.

The Interest Holder determined through engagement with the NLC, and its prior understanding of the area covered by EP 161, that the Traditional Owner's engaged through the NLC have the cultural authority to:

- Consider and identify the cultural heritage values for EP 161 Project Area.
- Speak to the Interest Holder on their considerations.
- Provide guidance as to any potential issues with works being undertaken in the Project Area.

The Interest Holder maintains consistent engagement with Traditional Owners, ensuring that ongoing consultation (both present and future) is undertaken through the NLC in accordance with the Co-operation and Exploration Agreement. Santos and the NLC (on behalf of Traditional Owners over the permit areas) are parties to a 'Co-operation and Exploration Agreement'. This agreement details the steps, and terms and conditions necessary for exploration activities to be undertaken.

5.2.2.4 Nurrdalindi Native Title Aboriginal Corporation

Santos considers Nurrdalindi Native Title Aboriginal Corporation (NNTAC) a stakeholder in accordance with Regulation 7 of the PER as members of this corporation may be traditional owners, and as such Santos has and will continue to engage with the NNTAC.

Since 2021, the NNTAC have remained active in the area, regularly expressing an interest in petroleum onshore operations generally and specifically in relation to Santos' Regulated Activities on Tanumbirini Station, including observation of the ongoing Regulated Activities on the pastoral station. Stakeholder engagement in accordance with Regulation 7 has been attempted with the NNTAC on the 26th of June 2025, with no response received to date. A record of the consultation with the NNTAC is available in *Stakeholder Engagement Log* (Appendix N) and summarised in Section 5.3, and Table 55. Santos will maintain an open line of communication with the NNTAC for any ongoing consultation.

5.2.3. Other stakeholder engagement

5.2.3.1 Power and Water Corporation

The McArthur River Mine Pipeline (PL33), which conveys gas, intersects EP 161. The gas pipeline and pipeline corridor will be traversed by the existing access track to Newcastle South, and as part of works associated with the ongoing rehabilitation monitoring for the 2D seismic and ground gravity survey.

It has been assessed that the Regulated Activities will have negligible impacts on the pipeline, as interactions are limited to vehicle movements along the existing access track and rehabilitation monitoring along seismic lines. To avoid any overlap with pipeline maintenance activities and to maintain positive stakeholder relations, Power and Water Corporation was consulted for the purposes of this EMP and has raised no objections.

A record of consultation with Power and Water Corporation is available in *Stakeholder Engagement Log* (Appendix N) and summarised in Section 5.3 and Table 55.

5.2.3.2 Telstra (Amplitel as the asset owner)

A Telstra communications tower is in the vicinity of the Project Area and is immediately adjacent to previously rehabilitated 2D seismic lines; however, the Regulated Activities is not expected to impact or impinge on the tower. To avoid maintenance windows and maintain good relations with the facility owner, Telstra via Amplitel was engaged as a stakeholder.

A record of the consultation with Telstra is available in *Stakeholder Engagement Log* (Appendix N) and summarised in Section 5.3, and Table 55.

5.2.3.3 Department of Logistics and Infrastructure

The Carpentaria Highway will be used as an access and transport route to conduct the Regulated Activities. The function of the highway will not be impacted, however as an upgrade to the intersection to service Newcastle South may be required, the Department of Logistics and Infrastructure (DLI) was engaged as a stakeholder.

A record of the consultation with DLI is available in *Stakeholder Engagement Log* (Appendix N) and summarised in Section 5.3, and Table 55.

5.2.3.4 Roper Gulf Regional Council

The Roper Gulf Regional Council holds a strong interest in EP 161 due to the potential impact of the Regulated on local communities, land use, and economic development within the region. Given the scale and nature of the Project, impacts are not anticipated to the regional council's interests, however the Council has been engaged as a stakeholder.

5.2.4. Contact details of stakeholders

Table 54 and Table 55 provides a list of stakeholders who were contacted as part of the engagement process to inform the EMP.

Table 54: Stakeholder contact details

Stakeholder	Role / Position	Phone Number	Email / Other Contact
Pastoralist			
[REDACTED]	[REDACTED] Tanumbirini Station (Rallen Australia)	[REDACTED]	[REDACTED]
Northern Land Council and Traditional Owners / Top End (PBC Default)			
[REDACTED]	Branch Manager – Resources and Energy Branch	[REDACTED]	[REDACTED]
[REDACTED]	Senior Oil and Gas Specialist – Resource and Energy Branch	[REDACTED]	[REDACTED]
Nurrdalinji Native Title Aboriginal Corporation			
[REDACTED]	Secretary	[REDACTED]	[REDACTED]
Services			
Power and Water Corporation – [REDACTED] [REDACTED]	Office of CEO – Chief of Staff	[REDACTED]	[REDACTED]
Telstra (via Amplitel as tower asset owner) – [REDACTED] [REDACTED]	Tower Asset Manager	[REDACTED]	[REDACTED]
Department of Logistics and Infrastructure – [REDACTED] [REDACTED]	Office of CEO – Executive Office	[REDACTED]	[REDACTED]
Roper Gulf Regional Council	Customer Service	[REDACTED]	[REDACTED]

5.3. Stakeholder engagement details

Engagement with key stakeholders was undertaken during preparation of this EMP to ensure that all relevant landholders, Traditional Owners, statutory authorities, and service providers were informed of proposed appraisal activities and had adequate opportunity to provide feedback. Engagement was conducted in accordance with the requirements of the PER and the *NT Government Guideline: Stakeholder Engagement and Consultation* (2019).

A range of engagement methods were used including meetings, emails, phone calls, and on-country consultations to ensure effective communication tailored to each stakeholder group was delivered. Feedback received through this process was recorded, assessed for merit where relevant, and, where appropriate, incorporated into the EMP through design modifications, additional controls, or clarification of commitments.

Table 55 provides a summary of stakeholder engagement undertaken for the EMP, including the method of contact, key discussion points, responses received and Section 5.4 provides a summary of where an assessment of merit of a stakeholder's response has been undertaken and an update to the EMP has occurred. Tables 3 and 4 of Appendix N provide complete details of all items addressed in Table 55 and Section 5.4, having regard to the requirements of the PER.

Table 55: Stakeholder engagement - EMP

Date	Method	Stakeholder	Summary of communication	Stakeholder response date	Stakeholder response summary
Landholder / Pastoralist					
29 November 2025	Email	Rallen Australia	Overview of upcoming propped activities and draft schedule for the completion of the EMP, including anticipated engagement period.	N/A	No objections raised.
8 April 2025	Meeting	Rallen Australia	Project update: EMP scope introduced; discussed proposed infrastructure locations (access tracks, bore tests, well integrity tests) and upcoming work plans.	N/A	No objections raised.
20 June 2025	Email	Rallen Australia	Delivered EMP Appraisal Information Pack and invited comment.	1 July 2025	Landholder reviewed the pack and raised no objections or concerns.
15 July 2025	Meeting	Rallen Australia	On-property meeting to confirm access track locations and treatment; landholder advised proposed alignment conflicted with yards and requested track be realigned along western boundary of the front paddock.	3 September 2025	Investigated alternative access arrangement such as improved access track conditions.
3 September 2025	Phone Call	Rallen Australia	Call to discuss various options around proposed alternative access track location.	3 September 2025	LH provided further information on access track alignment impacts to his business. LH requested access track be moved to run along western boundary of the front paddock. Santos to work on options. Objected to sealing option previously discussed.
19 September 2025	Phone Call	Rallen Australia	Call from LH further discussion on access track location.	26 September 2025	In principle agreement to the preference for track to align on western fence of entrance paddock (confirmed via email). Refer to Section 5.4.1.
15 October 2025	Email	Rallen Australia	Email providing summary of feedback that has resulted in a change to the project.	N/A	No objections raised.
Northern Land Council and Traditional Owners / Top End (PBC Default)					

28 November 2024	Meeting	NLC / Traditional Owners	Meeting between key EP 161 Santos Team and NLC representatives – • EP 161 Work Program update • 2025/26 forward works program • EMP overview and engagement approach • Production Agreement.	28 November 2025	No objections recorded.
December 2024	Survey	NLC / Traditional Owners	Cultural heritage survey conducted with 8 Traditional Owners; findings presented in Cultural Heritage Assessment.	December 2024	No objections recorded.
23 January 2025	Email	NLC / Traditional Owners	Outlined priorities for NLC-related tenure for 2025 including EP 161 Appraisal EMP activities.	24 January 2025	NLC advised earliest Traditional Owner consultations in May 2025 and requested 2025 work program and indicative appraisal activities. Engagement schedule adjusted.
23 Jan – 24 Feb 2025	Email	NLC / Traditional Owners	Ongoing correspondence providing updates on 2025 Work Program and EMP; confirmation of an on-country meeting date.	24 February 2025	On-country meeting scheduled for 11 th June 2025. Engagement schedule adjusted.
25 Feb 2025	Email	NLC / Traditional Owners	Issuing of EP 161 Work Program.	3 October 2025	Confirmation of executed work program.
11 March 2025	Meeting	NLC / Traditional Owners	Meeting covering appraisal update, 2025/26 work program overview, EMP status/way forward, and AAPA/Heritage Branch engagement.	11 March 2025	No objections recorded.
7 May 2025	Email	NLC / Traditional Owners	Sought progress of EMP and 2025 Work Program. Noted change of on-country meeting to 31 July 2025.	10 June 2025	No objections recorded. Engagement schedule adjusted.
14 May 2025	Meeting	NLC / Traditional Owners	Provided high-level EMP summary; offered meeting with representatives; sought progress of EMP.	14 May 2025	No objections recorded.
18 June 2025	Email	NLC / Traditional Owners	Delivered EMP Appraisal Information Pack and invited comment.	20 June 2025	NLC arranging on-country meeting with Traditional Owners to discuss EMP and 2025/26 Work Program.
18 June 2025	Email	NLC / Traditional Owners	Provided draft Cultural Heritage Assessment which is to be included within EMP (informed from December 2024 field survey with TOs).	31 October 2025	Santos is confident that it has met its obligations to manage potential cultural heritage risks for Project activities in accordance with the PER and that a CHMA is not an obligation associated with the work sought to be

					authorised under this EMP. Further, current cultural heritage protection mechanisms for exploration and appraisal activities, including the activities proposed by this EMP, are defined and covered in the existing 2012 Cooperations and Exploration Agreement. Santos is however also committed to collaborating with the NLC and to consider developing a CHMA with relevant parties in the future. The Heritage report has been updated in response to NLCs comments / clarifications, and a response provided via email.
9 July 2025	Email	NLC / Traditional Owners	Advised postponement of 31 July on-country meeting due to sorry business.	9 July 2025	Meeting postponed to 21 August 2025.
15 July 2025	Meeting	NLC / Traditional Owners	Introduced new lead; discussed on-country presentation expectations, liaison committee, and status of Nurrdalinji/Alawa engagement; requested draft EMP.	15 July 2025	Key concern identified as water protection; requested focus on water use/management; ILUA discussions to commence for beneficial use of gas.
5 August 2025	Email	NLC / Traditional Owners	Follow-up regarding August on-country engagement meeting details.	5 August 2025	On-country engagement postponed to September. Engagement schedule adjusted.
6 August 2025	Email	NLC / Traditional Owners	Provided early slide presentation draft for on-country engagement.	7 August 2025	Feedback provided at meeting: presentation length/structure to be reduced; water usage table to be moderated; cosmetic adjustments required.
7 August 2025	Meeting	NLC / Traditional Owners	Follow-up discussion on EMP, focus on water concerns and on-country engagement.	7 August 2025	Adjustments made to early draft of presentation materials. Concerns related to volumes of water use proposed. Santos response was EMP shows worst case scenario.
28 August 2025	Email	NLC / Traditional Owners	Confirmed planning for 30 September on-country engagement, including location and logistics.	28 August 2025	No objections recorded.
5 September 2025	Email	NLC / Traditional Owners	Provided EMP draft by email; sought confirmation on on-country engagement logistics and meeting availability.	7 October 2025	Receipt acknowledged; further details to be confirmed. Comments on EMP draft received.
10 September 2025	Meeting	NLC / Traditional Owners	Provided 2 hard copies of EMP draft; discussed EMP and on-country logistics; water usage reviewed with concern that earlier materials reflected worst-case rather than realistic use; AAPA certificates discussed.	10 September 2025	No formal objection recorded; feedback to refine water usage presentation and logistics.

16 September 2025	Email	NLC / Traditional Owners	Provided draft slide presentation and requested cultural monitors for revised access track.	17 September 2025	Slide presentation acknowledged; attendance for on-country engagement provided.
30 September 2025	Meeting	NLC / Traditional Owners	On-country meeting with Traditional Owners to present 2025/26 Work Program and key EMP elements, with focus on protection of water, land and culture.	30 September 2025	No objections recorded.
28 th October 2025	Email	NLC / Traditional Owners	NLC to Santos.	28 October 2025	Emailing confirming NLC and TEDAC role in the engagement with traditional owners.
5 November 2025	Email	NLC / Traditional Owners	Email providing responses to NLC comments on draft heritage assessment report and EMP.	N/A	No objections recorded.
NurrDALINJI Native Title Aboriginal Corporation					
26 June 2025	Email	NurrDALINJI Aboriginal Corporation (NAC)	Delivered EMP Appraisal Information Pack and invited comment.	N/A	No response recorded.
7 July 2025	Email	NurrDALINJI Aboriginal Corporation (NAC)	Follow-up to confirm receipt of information pack.	N/A	No response recorded.
17 July 2025	Phone Call	NurrDALINJI Aboriginal Corporation (NAC)	Follow-up call to confirm information pack received.	N/A	Call unsuccessful; no response recorded.
Telstra / Amplitel					
25 June 2025	Email	Telstra / Amplitel	Delivered EMP Appraisal Information Pack and invited comment; Amplitel (as asset operator of tower) requested project location relative to asset and stated access to structures must not be impeded.	16 September 2025	Requirement noted; mitigation included to ensure cell-tower access remains unrestricted during works.
Power and Water					
20 June 2025	Email	Power and Water	Delivered EMP Appraisal Information Pack and invited comment.	N/A	Response received, no objections on proposal.

DLI					
20 June 2025	Email	DLI	Delivered EMP Appraisal Information Pack and invited comment.	N/A	Response received, no objections on proposal.
Roper Gulf Council					
20 June 2025	Email	Roper Gulf Council	Delivered EMP Appraisal Information Pack and invited comment.	N/A	No response recorded.

5.4. Assessment of merit of objection or claim

Stakeholder engagement was undertaken with all relevant Interest Holders during preparation of this EMP. Feedback received through the engagement process directly informed the content and mitigation measures within this EMP. Key stakeholder responses and the resulting amendments are summarised below.

5.4.1. Landholder

During engagement, the Landholder raised concerns regarding the location of the proposed access track in relation to livestock management activities and existing infrastructure. Specifically, the landholder requested the access track be relocated to the western boundary of the front paddock to minimise disturbance near the cattle yards.

- **Assessment of merit:** The objection was assessed as reasonable, with potential for operational impacts to the pastoral business if the original alignment was maintained.
- **Response and outcome:** The EMP has been updated to adopt the alternative track alignment proposed by the Landholder. This revision avoids potential interference with pastoral operations and reflects a mutually agreed solution incorporated into the approved footprint

5.4.2. Northern Land Council

During engagement, the NLC requested that a Cultural Heritage Management Agreement (CHMA) be negotiated to ensure that any areas or objects of cultural significance are identified and appropriately managed. Santos has followed an assessment of heritage values consistent with the NT's *draft Environmental Factor Guideline – Culture Heritage*, including field cultural heritage surveys to support the appraisal activities.

- **Assessment of merit:** The request was assessed as reasonable and consistent with regulatory expectations under the *Heritage Act 2011* (NT) and the *Aboriginal Land Rights (Northern Territory) Act 1976*. Project activities occur within a culturally sensitive landscape, and the establishment of a CHMA provides an appropriate mechanism for avoiding or mitigating potential heritage impacts.
- **Response and outcome:** Santos is confident that it has met its obligations to manage potential cultural heritage risks for the proposed activities in accordance with the PER and that a CHMA is not an obligation associated with the work sought to be authorised under this EMP. Further, current cultural heritage protection mechanisms for exploration and appraisal activities, including the activities proposed by this EMP, are defined and covered in the existing 2012 Cooperations and Exploration Agreement. Santos is however also committed to collaborating with the NLC and to consider developing a CHMA with relevant parties in the future.

5.4.3. Telstra / Amplitel

Telstra, (via Amplitel as the service provider) has telecommunications infrastructure within the vicinity of the Project Area and requested assurance that access to their structures would not be impeded during operations.

- **Assessment of merit:** The concern was considered valid given the proximity of the site to operational telecommunications assets to rehabilitation of previously disturbed seismic lines.
- **Response and outcome:** A specific mitigation measure has been included in the EMP in the risk assessment (Appendix O) stating that "Access to the Amplitel cell tower will not be impeded by the activity." This measure ensures continued access to telecommunications infrastructure throughout the project lifecycle.

5.4.4. Assessment of merit – summary of outcomes

Feedback from stakeholders which has directly shaped the EMP are:

- **Revision of infrastructure layouts:** Relocation of the access track to accommodate pastoral operations.
- **Cultural Heritage Protection Measures:** Santos commits to collaborating with the NLC with a view to developing a CHMA in the future. Santos is confident that it has met its obligations to manage potential

cultural heritage risks posed by for the proposed Regulated Activities in accordance with the PER. Further, current cultural heritage protection mechanisms for exploration and appraisal activities, including the Regulated Activities proposed by this EMP, are defined in the existing 2012 Cooperations and Exploration Agreement.

- **Enhanced Commitments:** Inclusion of a management commitment to maintain Telstra (Amplitel) infrastructure access.

These amendments demonstrate that engagement outcomes have been appropriately considered, assessed, and integrated into the final EMP to address stakeholder concerns and regulatory expectations.

5.5. Ongoing engagement

Before any land access or the Regulated Activities commences, Santos will notify all owners and occupiers of land. Santos will also uphold and respect any specific requirements for notification and engagement under an executed agreement (e.g., Co-operation and Exploration Agreement between the Native Title holders, NLC and/or LAA).

During the Regulated Activities, Santos will have field representatives in the vicinity. Field-based representatives will be the primary point of contact for all landholders and community members during the work phases. Field representatives will manage the day-to-day Regulated Activities and communications concerning the landholders to ensure they are consistently updated on the Regulated Activities status.

Stakeholders will have direct access to a company representative based in an office location who has existing relationships and is familiar with the agreements required to conduct the Regulated Activities under this EMP.

Santos takes a proactive engagement strategy in its NT operations to ensure that stakeholders are consistently engaged and informed. Santos' ongoing strategy for respectful engagement is to maintain availability to inform stakeholders of current operations, review past operations' status and findings, and communicate plans for any potential future operations.

Where stakeholders have requested, or Santos believes it would be beneficial to engage with stakeholders on an ongoing basis during the Regulated Activities, communications will continue until the Regulated Activities have concluded.

6. Environmental risk and impact assessment

6.1. Introduction

The central concepts in the PER are environmental risk and environmental impact. This section details the approach and methodology used to assess the potential environmental risks and impacts associated with the proposed Regulated Activities.

Environmental risk is defined in the PER as 'the chance of something happening that will have an environmental impact, measured in terms of the environmental consequences and the likelihood of those consequences occurring'.

Environmental impact is defined in the PER as '*any adverse change, or potential adverse change, to the environment resulting wholly or partly from a regulated activity.*'

Environmental risks and impacts are inherent in onshore oil and gas activities, and without control measures, environmental impacts may arise. The PER requires detailed assessment, reduction and control of environmental risks and impacts through the development and implementation of the EMP for the regulated activity. This section provides an overview of the environmental risk assessment process, and presents the environmental risk and impact assessment for the Regulated Activities described in Section 3.

6.2. Environmental risk assessment process

The interactions between the proposed Regulated Activities and the existing environment are sources of risk that have the potential to result in a change to the environment (an impact).

An environmental risk assessment involves the assessment of the likelihood and consequence of these impacts. An EMP must demonstrate that the environmental risks and impacts will be reduced to a level that is ALARP and acceptable.

ALARP involves determining if all reasonably practicable measures are in place to control a potential risk or impact, considering the level of consequence and the proportionate impact of cost, time and resources involved to mitigate it.

To determine whether potential environmental risks and impacts are 'acceptable' depends on issues such as the nature and scale of impacts and the social or economic benefits of the activity. The PER requires the Minister to take into account the principles of Ecologically Sustainable Development (ESD) when considering whether the EMP meets the approval criteria set out in the PER. ESD requires that the principles of inter-generational equity, maintenance of biological diversity and ecological processes are considered.

An environmental risk assessment of the proposed Regulated Activities (see Section 3) in the context of the Project Area's existing environment (see Section 4) has been undertaken using the risk assessment framework as set out in the SMS.

To meet the requirements under the PER, this framework is based on the principles of Australian Standards (AS/NZS ISO 31000:2018 Risk Management and HB 203:2012 Managing environment-related risk). The risk assessment process is outlined in Table 43.



Figure 43: Framework for environmental risk assessment

The environmental risk assessment for the proposed Regulated Activities has been undertaken based on the assumption that the management practices that are discussed in this EMP are in place (i.e. the risk assessment presents the residual risk following implementation of control measures).

- The potential for risk to the environment as a result of the proposed Regulated Activities has been assessed using:
- 6 levels of environmental consequence to describe the severity, scale and duration of potential impacts.
- 6 levels of likelihood of potential environmental consequences occurring. The likelihood refers to the probability of the particular consequences of an event eventuating, rather than the probability of the event itself occurring.
- A risk matrix to characterise the resultant risk into one of 5 levels.

6.3. Environmental factors, risk source and potential impacts

A review of the existing environment (Section 4) has been undertaken to identify the environmental factors of relevance to the Project Area. The environmental factors that may be affected have been identified using the *NT EPA Environmental Factors and Objectives 2025* (NT).

Following the identification of the environmental factors, the activity and key risk have been identified and are summarised in Table 56. The assessment of these environmental factors can be found in the Risk Assessment (Appendix O).

Table 56: Summary of key environmental risks

Theme	Environmental Factor	Risk Source	Key Risks
Land	Landforms	• Site preparation • Clearing and earthworks • Ancillary Infrastructure.	• Earthworks resulting in disruption of natural drainage lines, impacting land use and productivity. • Civil works such as grading, excavation and soil removal affecting the localised landforms.
	Terrestrial environment quality	• All Activities.	• Use of heavy machinery and increase use of light vehicles causing compaction of soil. • Borrow pit excavation altering drainage patterns, causing erosion. • Increased erosion and sediment release from cleared infrastructure during project operations. • Disturbed areas are not appropriately rehabilitated. • Naturally occurring radioactive materials (NORM) in flowback fluids and/or radioactive tracers in cuttings. • Incorrect Management of residual drilling mud and cutting disposal. • Handling, use and transportation of hazardous chemicals and dangerous goods. • Spills of fluids, additives and chemicals to land from refuelling and equipment. • Irrigation of treated effluent in an area where it can enter a waterway or cause water logging. • Uncontrolled release of general waste.
	Terrestrial ecosystems	• Site preparation • Clearing and earthworks • Wastewater Management. • Ancillary Infrastructure.	• Disturbance of vegetation, habitat loss, or reduced habitat quality if appraisal activities are conducted in or near sensitive ecological communities. • Decrease in habit quality and quantity through clearing of key ecological communities. • Entrapment of fauna or stock in open water bodies e.g. clean water storage – dams.

			Spread of biosecurity risk material (e.g., weed and seed) to, or within the Project Area during operations.
Water	Hydrological processes	All Activities.	- Temporary drawdown of aquifers due to the operational water demand (i.e. 750 ML per year). - Uncontrolled release due to flooding or overland flow impacting drilling sumps/mud storage locations, flowback storage and other onsite water management. - Inadequate barriers applied during well suspension or decommissioning.
	Inland water environmental quality	All Activities.	- Uncontrolled release of gas or fluid to surface waters or aquifers. - Cross contamination between aquifers through inappropriate barrier controls and implementation. - Cross flow between hydrocarbon reservoirs and aquifers through water stimulation fracturing allow migration of fluids between geological layers. - Drilling of water bores through aquifers may create pathways for fluid migration between formations. - Poorly managed chemical additives for drilling resulting in spills or subsurface contamination. - Uncontrolled release to surface due to barrier failure. - Loss of containment of produced completions fluids. - Overflow of drilling by-product storage pit, flowback tanks, or failure of embankment from rain inundation.
	Aquatic ecosystems	- Wastewater management - Groundwater extraction	Potential impacts to GDEs and stygofauna due to groundwater drawdown and/or groundwater quality changes.
Air	Air quality	- Site preparation - Clearing and earthworks - Ancillary Infrastructure.	Nuisance (dust) from the Regulated Activities, inc. vehicle movements and construction-related works.
	Atmospheric processes	All Activities.	Greenhouse gas emissions from land clearing operations, fugitive emissions, venting and flaring.
People	Community and economy	- Site preparation - Drilling - HFS/testing - Well operations - Ancillary Infrastructure.	- Drilling operations causing landholder nuisance due to elevated noise and increase light emissions. - Nuisance caused from continuous 24 hour, 7 day a week HFS from potentially elevated noise levels and light emissions. - Production testing flaring generating continuous noise from activity. - Increased heavy and light vehicle movements causing greater interactions with the community, livestock and fauna. - Loss of rural amenity due to the introduction and increase of petroleum infrastructure. - Increased personnel working within the region.
	Culture and Heritage	- Site preparation - Clearing and earthworks - Ancillary Infrastructure.	Disturbance or damage to artefacts and / or cultural heritage sites.

	Human health	All Activities	Bushfire caused by project activities impacting on life and property.
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6.3.1. Determination of severity of consequences

The potential level of impact (consequence) was assessed using Santos Ltd Environmental Consequence Classification from the Santos Ltd Risk Matrix (Table 57). The consequence level for each environmental impact or risk is documented in the risk assessment (Appendix O).

Table 57: Santos Ltd risk matrix environmental consequence classification

Level	Environment
1	No impact to EV(s).
2	Small-scale impact to EV(s) of conservation significance. Potential surface or groundwater impact.
3	Moderate-scale impact to EV(s) of conservation significance. Localised surface or groundwater impact.
4	Large-scale impact to EV(s) of conservation significance. Moderate-scale surface water impact. Localised impact to groundwater with potential or known beneficial use.
5	Extensive population or community scale impact to EV(s) of conservation significance. Extensive impact to other EV(s).
6	Irreversible Impact to Environmental Values (EV).

Notes for EVs:

- Environmental Values (EVs) includes flora and fauna species (terrestrial and aquatic), populations and habitats, vegetation, water resources (surface water, groundwater and marine), soils and landforms.
- The assessment depends upon the nature of the receiving environment. Therefore, not all elements under each category will be applicable.
- A conservation significant value is subject to legal protection through regulation or has been identified as a priority by government in terms of special protection or management.
- The Environment category does not capture non-compliance with regulatory requirements or external reporting triggers. These should be assessed under the Compliance category.
- For Environmental costs (including short-term clean up, Environmental Incident Response costs, penalties & fines, total/lifecycle rehabilitation, monitoring and remediation/disposal) use financial consequence.

6.3.2. Determination of likelihood

Likelihood relates to the potential for a consequence to occur. This includes the likelihood of an event occurring and the subsequent potential consequence. This is defined using the Santos Ltd Likelihood Descriptors (Table 58) from the Santos Ltd Risk Matrix and as completed in Appendix O (Risk Assessment).

Table 58: Santos Ltd likelihood descriptors

Level	Likelihood	Criteria
F	Almost Certain	<4 monthly. Occurs frequently.
E	Likely	4 monthly – 1 yearly. Could occur within the annual plan.
D	Occasional	1 – 3 yearly. Could occur within the 3-year plan.

C	Possible	3– 10 yearly. Could occur within the 10-year, long term plan.
B	Unlikely	10 – 30 yearly. Not expected to occur, known to have occurred elsewhere.
A	Remote	30 – 100 yearly. Required exceptional circumstances and is unlikely even in the long term.

6.3.3. Pre-treatment risk ranking

Risk is expressed in terms of a combination of the likelihood of an event occurring and the environmental consequences of an impact. These factors are set out in the Risk Matrix in Figure 44.

As part of the risk assessment process, a pre-treatment risk ranking has been determined to assist with the level of controls required to reduce the risk or impact. Pre-treatment risk is determined by the combination of likelihood and consequence classification using the Risk Matrix.

The assessment of environmental risk depends on the nature of the receiving environment. Therefore, not all elements under each category will be applicable.

Consequence	Safety		Negligible Harm + No bodily damage or minimal harm or impairment (hours to days)	Minor Harm + Short term impairment (days to weeks)	Moderate Harm + Temporary disablement or medium-term impairment (weeks to months)	Severe Harm + Long term/life altering disablement or impairment	Single Fatality OR Critical Life Threatening Injuries	Multiple Fatalities
	Environment		+ No impact to Environmental Value (EV).	+ Small-scale impact to EV(s) of conservation significance + Potential surface or groundwater impact.	+ Moderate-scale impact to EV(s) of conservation significance + Localised surface or groundwater impact.	+ Large-scale impact to EV(s) of conservation significance + Moderate-scale surface water impact; + Localised impact to groundwater with potential or known beneficial use.	+ Extensive population or community scale impact to EV(s) of conservation significance + Extensive impact to other EV(s).	+ Irreversible impact to EV(s).
	Community & Reputation		+ No actual or potential community criticism + Details remain within Santos sites and/or offices	+ Minor level local community criticism (< week) + No reputation impact	+ Local community criticism (> week) or one-day community protest + Local company reputation impacted	+ State-level community criticism or protest over multiple days/locations + State-based company reputation impacted + Very short-term share price impact (< week)	+ National community criticism or large scale protest + Company reputation and approvals impacted + Shareholder intervention or short-term share price impact (< month)	+ Sustained national community criticism or widespread protest + Industry reputation and approvals impacted + Changes at executive/board level or long-term share price impact (> month)
	Financial (A\$)		< \$100k	\$100k to \$1m	\$1m to \$10m	\$10m to \$100m	\$100m to \$500m	> \$500m
	Workforce		+ Will require some staff attention over several days. + No actual or potential impact to culture	+ Will require several days local management time. + Minor impact to employee engagement and limited staff turnover	+ Will require head office staff and take several weeks of site management time. + Moderate impact to employee engagement and staff turnover above industry average with some key roles	+ Will require several weeks of senior management time + Impact to employee engagement (< 6 months), moderate turnover of key roles and no succession	+ Will require several months of senior management time + Impact to employee engagement (< 18 months), high staff turnover and attraction issues	+ Will require more than a year of senior management involvement and operations severely disrupted + Impact to employee engagement (> 18 months), significant key role turnover and attraction issues
	Compliance		+ Non-conformance with legislation, instruments (e.g. tenure licence) or contract + No regulatory or punitive action	+ Minor breach of legislation, instruments or contract + Notification/report to; request for information by; and/or administrative/warning notice from the regulator + LOCI Tier 3 or non-hydrocarbon releases notifiable to the regulator	+ Limited number of minor breaches of legislation, instruments or contract + Statutory notice from the regulator + LOCI Tier 2 or non-hydrocarbon releases immediately reportable to the regulator	+ Systemic minor breaches (or one moderate breach) of legislation, instruments or contract + Company charged with an offence with minor penalty/fine + LOCI Tier 1 or cumulative regulator notification of non-hydrocarbon releases	+ Systemic moderate breaches (OR single material breach) of legislation, instruments or contract + Company charged with an offence with moderate penalty/fine	+ Material breaches of legislation, instruments or contract + Company or officers charged with an offence with material penalty/fine, or loss of tenure/operatorship
			I	II	III	IV	V	VI
Likelihood	ALMOST CERTAIN (< 4 monthly) Occurs frequently	f	Low	Medium	High	Very High	Very High	Very High
	LIKELY (4 monthly - 1 yearly) Could occur within the annual plan	e	Low	Medium	High	High	Very High	Very High
	OCCASIONAL (1 - 3 yearly) Could occur within the 3-year plan	d	Low	Low	Medium	High	High	Very High
	POSSIBLE (3 - 10 yearly) Could occur within the 10-year, long term plan	c	Very Low	Low	Low	Medium	High	Very High
	UNLIKELY (10 - 30 yearly) Not expected to occur; known to have occurred elsewhere	b	Very Low	Very Low	Low	Low	Medium	High
	REMOTE (30 - 100 yearly) Requires exceptional circumstances and is unlikely even in the long term	a	Very Low	Very Low	Very Low	Low	Medium	Medium

Figure 44: Santos Ltd risk matrix

6.3.4. Residual risk rating

Following the identification of mitigations, the risk is assessed again in terms of the combination of the likelihood of an event occurring and the consequence of an impact. This risk is known as the residual risk rating.

Once the residual risk rating is determined, the magnitude of the risk may be used to evaluate if further action may be required to ensure the risk is reduced to ALARP and acceptable levels.

6.4. Risk determination and the Code

The purpose of the Code is to ensure that petroleum activities are managed according to minimum acceptable standards to ensure that risks are managed to a level that is ALARP and acceptable. The Code of Practice is mandatory and will be implemented during all stages of this activity.

The Code identifies industry standards, good and acceptable industry practice and mandatory requirements for the conduct of petroleum activities and will ensure on compliance with their obligations under the NT's petroleum legislation.

6.4.1. Control measure identification and ALARP decision framework

Based on the identified impacts, control measures were identified in accordance with the defined environmental outcomes, to eliminate, prevent, reduce or mitigate consequences associated with each of the identified environmental impacts. Control measures were identified through review of previous activities, in workshops (involving various subject matter experts relevant to this assessment) and through review of best practice techniques across the industry. When determining whether the risk or impact has been reduced to ALARP, it must be considered whether environmental risks can be lowered further without a grossly disproportionate increase in impost.

Santos' approach to this assessment is based on the *Oil and Gas UK's 'Guidance on Risk Related Decision Making'*. This framework considers impact severity and several guiding factors to achieve ALARP risk reduction demonstration:

- Activity type
- Risk and uncertainty
- Stakeholder influence.

This framework provides appropriate tools, commensurate to the level of uncertainty or novelty associated with the impact or risk (referred to as the Decision Type A, B or C). Decision types and methodologies to establish ALARP are outlined in Figure 45.

Decision context	Factor	A	B	C
	Type of Activity	Nothing new or unusual Represents normal business Well-understood activity Good practice well-defined	New to the organisation or geographical area Infrequent or non-standard activity Good practice not well defined or met by more than one option	New and unproven invention, design or development or application Prototype of first use No established good practice for whole activity
	Risk and Uncertainty	Risks are well understood Uncertainty is minimal	Risks amenable to assessment using well-established data and methods Some uncertainty	Significant uncertainty in risk Data or assessment methodologies unproven No consensus amongst subject matter experts
	Stakeholder Influence	No conflict with company values No partner interest No significant media interest	No conflict with company values Some partner interest Some persons may object May attract location media attention	Potential conflict with company values Significant partner interest Pressure groups likely to object Likelihood of adverse attention from national or international media
Assessment technique	Good Practice			
	Engineering Risk Assessment			
	Precautionary Approach			

Figure 45: Impact and risk 'uncertainty' ALARP decision making framework

6.4.2. Determination of impact and risk acceptability

The model Santos used for determining acceptability of residual risk is detailed in the Santos Ltd Residual Risk Acceptance Model in Figure 46.

In summary:

- A residual risk level of Very High is intolerable; the operation / activity must cease immediately following verification of the risk level and the operation / activity cannot recommence until the residual risk is High or below.
- A residual risk level of Low – High is acceptable provided that ALARP has been achieved and demonstrated.
- A residual risk level of Very Low is deemed to be acceptable and ALARP.

In addition to the requirements detailed above, for the purposes of petroleum activities, impacts and risk to the environment are considered broadly acceptable if:

- The residual risk is determined to be 1 (and ALARP Decision Type A selected, and good practice control measures applied), or
- The residual risk is determined between 2 and 4 and ALARP can be demonstrated; and
- The following have been met:
 - Principles of ecologically sustainable development.
 - Legal and other requirements.
 - Santos and Santos Ltd's applicable policies and standards.
 - Stakeholder expectations.

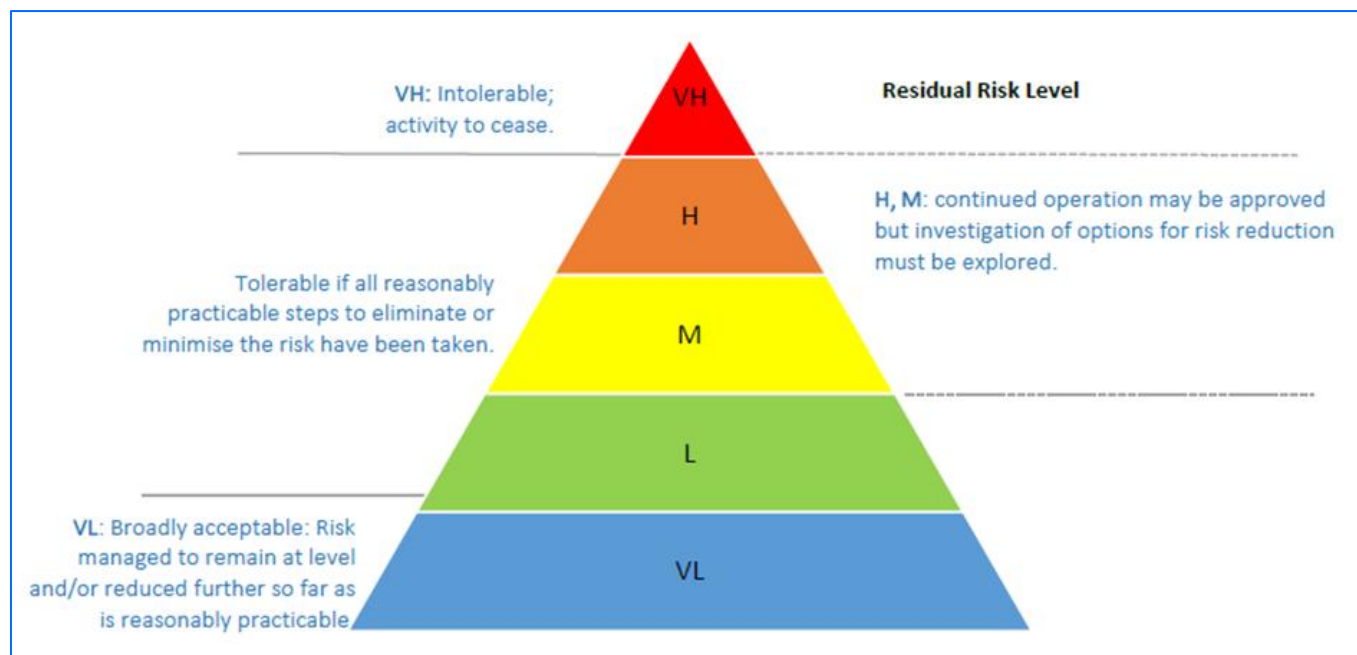


Figure 46: Santos Ltd residual risk acceptance model

6.4.3. Scientific uncertainty

The *Petroleum (Environment) Regulations* require an assessment of Scientific Uncertainty. The evaluation of potential impacts and effectiveness of controls must demonstrate that the works are carried out according to the ecologically sustainable development (ESD) principles to ensure that all works conducted do not impact the environment's future amenities.

Uncertainty is high where confidence in the available information is low in identifying risk or the effectiveness of a management control. Per EMP Guidelines, scientific certainty is qualitatively assessed using a generic means of ranking the data available in Table 59.

Table 59: Acceptability and scientific uncertainty

Score (uncertainty type)	Uncertainty description [EFSA, 2009]
Low	Comprehensive data with strong evidence in multiple peer-reviewed data. Little disagreement between authors or experts. Considerable and consistent on-ground experience and/or monitoring.
Medium	Some or incomplete data is available. Evidence provided based on a small number of references. Authors' and experts' conclusions vary. Limited on-ground experience and/or monitoring.
High	Scarce or no data available; evidence provided in unpublished reports. Few on-ground observations. Authors' and experts' conclusions vary considerably.

An *Environmental Risk Assessment* (Appendix O) has been included within this EMP, which identifies the scientific uncertainty associated with each environmental risk identified above in Section 6.3. All risks, except 3, were identified as having a Low scientific uncertainty. The risks identified as a medium scientific uncertainty are;

- Drilling activities and cross contamination between aquifers.
- HFS activities and cross contamination between aquifers.
- Water use requiring extraction and drawdown of beneficial use aquifers.

6.4.4. Independent Expert Scientific Community advice

The Independent Expert Scientific Community (IESC) was requested by the Australian Government Minister for Environment and Water, to provide advice on the potential impacts and/or risks to water resources and water dependent matters of national environmental significance arising from potential unconventional gas exploration and appraisal activities in the Beetaloo Basin.

The IESC identified groundwater drawdown from wells supplying water for HFS as the primary potential impact on water resources. Additional risks include accidental spills of chemicals or flowback wastewater, and failures of well integrity (IESC, 2024).

Acknowledging these findings, the IESC concluded that if best practices are followed, the risks to water resources are considered low. The IESC emphasised that these risks can be effectively mitigated through stringent environmental management practices. The committee's advice underscores the importance of adhering to the CoP – Well Integrity, the Code and obtaining and complying with a WEL. Santos has designed the appraisal pilot to include proven industry best practice mitigation strategies and controls to minimise the potential (minor) impacts to water resources. These are included in the *Risk Assessment* (Appendix O).

6.4.5. Discussion on ALARP, acceptability and ESD

All the residual risks in the environmental risk assessment (Appendix O) have a residual risk of very low to low, which means that they are acceptable, ALARP and have considered ESD.

In the risk assessment, all risks have either been considered a decision 'Type A', meaning that the majority of risks are well understood and that there are established practices in place to manage these risks, or those considered 'Type B' risks, have applied best practice mitigations to mitigate any scientific uncertainty.

Activities conducted under this EMP will be implemented in compliance with the *Code of Practice: Petroleum Activities in the Northern Territory* and the *CoP – Well Integrity*. This ensures that petroleum activities are managed to ensure that risks are managed to a level that is ALARP and acceptable.

6.5. Environment risk assessment

A comprehensive evaluation of environmental, cultural, and social risks associated with the proposed Regulated Activities has been undertaken using the Santos methodology described above. This process systematically assessed potential impacts arising from planned and unplanned events associated with the activity, including but not limited to drilling, hydraulic fracturing, and associated site operations. The results of the risk assessment for all aspects of the Regulated ActivityProject can be found in the Risk Assessment (Appendix O) of this EMP.

Each potential impact scenario was evaluated in terms of both likelihood and consequence, and assigned a residual risk rating after the application of proposed mitigation measures. The risk assessment has considered and addressed a range of key risks, including:

- Groundwater protection through following best practice approaches such as the *Northern Territory 2025 Code of Practice – Well Integrity*.
- Preventing loss of containment failures through chemical management, wastewater handling, and well integrity principles.
- Controlling wastewater generated during drilling and hydraulic fracturing operations.
- Reducing the risk of bushfires in and around project areas.
- Preserving cultural heritage, particularly in cases of unexpected discoveries.
- Protection local ecology through minimising habitat loss, avoiding sensitive vegetation and fauna habitats.
- Implementing measures for erosion and sediment control.
- Management of amenity impacts to the local sensitive receivers.
- Preventing the spread of invasive weed species.
- Ensuring GHG emissions are reduced to ALARP.
- Managing operational traffic stakeholder impacts.

It was concluded that with the proposed mitigation measures in place, all identified risks will be reduced to low or very low and acceptable levels (see Table 60). There were no medium, high or very high residual risks remaining.

Table 60: Summary of residual risk ratings

Environmental Risk Rating	Very Low	Low	Medium	High	Very High
Number	16	21	0	0	0

This assessment demonstrates that the risk of unacceptable environmental impacts associated with the proposed Regulated Activities will be reduced to ALARP and acceptable levels. To achieve this objective, the Regulated Activities will be carried out in such a manner so that all the requirements of the Code will be met, and all reasonably practicable risk management controls have been identified and will be implemented as described in *Risk Assessment* (Appendix O).

6.6. Cumulative impacts

In accordance with Schedule 1, clause 3 (b) of the PER, an EMP must include the cumulative effects of the environmental risks and impacts of the regulated activity when considered together and in conjunction with any other activities or events that occurred or may occur in or near the Project Area for the proposed Regulated Activities

Table 61 presents a list of currently approved EMPs for other proponents included in the cumulative impact assessment, while Table 62 includes both Santos and third-party activities and summarises the related activity details that informed the assessment of cumulative impacts. Where activity details were not presented in the respective EMP, estimates have been calculated based on similar projects.

Table 61: Approved EMPs included in the cumulative impact assessment

Interest Holder	EP	Site	Approved EMPs
Santos	EP 161	Mt Brown / Inacumba	• STO 7-4 • STO 2-7 • STO 1-4
Sweetpea - 2020 - 2025	EP 136	Maverick	• SWP 4-3 • SWP 2-3 • SWP 1-4.
Tamboran B2 (Origin) -2016 – 2029	EP 98 / EP 117	Amungee NW	• ORI 11-3 • ORI 10-3 • ORI 7-2 • NT-2050-35-PH-0018 • NT-2050-15-MP-0014 • NT-20.
		Kalala S	• ORI 9-2 • NT-2050-15-MP-0010.
		Velkerri 76 S2	• NT-2050-15-MP-0014.
		Shenandoah	• TAM 1-3 • TAM 2-3. • TAM 3-2 • TAM 4-2
Imperial Oil and Gas -2015-2025	EP 187	Carpentaria	• IMP 4-3 • IMP 3-4 • IMP 2-6.1

6.6.1. Cumulative study area description

The cumulative study area comprises petroleum exploration permits EP 117, EP 98, EP 76, EP 136, EP 161 and EP 187, which together cover approximately 3,624,270 ha across the Beetaloo Basin. This area includes a mix of pastoral leases, native vegetation communities and existing and planned petroleum activities. Considering these permits collectively, they provide a regional scale assessment boundary for understanding cumulative land disturbance associated with ongoing and future petroleum appraisal activities within the basin.

6.6.1.1. Land disturbance and clearing

A total of approximately 1,843.1 ha of land has been cleared to date within the cumulative study area under existing approved petroleum activity EMPs. This represents about 0.051% of the cumulative study area. The current proposal will require 87.34 ha of new or previously cleared land associated with Santos activities, which incrementally increase the overall disturbance attributed to petroleum activities by 0.002%. The proposed total area of clearing is considered not significant when assessed as a proportion of the cumulative study area footprint.

6.6.1.2. Greenhouse gas emissions

The cumulative study area has an estimated GHG emissions forecast of 2,996,257.3 tCO₂-e over all current proponents with active EMPs. The proposed Regulated Activities (as described in Section 3.1, Table 10) will generate an additional 276,896 tCO₂-e over the 5-year EMP period, representing an incremental increase of approximately 1% above the current approved activities. Annual emissions from the Regulated Activities remain well below the NT's large emitter threshold of 100,000 tCO₂-e per year, indicating that the Regulated Activities contribute a negligible increase to the overall greenhouse gas profile of petroleum exploration activities within the cumulative study area.

6.6.1.3. Groundwater extraction

Groundwater extraction associated with the Regulated Activities will occur in accordance with the requirements of the NT *Water Act* and the conditions of the relevant WEL. Under the *Georgina–Wiso Water Allocation Plan*, a total of 10,000 ML / year is available for petroleum activities across the basin. Santos proposes to apply for a WEL to increase it to 750 ML / year, which represents 7.5% of the annual petroleum activity allocation for the basin. Other approved petroleum-related WELs in the region account for 1,732.5 ML / year (including the existing allocation of 193.5 ML / year under WEL GRF10280). If the proposed amendment is approved, the total petroleum sector groundwater allocation within the Georgina–Wiso basins would be 2,289 ML / year, equivalent to approximately 23% of the total annual allocation available for petroleum activities. This level of groundwater use keeps total sector extraction within the lower 25% of the allowable allocation, ensuring that petroleum activities remain a comparatively small and sustainably managed component of overall basin water use.

6.6.1.4. Traffic and workforce

Baseline conditions within the cumulative study area include an estimated 681 vehicle movements per day and a workforce of approximately 1,410 personnel associated with existing regional activities. The proposed Regulated Activities will contribute an additional 45 vehicle movements per day and up to 105 personnel, representing only a modest increase relative to current activity levels. Given the scale of existing traffic volumes and workforce presence in the region, the incremental addition from the proposed Regulated Activities is not expected to materially alter local traffic conditions or place significant pressure on community services or social infrastructure.

Table 62: Cumulative impact assessment details

Interest Holder	Site /EMP Number	Land Cleared	Disturbance % of Exploration Permit Areas	Groundwater	Greenhouse Gas Emissions	Traffic	Workforce	Rehabilitation
		Clearing (ha)		~Total (ML)	~ Total (t CO2-e)	Peak Vehicle No. (per day)	Personnel No. (peak)	Rehabilitation Stage
Santos EP 161²⁵	STO7-4	121.9		5	5,600	44	46	Current rehabilitating
	STO2-7	0		40	3,655.3	8	75	Project still active (monitoring and maintenance only)
	STO1-4	36.2		45.5	11,714	8	28	Project still active
	Total	158.1	0.0042	90.5	20,969.3	60	149	
Sweetpea EP 136	SWP 4-3	2		578	728,399	44	100	Project still active
	SWP 2-3	166-173		318	14,909	56	55	Project still active
	SWP 1-4	279		1	5,377	30-40	50-60	Partial rehabilitation (~72ha).
	Total	454	0.0125	897	748,685	140	215	

²⁵ STO3-8 has been closed out as of 16 February 2026

Tamboran B2 (Origin) EP 76, 98, 117	Amungee NW & Kalala S							
	Velkerri 98 N-1	136		~614	739,389	44	100	Project still active
	Velkerri 76 S2	1		1	994	~10	55	Current rehabilitating
	TAM1-3:	26		170	198,779	44	50-60	Project still active
	Shendandoah	119		1175	400,010	44	75	Project still active
	Tam2-3: Sturt Plateau	8		50	200,880	23	150	Project still active
	Compressor facility	221 ²⁶		2	4,393	40	68	Project still active
		11.2		0.1	2,616	26	32	Project still active
	TAM 3-2 TAM 4-2							
Total		522.2	0.0144	2,012.1	1,547,061	231	540	
Imperial Oil and Gas EP 187	IMP 4-3	166		435	250,893	50	40	Project still active
	IMP 3-4	11		8	9,991	50	40	Project still active
	IMP 2-6.1	14		5	4,158	50	30	Project still active
	Seismic	70		0	6,638	50	27	Project still active
	IMP1-5	222		410	227,432	~10	94	Project still active
	IMP 5-3	226		950	180,381	~40	Up to 275	Project still active
	Total	709	0.0196	1,808	679,493	250	506	
Total		1,843.3	0.0507 ²⁷	4,807.6	2,996,208.3	681	1,410	
Santos – Beetaloo Basin Appraisal Activity – Proposed		87.3428	0.0013	750	276,896	45	105	

²⁶ 221 ha based on total length of seismic program by 3.5 m wide seismic lines. Of the 221 ha, worse-case scenario of 56.25 ha (plus 20 ha contingency) will be cleared (TB2-HSE-MP-14).

²⁷ This is a % of total clearing footprint against the combined Exploration Permit areas of all EMPs listed.

²⁸ Total disturbance area which includes both non-remnant and remnant vegetation areas.

6.7. Environmental outcomes and environmental performance

Santos is committed to ensuring that the proposed Regulated Activities are undertaken in a manner that is environmentally responsible through establishment and implementation of Environmental Outcomes (EO) and Environmental Performance Standards (EPS).

Environmental outcomes are those that will be achieved if the environmental impacts and environmental risks of the Regulated Activities are reduced to a level that is ALARP and acceptable.

Environmental Performance Standards are those standards that relate to manage environmental impacts and environmental risks of a Regulated Activity; and apply to persons, systems, equipment or procedures involved in the Regulated Activities.

Under the PER, an EMP must include EOs that address the risks identified in the Risk Assessment (Appendix O). The EO's must address the legislative and other controls that manage the environmental aspects of the activity.

For each EO, there must be at least one related EPS, that either reduces the likelihood of the risk or impact occurring, or reduces the impact or consequence of the risk. The EPS intend to validate the controls that have been implemented to manage the environmental risks. For each EO and its relevant EPS, specifically related measurable criteria should be included to measure the performance against the EO and EPS. These Measurement Criteria (MC) must enable a determination to be made on whether the EOs and EPS are being consistently met. The EOs, EPSs and MC for the proposed Regulated Activities are described in Table 63.

Table 63: Environmental outcomes, environmental performance standards and measurement criteria

Planned / unplanned events	Environmental outcome	Environmental performance standard	Measurement criteria / records
Clearing and earthworks			
Nuisance (dust) from the proposed Regulated Activities, inc. vehicle movements and construction-related works.	Air quality is maintained and dust does not cause environmental harm or unreasonable nuisance at sensitive receptors during operations.	- Speed limits are clearly sign-posted and enforced for all visitors and workers (60 km/h formed tracks; 40 km/h unformed tracks). - No unresolved complaints related to dust during operations. - Dust suppression will be implemented where required through tracking weather forecasts, use of dust suppression when undertaking operations.	- Records show all personnel have completed site inductions, which includes requirements for managing impacts from dust. - Stakeholder engagement records demonstrate all dust complaints were resolved. - Records show when water trucks have been used for dust control. - Daily pre-starts include weather conditions and forecast. - IVMS records show no speed limit exceedances. - Equipment maintenance records demonstrate engines and relevant plant were maintained.
Disturbance of previously unidentified items or places of Aboriginal cultural heritage significance.	No unauthorised disturbance to Aboriginal cultural heritage resulting from the Regulated Activities.	- No disturbance outside areas authorised under relevant AAPA Authority Certificates / approved work areas. - Unexpected Finds Protocol implemented.	- Records show all personnel have completed site inductions, which includes requirements for AAPA approved works areas and unexpected finds procedures. - The unexpected finds register shows that Aboriginal archaeological places or objects, sacred or cultural heritages sites, if discovered during construction, are recorded and reported to the CEO of the Northern Territory Heritage Office – as soon as practical after discovery. - GIS records demonstrate the final disturbance footprint is within approved areas - IVMS records show no unauthorised driving off designated access tracks. - Audit records show that all activities occur within the areas shown in AAPA Authority Certificate C2020/011.
Increased erosion and sediment release from cleared infrastructure during project operations.	No uncontrolled sediment release from constructed pads, access tracks or borrow pits occurs during construction and operations. Disturbed areas are rehabilitated progressively.	- ESC controls installed prior to disturbance and maintained in accordance with the ESCP (Appendix G). - ESC inspections undertaken in accordance with Section 8.6.1 and 8.6.2. - Any observed erosion/sediment releases are remediated by implementing/restoring ESC	- Records of ESC inspections, and any implementation of any associated remedial actions - Rehabilitation records are maintained in accordance with the Rehabilitation Management Plan (Appendix K). - Records show that progressive rehabilitation of significantly disturbed areas commences as soon as practicable and no later than 12 months after the cessation of the Regulated Activity.

		controls in accordance with the ESCP as soon as practicable.	
Use of heavy machinery and increase use of light vehicles causing compaction of soil.	Soil disturbance is limited to approved disturbance areas and rehabilitation returns the site to a stable condition consistent with agreed post-activity land use.	- Vehicle movements restricted to approved tracks and work areas. - Constructed appraisal wells and well pads no longer required are rehabilitated to meet the rehabilitation success criteria (Appendix K). - Progressive rehabilitation of significantly disturbed areas commences as areas become no longer required for the Regulated Activities and no later than 12 months after cessation of the relevant activity.	- Records show all required personnel have completed required inductions, which includes requirements for remaining on approved access tracks and work areas. - GIS records demonstrate the final disturbance footprint is within approved areas. - Rehabilitation records are maintained in accordance with the Rehabilitation Management Plan (Appendix K). - Records demonstrate that progressive rehabilitation of significantly disturbed areas commences as areas become no longer required for the Regulated Activities and no later than 12 months after cessation of Project activities. - Rehabilitation monitoring records (including photo points and inspections) demonstrate progress against the Appendix K success criteria until completion is accepted by the Minister.
Civil works such as grading, excavation and soil removal affecting the localised landforms.	Disturbed landforms are reinstated to a stable, safe and self-sustaining condition within rehabilitation timeframes.	- Disturbance is successfully rehabilitated at end of project life. - Constructed appraisal wells and well pads no longer required are rehabilitated to meet the rehabilitation success criteria (Appendix K). - Stable and self-sustaining landform reinstated in accordance with Appendix K success criteria. - Progressive rehabilitation of significantly disturbed areas commences as areas become no longer required for the Regulated Activities and no later than 12 months after cessation of the relevant activity.	- GIS records demonstrate the final disturbance footprint is within approved areas. - Records demonstrate that progressive rehabilitation of significantly disturbed areas commences as soon as practicable and no later than 12 months after cessation of Regulated Activities. - Rehabilitation records are maintained in accordance with the Rehabilitation Management Plan (Appendix K). - Rehabilitation monitoring records (including photo points and inspections) demonstrate progress against the Appendix K success criteria until completion is accepted by the Minister.
Earthworks resulting in disruption of natural drainage lines, impacting land use and productivity	Natural drainage is reinstated to pre-disturbance functionality following completion of the Project.	- Drainage controls/ESC measures implemented and maintained in accordance with ESCP (Appendix G). - Any observed scour/ponding/flow concentration caused by earthworks is rectified as soon as practicable.	- ESCP inspection and maintenance records demonstrate drainage controls were installed, inspected and maintained in accordance with Appendix G. - Post-rainfall inspection records (where site access was available) demonstrate any observed scour, ponding or flow concentration was identified and rectified as soon as practicable.

Disturbance, habitat loss, or reduced habitat quality may impact threatened species if appraisal activities are conducted in or near sensitive ecological communities.	Avoid unauthorised disturbance to protected native flora and fauna habitat, particularly any threatened species or sensitive habitats, unless required for safe and efficient implementation of the Regulated Activities.	- Clearing confined to approved disturbance footprint. - Fauna spotter-catcher present during site/vegetation clearing. - Any injury/fatality of threatened fauna attributable to project activities is recorded as an incident and triggers review of controls and additional mitigation where required. - Clearing of hollow-bearing trees is limited to approved disturbance footprint; removals recorded where unavoidable.	- Pre-clearance reports demonstrate sensitive areas and relevant habitat features were identified and avoided where not required for safe and efficient implementation of the Regulated Activities. - Records demonstrate fauna spotter-catcher attendance during new clearing activities. - GIS records demonstrate the final disturbance footprint is within approved areas. - Incident records demonstrate any injury/fatality of native fauna (including threatened fauna), where attributable to project activities, was recorded and investigated and that corrective actions were implemented where required. - Field records demonstrate hollow-bearing trees were avoided where practicable and any unavoidable removals were recorded. - Rehabilitation records maintained under Appendix K demonstrate progressive rehabilitation is implemented to reduce longer-term fragmentation post-activity.
Disturbed areas are not appropriately rehabilitated.	Disturbed areas are rehabilitated to a stable and self-sustaining condition within defined timeframes and demonstrated by monitoring results.	- Rehabilitation commences progressively as areas become no longer required for the Regulated Activities and no later than 12 months after Regulated Activities cease. - Rehabilitation is demonstrated against Appendix K success criteria until accepted by the Minister.	- Rehabilitation records are maintained in accordance with the Rehabilitation Management Plan (Appendix K). - Records demonstrate progressive rehabilitation commences as areas become no longer required for the Regulated Activities and no later than 12 months after cessation of Regulated Activities. - Rehabilitation monitoring records (including photo points and inspections) demonstrate progress against Appendix K success criteria until completion is accepted by the Minister. - Records demonstrate erosion and weed management measures were implemented where required as part of rehabilitation.
Drilling Activities			
Drilling operations causing landholder nuisance due to elevated noise and increase light emissions.	Noise and light emissions from the Regulated Activities will comply with applicable criteria at sensitive receptors and any community noise or light complaints will be resolved in a timely manner.	- Compliance with NT Noise Management Framework Guideline at nearest sensitive receptors for relevant activities (as assessed). - All noise and light complaints during operations are recorded and resolved.	- Noise assessment summary is retained within the EMP to demonstrate compliance with applicable criteria (as assessed). - Stakeholder engagement and complaints records demonstrate any noise and light complaints were recorded, investigated and resolved as soon as practicable. - Equipment maintenance records demonstrate engines and relevant plant were maintained.

Contamination to surface water or aquifers, resulting from uncontrolled release of gas, reservoir fluids or operational fluids, or cross-contamination due to inappropriate barrier controls and implementation.	No contamination of surface waters or aquifers as a result of the Regulated Activities.	- No uncontrolled releases of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values). - No measurable environmental harm to groundwater from the loss of circulation or loss of well control while drilling. Well barriers designed, installed and verified in accordance with the NT Code of Practice – Well Integrity and the approved WOMP. - Well control is maintained during drilling and completions	- Drilling reports and well monitoring logs demonstrate well control measures were implemented and that well control events were managed and recorded. - WOMP compliance records. - Well completion report and/or well barrier verification report. - Well acceptance criteria records. - Records of spills and completed remediation are captured in the Incident Management System. - Groundwater monitoring records demonstrate monitoring was undertaken in accordance with the approved program.
Naturally occurring radioactive materials (NORM) in flowback fluids and/or radioactive tracers in cuttings.	No uncontrolled releases of flowback fluids (that may contain NORM) to the environment.	- No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values). - NORM monitoring/handling undertaken in accordance with Code / Santos procedures and applicable radiation safety guidance.	- Records demonstrate NORM monitoring and/or screening was undertaken where required in accordance with applicable procedures. - Waste transport and disposal records demonstrate NORM-related materials were managed and disposed of appropriately. - Incident records demonstrate any NORM-related containment or handling issues were recorded and corrective actions implemented where required.
Poorly managed chemical additives for drilling resulting in spills or subsurface contamination	Prevent uncontrolled releases of chemicals to the environment.	- No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values). - No release resulting in land contamination that requires active remediation beyond 12 months. - Chemicals stored/handled in accordance with Code, SMP (Appendix E) and approved procedures (bundling/secondary containment, drip trays, spill kits).	- Chemical register and SDS records demonstrate chemicals used and stored onsite were documented and managed in accordance with approved procedures. - Inspection records demonstrate primary/secondary containment and storage areas were checked and maintained in effective condition. - Incident records demonstrate any chemical spills/releases were recorded and remediated and close-out actions completed.
Incorrect management of residual drilling mud and cutting disposal	Prevent uncontrolled releases of drilling by-products to the environment.	No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values).	Testing records demonstrate drilling by-products were characterised in accordance with WWMP (Appendix F) and Code requirements.

		- No release resulting in land contamination that requires active remediation beyond 12 months. - Testing and management undertaken in accordance with WWMP (Appendix F) and Code requirements.	- Waste transport and disposal records demonstrate the volume removed from site and the destination (including licensed transporter and facility details where applicable). - Inspection records demonstrate that freeboard of pits/sumps/tanks was maintained. - Incident records demonstrate any containment failures/spills were recorded and remediated and close-out actions completed.
Well Operations			
Greenhouse gas emissions from land clearing, vehicle / machinery use, fugitive emissions, venting, testing, and flaring	GHG emissions are minimised as low as reasonably practicable and reported in accordance with legislative requirements.	- Leak classification and response management requirements will be implemented as per the Code of Practice: Well Integrity (Section 5.2.4 (with inspection and detection as per Methane Emissions Management Plan). - Flaring preferred over venting; venting limited and minimised. - Where flaring occurs, the flare stack will be operated and maintained to achieve high combustion efficiency (>98%) consistent with relevant standards. - Scope 1 emissions estimated and reported in accordance with NGER.	- Leak classification and response management implemented as per the <i>Code of Practice: Well Integrity</i> (Section 5.2.4). - Inspection / detection in accordance with the Methane Emissions Management Plan (Appendix H). - Equipment maintenance records demonstrate engines and relevant plant were maintained. - Records demonstrate venting decisions were subject to management of change where relevant. - Annual emissions reporting records demonstrate Scope 1 emissions were estimated and reported in accordance with NGER Act (including comparison to EMP estimates where undertaken). - Flare operational records demonstrate flaring events are logged and that flame presence is monitored during flaring with action taken in the event of abnormal operation.
Well suspension or decommissioning resulting in inadequate barriers	Well suspension/decommissioning maintains aquifer protection and prevents contamination of waters.	- Well suspension/decommissioning undertaken in accordance with the approved WOMP and Code barrier requirements. - No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values).	- Records demonstrate well suspension/decommissioning activities were undertaken in accordance with the approved WOMP and Code requirements. - Barrier verification records demonstrate required barriers were installed and verified. - Incident records demonstrate any integrity/non-conformance issues were recorded and corrective actions implemented where required.
Loss of rural amenity due to the introduction and increase of petroleum infrastructure	Proposed infrastructure is limited to that required for safe and efficient operations and visual amenity complaints are resolved in a timely manner.	No unresolved complaints related to visual amenity during operations.	- Stakeholder engagement records demonstrate landholders were provided with project information and that visual amenity concerns/complaints were recorded and responded to. - Complaints records demonstrate all reasonable visual amenity complaints were resolved.

			• GIS records demonstrate the final disturbance footprint is within approved areas.
Hydraulic fracture stimulation activities			
Nuisance caused from continuous 24-hour, 7 day a week HFS from potentially elevated noise levels and light emissions.	Noise and light emissions from the Regulated Activity will comply with applicable criteria at sensitive receptors and any community noise or light complaints will be resolved in a timely manner.	• Compliance with NT Noise Management Framework Guideline intrusiveness criteria (as assessed). • Lighting directed inward/downward to minimise off-site light spill. • Complaints process applied; repeat substantiated complaints trigger review and additional feasible mitigation.	• Stakeholder engagement and complaints records demonstrate any noise/light complaints were recorded, investigated and resolved. • Equipment maintenance records demonstrate engines and relevant plant were maintained.
Cross flow between reservoirs and aquifers through water stimulation fracturing allow migration of fluids between geological layers.	Aquifer separation maintained across the life of the well.	• No release of contaminants resulting in a groundwater quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values). • Well control and barrier verification demonstrate compliance with WOMP/Code requirements.	• Well monitoring and well control records demonstrate adequate well control measures were implemented and recorded. • Barrier verification records demonstrate barriers were installed and verified in accordance with the WOMP and Code requirements. • WOMP compliance records. • Incident register and remediation close-out records. • Well completion report and/or well acceptance criteria records.
Uncontrolled release to surface due to barrier failure	No uncontrolled releases due to barrier failure that could cause contamination of surface waters or aquifers.	• No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values). • No release resulting in land contamination that requires active remediation beyond 12 months. • WOMP/Code barrier guidelines implemented.	• Barrier verification and well acceptance records demonstrate barriers were installed and verified in accordance with the WOMP and Code requirements. • Incident and remediation records demonstrate any releases were recorded, remediated and closed out. • Groundwater monitoring records demonstrate monitoring was undertaken in accordance with the approved program.
Water management activities			

Entrapment of fauna or stock in open water bodies e.g. clean water storage – dams.	No fauna/stock entrapment.	- Fauna exclusion and egress controls implemented (including fencing, escape ladders/ramps). - Any injury/fatality of native fauna (including threatened fauna) attributable to entrapment is recorded - During non-operational periods remote inspections of pits/tanks for entrapment risks and physical inspection when personnel attend site.	- Inspection records demonstrate fauna exclusion and egress controls were installed and checked during operations in accordance with the monitoring program. - During non-operational periods, records demonstrate monthly remote inspections were undertaken and that observations/actions were recorded. - Incident records demonstrate any injury/fatality attributable to entrapment was recorded and that corrective actions were implemented where required. - Weekly field reports demonstrate fauna rescues/observations were recorded during operations.
Loss of containment of produced completions fluids	No releases of wastewater/produced fluids to the environment due to loss of containment.	- No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values). - No release resulting in land contamination that requires active remediation beyond 12 months. - Freeboard maintained per WWMP and integrity maintained through inspections/telemetry. - Flowback fluids reused where suitable in accordance with the WWMP to reduce stored volumes and offsite disposal requirements.	- Freeboard and level monitoring records demonstrate wastewater volumes were monitored during operations in accordance with the monitoring program (including use of telemetry/cameras where installed). - Inspection records demonstrate pits/tanks/secondary containment were inspected and maintained in effective condition. - Incident and remediation records demonstrate any releases were recorded, remediated and closed out. - Operational records demonstrate flowback reuse volumes and transfers were recorded where undertaken. - Operational records demonstrate when closed-top tanks were used during the wet season to limit stormwater ingress and preserve available storage capacity, in accordance with the WWMP.
Uncontrolled release due to flooding or overland flow impacting on drilling sumps / mud storage locations, flowback storage and other onsite water	No releases of wastewater/produced fluids during rainfall/flood events.	- No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values). - Freeboard maintained per WWMP and significant rainfall procedures implemented.	- Weather and rainfall trigger records demonstrate forecasts/alerts were monitored and significant rainfall procedures were initiated where required. - Freeboard and level monitoring records demonstrate pits/tanks were managed in accordance with the WWMP. - Records demonstrate any triggered transfers/shutdown actions were implemented where required. - Incident records demonstrate any overflow/release events were recorded and corrective actions implemented where required.
Overflow of drilling by-product storage pit, flowback tanks, or failure of	No releases of wastewater / produced fluids to the environment.	No overtopping of produced/flowback fluids from above-ground tanks during operations.	Records to demonstrate the Bureau of Meteorology provided timely notification of significant rainfall event and mitigations as per the WWMP completed as required.

embankment from rain inundation.		- No overtopping of drilling by-products from storage pits during operations. - Any leak/release is contained and remediated promptly to prevent a water quality change persisting >12 months and attributable to the activity.	- Freeboard and level monitoring records demonstrate pit/tank levels were monitored during operations in accordance with the monitoring program (wet season daily; dry season weekly). - Weather and rainfall trigger records demonstrate forecasts/alerts were monitored and rainfall response actions were initiated where required. - Inspection and incident records demonstrate any overtopping/leak events were recorded, contained and remediated and close-out actions completed.
Handling, use and transportation of hazardous chemicals and dangerous goods.	No releases of dangerous goods and other hazardous chemicals to the environment resulting from the Regulated Activity.	- No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values). - No release resulting in land contamination that requires active remediation beyond 12 months. - Secondary containment provided and spill response applied as per SMP.	- Inspection records demonstrate hazardous materials were stored and managed in accordance with the EMP, Code and SMP. - Chemical register and SDS records demonstrate chemicals and dangerous goods were documented and SDS were available at point of storage where required. - Records demonstrate road/track conditions were assessed prior to mobilisation in wet weather where required. - Incident and remediation records demonstrate any spills/releases were recorded, remediated and closed out.
Ancillary Infrastructure			
Drilling of water bores through aquifers may create pathways for fluid migration between formations.	Aquifer separation is maintained across the life of the well.	No release of contaminants resulting in a water quality change that persists for >12 months and is attributable to the activity (measured against baseline and relevant guideline values).	- WEL records demonstrate compliance with licence conditions and extraction limits. - Groundwater monitoring records demonstrate monitoring was undertaken in accordance with the approved program.
Temporary drawdown of aquifers due to the operational water demand (i.e. 750 ML per year).	Groundwater use volumes do not exceed permitted water extraction volumes.	- Extraction volumes remain within WEL conditions. - No >12 month reduction in groundwater quality of impact monitoring bores attributable to the activity (assessed against baseline and relevant guideline values). - No >12 month reduction in groundwater levels attributable to the activity resulting in >1 m decline in the impact monitoring bore.	- Flowmeter and extraction records demonstrate volumes were measured and recorded in accordance with the WEL. - Groundwater monitoring records demonstrate groundwater levels and quality were monitored in accordance with the approved program and reviewed against baseline/trends. - Records demonstrate that if unexpected drawdown or quality change is identified, response actions (including notifications where required) were implemented and documented.

Borrow pit excavation altering drainage patterns, causing erosion.	No uncontrolled sediment release from constructed pads, access tracks or borrow pits occurs during the Project. Disturbed areas are rehabilitated progressively.	- Borrow pits sited and managed in accordance with borrow pit design/management measures; erosion controls implemented and maintained. - No uncontrolled sediment releases attributable to borrow pits during operations.	- Borrow pit inspection and maintenance records demonstrate erosion controls were installed, inspected and maintained where required. - ESC inspection records demonstrate borrow pit areas were included in relevant inspections as specified in Section 8.6. - Records demonstrate any observed erosion/sediment issues were rectified as soon as practicable.
Irrigation of treated effluent in an area where it can enter a waterway or cause water logging.	No releases of treated effluent outside of permitted irrigation/discharge areas.	- No runoff of treated effluent/greywater outside designated irrigation area. - Irrigation area inspections undertaken during irrigation periods and issues rectified.	- Inspection records demonstrate irrigation was undertaken within the designated irrigation area and that pooling, runoff or waterlogging were not observed, or if observed were rectified as soon as practicable. - Incident records demonstrate any irrigation-related non-conformances were recorded and corrective actions implemented where required.
All activities			
Bushfire caused by project activities impacting on life and property.	No bushfire as a result of proposed Regulated Activities.	- Bushfire Management Plan implemented. - Fire weather monitored during operations - Firefighting equipment available - Flare exclusion zone maintained. - No flaring during periods of fire ban. - No burning of waste onsite.	- Site induction records show all personnel have completed site inductions, which include information on fire risk and impact to landholder for unplanned fire. - When flammable material stores present on site (during Regulated Activities), checklist shows SDS available and appropriate and in-test fire-fighting equipment next to flammable material stores. - When Regulated Activities are being undertaken, checklist shows all vehicles have portable fire extinguishers and operational VHF or UHF radio receivers. - Records show toolbox meeting discussions of fire risk levels and fire risk management and remedial actions. - Daily pre-start records demonstrate fire weather and conditions were reviewed during high-risk periods.
Increased personnel working within the region resulting in an increase in associated vehicle movements and interaction with the community.	The workforce for the Regulated Activities does not have any adverse interactions with landholders/community and any complaints are resolved in a timely manner.	- Workforce code of conduct implemented. - Complaints recorded, investigated and closed as soon as practicable. - Speed limits and approved access points communicated and enforced. - Incidents recorded and corrective actions implemented where required.	- Site induction records demonstrate personnel were inducted on workforce code of conduct requirements prior to commencing works. - Site induction records show that speed limits and approved access points are covered for visitors and workers travelling to site.

			- Stakeholder engagement and complaints records demonstrate complaints were recorded, investigated and closed as soon as practicable. - IVMS records demonstrate compliance with posted speed limits and access tracks. - Incident and near miss records demonstrate interactions and vehicle-related events were recorded and corrective actions implemented where required.
Spread of biosecurity risk material (e.g. weed and seed) to, or within the Project Area during operations.	No new weed incursions attributable to the Regulated Activities.	- Weed hygiene and clean-down requirements implemented. - Annual weed survey completed and records maintained; new incursions reported and treated as required.	- Site induction records show all personnel have completed site inductions, which include information on weeds in the region and method of spread. - Records show requirements under the Weed Management Plan (Appendix C) have been implemented in accordance with commitments. - Clean-down and inspection records demonstrate vehicles and machinery were inspected and cleaned prior to mobilisation where required. - Weed survey and treatment records demonstrate annual weed monitoring was completed and that any new incursions were recorded and managed as required.
Uncontrolled release of waste (non-wastewater as per the Code).	No release of waste by-products from the Regulated Activities to the environment	- Waste stored in covered receptacles; removed by licensed contractor; no uncontrolled waste release. - Complaints recorded and closed as soon as practicable; no unresolved waste complaints during operations..	- Daily waste area inspection records demonstrate bins were secured, not overflowing and waste was contained. - Waste tracking and disposal records demonstrate waste was removed by a licensed contractor and taken to an appropriate facility. - Stakeholder engagement and complaints records demonstrate any waste-related complaints were recorded, responded to and closed as soon as practicable.

7. Management Plans

In support of meeting the objectives of this EMP, the following management plans have been developed to reduce the impact of the proposed Regulated Activities on the surrounding environment and community.

7.1. Appendix B – Bushfire Management Plan

The *Bushfire Management Plan* outlines the strategies and procedures for preventing, mitigating, and responding to bushfire risks associated with the proposed Regulated Activities. It is aligned with the *Savanna Regional Bushfire Management Plan* and the *Bushfire Management Planning Guide: Onshore Petroleum Project* (2020). The Plan applies risk management principles to ensure preparedness and coordinated response measures, protecting personnel, infrastructure, and the surrounding environment from potential fire hazards.

7.2. Appendix C – Weed Management Plan

The *Weed Management Plan* establishes the framework for identifying, preventing, and controlling the introduction and spread of weeds during project activities. It includes baseline assessments, ongoing monitoring, and the appointment of a dedicated weed officer. The plan ensures compliance with the Code and relevant federal legislation such as the *Environment Protection and Biodiversity Conservation Act 1999*.

7.3. Appendix E – Spill Management Plan

The *Spill Management Plan* details the procedures and resources in place to prevent, respond to, and mitigate the effects of any spills associated with project operations. Developed in accordance with the Code, the Plan supports the safe handling, containment, and remediation of potential hydrocarbon or chemical releases to minimise environmental harm.

7.4. Appendix F – Wastewater Management Plan

The WWMP outlines the management of all wastewater generating activities throughout the project lifecycle, including drilling, hydraulic fracture stimulation, completion, decommissioning, and maintenance. It sets out compliance with the Code and includes certified methodologies for the management of the residual drilling material burial. The WWMP should be read alongside the *Spill Management Plan* and *Emergency Response Plan*.

7.5. Appendix G – Erosion Sediment Control Management Plan

This Plan establishes measures to prevent erosion and sedimentation during site preparation and civil works. Developed by a Certified Professional in Erosion and Sediment Control (CPESC), it includes site-specific designs and control measures to protect soil stability and downstream water quality during all phases of the proposed Regulated Activities.

7.6. Appendix H – Methane Emissions Management Plan

The Methane Emissions Management Plan (MEMP) outlines procedures to detect, monitor, and reduce methane emissions associated with exploration and appraisal activities. The Plan adopts a proactive approach to ensure emissions are maintained to ALARP through continuous monitoring and mitigation, supporting compliance with environmental and greenhouse gas objectives.

7.7. Appendix I – Surface Water and Groundwater Management Plan

This Plan defines the approach for managing and monitoring surface and groundwater resources during the proposed Regulated Activities. It ensures compliance with the Code of Practice and the *Preliminary Groundwater Guideline* for the Beetaloo Sub-basin, focusing on protection of water quality, sustainable use, and early detection of any potential impacts from project activities.

7.8. Appendix K – Rehabilitation Management Plan

The Rehabilitation Management Plan (RMP) provides the framework for restoring areas disturbed by the project to agreed post-activity land uses. It covers rehabilitation strategies, objectives, and monitoring requirements for access tracks, well pads, borrow pits, and campsites. The Plan outlines methods for progressive and final rehabilitation, ensuring land stability, ecological recovery, and compliance with regulatory expectations.

7.9. Appendix M – Emergency Response Plan

The Emergency Response Plan (ERP) is a Santos Ltd document that describes the broader organisational structures, responsibilities, and procedures applicable for managing emergency situations across the McArthur (Beetaloo) and Amadeus Basins. It ensures a coordinated and timely response to incidents to protect workers, the community, and the environment, consistent with Santos Ltd's Corporate Emergency Management Framework.

8. Implementation Strategy

The Implementation Strategy described in this section is a summary of the Santos Ltd systems, practices and procedures in place that Santos will implement to manage the environmental impacts and environmental risks of the proposed Regulated Activities. The Strategy aims to ensure that the control measures, environmental outcomes and standards, are implemented and monitored to ensure environmental impacts and risks are continually reduced to a level that is ALARP and acceptable.

8.1. Santos Management System

Santos manages the environmental impacts and risks of its activities through the implementation of the SMS. The SMS is the central system that contains the policies and procedures that Santos will utilise to manage and minimise the impact of its activities. The SMS provides a formal and consistent framework to manage all Santos employee and contractor activities. The SMS Framework is provided in Figure 47.

The framework for the SMS includes:

- Constitution, Board Charters, Delegation of Authority - defines the purpose and authorities of the Santos Limited Board, Board Committees and senior staff.
- Code of Conduct and Policies – outline the key requirements and behaviours expected of anyone who works for Santos Ltd entities. The Policies are set and approved by the Board.
- Operating Standards - prescribe the minimum performance requirements and expectations in relation to the way we work at Santos (the 'What').
- Processes, procedures and tools - support implementation of the Management Standards and Policy requirements by providing detail of 'How' to achieve performance requirements.

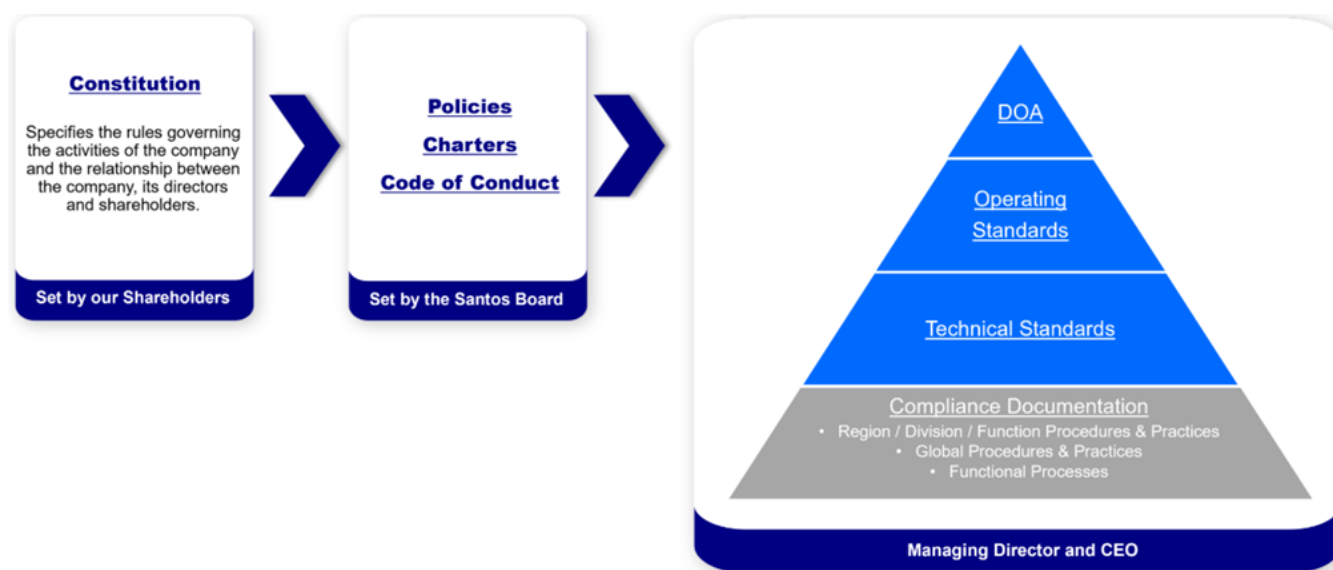


Figure 47: SMS framework

8.2. Roles and responsibilities

Key roles and responsibilities for the activity are detailed in Table 64 and will be communicated to these positions prior to the proposed Regulated Activities commencing and when any changes are made to these positions. References to Santos in this Section may refer to Santos Ltd personnel or Santos QNT personnel or contractors.

Table 64: Key personnel roles and responsibilities

Role	Responsibilities
Santos Project Manager / Lead / Superintendent	- Oversees all planning and the execution of the proposed Regulated Activities and is responsible for compliance with the EMP and the SMS. - The emergency commander as per the roles and responsibility of the <i>Emergency Response Plan</i> (Appendix M).
Contractor Site Supervisor / Representative	- Civil Construction, drilling, completion and well testing service providers (contractors) that are responsible for delivering the commitments outline in this EMP. - Contractors to comply with the nominated contractual terms and work instructions issued under this EMP. - Contractors must ensure all staff are aware of their obligations, are appropriately trained and that procedures and controls are implemented and complied with.
Santos Drilling and Completions Engineering Lead	- Responsible for ensuring the drilling, completion and well testing are designed and implement per the NT legislation, CoP – Well Integrity, the Code, the WOMP and this EMP. - Responsible for selecting and designing equipment and practices to manage environmental risk. - Responsible for selecting and engaging drilling, completion and well testing contractors. - Responsible for ensuring all contractors comply with the contract terms, including compliance with the EMP requirements. - Ensures all contractors comply with the contract terms, including compliance with the EMP requirements.
Santos Representative / Site Supervisor	- Responsible for ensuring that all areas of drilling, completion and well testing are carried out in accordance with the WOMP, EMP and SMS. - Responsible for the planning and executing of the drilling, completions and well testing works on-site, including understanding and communicating the environmental requirements of this Plan.

	- Facilitate inductions and review training of all workers (including sub-contractors). - Ensures all reporting requirements are met. - Acts as the point of contact for all drilling, completions and well testing contractors. - Acts as the designated point of contact for any Regulated Activity related complaints and incidents following the pre-determined strategies in this EMP. - Undertakes monitoring, inspections and compiles records of compliance. - Typically the on-scene commander as per the roles and responsibility of the Emergency Response Plan (Appendix M).
Santos Land Access Adviser	- Undertake consultation with relevant landowners throughout project planning and implementation. - Document consultation with relevant persons. - Ensure any commitments to relevant persons are undertaken.
Santos Environmental Team Representative	- Monitoring compliance with the EMP. - Verification that monitoring and inspections are occurring and records available. - Completion of audits and regulatory reporting.
Field Personnel (Santos or Santos contracted)	All staff and contractors working in the exploration permit areas are responsible for complying with this plan and associated procedures.

8.3. Training and competencies

The SMS sets out policies and procedures that specify the minimum training and competency requirements for all staff and contractors of Santos Ltd entities, ensuring that all tasks are performed by appropriately qualified and experienced personnel.

Santos staff and contractors undertaking work in the field are required to undertake a 2-stage induction process. The general Onshore EHS Induction focuses on environmental risk identification and sets Santos' expectations for EHS management for workers at Santos' onshore operational sites.

All staff and contractors entering the site will be required to attend a site-specific induction. The induction covers the following aspects:

- Regulatory requirements for the area, including specific conditions of the EP, this EMP and land access agreements.
- The importance of reporting environmental incidents e.g. spills and sediment releases.
- Environmental considerations and procedures for environmental protection, e.g. weed and spill management.
- Bushfire and emergency response.
- Landowner sensitivities, including Aboriginal communities and their specific cultural requirements.
- Procedures for handling any culturally or archaeologically sensitive materials that may be discovered.
- The competency of contractors is assessed as part of the contracting qualification and via the prestart audit. Competencies assessed during the contracting process include:
 - Maturity of Environment, Health and Safety (EHS) system
 - EHS performance
 - Internal training and auditing processes
 - Existing procedures and training
 - Awareness of environmental values
 - Weed identification and management
 - Identification of features to be avoided and protected
 - Refuelling procedures
 - Specific procedures to be undertaken for a range of Santos activities

- Hazardous material and waste management procedures
- Incident notification and management processes.

8.4. Interface with other project plans

8.4.1. Emergency Response Plan

The emergency response arrangements within the *Emergency Response Plan* will be exercised early in the campaign to ensure that personnel are familiar with the Plan and the type of emergencies to which it applies and that there will be a rapid and effective response in the event of a real emergency occurring. Following the exercise, lessons will be captured and the plan updated if required.

Other triggers for revising or updating the *Emergency Response Plan* may include:

- New information becomes available following an incident, near miss or hazard
- Learnings from an exercise or drill
- Change in contractor undertaking the work
- Organisational changes.

8.4.2. Well Operations Management Plan

Well Operations Management Plan (WOMP) will be submitted to the regulator for approval prior to spud of the first well activity to which the plan will apply. The WOMP will provide details on:

- Description of the well and well activities
- Well integrity risk management process
- Design, construction, operations and management of wells
- Performance outcomes
- Well lifecycle control measures
- Performance standards for control measures
- Performance objectives measurement criteria
- Monitoring, audit and well integrity assurance (including Induced Seismicity Management Plan (ISMP))
- Well Abandonment and suspension considerations
- Responsibilities and competencies of contractor's service providers
- Source control and blowout contingency measures.

A copy of the approved WOMP will be provided to DME post approval by the regulator.

8.5. Incident reporting

All EP 161 activities incorporated into this EMP, incidents that impact on the environment or have the potential to impact on the environment (i.e. near-misses) are to be reported and entered into the Santos Ltd EHS Toolbox Incident Management System (IMS). In accordance with legislative requirements, environmental incidents within EP 161 that relate to Beetaloo Appraisal Pilot EMP may also be reportable to external stakeholders (i.e. government, Northern Land Council (NLC), non-governmental organisations, etc.).

All required incident reports shall be made formally in writing to external stakeholders with copies sent to applicable Santos Ltd managers, with incident details registered into the EHS Toolbox IMS. Table 65 details the external incident notification, reporting requirements and timeframes for environmental incidents associated with the activity.

Table 65: Incident reporting requirements

Requirements	How and by when
<i>Petroleum (Environment) Regulations 2016</i>	
Recordable Incident Reporting - A recordable incident is an incident arising from the proposed Regulated Activities that has resulted in an environmental impact or environmental risk (not specified in this EMP), or has resulted in a contravention of an Environmental Performance Standard in the EMP, or is inconsistent with an environmental outcome specified in the EMP; and which is not a reportable incident under the <i>Petroleum (Environment) Regulations 2016</i> (as set out below).	
The recordable incident report must contain: (i) a record of all recordable incidents that occurred during the reporting period; and (ii) all material facts and circumstances concerning the recordable incidents that the interest holder knows or is able, by reasonable search or enquiry, to find out; and (iii) any action taken to avoid or mitigate any environment impacts and environmental risks of the recordable incidents; and (iv) the corrective action that has been taken, or is proposed to be taken, to prevent similar recordable incidents.	• A report about recordable incidents, relating to each reporting period for the Regulated Activities must be given to the Minister in writing as soon as practicable, but not later than 15 days after the reporting period. • The 'reporting period' is as agreed in writing with the Minister or, otherwise, each 90 day period after the day on which the EMP is approved.
Reportable Incident Reporting - A reportable incident is an incident relating to the activity that has caused, or has the potential to cause material or significant environmental harm as defined under the PER.	
The initial written report will include comprehensive details about: • The results of any assessment or investigation of the conditions or circumstances that caused or contributed to the occurrence of the reportable incident, including an assessment of the effectiveness of the designs, equipment, procedures and management systems that were in place to prevent the occurrence of an incident of that nature. • The nature and extent of the material environmental harm or significant environmental harm that the incident caused or had the potential to cause. • Any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident. • Any actions taken, or proposed to be taken, to prevent a recurrence of an incident of a similar nature.	• Notify the Minister orally or in writing as soon as practicable but not later than 2 hours after the incident first occurred, or the Interest Holder becomes aware of the reportable incident. • The notification must accord with regulation 33(3)(c) of the PER 2016. It must specify the contact details of the Interest Holder, all material facts and circumstances about the incident that the interests holder knows or is able, by reasonable search or enquiry, to find out, information about any action taken to avoid or mitigate material or significant environmental harm in relation to the reportable incident and information about the corrective action that has been taken or is proposed to be taken to prevent a similar reportable incident. • Any verbal notification will be followed up by a written notification within 24 hours of giving verbal notice, which will also specify the above information in accordance with regulation 33(4) and regulation 33(3)(c) of the PER 2016. Then, an initial report will be provided to the Minister no later than 3 days after the incident first occurs. • Notify AAPA verbally or in writing as soon as practical if the reportable incident impacts a sacred site. • Initial report about the reportable incident must be given to the Minister as soon as practicable, but not later than 3 days of the occurrence and include all details in Regulation 34(3) of the PER.

Interim reports will include further information about: • The results of any assessment or investigation of the conditions or circumstances that caused or contributed to the occurrence of the reportable incident, including an assessment of the effectiveness of the designs, equipment, procedures and management systems that were in place to prevent the occurrence of an incident of that nature. • The nature and extent of the material environmental harm or significant environmental harm that the incident caused or had the potential to cause. • Any actions taken, or proposed to be taken, to clean up or rehabilitate an area affected by the incident. • Any actions taken, or proposed to be taken, to prevent a recurrence of an incident of a similar nature. • Any other matters relevant to the reportable incident.	• Interim reports to be provided as agreed with the Minister or at intervals of 90 days, starting on the day the initial report was given.
The final reportable incident report must include a root cause analysis of the reportable incident.	• The final report to be provided to the Minister as soon as practicable but no later than 30 days after the clean up or rehabilitation of the area affected by the reportable incident is completed.
Waste Management and Pollution Control (WMPC) Act	
Duty to notify of incidents causing or threatening to cause pollution where an incident occurs in the conduct of an activity and the incident causes, or is threatening or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm. A notification is required to 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. • The identity of the person notifying.	• The proponent must notify the NT EPA as soon as practicable (and in any case within 24 hours) after first becoming aware of the incident or the time they should reasonably be expected to become aware of it. • Refer to Spill Management Plan (Appendix E).
Heritage Act 2011	
When a proponent discovers a place or object that is known to be Aboriginal or Macassan archaeological place or object, they must provide a written report to the CEO of the Heritage Council, which includes: • A description of the place or object. • Its location. • The person's name and address. • If known by the person –the name and address of the owner or occupier of the place or place where the object is located.	• The proponent must advise the director of the Heritage Branch (08 8999 5039) of the discovery and its location.

<i>Work Health and Safety (National Uniform Legislation) Act, 2011 (NT) and Regulations, 2011 (NT)</i>	
A person who conducts a business or undertaking must ensure that the Regulator is notified immediately after becoming aware that a notifiable incident arising from the conduct of the business or undertaking has occurred. A notifiable incident means. • The death of a person • A serious injury or illness of a person • A dangerous incident. The person with management or control of a workspace (Interest Holder) has a duty to preserve incident sites at which a notifiable incident has occurred so far as reasonably practicable. Requirement to notify NT WorkSafe if the volumes of chemicals held on-site exceed requirements	• The proponent must notify NT WorkSafe immediately after becoming aware that a notifiable incident has occurred. Notify by phone or in writing. • A person giving notice by telephone must give details of the incident and (if required) give written notice within 48 hours of being required to do so. • The Interest Holder will preserve any incident site so far as reasonably practicable.
<i>Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) (NT)</i>	
If a driver of a road vehicle transporting dangerous goods and the vehicle is involved in an incident resulting in a dangerous situation, they must notify the prime contractor for the goods, the Competent Authority, and the police or fire service of the incident.	• As soon as practicable after the incident occurred.

8.6. Environmental performance, monitoring and reporting

8.6.1. Routine monitoring during construction and earthworks, drilling, stimulation, flowback and testing

Santos will undertake a suite of monitoring to implement this management plan and to deliver on the obligations described above in Table 63. A summary of the key monitoring requirements during active operational periods is listed in Table 66.

Active operational periods are defined as periods during construction and earthworks, drilling, stimulation, flowback and testing. Where applicable (i.e. where Regulated Activities requiring monitoring are still being undertaken such as rehabilitation and inspection for fauna entrapment) during active operational periods, this monitoring schedule will also apply to previously approved Regulated Activities undertaken on EMP's being consolidated into this EMP (refer to Section 3.14).

Table 66: Routine monitoring during active operations

Monitoring program	Description	Frequency
Construction and earthworks		
Erosion and Sediment Control	ESC measures in place as per the ESC plan.	- Daily inspections during active ground-disturbing works when personnel are on site. - Weekly inspections during manned periods in the wet season when no active disturbance is occurring. - During manned periods, post-rainfall inspections following significant rainfall (>20 mm in 24 hours) will be undertaken as soon as safe access is available.
Rehabilitation	- Land disturbance is successfully rehabilitated. - Photo points established and revisited as part of the civils scope. - Presence of a stable and self-sustaining landform re-instated as per the success criteria of the Rehabilitation Management Plan.	Annually, starting 12 months after it is determined the disturbed land is no longer required for the Regulated Activities, until rehabilitation criteria are met and accepted by the Minister.
Drilling		
Drilling by-products	- Assess the potential impacts posed by the drilling by-products, and the available disposal options and collect data for Third Party on-site disposal assessments / approvals. - Compliance with the WWMP Plan (Appendix F).	- Post-drilling activity prior to pit re-instatement or off-site management. - Testing as per the WWMP (Appendix F). - Other analytes as per Table 9 of the Code.
Freeboard of pit/s and tanks	- Drilling by-product and open topped-treatment tank levels monitored. - Minimum freeboard maintained in accordance with the WWMP. - Tanks, clean water storage – dams, and sumps will be checked manually when site access is available. - Monitoring of pits and tanks when used for storage will be completed by online telemetry or photography until closure. Telemetry equipment maintained/calibrated in accordance with manufacturer specifications.	Daily during active operations in the wet season and weekly during active operations in the dry season.
Wastewater Management		
Groundwater extraction	Ensure that the volume of water utilised is less than the authorised licenced volume.	Extracted water volumes for each bore used to supply water for the proposed Regulated Activities will be recorded in accordance with the conditions of the WEL.

Waste (drill fluid, wastewater, effluent)	• Total volume of wastewater / material removed from the site and its destination (including license number of the transporter). • Total volume of water (including stormwater) and wastewater re-used or discharged during drilling/stimulation works or for other purposes. • Characteristics of waste. • Sampling and laboratory analysis of stimulation source water for analytes listed in Section C.8 of the Code. • Total volume of stimulation fluid pumped for each well stage will be recorded.	• Wastewater volume and destination recorded at the time of transport by on-site personnel. • Water (including stormwater) and wastewater reuse and discharge volumes will be recorded at the time of reuse or discharge via the applicable site transfer records (e.g. pump transfer volumes, tank level changes, water cart fill logs). • Wastewater quantity and quality monitoring with 6 monthly wastewater samples analysed at a NATA-accredited laboratory for the analytes listed in the Code. • At the time of well suspension an assessment of the potential accumulation of NORM in well equipment will be assessed and measures put in place to reduce the risk to HSE as per the Code. • NORM in wastes and fluids will be managed as per the Code, including testing of residual drilling wastes and produced water/flowback to inform handling, storage, transport and disposal requirements. • A report must be given to the Minister containing information about flowback fluid within 6 months of the flowback occurring. Similarly, a report on produced water must be given to the Minister within 6 months about produced water. • Stimulation source water sampling and laboratory analysis prior to HFS. • Stimulation fluid volume recorded for each HFS stage.
Fauna Management	• Effectiveness of measures to mitigate stock, wildlife, and human interaction. • Includes checks for fauna entrapment risks and functionality of any installed escape mechanisms where required.	• Visual checks during daily site inspections when personnel are on site. • Incident reports and fauna interaction records reviewed weekly during active operations. Native fauna or livestock entrapment/injury incident to be captured in the IMS appropriate corrective actions to be put in place.
Daily Inspection Checklist	• Inspection during stimulation, flowback and testing. • Checks of storage tanks / clean water storage dam integrity. • Real time monitoring of conditions during HFS. • Monitoring of weather and for predicted significant rainfall events will be undertaken. • Checks of freeboard. • Monitoring freeboard during and after rainfall events. • Secondary containment areas.	• Daily during active operations.
Flowback Fluid Monitoring	• The fluid levels in tanks containing flowback fluids will be monitored to calculate the stored volume. • End-of-pipe flowback monitoring will include electrical conductivity, pH and temperature. • Sampling and laboratory analysis of flowback fluid will be undertaken for analytes listed in Section C.8 of the Code. • Cumulative flowback fluid volume for each well will be recorded.	• Daily during operations in the wet season, weekly all other times. • Electrical conductivity, pH and temperature – minimum once per 24 hours during flowback. • Sampling and laboratory analysis – weekly until sufficient data has been gathered to ascertain the chemical composition of the flowback fluid. • Cumulative flowback fluid volume – at one month, three months, six months and 12 months after flowback has commenced.

Effluent	Visual inspections of irrigation fields will occur to ensure no pooling of water or uncontrolled runoff off site.	During operations, daily inspection of designated effluent irrigation area for leaks or pooling.
Groundwater Monitoring	Detect changes in groundwater as a result of drilling and stimulation activities. Monitoring will be done in accordance with the <i>Surface Water and Groundwater Management Plan</i> (Appendix I).	- Monitoring occurring in accordance with CoP and the <i>Surface Water and Groundwater Management Plan</i> (Appendix I) (quarterly for 3 years post HFS). - Continuous level and EC logging before, during and one month after HFS, where loggers are installed.
	Volumes of water is abstracted from the water bore will be measured using flowmeter.	Recorded weekly during bore operations.
	Fluid levels in storage containing abstracted groundwater will be monitored to provide a measure of the stored quantity of water.	Daily during active operations.
	For older wellsites after completion of the 3 year post-HFS quarterly monitoring period (including wells authorised under STO2-7), ongoing groundwater monitoring will continue.	Annually.
Well operations		
Methane Emissions	- Leak monitoring and detection. - Volume of emissions (where possible).	- Visual inspection of equipment - including external corrosion, tubular and annular pressures measured. - Leak detection tests and reporting – in accordance with the <i>Code of Practice: Well Integrity 2025</i>. - Emissions measured in accordance with Methane Emissions Management Plan (Appendix H) and NGER reporting requirements.
Flaring	- Verify flare lit/stable during flaring. - Record flaring duration and any abnormal operation/corrective actions. - Flare combustion efficiency will be monitored indirectly through measured gas flow rates and engineering calculations. - Flare performance data will be reviewed and reported in the annual emissions audit report.	- During flaring events. - Annually (in the annual emissions report).
HFS	Monitor localised ground motion via accelerometers (refer to Section 3.9.4).	- Commence two days prior to the commencement of a hydraulic fracturing operation. - Be maintained for the entire duration of the operation (including during flowback). - Continue for a period of 30 days after completion of a hydraulic fracturing operation.
All		

Inductions	Ensure induction and training records are maintained to demonstrate personnel have been inducted and are aware of relevant environmental controls, incident response requirements and EMP obligations prior to undertaking activities.	Prior to commencing work on site.
Bushfire	Hot spot alerts and fire danger is known.	- Daily checks of BOM fire and weather forecasts during operations.. - Annual fire mapping.
	Onsite Company Representative is responsible for monitoring for bushfire alerts and notifying all site personnel of the risks of fire during toolbox meetings.	Daily during operations.
	Visual inspection of cleared areas (including fire access trails/breaks) for bushfire risk material post-wet season/prior to October (typically start of high bushfire period), in conjunction with weed surveys.	Annually (post-wet season / pre-October).
Spills	Sites free of spill-related contamination and all spills are managed and reported.	- Secondary containment, when in use, to be visually inspected weekly during the dry season and daily during the wet season for damage, spills or water for management. Damaged/compromised containment repaired as soon as practicable. - All spills are to be reported in Incident Management System, including volumes, spill type, location, cause, response actions and close-out status. If the spill is considered a recordable/reportable incident, the actions in Section 8.5 shall be followed.
Weeds	Weeds identified and treated.	- Annual survey post-wet season weed survey (as per Weed Management Plan). - Opportunistic observations recorded via the WeedMate app during site attendance. - Follow-up inspections of new weed incursions within three months, or as otherwise directed by the Dedicated Weed Officer.
Waste	Daily checks of all domestic waste receptacles to ensure they have lids secured and not overflowing.	- Daily during operations. - Waste transported off-site recorded.

8.6.2. Routine monitoring – non-operational periods

Given the nature of the proposed Regulated Activities, there may be non-operational periods of reduced Regulated Activities occurring in the Project Area where personnel are not routinely on-site (e.g. after active operations, where site infrastructure remains in place and rehabilitation obligations continue). During these periods of limited on-site activities, the monitoring activities detailed in Table 67 will be undertaken. Where applicable (i.e. where Regulated Activities requiring monitoring are still being undertaking such as rehabilitation and inspection for fauna entrapment) during non-operational periods, this monitoring schedule will also apply to previously approved Regulated Activities undertaken on EMP's being consolidated into this EMP (refer to Section 3.14).

Table 67: Routine monitoring during non-operational periods of limited on-site activity

Item	Purpose	Frequency
Waste, freeboard and wastewater	- Ensure removal of all waste introduced or generated. - Effectiveness of measures to mitigate stock, wildlife and human interaction with waste and wastewater stored on site.	- Waste storage (other than wastewater) areas to be inspected pre / post wet season. - Monthly remote inspection by telemetry / camera of freeboard for pits, tanks, and clean water dams (when used for storage) will be completed by online telemetry or photography until closure. - Inspections will also include checks for fauna access/entrapment risks and condition of any escape mechanisms (where required).
		Physical inspection when personnel attend site, and as soon as practicable after any alert/alarm (where site access is safely available).
Hazardous chemicals	Confirm hazardous chemical storage remains secure and secondary containment remains intact during limited activity periods.	Any hazardous materials required to be retained on site will be contained in suitable chemical storage areas (e.g. banded). Chemical storage to be inspected pre/post wet season. Non-essential hazardous chemicals are to be moved off-site at the completion of each operational phase where practicable.
Weather and Bushfire	Hot spot alerts and fire danger is known.	Fortnightly checks of fire and weather forecasts.
Spills	Sites free of spill-related contamination.	Any hazardous materials required to be retained on site will be contained in suitable chemical storage areas (e.g. banded). Any non-essential hazardous chemicals retained on-site will remain in banded chemical storage areas and will be inspected pre/post wet season. All spills will be cleaned up, captured in the IMS and closed as required.
Erosion and Sediment Control	ESC measures in place and as per the EMPs ESC plan (Appendix G).	- Pre and post-wet season inspections during non-operational periods to identify required repairs and confirm stability. - Within 2 months where safe access is available or as soon as practicable thereafter.
Weeds	Continue with opportunistic monitoring, complete any weed monitoring and survey activities as identified in the <i>Weed Management Plan</i> (Appendix C).	- Annual survey post-wet season weed survey (as per <i>Weed Management Plan</i>). - Opportunistic observations recorded via the WeedMate app during site attendance.
Rehabilitation	Continue with photo points as part of ensuring any rehabilitation completed is fulfilling the requirements of the <i>Rehabilitation Management Plan</i> (Appendix K).	As per the <i>Rehabilitation Management Plan</i> (Appendix K).
Groundwater monitoring	Ongoing groundwater monitoring for older wellsites after completion of the 3-year post-HFS quarterly monitoring phase.	Annually, in accordance with Appendix I (Section 5.4).

8.6.3. Reporting details

Table 68 presents the routine reporting details required under this EMP.

Table 68: Routine reporting details

Frequency	Report detail	Recipient
Before the commencement of the proposed Regulated Activities	The commencement of the Regulated Activities.	- The Minister for Environment. - The occupier of the land in which the activity is carried out. - The owner of the land in which the activity is to be carried out.
Before the commencement of flaring	Final contractor radiant heat modelling completed prior to flaring to confirm the vegetation-free exclusion zone.	Available on request to DLPE.
Within 6 months of flowback/produced water occurring	A report must be given to the Minister containing information about flowback fluid within 6 months of the flowback occurring. Similarly, a report on produced water must be given to the Minister within 6 months about produced water. See Section 8.6.4 for further details.	The Minister for Environment.
Each reporting period (i.e: each 90 day period after the day on which the EMP is approved; or as agreed in writing with the Minister)	Recordable incident report summarising recordable incidents in accordance with regulation 35(3) of the PER 2016 during operational and non-operational works for each monitoring period. To be provided as soon as practicable, but not later than 15 days after the end of the reporting period.	Minister for Lands Planning and Environment
Annually	- An annual environmental performance report will be prepared and submitted, covering the following: - A summary of the works completed under the EMP during the reporting period. - A summary of performance against measurement criteria. - A summary of all the recording, monitoring, and reporting information about the Regulated Activities to which this EMP relates in a manner that will enable the Minister to determine whether the environmental outcomes and environmental performance standards in the plan are being met. - A summary of water and wastewater tracking, including reuse, discharge and spill volumes recorded under the Code. - Groundwater Monitoring Data Review report (detect of changes in groundwater as a result of drilling and stimulation activities).	DLPE.
When Clearing Completed	Records of the nature, location, and extent of disturbance of flora and fauna including geospatial information depicting areas cleared will be updated and submitted annually from the date of approval (where disturbance occurred during that 12-month period).	DLPE and Minister.
Emissions Report	Emissions reporting must be in accordance with the Code.	- CER. - DLPE.

	• The natural gas industry must estimate and report all Scope 1 and 2 greenhouse gas emissions to the Australian Government's Clean Energy Regulator annually in accordance with the NGER regulations. • Hence emissions associated with venting and flaring, as described in the Code, must be consistent with the requirements of the Clean Energy Regulator but must be provided separately to DLPE in accordance with the Code. • DLPE reporting will include a comparison of actual emissions against the EMP estimates (predicted). • Scope 1 and 2 emissions that exceed statutory limits must be reported to the Clean Energy Regulator. • Reporting period 1 July to 30 June. • Reporting is through the Emissions and Energy Reporting System (EERS). • The deadline for reporting to the Clean Energy Regulator is 31 October of the relevant reporting year.	
As Required	• Reportable incident notification (verbal or written), where an incident has caused, or has the potential to cause, material environmental harm or significant environmental harm (as soon as practicable, but no later than 2 hours after occurrence/becoming aware.) Notification to specify matters set out in regulation 33(3)(c) of the PER 2016. If notification is given verbally, this must be followed by written notification within 24 hours, also specifying matters set out in regulation 33(3)(c). • Written initial report for a reportable incident as soon as practicable (within 3 days of the incident first occurring) • Interim reports for a reportable incident if and as required pursuant to regulations 34(6) and 34(7) of the PER 2016. • Final report for a reportable incident as soon as practicable, but no later than 30 days after the clean up or rehabilitation is complete. Reports for reportable incidents must include information as relevantly set out in regulation 34. • If a fire occurs in/around the project footprint during operations, the extent of the fire's effects will be mapped (in consultation with the landholder) and information provided to the regulator. • Flowback reuse volumes, where reuse occurs, will be recorded in wastewater tracking records and summarised in annual environmental reporting.	• Minister for Lands, Planning and Environment.

8.6.4. Reporting requirements for hydraulic fracturing – flowback and produced water

Within 6 months of flowback occurring, and within 6 months of produced water being extracted, Santos will provide the Minister with 2 separate reports (one relating to flowback fluid and one relating to produced water) each containing the following information:

- The identification of any chemicals or naturally occurring radioactive material (NORM) detected in the flowback fluid.
- The concentration of any chemicals or NORM detected in the flowback fluid.
- Details of how any identified chemicals or NORM have been, or will be, managed.
- Details of how any identified chemicals or NORM have been, or will be, transported.
- Details of how any identified chemicals or NORM have been, or will be, treated.
- Details of any actions proposed to prevent chemical or NORM spills.
- Details of the emergency contingency plan relevant to the activity, as included in this EMP.
- Flowback and produced water reports will include the required human health risk assessments for all detected chemicals.
- Reference to applicable requirements under prescribed chemical management legislation.

8.6.5. Equipment maintenance and calibration

Testing and monitoring requirements associated with the *CoP – Well Integrity* are detailed within the *Well WOMP*.

Telemetered groundwater level monitoring data will be reviewed monthly at a minimum. The purpose of the monthly review will be to ensure telemetered monitoring sites are still functioning. In the event that erroneous data is detected, maintenance or inspections will be undertaken within practical timeframes and future inspections scheduled as required.

All field probes and other field based monitoring equipment will be calibrated and maintained in accordance with the manufacturer's specifications. Calibration and maintenance records will be stored within Santos's database and included in the relevant annual reporting to the Minister, consistent with the Code's monitoring and reporting obligations.

8.6.6. Record management

The SMS outlines the policies and procedures governing data management and prescribed records.

To the extent the following documents are prescribed records for the PER, they will be kept for the longer of 5 years following the period during which the petroleum interest is in force or fifteen years after the record comes into existence:

- The original EMP, and each revision of the plan, as approved by the Minister.
- Records of calibration and maintenance of monitoring devices used.
- Records of measurement criteria, commitments, and statutory reporting requirements.
- Weed washdown records.
- Induction records.
- Waste / wastewater transport records.
- Fuel usage.
- Records of emissions reporting.
- Regular inspection reports.
- Photopoint records.
- Reports of monitoring program about environmental performance or the implementation strategy.
- Reports related to audits / inspections about environmental performance or the implementation strategy.
- Records relating to investigation of reportable and recordable incidents and non-compliances.
- Rehabilitation and weed monitoring reports.
- Management of change records.
- Certificates for the disposal of waste.
- Information or records relating to stakeholder engagement.
- All documents developed or received in relation to matters under the PER.

8.7. Audit

In addition to the routine monitoring outlined in this document, audits will be conducted to assess compliance with the plan.

Audit review findings including actions are communicated to the Santos Ltd and Contractor Project Managers and Santos Ltd Field Representative. Actions are agreed with all parties and assigned an actioner and required completion date. The audit and actions are recorded in the EHS Toolbox Audit & Compliance Manager which notifies the actioner and their manager when actions are due. If actions are not closed within the due date, the system has a hierarchy notification system based on the number of days an action is overdue as to the level of manager who receive notification of the overdue action.

8.8. Management of change

The SMS establishes the processes required to ensure that when changes are made to a project, control systems, an organisational structure or to personnel, the EHS risks and other impacts of such changes are identified and appropriately managed.

The SMS requires that all environmentally relevant changes must obtain environmental approval (internal i.e. within Santos and/or external i.e. regulatory) prior to undertaking any activity.

Environmentally relevant changes include:

- New activities, assets, equipment, processes or procedures proposed to be undertaken or implemented that have potential to impact on the environment and have not been:
 - Assessed for environmental impact previously, in accordance with the requirements of the standard.
 - Authorised in the existing management plans, procedures, work instructions, or maintenance plans.
- Proposed changes to activities, assets, equipment, processes or procedures that have potential to impact the environment or interface with an environmental receptor.
- Changes to requirements of an existing external approval (e.g., changes to conditions of environmental licence).
- New information or changes of information from research, stakeholders, legal and other requirements, and any other sources used to inform the EMP.

Where an environmentally relevant change is identified, the Management of Change (MoC) is assessed by an Environmental Adviser and if required appropriate technical and/or legal advice is sought. The MoC assessment is made against the approved EMP to ensure that impacts and risks from the change can be managed to ALARP and acceptable levels.

In the event that the proposed change is a modification or new stage of the proposed Regulated Activities, introduces a significant new environmental impact or risk, results in a significant increase to an existing environmental impact or risk, or, as a cumulative effect results in an increase in environmental impact or risk, this EMP will be revised and submitted for re-assessment and acceptance by the Minister (as per regulation 17 or 22 of the PER subject to the extent of change).

Where a change represents a modification to a Regulated Activities in a manner that does not require a revision or resubmission of the EMP, before the Regulated Activities are modified, Santos will provide a PER Regulation 22 notice to the Minister that includes the details of the proposed modification.

Where there is an identified and verified change to the existing environment (as described in Section 4) that will not require a revision or resubmission of the EMP, within 30 days after the change has occurred Santos will notify the Minister that specifies the details of that change as per Regulation 23 of the PER.

Where a change is not considered significant, this will be managed as a minor internal revision with no requirement to notify the Minister.

8.9. Management of non-conformances

For the activity, a non-conformance is classed as:

- A breach of an Environmental Outcome or Environmental Performance Standard (Section 6.7). This triggers the requirement to report as a “recordable incident” as per Section 8.5.
- Failure to implement a requirement in the implementation strategy.

Non-conformances are identified via:

- Audits and inspections
- Incident reporting and investigations.

Where a non-conformance is identified, actions are implemented to assess the cause of the incident, action(s) taken to avoid or mitigate the incident, to correct the non-conformance and prevent reoccurrence of similar incidents.

To ensure that non-conformances lead to learning and improvements for the activity and on a company-wide basis, non-conformance are:

- Communicated to the NT Exploration Manager via EHS Toolbox (see below), daily and weekly meetings and the appropriate reports (i.e. audit, performance, incident investigation) to ensure personnel are made aware of non-conformances and corrective actions to help prevent recurrence of similar incidents.
- Communicated to operational personnel at daily pre-start meetings via the Drilling Field Supervisor to ensure personnel are made aware of non-conformances and corrective actions to help prevent recurrence of similar incidents.
- Communicated internally within Santos and Santos Ltd, as per the Santos Ltd Internal Incident Notification Guide and where there are lessons learnt that are applicable to other areas of the business a Flash Notification is issued.
- Recorded in EHS Toolbox and actions tracked to completion.
- Reviewed by the actioner’s manager prior to being closed to ensure actions are completed and implemented.

8.10. EMP Revision

This EMP must be reviewed and proposed revisions submitted to the Minister for approval every 5 years as required by Regulation 18 of the PER.

9. References

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Appendix A – Summary of Approved Regulated Activities

Appendix B – Bushfire Management Plan

Appendix C – Weed Management Plan

Appendix D – Chemical Risk Assessment

Appendix E – Spill Management Plan

Appendix F – Wastewater Management Plan

Appendix G – Erosion and Sediment Control Management Plan

Appendix H – Methane Emissions Management Plan

Appendix I – Surface Water and Groundwater Management Plan

Appendix J – Environmental Report

Appendix K – Rehabilitation Management Plan

Appendix L – Cultural Heritage Assessment

Appendix M – Emergency Response Plan

Appendix N – Stakeholder Engagement Log

Appendix O – Risk Assessment

Appendix P – Engineering Drawings