Mereenie Appraisal Wells – WM 31 / 32

Environment Management Plan

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Document Control

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9-1	Initial submission	Environmental Specialist	Risk & HSE Manager	4 October 2024
9-2	Update post DLPE Reg 10 / Reg 11 notices	Environmental Specialist	Risk & HSE Manager	14 February 2025
9-2	Update post DLPE Reg 10 / Reg 11 notices and correspondence	Environmental Specialist	Risk & HSE Manager	20 February 2025

Disclaimer

This document has been prepared by Central Petroleum Limited (Operator) of Operating Lease 4 (OL4) and Operating Lease 5 (OL5) on behalf of the interest holders (see Table 1). It has been prepared using the skill and care expected from persons with professional qualifications, training, skills and experience on the subject matter of environment, safety, risk management and petroleum development and operations to provide factual and technical information and reasonable solutions to identified risks.

Whilst every care has been taken to prepare figures presented in this report, the interest holders make no representations or warranties about the accuracy, reliability, completeness or suitability for any particular purpose and do not accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the illustration being inaccurate, incomplete or unsuitable in any way and for any other reason. The figure is for informational purposes only and is subject to change.

Document ownership and revision

The Operator is the custodian of this EMP and has overall responsibility for its implementation, compliance and revision on behalf of the interest holders. They will also ensure that this EMP is reviewed and, if necessary, revised:

- when there is a significant change to normal operations for the activities covered by this EMP
- when there is a significant change to the regulatory framework within which the activities under this EMP are carried out
- when recommendations or comments from the government approval process are made
- if there is a new environmental impact or environmental risk not provided for in the current plan for the activity or an increase not provided for in the current plan for the activity
- in the event an incident causing significant environmental harm or loss occurs

This document shall not be issued and / or revised without the express approval of the Operator and / or its interest holders.

Executive summary

Operated under petroleum titles Operating Licence 4 (OL4) and Operating Licence 5 (OL5), the Mereenie Field is an oil and gas field located west of Alice Springs in a remote part of the Northern Territory (Figure ES-1). The field has been operated by the current Operator since 2015.

This Environment Management Plan (EMP) relates to constructing 2 new petroleum appraisal wells (West Mereenie WM31 and WM32) at 2 locations within OL4. Each site will require the construction of access tracks and well sites. Two location / layout options are discussed within the EMP for the well site design of each well. The proposed wells are conventional in design and require no hydraulic fracturing / stimulation.

In the event of successful petroleum recovery, wellhead equipment and gathering flowlines will be installed; otherwise, the wells will be suspended/abandoned or decommissioned. Upon project completion, the wells will be transferred to the existing management process for Mereenie production activities as per the Mereenie Field EMP and Mereenie Well Operations Management Plans.

This EMP provides a detailed description of how the Operator proposes to manage the environmental impacts and risks associated with its activities, including how it will:

- remain consistent with the principles of ecologically sustainable development.
- comply with regulatory obligations, including relevant requirements of the Department of Land, Planning and the Environment (DLPE) Code of Practice for Petroleum Activities in the Northern Territory (the Code).
- reduce impacts and risks to as low as reasonably practicable and acceptable levels.

Key contacts

The Operator and custodian of the EMP is responsible for its implementation across the Mereenie Field. The nominated liaison is the Chief Operating Officer, who can be contacted via mail: 7/369 Ann Street, Brisbane QLD 4000, phone: +61 (07) 3181 3800 or email: *info@centralpetroleum.com.au*

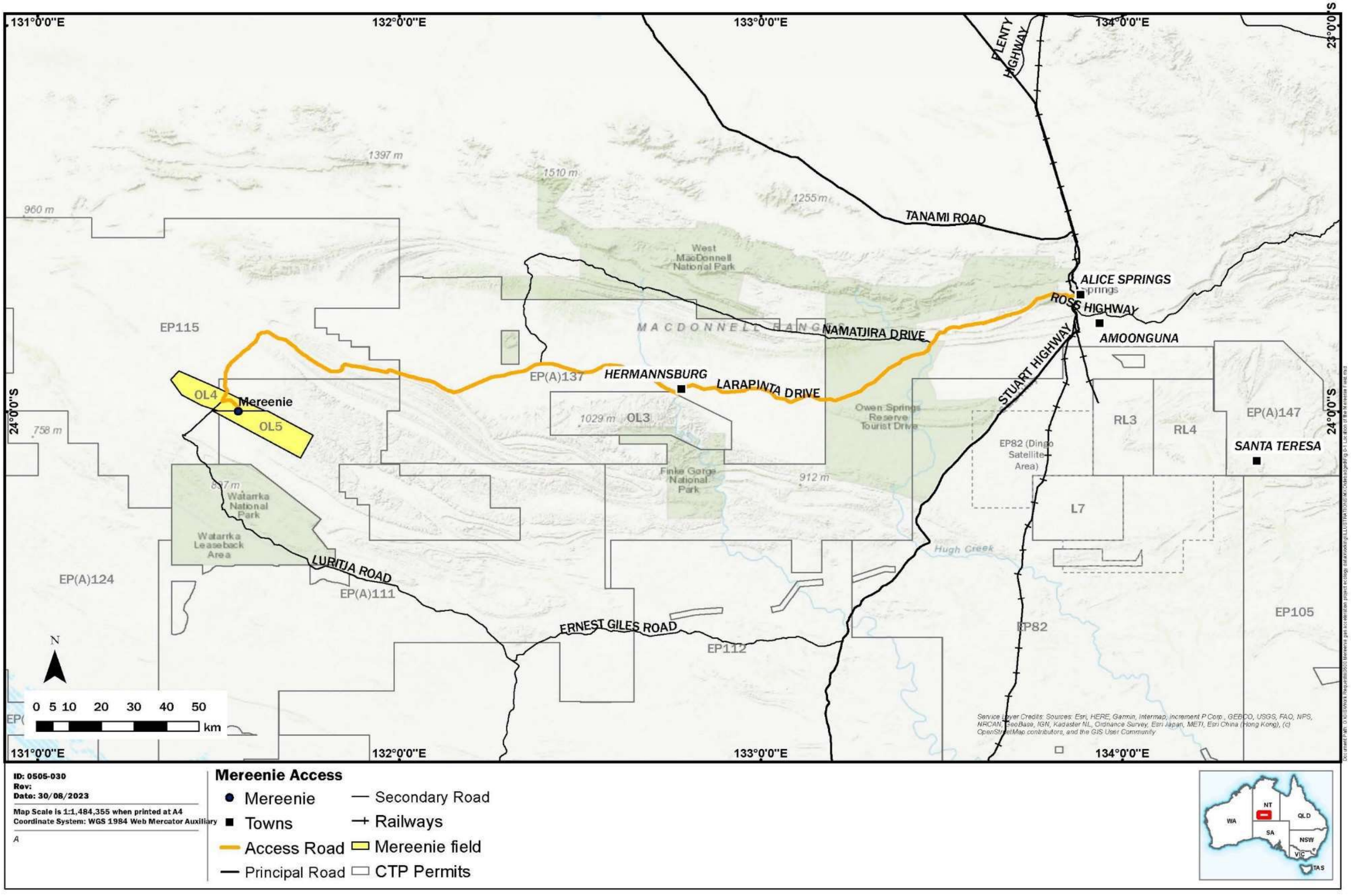

Figure ES-1: Location of Mereenie Oil and Gas Field

Description of the activity

The Mereenie Field is an oil and gas field operating under the Mereenie Field EMP. This EMP covers the regulated activities required for 2 well site layout options to drill 2 conventional petroleum appraisal wells, undertake well flow testing and complete or decommission the wells, safely and responsibly, depending on the well flow testing outcomes.

Well site layout options

Two layout options for the proposed appraisal wells are under review.

Option A – Shared well sites (preferred)

The preferred option will be to utilise the existing well sites of WM29 and WM30 to place the new well centres of WM32 and WM31, respectively. The result would be a well site sharing 2 well heads, placing the new WM32 well head with WM29 and the new WM31 with WM30.

Option B – Separate well sites

The second option requires further clearing places the WM31 and WM32 well sites adjacent to the existing WM29 and WM30 pads. Allowing for simple transfer of drilling infrastructure between the well sites.

Additional clearing associated with Option A is not required as previous infrastructure associated with WM29 and WM30 will be utilised, and any additional infrastructure, such as flow line tie-ins, will occur within existing hardstand areas.

Clearing required for Option B is approximately 1.99 hectares (ha) for developing well WM31 and 2.169 ha for WM32. A summary description of the activities under this EMP is shown in Table ES-1.

Whilst Option A is the preferred option from an economical and environmental perspective, since it requires less clearance and the use of existing infrastructure, this is subject to equipment availability and the capacity of the site to accommodate the rig. Should the site not be able to accommodate the rig equipment then Option B becomes a better option. The regulated activities listed below assume worst-case clearing and civil infrastructure development requirements associated with the implementation of Option B.

Table ES-1: Activities proposed under this EMP

Activity	Brief Description
EMP Implementation Strategy	Ensuring compliance/conformance of EMP activities with the Implementation Strategy outlined in Section 8 of the approved Mereenie Field EMP and the operators' HSE Management System.
Civil and project activities	This includes the construction of 2 well access tracks and engineered petroleum stairway well sites, similar to those constructed in previous years at Mereenie Field within OL4. Each well site includes an engineered and lined drilling sump, new flare pits and new turkeys nests (Option B).
Petroleum well construction	WM31 and WM32 will be constructed to meet the requirements of the NT Petroleum Regulations and in accordance with an approved Well Operations Management Plan (WOMP).
Petroleum well testing	During the drilling of the production hole at each well site, measurements will be taken for the incoming compressed air and the outgoing flow rates of gas. Gas flow rates will be periodically assessed to confirm the well's success. This process involves a controlled release/flow of hydrocarbon (dry gas) diverted through a gas flow metre to a flare pit for combustion. Following the results obtained from flow tests (if applicable), a decision will be made to either run a completion or to decommission the well.

Activity	Brief Description
Petroleum well completion – success case	If gas flow rates to surface are satisfactory, the stairway well will be completed as a production well and linked to the existing in-field gathering network of petroleum flowlines at Mereenie.
Petroleum well decommissioning – non-success case	Wells will be decommissioned to meet the requirements of the NT Petroleum Regulations and in accordance with an approved WOMP.
Progressive rehabilitation	Rehabilitation of disturbed areas and removal of/or make safe infrastructure no longer required for development well construction and completion.
Support activities	Includes the activities required to support the regulated activity at the Mereenie Field, including temporary accommodation camp, waste and wastewater handling, power generation, water supply, and chemical storage and handling.
Activities not within scope	Hydraulic fracturing – the Code explicitly requires *all 'produced water and flowback fluid' from hydraulic fracturing operations to be held in above-ground enclosed tanks*. The monitoring required in the Code is also aligned with wastewater arising specifically from hydraulic fracturing. This Clause is irrelevant at Mereenie, where all the petroleum wells are conventionally developed and do not require hydraulic fracturing. This is because no 'produced wastewater' exists during conventional well construction operations.

Description of the Environment

A summary of the physical and social environment for the Mereenie Field is provided in Table ES-2.

Table ES-2: Summary of the environment

Attribute	Description
Climate	Semi-arid to arid, influenced by monsoonal wet season from November to March, with the highest mean rainfall in January (45.7 mm) and a 30-year annual total average of ~310 mm. The annual total evaporation average is 2,910 mm. Average temperatures between July and January: ▪ maximum 21.3ºC to 38.3ºC ▪ minimum 6.1ºC to 23.4ºC.
Petroleum geology	Located within the Amadeus Basin, an east-west trending sedimentary basin extending across the southern part of the Northern Territory and into Western Australia. The basin covers an area of approximately 170,000 km^2 and a maximum sediment thickness of 14,000 m. Existing wells target the Pacoota Sandstone and Stairway Sandstone formations.
Surface geology	A thin veneer of Quaternary dune sands and alluvial sediments characterises the surface geomorphology in the vicinity of WM31 and WM32. These overlie and interfinger with the Mereenie Sandstone, which outcrops along the exposed hinge of the anticline.
Land systems	WM31 and WM32 are located in the Gillen Sandstone hills with Mulga or Witchetty Bush country. Moderate erosion risk exists in shallow soils with stones or gravel, as well as in certain areas with red sands or clayey red sands.
Groundwater	▪ The Mereenie Sandstone aquifer occurs at an interpolated measured depth of: - ~140m+/-10 BGL at WM31 - ~220m +/-10m BGL at WM32

Attribute	Description
	▪ WM31 and WM32 well construction will include 2 strings of cemented steel casing that meet the Code requirements for barrier testing to permanently protect and isolate aquifer(s) that may be present at a well site. ▪ The target Pacoota Sandstone has an inferred depth of ~1200–1500 m depth at WM31 and WM32. It is an oil and gas reservoir with some saline groundwater. It will be permanently isolated from all formations above it during well construction.
Groundwater bores	Groundwater for the activity will be sourced from a nearby registered Mereenie groundwater bore in the Mereenie Field. All registered bores are labelled and metered during groundwater extraction. A groundwater extraction licence (M10001) has been granted, allowing for 52.8 mL per annum for use throughout the field, which includes groundwater for development well drilling. Ongoing groundwater monitoring confirms that all bores are below drinking water/stock watering guideline limits; there is nil detection of hydrocarbon gases or products.
Surface water	WM31 and WM32 well site locations are located at the top of a tributary of the Parke Creek drainage line sub-catchment, which eventually runs east into the Diamantina catchment. Immediately to the west is the Simpson Desert dune system.
Bioregion	WM31 and WM32 well site locations are located at the western end of the MacDonnell Ranges.
Sites of Conservation Significance/Sites of Botanical Significance	There are no Sites of Conservation Significance (SOCS) locally. The Mereenie Field is located within the Laycock Sandplain Sites of Botanical Significance (SOBS) and the Mereenie SOBS. Both SOBS are designated as bioregionally significant based on their importance to the evolution of Australian flora, fauna, landscape or climate, and geographically and/or ecologically disjunct populations.
Conservation significant fauna	Forty-six conservation significant fauna species have been identified as potentially occurring within the Mereenie Field, 8 of which have been confirmed during site surveys.
Conservation significant flora	Forty-five conservation significant flora species have been identified as potentially occurring within the Mereenie Field, 15 of which have been confirmed during site surveys.
Weeds/pests	No weeds of national significance have been found within the Mereenie Field. Caltrop has been identified as a Class B Weed under NT Legislation (NT *Weeds Management Act 2001*). Buffel grass, a priority weed under the *Alice Springs Regional Weed Strategy 2021-2026*, was detected during a 2023 site survey, along with other environmental weeds. Under the NT Weeds Management Act 2001 Buffel grass is declared as unclassified and is therefore subject to the general duties of the NT Weeds Management Act 2001.
National parks and reserves	No National Parks or Indigenous Protected Areas are within or immediately adjacent to the Mereenie Field.
Fire history	▪ The area around WM31 has been burned recently (2023). ▪ The area around WM32 was burned in 2021.
Surrounding land tenure/use	The surrounding land uses / tenures are comprised of Haasts Bluff Aboriginal Land Trust, Aboriginal land and petroleum activities. The interest holders lease OL4 and OL5 under the Mereenie Agreement 2003 with the Central Land Council as representatives of the site's Indigenous Traditional Owners. The conditions applied to activities are outlined in the Agreement and the Mereenie Sacred Sites Clearance Certificate (SSCC) (SSCC C2022-046, renewed January 2023).

Attribute	Description
	The proposed activities are consistent with the current land use of the field and will not impact Aboriginal land use (authorised under the Mereenie Agreement 2003) beyond the existing day-to-day operations at Mereenie.
Surrounding populated places	Mereenie Field is located in a remote area in the Northern Territory. Alice Springs is located approximately 280 km west, and Hermannsburg is approximately 110 km east. Aboriginal communities near to, or who have ties to, the Mereenie Field include the following: Kulpidjara, Areyonga, Underana, Undandita, Haasts Bluff, Papunya, Ipolera, Morris Gap, Ulpanvali, Lilla, Wanmarra, Camel's Hump and Yateman's Bore.
Roads / traffic	Access to Mereenie Field from Alice Springs is via a network of sealed and unsealed public and private roads: ▪ head west from Alice Springs along Larapinta Drive/Red Centre Way to Hermannsburg, continuing towards Kings Canyon ▪ the turn-off to the Mereenie Field is to the left off Red Centre Way, approximately 175 km past Hermannsburg.
Heritage areas identified in the EPBC Protected Matters Search	No National Heritage Places have been identified within or surrounding the Mereenie Field.
Archaeological surveys	The planned impacted area has been surveyed and assessed. Site selection considered the findings of a heritage survey conducted as part of the process.
CLC Sacred Sites Clearance Certificate	The Operator has obtained a CLC SSCC for the works described in this EMP (certificate number C2022-046 (renewed January 2023)). Activities will comply with the conditions of the approved certificate.
Aboriginal Areas Protection Authority (AAPA) Certificate	The Operator has obtained an AAPA Authority Certificate for the works described in this EMP (AAPA Authority Certificate (202305946 – C2023/105) – At DLPE's request, the AAPA certificate has been omitted from this document. Activities will comply with the conditions of the approved certificate.

Risk Assessment Summary

The Operator has undertaken a risk assessment that is consistent with the requirements of ISO 31000 for the activities under this EMP. The risk assessment has considered both the inherent and residual risk of an activity.

The detailed risk assessment presents the range of potential impacts and corresponding mitigation measures. The key risks assessed under this EMP include:

- protection of groundwater through sustainable groundwater use and zonal isolation
- managing the risk of bushfires in the area
- protecting potential surface water paths through managing erosion and sediment control, spills, etc.
- avoid any potential loss of containment:
  - assessment and management of chemicals
  - generation and management of wastewater, including prevention of spills
  - well integrity
- protection of local flora and fauna
- generation and management of waste associated with drilling
- managing Aboriginal archaeological places and objects or heritage places or objects and/Sacred Sites
- protecting people and the community
- mitigating the introduction and spread of weeds

- managing any potential air pollution and minimising greenhouse gas emissions.

Residual risks with a 'Low' risk score are considered as low as reasonably practicable and acceptable. For residual risks with a risk score that is not ‘Low’, the risk assessments have included discussions on whether these risks are as low as reasonably practicable.

Table ES-3 summarises the residual risks for activities under the EMP. Interest holders consider all risks to be as low as reasonably practicable and are accepted.

Table ES-3: Risk assessment summary

	Residual Risk			
	Low	**Medium**	**High**	**Very High**
Count	35	4	0	0

The ‘Medium’ residual risks for activities under this EMP are:

- injury or death of conservation significant fauna from civil works, vehicle movements and earthworks
- increased occurrence of weeds (including weeds of national significance)
- contamination of soil from chlorides because of drilling fluid release to grade/ground
- loss of places or items of cultural significance from fire as a result of regulated activities under this EMP.

Environmental Outcomes

The Environmental Outcomes of the regulated activities include:

- no significant impact[1] on threatened fauna, their habitat and sites of conservation significance
- no significant impacts on soil stability, soil quality and land formations
- no long-term impact1 on surface water quality
- no long-term impact on groundwater quality, levels and availability
- drilling activities do not create a measurable decrease in air quality at sensitive receptors
- greenhouse gas emissions are minimised
- bushfires are not started from the conduct of the regulated activity, and infrastructure is protected from fires started outside of the OL areas
- no significant impact on the natural environment from drilling activities in association with weather events
- the extraction of subsurface equipment, hydrocarbons, and water does not result in human health impacts
- no significant impact on Aboriginal and non-Aboriginal artefacts, Aboriginal Sacred Sites and non-Aboriginal heritage sites
- no long-term impact on the community

Environmental Outcomes will be achieved when a regulated activity's environmental impacts and risks are reduced to a level that is ALARP and acceptable.

[1] Refer to EMP glossary for definition of 'Significant Impact' and 'Long term Impact'

Stakeholder Consultation

- Consultation with the Central Land Council, which is the only stakeholder per the stakeholder definition in the Petroleum (Environment) Regulations 2016 for the area, was undertaken by the Operator of the Mereenie Field at the Liaison Committee Meetings held in September 2022, September 2023 and January 2025.
- Under the SSCC and Mereenie Agreement, Formal Liaison Committee Meetings are the method by which the Central Land Council and Traditional Owners will be engaged. These meetings have been and will continue to be undertaken annually.

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1. Introduction

Central Petroleum Limited (Operator) operates on behalf of the interest holders under petroleum titles Operating Licence 4 (OL4) and Operating Licence 5 (OL5). The Mereenie Oil and Gas Field is located west of Alice Springs in a remote part of the Northern Territory (NT) (Figure 1). The current operator has been operating this field since 2015.

The planned drilling and related exploration activities at Mereenie are essential to maintaining and maximising the Mereenie Field petroleum commercial resource. This complies with the objective of the *Petroleum Act 1984*, which is to undertake effective petroleum exploration and develop petroleum production so that the optimum resource value is returned to the Territory. The Mereenie Field is connected to the market via the APA gas transmission pipeline and is an important domestic gas supplier to the NT.

This Environment Management Plan (EMP) covers the construction of two new petroleum wells, WM31 and WM32. Option A (preferred) proposes sharing the sites with existing wells WM29 and WM30, co-locating WM31 with WM30 and WM32 with WM29, utilising existing infrastructure to minimise clearing.

Option B involves building new sites adjacent to WM29 and WM30. Both options require a new flowline tie-in if successful however, option A benefits from using existing access tracks, sumps, and turkeys nests and any flow line tie in would occur on an existing well site reducing the need for additional land clearing.

Whilst Option A is the preferred option from an economical and environmental perspective, since it requires less clearance and the use of existing infrastructure, this is subject to equipment availability and the capacity of the site to accommodate the rig. Should the site not be able to accommodate the rig equipment then Option B becomes a better option.

The proposed well head locations are within 100m of each other in both option A and B, the EMPs description of the environment covers both options however, as option A results in a lesser impact to the environment, the risk assessment carried out and mitigation measures proposed have been a worst case scenario against the impacts associated with option B. To ensure ALARP is achieved in both scenarios, the worst case mitigation measures will be applied to all relevant components of the option A design, if approved.

In the event of a successful new petroleum discovery, the management of the stairway well and well site, including any incidental access tracks, will be transferred to the existing management processes for the fleet of conventional wells at Mereenie, which are presently covered under the approved Mereenie Field EMP and Mereenie Well Operations Management Plan. Wellhead equipment and a flowline to the in-field gathering network will then be installed. In the event of a non-success, the well will be suspended, and options are further evaluated before a decision to decommission the well. All works covered under this EMP are within OL4 and OL5.

This EMP provides a detailed description of how the Operator proposes to manage the environmental impacts and risks associated with its activities, including how it will address its regulatory obligation that underpins the Code. However, it should be noted that because the proposed appraisal wells are conventional wells, the mandatory hydraulic fracturing wastewater Code requirements for and transfer to closed-top wastewater tanks ahead of an event of predicted heavy rains are not applicable.

It is also largely unnecessary, considering its known and negligible toxicity, the region's extreme aridity, and the existing proven drilling waste (cuttings and drilling fluid) management systems the interest holders already use at new development well sites in Mereenie.

1.1. Mereenie Oil and Gas Field

The Mereenie Field was discovered in 1963, and production commenced in 1984. The field produces oil, condensate and gas, with all oil and condensate produced on-site being trucked to interstate prior to export. Gas is processed on-site to supply commercial markets in the NT and elsewhere.

The Mereenie Field is comprised of Operating Licence 4 (OL4) and Operating Licence 5 (OL5) tenement areas (123 km^2 and 158 km^2, respectively) and contains a fleet of existing petroleum wells. A total of 73 conventional wells have been drilled in the field over the decades and are maintained based on the needs of the field and the domestic market. The active wells produce oil and gas; several wells are used for gas reinjection. Those wells not in production are classified as suspended or have been decommissioned.

The principal oil and gas reservoirs are the P1 and P3 units of the Ordovician Pacoota Sandstone. The Pacoota Sandstone is greater than 1300 m below ground level at these locations. The overlaying Horn Valley Siltstone is both the source and seal. Many flank wells deviate naturally (up to 45%) through the hard-abrasive rock to intersect the narrow oil rim that surrounds the gas cap. Reserves have also been identified in the Pacoota P4 unit and the Stairway Sandstone

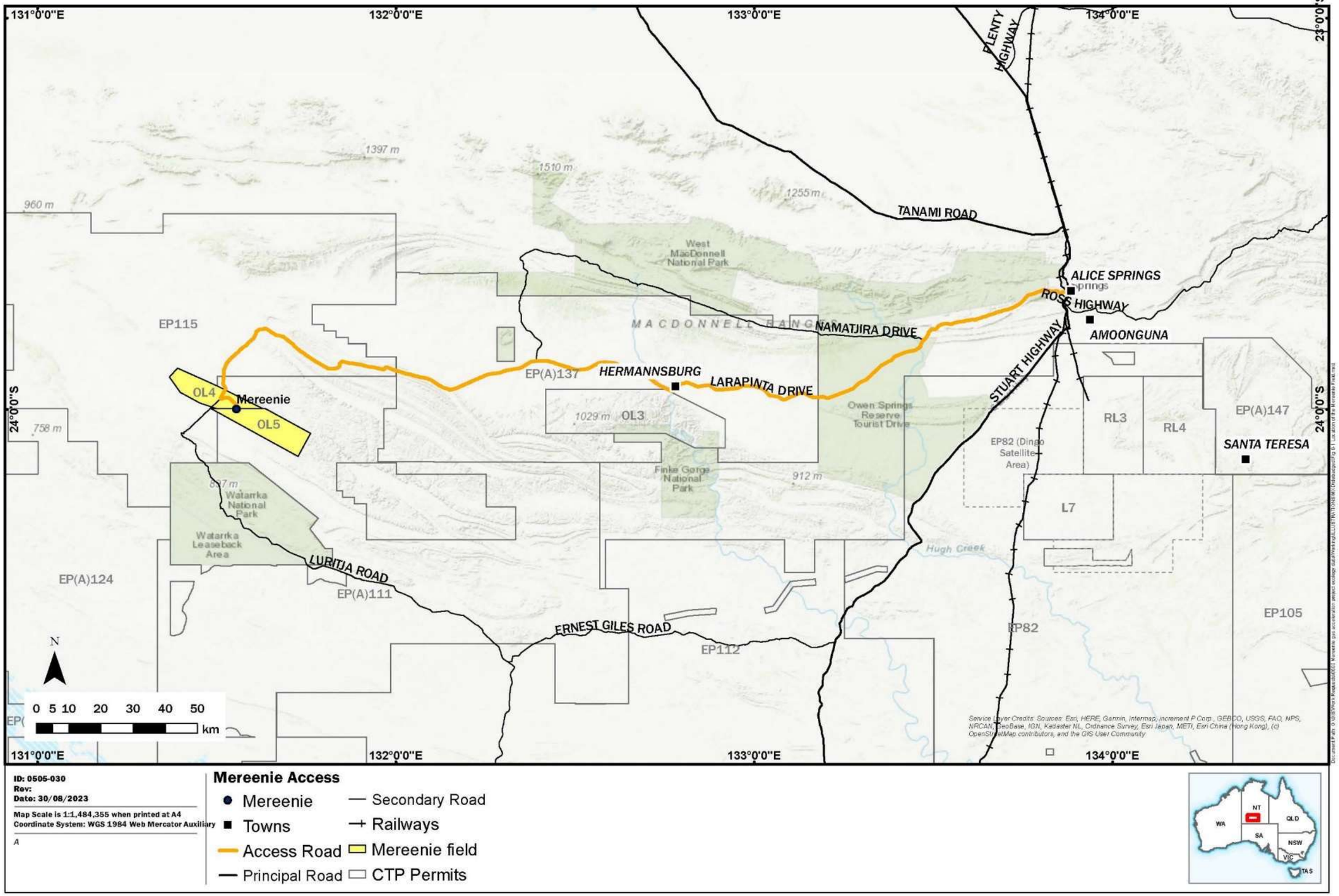


Figure 1: Location of Mereenie Oil and Gas Field

1.2. Interest Holders

Table 1 provides information on the registered OL4 and OL5 titleholders and their contact details. The most up-to-date contact details are available on each company's website. As detailed in joint venture agreements, the interest holders are collectively designated as the Mereenie Field Operator.

Table 1: Interest holders

OL4/OL5 Titleholders	
Name: Central Petroleum Mereenie Pty Ltd **ABN**: 95 009 718 183 **Website:** *www.centralpetroleum.com.au* **Liaison:** Exploration and Development Manager	**Name**: Echelon Mereenie Pty Ltd **ABN:** 72 650 386 360 **Website:** *www.echelonresurces.com* **Liaison:** Amadeus Assets Manager
Name: Horizon Australia Energy Pty Ltd **ABN:** 95 673 423 295 **Email:** *info@horizonoil.com.au* **Liaison:** Chief Executive Officer	**Name:** Cue Mereenie Pty Ltd **ABN:** 22 650 385 336 **Email:** *mail@cuenrg.com.au* **Liaison:** Chief Executive Officer

1.3. Purpose

This EMP aims to demonstrate how the interest holders will conduct their scope of activities under the EMP in a manner consistent with the principles of ecologically sustainable development such that impacts and risks are reduced to as low as reasonably practicable and acceptable levels.

More specifically, this EMP aims to:

- provide a framework for drilling and constructing 2 conventional petroleum appraisal wells, each at a separate locations in the Mereenie Field
- address regulatory requirements
- provide impact management strategies to assist interest holders in maintaining a positive position in the local community throughout the activities
- describe the existing environment (physical, biological and social)
- be a practical and usable document with environmental management principles that are easily implemented and effective.

1.4. Scope

The EMP covers the activities required to drill, test, complete, decommission and rehabilitate 2 conventional petroleum appraisal wells (WM31 and WM32) in OL4 and includes the following:

- construction of well site access track, well site hardstand area, and vehicle turnarounds (Option B only)
- utilising a mixture of extraction of gravel and sand at each well site and, if required, gravel from existing approved gravel pits in Mereenie Field to support civil construction activities
- construction of well site infrastructure including hardstand, engineered and high-density polyethylene (HDPE) lined turkey nests for water storage and drilling sump, steel-lined (and hydro tested) flare pit, temporary worksite sheds and turnarounds (Option B only)
- utilising existing licensed groundwater bores at Mereenie for drilling water requirements
- utilisation of either the existing Mereenie camp or a temporary 50-man accommodation camp at a previously cleared and operational area (WM13) in proximity to WM31 and WM32

- drilling 2 conventional petroleum appraisal wells, one each at WM31 and WM32, using a combination of mud-based and air/mist drilling systems
- flaring of gas during drilling and well testing
- completion of wells at WM31 and WM32, in a success case
- installation and commissioning of above and below-ground flowlines from wellhead to gathering network
- installation of well site production equipment and safety systems
- on-site disposal of drill cuttings and residual drill fluids in appropriately lined drilling sump with 500 mm freeboard
- decommissioning of wells that are not completed
- rehabilitation of wells and well sites that are decommissioned
- the EMP seeks authorisation for new ground disturbance within these infrastructure footprints for the areas detailed in Table 2.

The extent of proposed ground disturbance varies significantly depending on the implemented option.

Option A will co-locate the WM31 well head with the existing WM30 well site and WM32 with WM29, utilise existing well site infrastructure, including access tracks, flare pits, sumps and turkey nests (Figure 2),

Option B will require new well sites to be constructed adjacent to the existing WM29 and WM30 well sites and will require new well site access tracks and turnaround, sumps, flare pits and turkey nests in both locations. The proposed well sites required for option B are similar in size (~2 to 3 ha) to previous drilling operations within the Mereenie field, including additional clearing to accommodate a flowline corridor connecting the new appraisal wells to the treatment plant via the existing Mereenie Field gathering network. The indicative location of WM31, WM32 and a temporary 50-man campsite (i.e. the same campsite approved for WM29 and WM30) location for both options is shown in Figure 2 and Figure 3, respectively.

Table 2: Clearing footprints for each well site and associated flowline corridor

OPTION A	
WM31 well site	WM32 well site
Well site – existing well site	Well site – existing well site
Access tracks – existing WM30 well site access to be utilised	Access tracks – existing WM29 well site access to be utilised
Flow lines – no clearing required	Flow lines – no clearing required
0 ha	0 ha
OPTION B	
WM31 well site	WM32 well site
Well site – 1.99 ha	Well site – 2.11 ha
Access tracks – N/A (direct access from Mereenie access road)	Access tracks – N/A (direct access from Mereenie access road)
Flow lines – N/A (no clearing required)	0.059ha
1.99 ha	2.169 ha

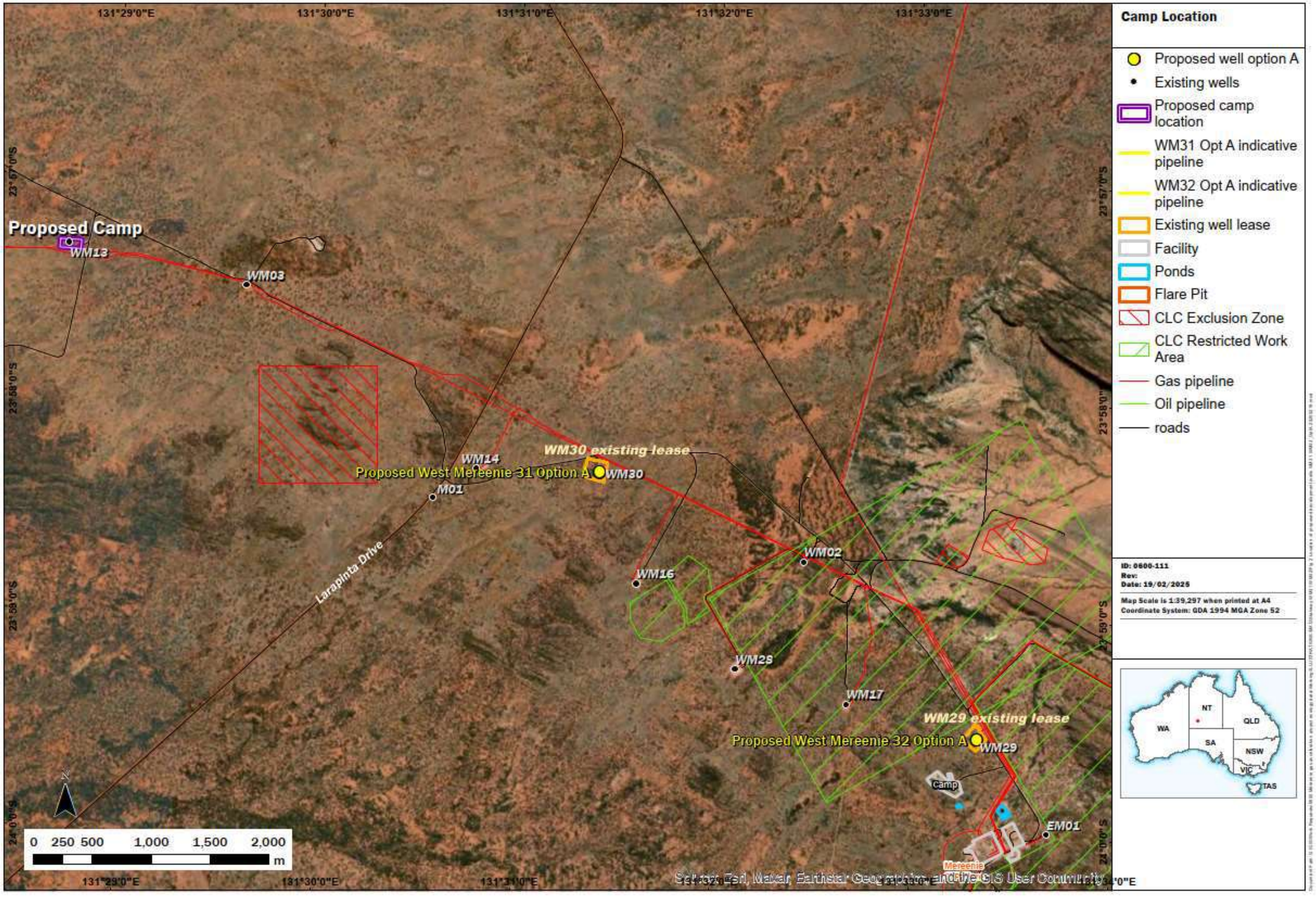


Figure 2: Location of proposed appraisal wells WM31 and WM32 (Option A)

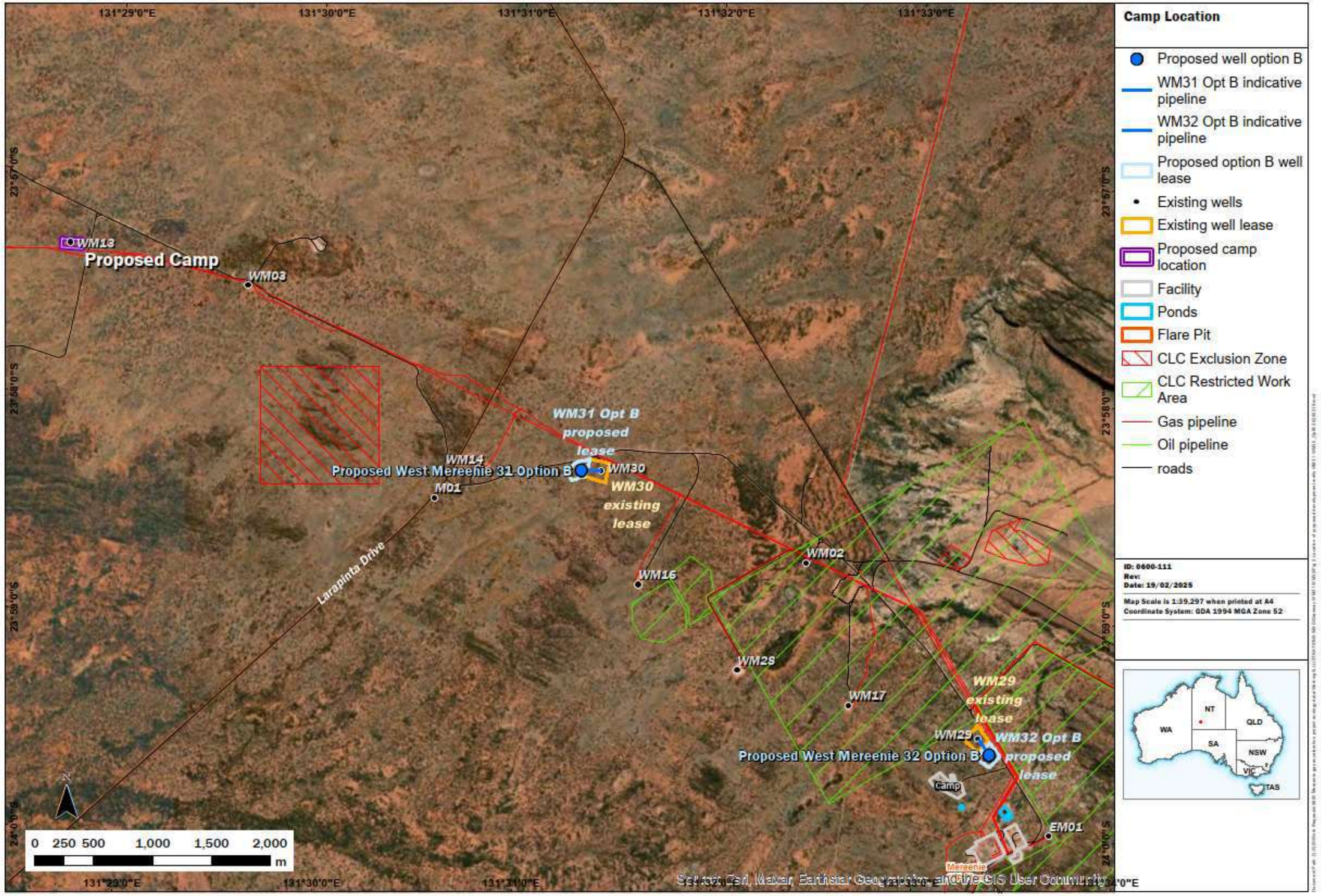


Figure 3: Location of proposed appraisal wells WM31 and WM32 (Option B)

2. Environmental legislation and other requirements

2.1. Key Legislation

Legislation of relevance to the Mereenie Field petroleum exploration well drilling operations is provided in Table 3.

2.2. Key Codes of Practice and Guidelines

In addition to legislative requirements, interest holders work according to codes of practice, standards, and guidelines in their production operations. These include, but are not limited to:

- DEPWS (now DLPE) Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019
- Schedule of Onshore Petroleum Exploration and Production Requirements, 2021
- Australian Pipeline Industry Association Code of Environmental Practice – Onshore Pipelines 2022
- APPEA Code of Environmental Practice, 2008
- Best Practice Erosion and Sediment Control, 2008
- DEPWS (now DLPE) Onshore Petroleum Guidelines (various)
- International Organisation for Standardisation (ISO) 31000 Risk Management – Guidelines
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2018
- National Environment Protection (Assessment of Site Contamination) Measure, 2013
- Australian Standards
- Northern Territory Noise Management Framework Guidelines, 2018

2.3. Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) is a concept based on implementing practices and principles that meet the needs of ecological processes and people today without impeding future generations to meet theirs. There is no universally accepted definition of ESD; however, the Commonwealth Government of Australia suggested the following:

'Using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained and the total quality of life, now and in the future, can be increased' (Ecological Development Steering Committee, 1992).

The interest holders' aim of ESD is to utilise the natural environment to meet the current needs without jeopardising the environment for future operations or other land managers. All aspects of environmental impacts have been assessed, and appropriate preventative and mitigation measures have been implemented to ensure that all aspects of the OL areas are managed and developed in accordance with the ESD concepts and this EMP.

Forward planning and adaptation of ESD concepts from the inception of development will ensure that the environmental impacts of daily operations activities are minimised. Further assessment of the consideration of ESD, the environmental values of Mereenie and the potential impacts are presented in Section 6.

2.4. Central Land Council Agreement and Sacred Sites Certificates

The interest holders have an agreement with the Central Land Council (CLC) for the use of OL4 and OL5 land for petroleum activities under the Mereenie Agreement 2003. The CLC acts as a representative of the Indigenous Traditional Owners. The Mereenie Agreement 2003 includes land access and other matters such as royalties, administration and Sacred Sites protection.

Under the Mereenie Agreement 2003, the Operator, on behalf of the interest holders, has obtained a Sacred Sites Clearance Certificate from the CLC (SSCC 2022-046). These certificates were issued following an assessment and survey of the current and future activities to be conducted by the Operator at Mereenie.

Table 3: Key Legislation

Legislation	Requirement	How interest holders meet the requirement	Administered by
Commonwealth			
Environment Protection and Biodiversity Conservation Act 1999	Referral of proposed action / ministerial approval.	A self-assessment of the activities to be undertaken within this EMP has been conducted, and it has been determined that significant impacts to Matters of National Environmental Significance (MNES) are not likely to occur, and a referral is not required at this stage.	Department of Climate Change, Energy, Environment and Water (DCCEEW)
National Greenhouse and Energy Reporting Act 2007 (NGER Act)	Reporting under the National Greenhouse and Energy Reporting Scheme where thresholds are exceeded.	The project will report energy consumption, production and greenhouse gas emissions in accordance with the NGER Act.	Clean Energy Regulator (CER)
National Environment (National Pollution Inventory Protection) Measure 1998	Reporting under the National Pollution Inventory (NPI) where trigger thresholds are exceeded.	Interest holder activities may contribute to triggering the threshold for NPI reporting. The Operator reports usage against the potential 93 NPI substances where required.	DCCEEW
Native Title Act 1993		The Operator works alongside Traditional Owners, represented by the Central Land Council, regarding all activities undertaken on the Aboriginal Freehold Land on which the Mereenie Field is located. Mereenie Agreement, 2003 is in place.	Attorney-General's Department
Northern Territory			
Bushfires Management Act 2016 / Bushfire Management Planning Guideline: Onshore Petroleum Projects	Bushfire Management Plan/Permit to burn	The Operator has included a Bushfire Management Plan consistent with the requirements of the Act and guideline. The Mereenie Field is not within a fire protection zone, though permits to burn may be required during a fire danger period where the fire danger area includes the Mereenie Field.	DLPE
Petroleum Act 1984	Petroleum titles	Interest holders have obtained the necessary petroleum titles (Operating Licence 4 and Operating Licence 5) to undertake the activities listed in this EMP.	DME
	Land access and compensation agreements	Land access agreements are in place with the Central Land Council for Mereenie as per the Mereenie Agreement, 2003.	Central Land Council (CLC)

Legislation	Requirement	How interest holders meet the requirement	Administered by
Petroleum (Environment) Regulations 2016 (PER)	Approved EMP	This EMP has been submitted to comply with the PER. The EMP activities seek to comply with the requirements of the Code and Schedule 1 of the Regulations.	DLPE
Environmental Protection Act 2019 and associated Environment Protection Regulations 2020	Referral of proposed action/environmental approval	The activities within the scope of EMP do not constitute any material change of use in OL4 and OL5. Interest holders are of the view that the activities covered by this EMP do not have a significant effect on the environment and that any new assessment under the Environment Protection Act 2019 is not required.	NT Environment Protection Authority (NT EPA)
Northern Territory Aboriginal Sacred Sites Act 1989	Must not enter, damage or interfere with a Sacred Site (even if not registered)/Authority Certificate	Restricted work areas and no-go areas have been identified across the Mereenie Field. All personnel and visitors are educated about these areas, and they are clearly delineated on maps and with signage. Central Land Council Sacred Sites Clearance Certificate (SSCC C2022-046 renewed January 2023); AAPA Authority Certificate (202305946 – C2023/105).	AAPA/CLC
Heritage Act 2011	Work approval (for removal or damage of archaeological sites)	All activities outlined in this EMP will be conducted within the existing operational footprint of Mereenie Field; any further discovery of heritage places and objects or the identification of human remains will be managed through the unexpected finds protocol (Section 4.3.4.2).	NT Heritage
Aboriginal Land Rights Act 1976	Provides for the key mechanism for the creation of Aboriginal-owned freehold land in the NT. Includes the establishment of land trusts over which Aboriginal Land Councils have oversight.	The land on which Mereenie operates is Aboriginal freehold land belonging to the Haasts Bluff Aboriginal Land Trust. Undertakings have been given in the Mereenie Land Use Agreement to maintain the right of the Traditional Owners to move freely throughout Mereenie and use non-operational land within Mereenie for pastoral grazing activities and conservation purposes.	NT Heritage
Radiation Protection Act 2004	Disposal of radiation sources (NORM)	The Operator is to undertake NORM testing. If limits specified in the act are exceeded, disposal of the material is to be in accordance with the Act.	NT Health
Territory Parks and Wildlife Conservation Act 1976	Protects wildlife and listed threatened species in the NT Feral animal management	EMP camp and access activities will be conducted within the existing Mereenie operational footprint and in existing disturbed areas. Small areas are to be cleared for well sites and access tracks (5.2 ha), so significant impacts to wildlife and listed threatened species are unlikely.	DLPE

Legislation	Requirement	How interest holders meet the requirement	Administered by
		The Operator responds to feral animal management as required for those species identified at Mereenie.	
Food Act 2004	Providing for the safety and suitability of food for human consumption, for security of access to food, drink and grocery items in remote communities and for related purposes	Applicable food standards are applied and Camp kitchen approvals and registration to remain current.	NT Health
Public Health and Environmental Act 2011	To protect the health of particular individuals and communities in the Territory from emerging environmental conditions, or public and environmental health issues, that may impact on their health and wellbeing. Relevance to the project: Wastewater Management	On-site systems meet the requirements of the Code of Practice for on-site wastewater management.	NT Health
Public and Environmental Health Regulations	Regulations under the Public and Environmental Health Act 2011 with reference to Commercial Visitor Accommodation: Wastewater Management	On-site systems meet the requirements of the Regulations with regard to the regulated activities (Commercial Visitor Accommodation).	NT Health
Water Act 1992	Groundwater extraction licence	A groundwater extraction license (M10001) is currently in place and valid until 30 June 2033.	DLPE
Waste Management and Pollution Control Act 1998	General environmental duty	All operators must abide by the general environmental duty when activities occur outside OL4 and OL5 (e.g., during transportation). An example of this would be following the *Northern Territory Contaminated Land Guideline* (2017) if a contamination event occurred.	NT EPA

Legislation	Requirement	How interest holders meet the requirement	Administered by
	Licensed waste contractors	A licensed waste transporter disposes of any listed waste produced.	NT EPA
Weeds Management Act 2001	Weed declarations and statutory weed management plans	The Operator ensures its activities are consistent with statutory weed management plans and undertakes weed management activities consistent with weed declaration classes (including the recent updated weed listing).	DLPE
Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Regulations 2011	Transport of dangerous goods by licensed persons within licensed vehicles	The Operator ensures that any transportation of dangerous goods that occurs above the trigger levels is done by appropriately licensed transportation personnel (including vehicles).	NT Worksafe
Code of Practice: Onshore Petroleum Activities in the Northern Territory 2019	Activities to be performed under an approved EMP are to be consistent with the Code	The EMP activities are subject to Code compliance, and this EMP has been prepared to meet those requirements. There are instances of the Code not applicable to the activities at the Mereenie Field, namely Section D. The scope of Section D, as defined in D.2, is specific to 'onshore shale gas fields'. The Mereenie Field is a conventional gas field. Where infrastructure and/or processes are not aligned with the Code, interest holders will ensure that any new facilitates or upgrades are aligned with Code requirements.	DLPE
Agricultural and Veterinary Chemicals (Control of Use) Act 2004	Use of chemicals to control weed and pest species across operations	The Operator ensures the application of weed control products aligns with the Act.	DLPE
Work Health and Safety (National Uniform Legislation) Act 2011	Activities to be performed under an approved EMP are to be compliant	Field operations described in this EMP are subject *to Work Health and Safety (National Uniform Legislation) Act 2011* and its subordinate Regulations.	NT WorkSafe

3. Description of Activity

3.1. Proposed Timetable and Associated Workforce

The civil construction and drilling components of the Mereenie development well campaign at WM31 and WM32 well site locations are expected to commence in the calendar year 2025 (1st quarter), with each well taking approximately 4 months to construct. The Minister will be notified that civil construction and drilling activities will commence under Schedule 1, Item 12 of the *Petroleum (Environment) Regulation 2016* for each well.

Table 4 below provides an indicative campaign timetable and the workforce required to complete the activities. It is important to note that these are the total personnel to support the activities; the workforce will fluctuate on-site as not all activities will be undertaken simultaneously. In addition, the works will be carried out as a campaign, and the workforce will be actively moving from the temporary camp to each well site (roughly 3.5 km apart) on an internal private road.

- The workforce for civils, surface infrastructure installation and rehabilitation works will be locally sourced. These activities will likely be undertaken on a two-week on and one-week off roster, working 12 hours a day. Civil activities will be undertaken between the hours of 6 am to 6 pm.
- The drilling crews will most likely be fly-in fly-out (FIFO) or drive-in drive-out (DIDO) to Alice Springs and staying at a temporary, on-site 50-man accommodation camp for drilling. Crews will be on two-week rotations, with 2 crews at a time to support operations. Drilling and completion activities will be undertaken 24 hours a day. A temporary camp will be established in the Mereenie Field at an existing cleared area near the drill sites (see Figure 2).

Table 4: Proposed timing and associated workforce

Activity	Estimated Duration	Workforce*
Civil works	WM31 – 21 days* WM32 – 21 days*	5-7 personnel, including: ▪ equipment operators ▪ surveyors ▪ site supervisor
Drilling	WM31 – 40 days WM32 – 40 days	Up to 50 personnel, including: ▪ drilling crew ▪ service companies' crews ▪ OCR
Well site production and safety equipment installation and commissioning	30 days	10 personnel, including: ▪ welders and pipe fitters ▪ equipment operators ▪ site supervisor
Rehabilitation	30 days plus ongoing monitoring as per the Rehabilitation Plan	3-5 personnel, including: ▪ equipment operators ▪ surveyors ▪ site supervisor

**These timeframes are associated with Option B and the infrastructure associated with the new well site construction. This would be mitigated completely for Option A.*

WM31 and WM32 appraisal wells will be drilled consecutively using the same drilling rig and technique. Indicative timing for the regulated activity is provided in Table 5.

Table 5: Regulated activity indicative timeframes

Item/Description	Duration
EMP approvals	4-8 months
Civils – access tracks and well site pad 1	21 days (Option B only)
Civils – access tracks and well site pad 2	21 days (Option B only)
Mobilisation of rig	10 days
Spud Well 1 West 31	35 days
Move to Well 2 West 32	5 days
Spud Well 2 – West Mereenie 32	35 days
Release rig and demobilisation	5 days
Hook up production equipment	14 days
Intermediate rehab – post-final hook-up	4 days

The existing Mereenie camp or the same, approved 50-person temporary camp utilised for the drilling operations of WM29 and WM30 will be utilised for WM31 and WM32 (refer to Table 6). The temporary camp location has been selected because it was previously utilised as a camp (during drilling of WM13, WM29 and WM30), its proximity to the proposed WM31/WM32 well sites and it avoids all mapped CLC restricted work and exclusion zones.

Table 6: Proposed temporary campsite

Reasoning	**Temporary camp location preferred due to the following:** ▪ having previous approval for a temporary camp here for the WM13 / WM29 / WM30 drilling campaign ▪ outside all CLC ▪ restricted work and exclusion zones ▪ close proximity to WM31
Proposed temporary campsite	

3.2. Well Site Selection

3.2.1. Project Footprint

Section A of the Code outlines the requirements for consideration in well site selection. Appropriate site selection is a primary risk mitigation environmental control for onshore petroleum wells. Producing petroleum well sites may remain active for several decades before the final decommissioning of the well.

In certain instances, following the decision to commence with drilling of a well, it may also be necessary to abandon a well if it fails to meet the required standards. In such cases, there are two options: repurposing the well for alternative uses, such as an investigative bore, or decommissioning it in accordance with the Well Operations Management Plan (WOMP) and the latest legislation. The location and indicative disturbance area for petroleum well site WM31 and WM32 and the associated access track and flowline corridor are summarised in Table 7.

Table 7: Proposed ground disturbance for each development well

OPTION A		
Appraisal well	WM31	WM32
Wellhead surface location	X: 756778.900; Y: 7346545.400	X: 759987.295 Y: 7344269.502
Elevation	784.16 m	767.907 m
Area of well site	N/A – existing well site	N/A – existing well site
Access tracks	N/A – existing WM30 well site access to be utilised	N/A – existing WM29 well site access to be utilised
Area of flowline corridor (outside pad)	N/A – no clearing required since the pipeline uses the same pipeline corridor as WM30 pipeline.	N/A – no clearing required since the pipeline uses the same pipeline corridor as WM29 pipeline.
Total	0 ha	0 ha
OPTION B		
Appraisal well	WM31	WM32
Wellhead surface location	X: 756608.000 Y: 7346566.000	X: 760072.000 Y: 7344145.000
Elevation	784.684 m	766.938 m
Area of well site	1.99 ha	2.11 ha
Access tracks	N/A – direct access from Mereenie access road	N/A – direct access from Mereenie access road
Area of flowline corridor	N/A – no clearing required. The pipeline goes from WM31 lease onto WM30 lease via overlapping lease area and then through the WM30 pipeline corridor to tie-in.	0.059ha
Total	1.99 ha	2.169 ha

3.2.2. Well Site Locations – Multi-criteria Analysis

The location and indicative layout footprint for well site WM31 and WM32 and the two options being explored for each are shown in Figures 4 – Figure 7 below. The well site locations have been assessed based on Code requirements, using Multiple Criteria Analysis (MCA) and include the following attributes:

- technical assessment of the sub-surface reservoir and optimal surface drilling location to intersect the sub-surface target(s)
- proximity to existing well sites and connecting infrastructure (tie-ins)
- Land Clearing Guidelines (2021)
- high-resolution surface elevation model and flood risk mitigation (Figure 8).
- archaeological constraints
- environmental sensitivity mapping for each well site domain of potential influence
- optimisation design in terms of minimising land disturbance and infrastructure layout, including cut and fill requirements, flowline corridor and access tracks

The MCA relied upon desktop assessment and ground-truthed information to assess the location of the appraisal wells, associated infrastructure, and project footprint (EcOz, 2022; Hall, 2022).

The assessment based on local information for environmental factors for the proposed well site locations is provided in Section 4. The information has been assessed at sufficient spatial resolution to provide meaningful environmental sensitivity mapping for each well site domain.

3.2.3. Well Site Locations – Footprint Analysis

The well site layout footprints for Option A and Option B WM31 and WM32 are illustrated in Figure 4 to Figure 7 respectively. They provide high-definition satellite imagery and high-resolution surface elevation contours, interpolated at 0.5 m intervals from existing LiDAR data for the Mereenie Field. This imagery provides critical criteria visual information for each well site selection risk assessment and, in summary, confirms:

- local topography is elevated with an absence of localised flood risks, such as sheet flow pathways and topographical depressions
- red soils suitable for well site cut and fill construction
- vegetation cover is low in the general area
- proximity and mapping of local sensitive receptors, which includes archaeological constraints (Hill, 2022) and key sites and buffers from Land Clearing Guidelines
- proximity to existing connecting infrastructure, such as roads and pipelines
- GPS boundary points of each proposed well site footprint and flowline corridor.

The indicative civil engineering well site layout design for each option at WM31 and WM32 are shown in Figure 9 to 12 respectively. Details for each option and relevant Erosion and Sediment Control (ESC) at each well site with respect to:

- well site dimensions
- existing overland flow path
- existing elevations
- anticipated cut and fill requirements
- final elevations and cross-fall design for rain
- diversion bank locations.

It can be viewed in each well site's ESC plan, shown in APPENDIX G.

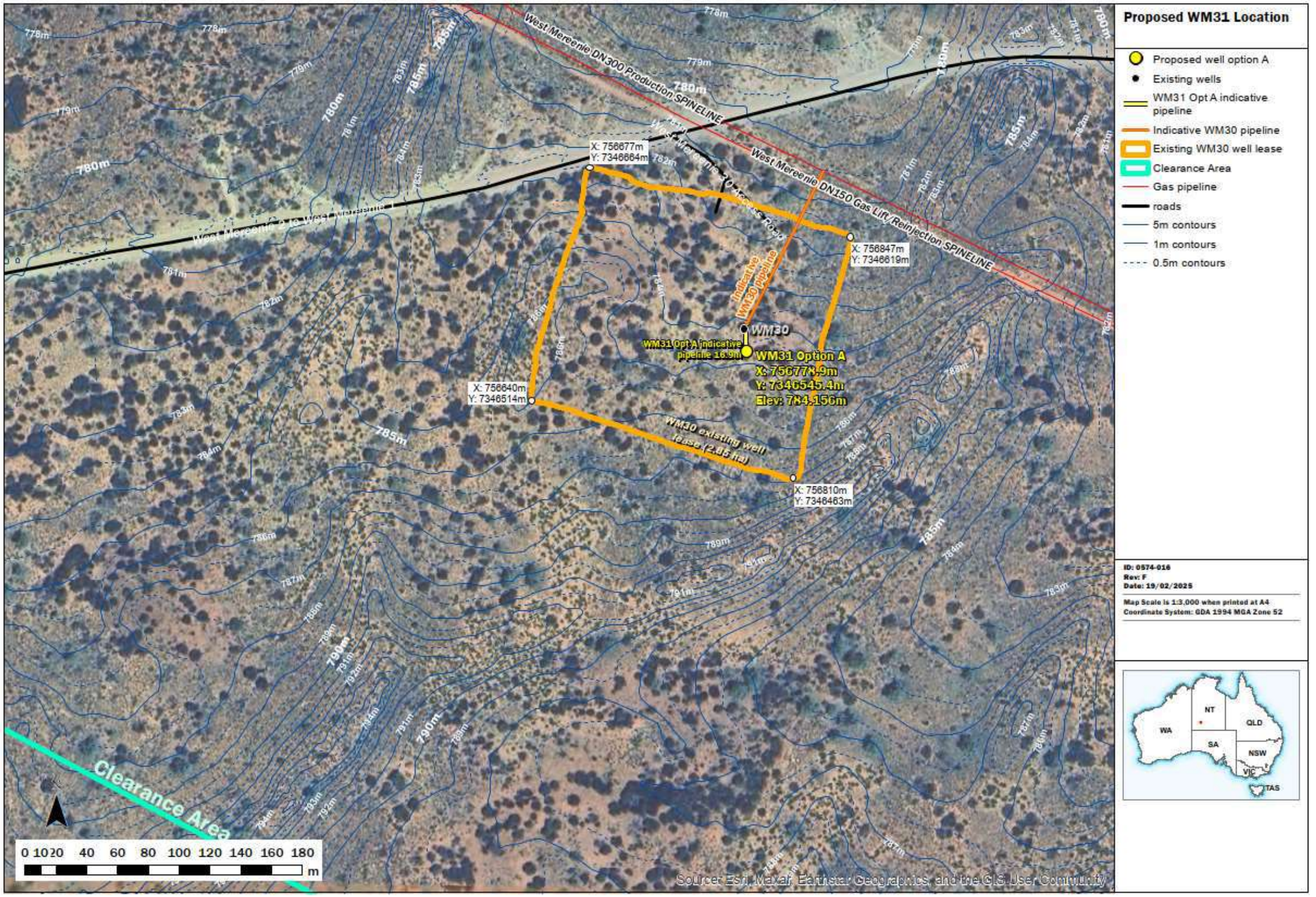


Figure 4: Location of WM31 Option A well site – well site, access track, flowline corridor

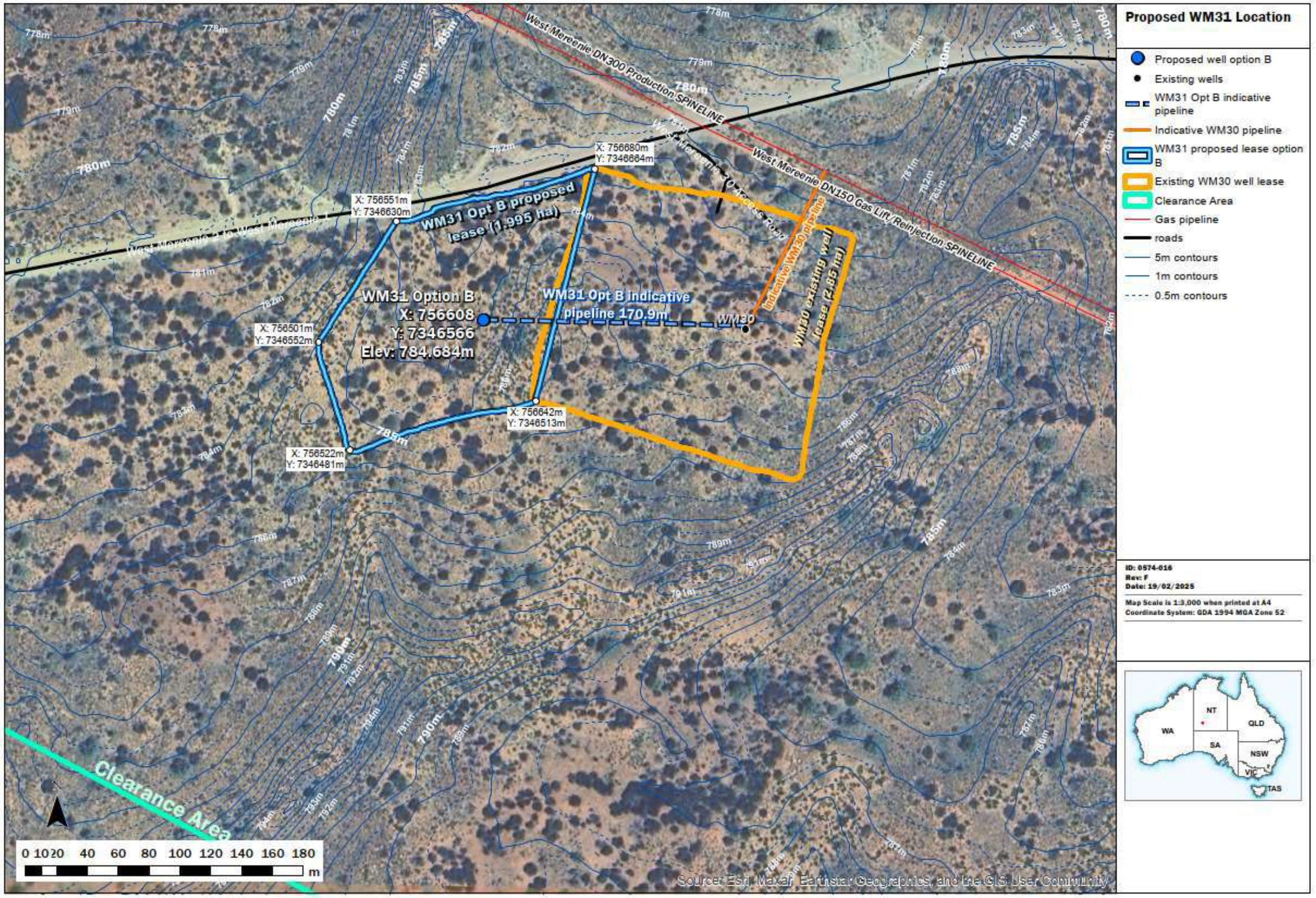


Figure 5: Location of WM31 Option B well site – well site, access track, flowline corridor

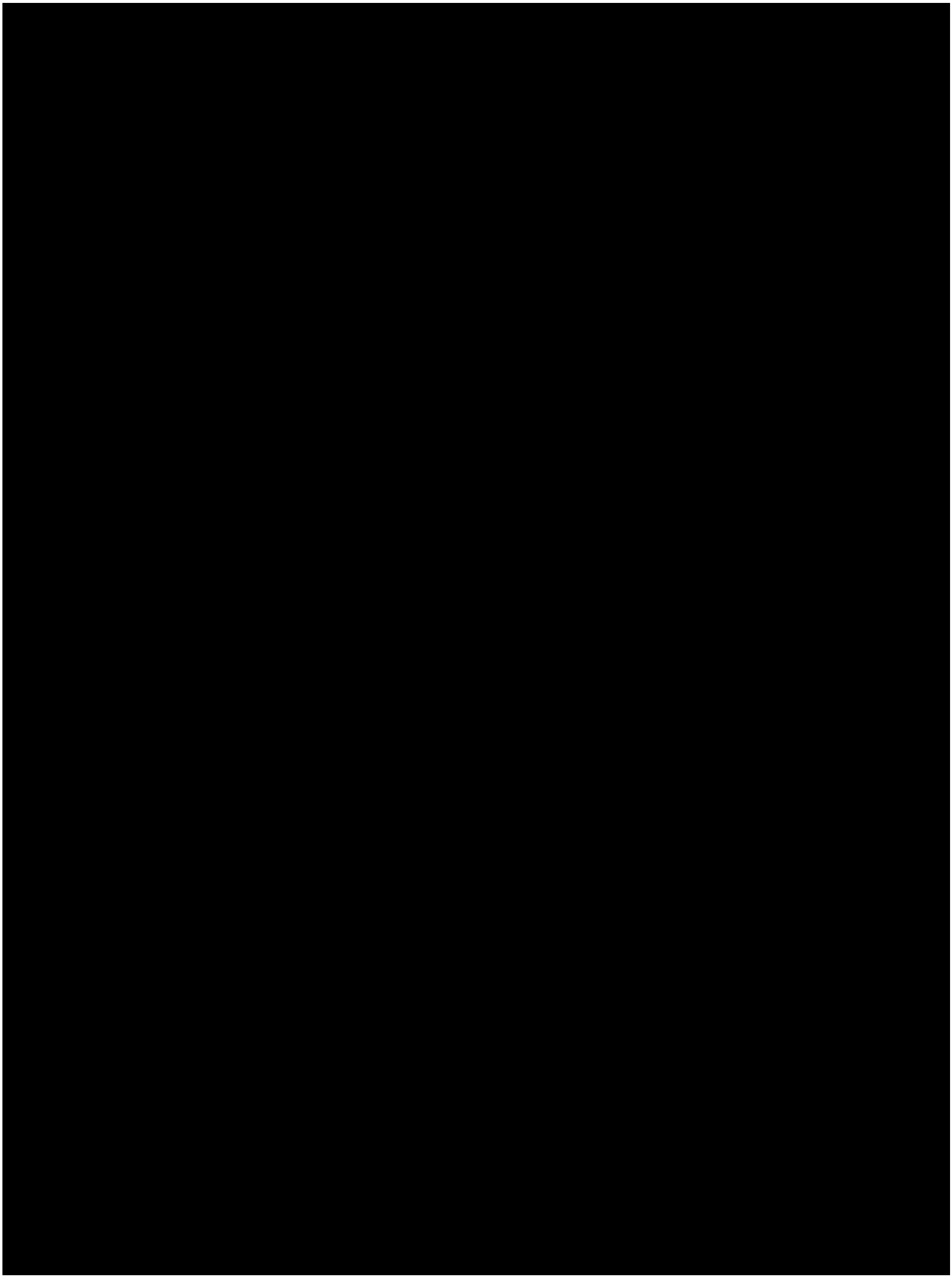


Figure 6: Location of WM32 Option A well site - well site, access track, flowline corridor

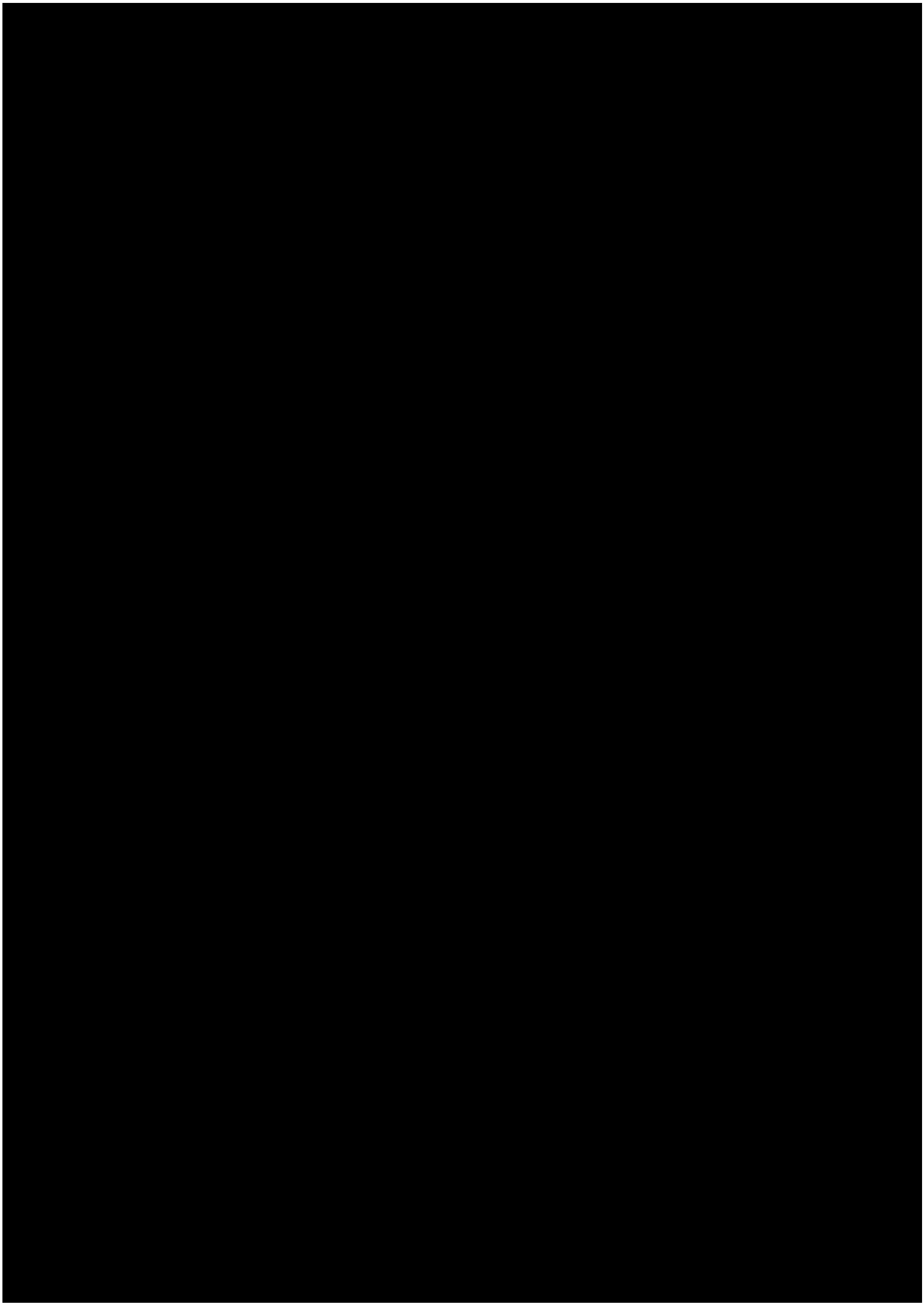


Figure 7: Location of WM32 Option B well site - well site, access track, flowline corridor

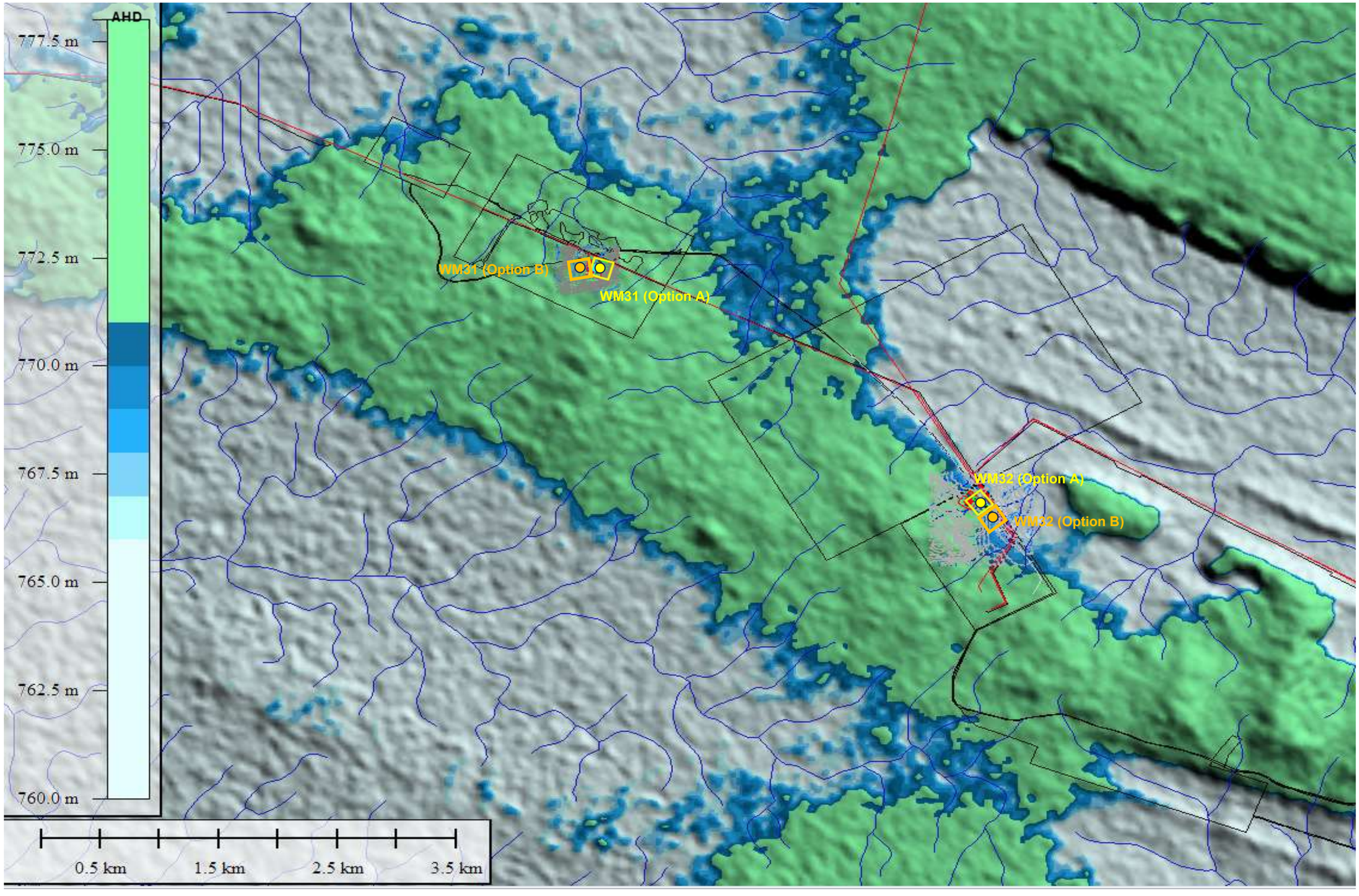


Figure 8: Elevation (AHD) and flood risk

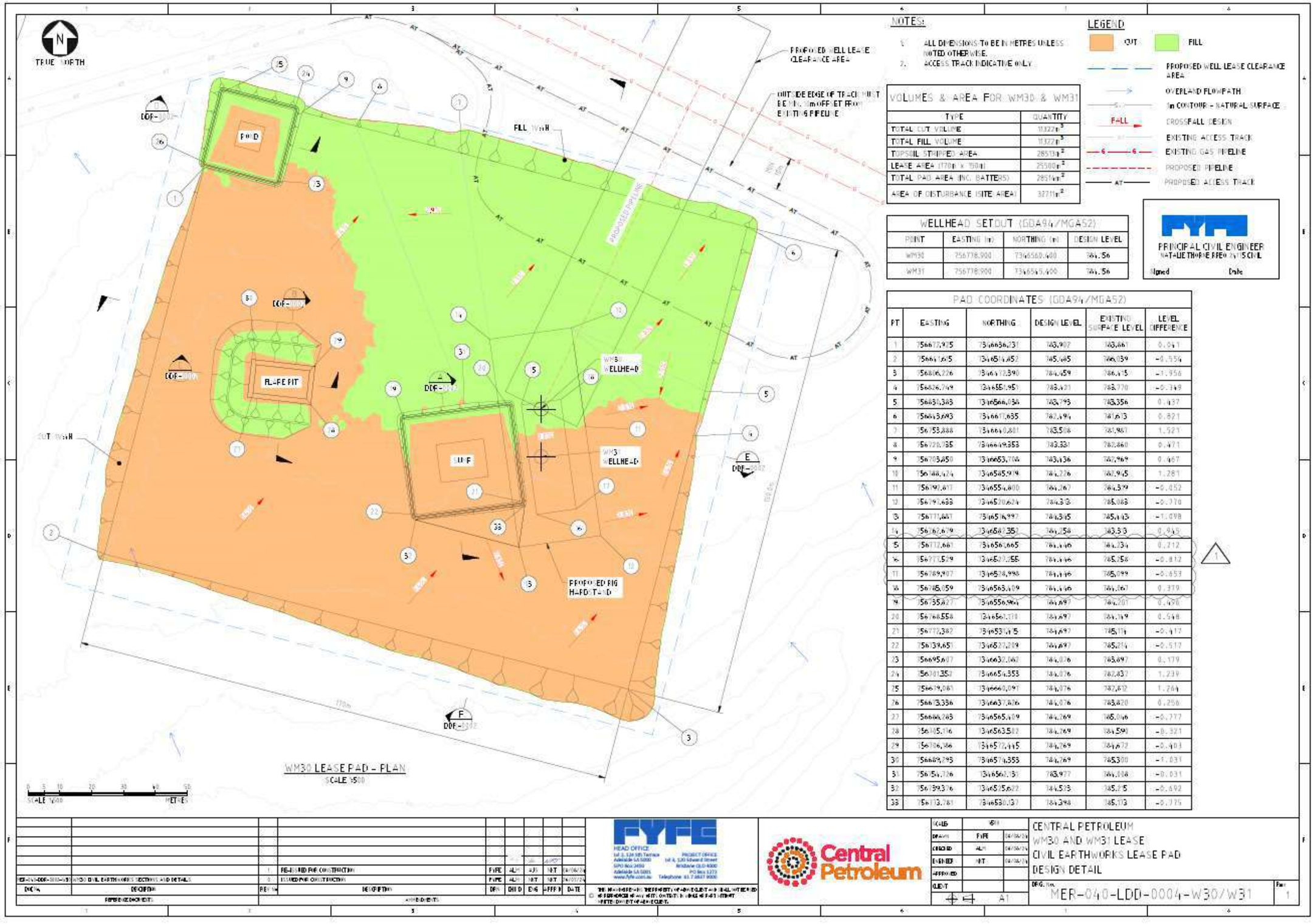


Figure 9: WM31 Option A indicative Civil drawing

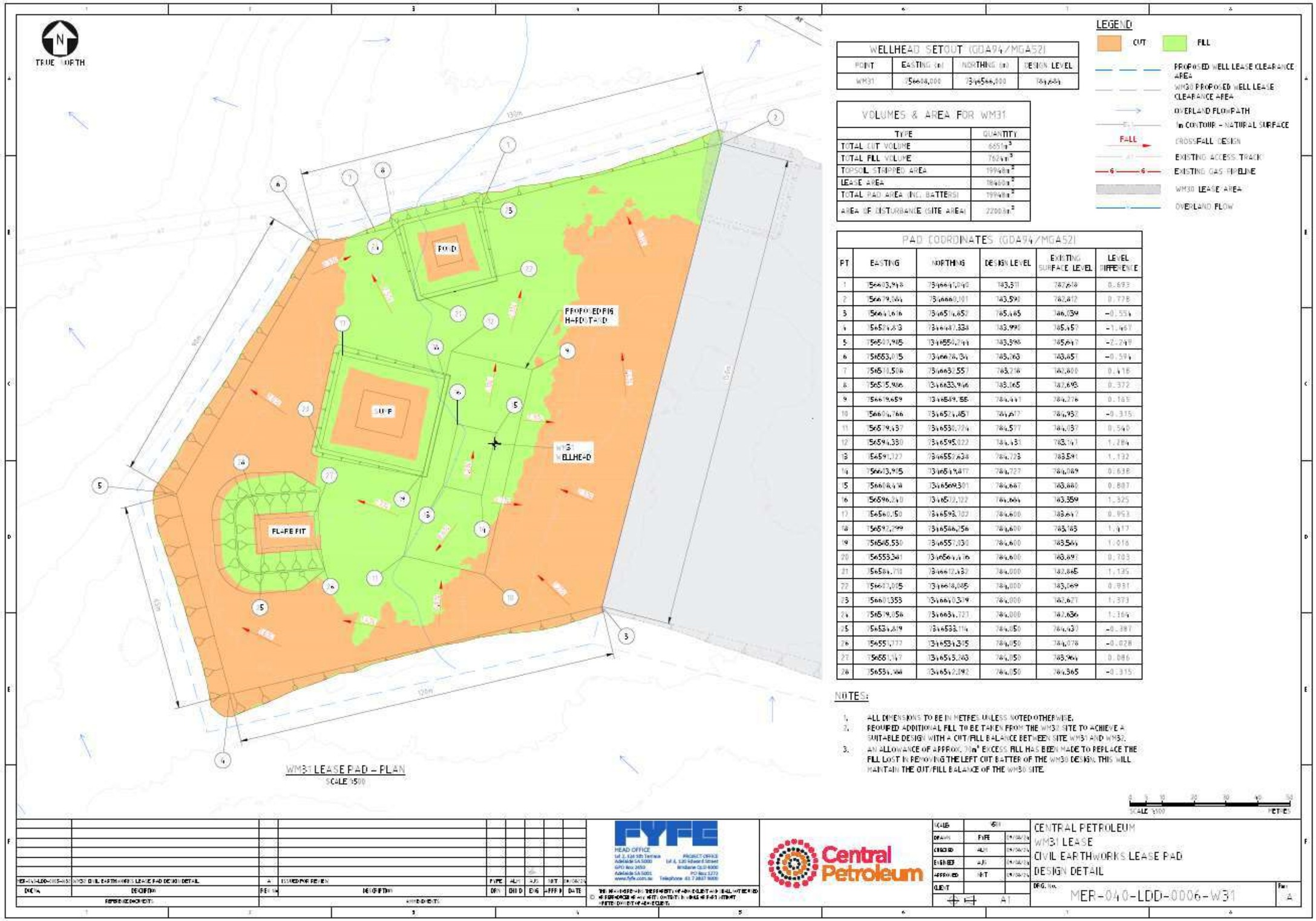
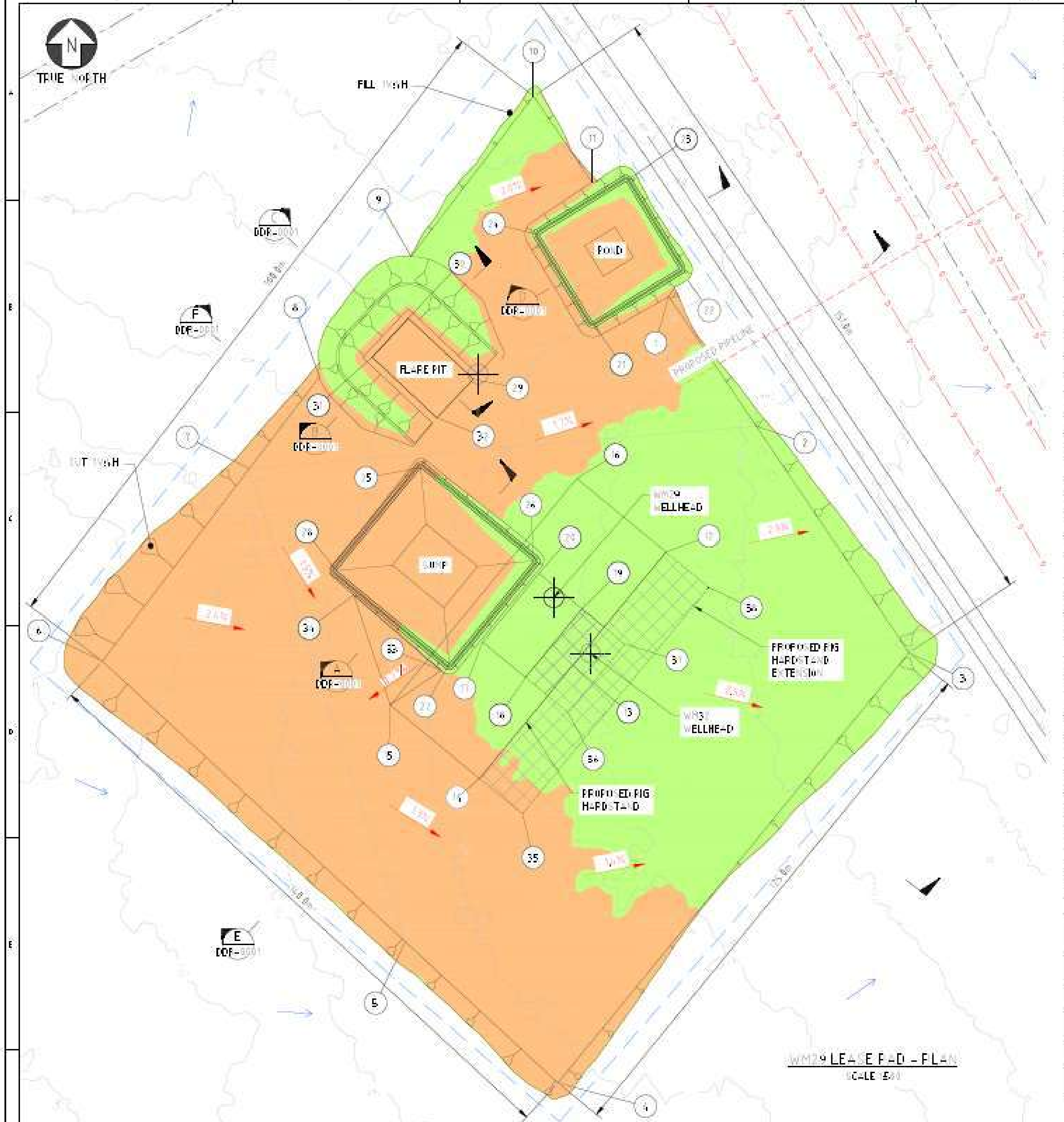


Figure 10: WM31 Option B indicative Civil drawing



WELLHEAD SETOUT (GDA94/MGA52)			
POINT	EASTING (m)	NORTHING (m)	DESIGN LEVEL
WM29	759979.000	7344282.000	767.907
WM32	759987.295	7344269.502	767.907

PAD COORDINATES (GDA94/MGA52)					
PT	EASTING	NORTHING	DESIGN LEVEL	EXISTING SURFACE LEVEL	LEVEL DIFFERENCE
1	760004.930	7344349.829	766.765	767.297	-0.532
2	760024.637	7344321.590	766.533	765.943	0.590
3	760059.054	7344269.601	766.458	765.001	1.457
4	759979.970	7344172.799	767.228	767.852	-0.624
5	759945.584	7344204.613	767.375	768.414	-1.039
6	759877.381	7344267.715	768.721	770.699	-1.978
7	759910.436	7344310.996	768.605	769.477	-0.872
8	759926.233	7344331.675	768.337	768.784	-0.447
9	759946.917	7344354.759	767.730	767.693	0.037
10	759974.499	7344394.869	766.973	766.574	0.399
11	759987.638	7344375.403	766.903	767.154	-0.255
12	760034.292	7344292.361	767.443	766.567	0.876
13	759983.313	7344266.788	767.885	767.092	0.793
14	759962.334	7344241.315	767.399	767.635	-0.236
15	759942.264	7344257.645	767.741	768.233	-0.492
16	759984.223	7344308.790	767.457	767.397	0.060
17	759963.116	7344272.881	767.907	767.615	0.292
18	759972.665	7344264.054	767.907	767.303	0.604
19	759985.379	7344279.492	767.907	767.021	0.886
20	759975.730	7344287.439	767.907	767.266	0.641
21	759987.718	7344344.155	766.148	767.935	0.205
22	760001.327	7344356.063	766.148	767.360	0.780
23	759995.316	7344315.619	766.148	767.147	0.993
24	759915.702	7344363.611	766.148	767.819	0.321
25	759949.040	7344311.251	768.307	768.430	-0.123
26	759974.553	7344290.271	768.307	767.308	0.999
27	759955.481	7344267.114	768.307	767.928	0.379
28	759930.008	7344288.094	768.307	769.090	-0.783
29	759960.922	7344331.168	766.787	768.524	-1.337
30	759946.331	7344344.465	766.787	768.770	-1.983
31	759938.125	7344336.111	766.787	768.546	-1.359
32	759952.716	7344322.434	766.787	768.635	-1.448
33	759953.697	7344265.645	767.823	767.992	-0.169
34	759933.988	7344282.612	768.107	768.853	-0.746

FUTURE WELLHEAD EXTENSION COORDINATES (GDA94/MGA52)		
POINT	EASTING (m)	NORTHING (m)
35	759971.982	7344233.369
36	759982.313	7344256.108
37	759995.028	7344271.546
38	760011.941	7344284.314

LEGEND

- CUT
- FILL
- PROPOSED WELL LEASE CLEARANCE AREA
- OVERLAND FLOWPATH
- 1m CONTOUR - NATURAL SURFACE
- CULTURAL HERITAGE
- CROSSFALL DESIGN
- EXISTING ACCESS TRACK
- EXISTING GAS PIPELINE
- PROPOSED PIPELINE

FYFE
PRINCIPAL CIVIL ENGINEER
NATALIE THORNE RPEQ 24175 CIVIL
Signed: NThorne Date: 26/07/2024

NOTES:

1. ALL DIMENSIONS TO BE IN METRES UNLESS NOTED OTHERWISE.

VOLUMES & AREA FOR WM29/WM32	
TYPE	QUANTITY
TOTAL CUT VOLUME	8394m^3
TOTAL FILL VOLUME	8394m^3
TOPSOIL STRIPPED AREA	22622m^2
LEASE AREA	20177m^2
TOTAL PAD AREA (INC. BATTERS)	22622m^2
AREA OF DISTURBANCE (SITE AREA)	26087m^2

SCALE 1:500 METRES

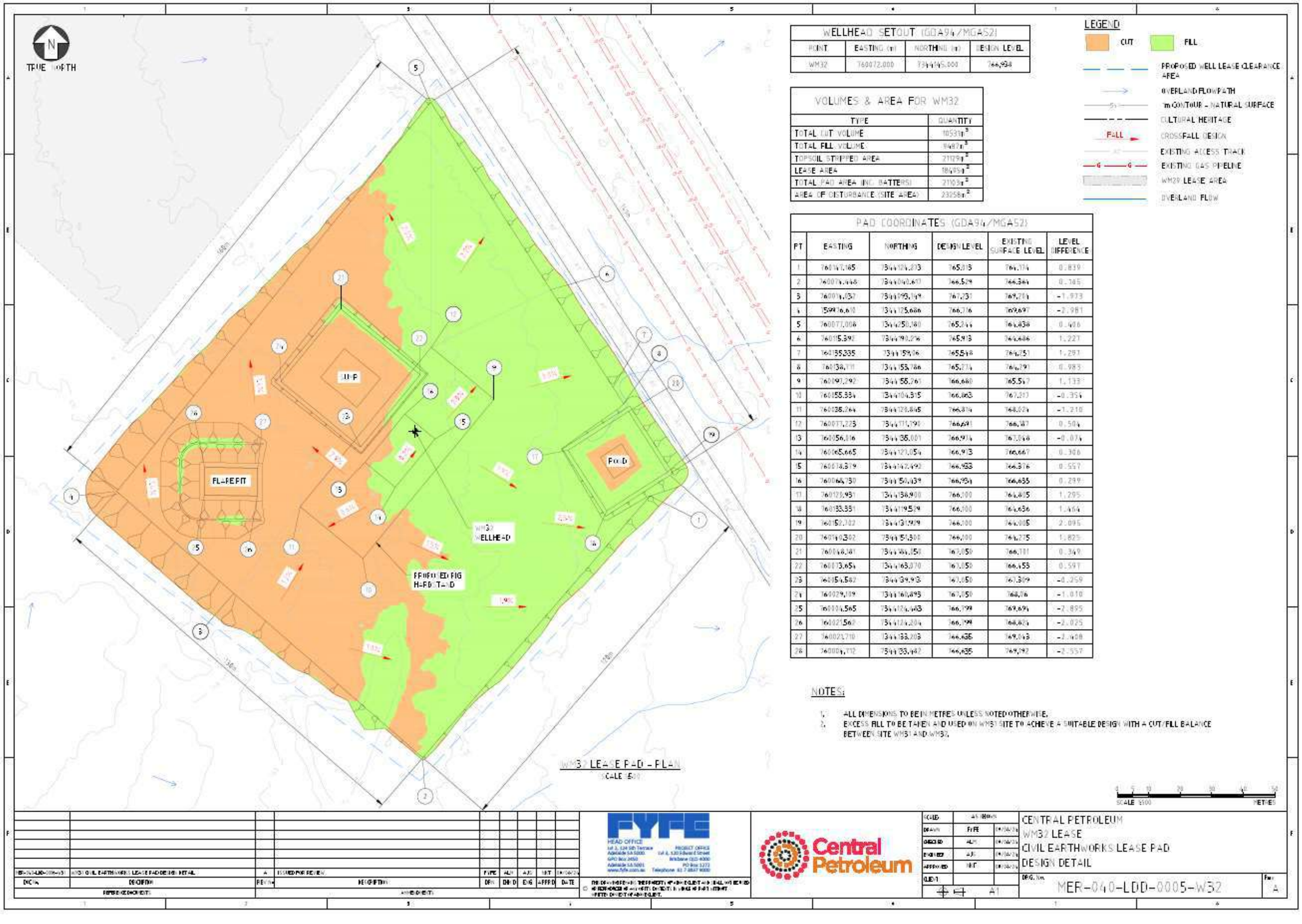
SCALE	AS SHOWN	
DRAWN	FYFE	26/07/24
CHECKED	ALM	26/07/24
ENGINEER	NKT	26/07/24
APPROVED		
CLIENT		
		A1

CENTRAL PETROLEUM
WM29 AND WM32 LEASE
CIVIL EARTHWORKS LEASE PAD
DESIGN DETAIL

DRG. No. MER-040-LDD-0003-W29/W32 Rev 0

0 ISSUED FOR CONSTRUCTION FYFE ALM NKT NKT 26/07/24

Figure 11: WM32 Option A indicative Civil drawing



WELLHEAD SETOUT (GDA94/MGA52)

POINT	EASTING (m)	NORTHING (m)	DESIGN LEVEL
WM32	760072.000	7344145.000	166.934

VOLUMES & AREA FOR WM32

TYPE	QUANTITY
TOTAL CUT VOLUME	10593m^3
TOTAL FILL VOLUME	9487m^3
TOPSOIL STRIPPED AREA	21129m^2
LEASE AREA	184950m^2
TOTAL PAD AREA (INC. BATTERS)	21103m^2
AREA OF DISTURBANCE (SITE AREA)	23258m^2

PAD COORDINATES (GDA94/MGA52)

PT	EASTING	NORTHING	DESIGN LEVEL	EXISTING SURFACE LEVEL	LEVEL DIFFERENCE
1	760147.165	7344104.813	165.813	164.774	0.839
2	760076.448	7344040.610	166.529	166.364	0.165
3	760014.037	7344099.149	167.731	169.704	-1.973
4	759976.610	7344125.686	166.716	169.697	-2.981
5	760077.008	7344250.180	165.244	164.838	0.406
6	760115.392	7344190.296	165.913	164.686	1.227
7	760135.335	7344159.916	165.548	164.251	1.297
8	760138.711	7344153.786	165.274	164.291	0.983
9	760097.292	7344158.261	166.660	165.527	1.133
10	760155.334	7344104.315	166.663	167.213	-0.354
11	760138.264	7344128.845	166.814	168.024	-1.210
12	760077.223	7344171.790	166.691	166.187	0.504
13	760156.816	7344136.001	166.914	167.048	-0.074
14	760165.665	7344121.054	166.973	166.667	0.306
15	760018.319	7344142.493	166.933	166.376	0.557
16	760065.150	7344154.439	166.954	166.655	0.299
17	760128.951	7344136.900	166.100	164.805	1.295
18	760183.351	7344119.519	166.100	164.636	1.464
19	760152.702	7344131.919	166.100	164.005	2.095
20	760140.302	7344154.308	166.100	164.275	1.825
21	760016.181	7344164.850	167.050	166.701	0.349
22	760013.654	7344168.070	167.050	166.453	0.597
23	760154.582	7344139.913	167.050	167.309	-0.259
24	760029.109	7344168.895	167.050	168.06	-1.010
25	760014.565	7344124.463	166.199	169.094	-2.895
26	760021.562	7344124.204	166.199	168.824	-2.625
27	760021.710	7344133.203	166.635	169.043	-2.408
28	760004.772	7344133.942	166.635	169.192	-2.557

NOTES:

1. ALL DIMENSIONS TO BE IN METRES UNLESS NOTED OTHERWISE.
2. EXCESS FILL TO BE TAKEN AND USED ON WM31 SITE TO ACHIEVE A SUITABLE DESIGN WITH A CUT/FILL BALANCE BETWEEN SITE WM31 AND WM32.

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PROJECT OFFICE
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Brisbane QLD 4000
PO Box 1272
Telephone 61 7 3867 9000

Central Petroleum

SCALE	AS SHOWN
DRAWN	FyFE
CHECKED	ALM
ENGINEER	AJS
APPROVED	MKT
CLIENT	

A1

CENTRAL PETROLEUM
WM32 LEASE
CIVIL EARTHWORKS LEASE PAD
DESIGN DETAIL

DRG. No. MER-040-LDD-0005-W32
Rev. A

REV	DESCRIPTION	DRN	ALM	AJS	MKT	DATE
A	ISSUED FOR REVIEW	FyFE	ALM	AJS	MKT	04/04/24

Figure 12: WM32 Option B Civil drawing

3.2.4. Well Site Locations – Environmental Sensitivity Analysis

Environmental sensitivity analysis provides a framework for systematically and objectively determining the potential for significant environmental impacts and risks in a spatial context. The Geographic Information System (GIS) web tool enables a rapid and replicable spatial examination of multi-variate environmental sensitivities and potential for land use impacts that support strategic environmental assessment and, ultimately, informed planning and decision-making.

Sensitivity mapping provides a useful visual representation of environmental risks and constraints that may be relevant to the wells site construction and subsequent drilling operations. It is an ideal tool for supporting onshore petroleum well site environmental risk assessments when underpinned by high-resolution environmental spatial data.

In this context, a range of environmental attributes relevant to the proposed development have been mapped for well sites WM31 and WM32. This includes high-resolution satellite imagery, existing infrastructure, site survey for archaeological artefacts (Hall, 2022) and site survey for environmental impact assessment features (EcOz, 2022), including land type, topographic features, soil type, vegetation types, threatened fauna and flora and weeds.

Figure 13 and Figure 14 provide a spatial analysis of groundwater and surface elevations at the WM31 and WM32 well site locations and environs to evaluate the physical features of these sites.

Site topography has been considered when deciding on the placement of civil structures on each well site for both Option A and B (Erosion and sediment control drawings are shown in Figure 15 to Figure 18) . Further detailed erosion and sediment control plans were developed for each new well site, and appropriate RUSLE calculations were undertaken to determine erosivity at each site (refer to complete plans for both options in APPENDIX G). Additionally, appropriate controls have been designed to manage erosion and sedimentation risk. Site engineers and civil teams will decide on any additional erosion and sedimentation control measures should they be required during construction.

The selection of the proposed well sites in this area at Mereenie avoids the following land types to manage potential impacts on biodiversity values and/or erosion-prone landforms (EcOz, 2022):

- significant sand dunes
- flood-prone areas
- topographic depressions, often with Mulga stands that are heavily impacted by horses and Buffel Grass
- sandstone hills and outcrop
- minor drainage lines (2 only).

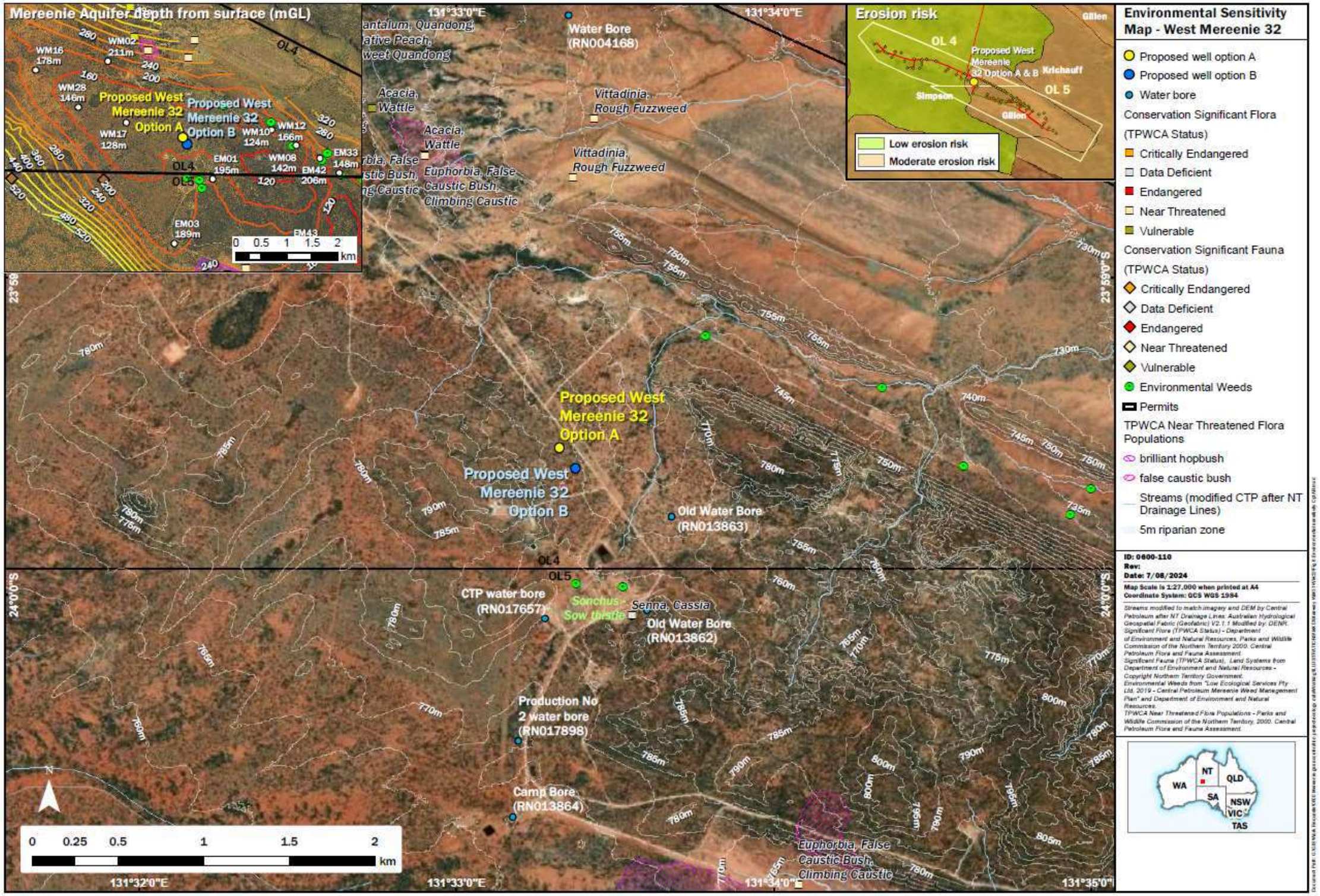


Figure 13: Environmental sensitivity mapping for the WM32 environs

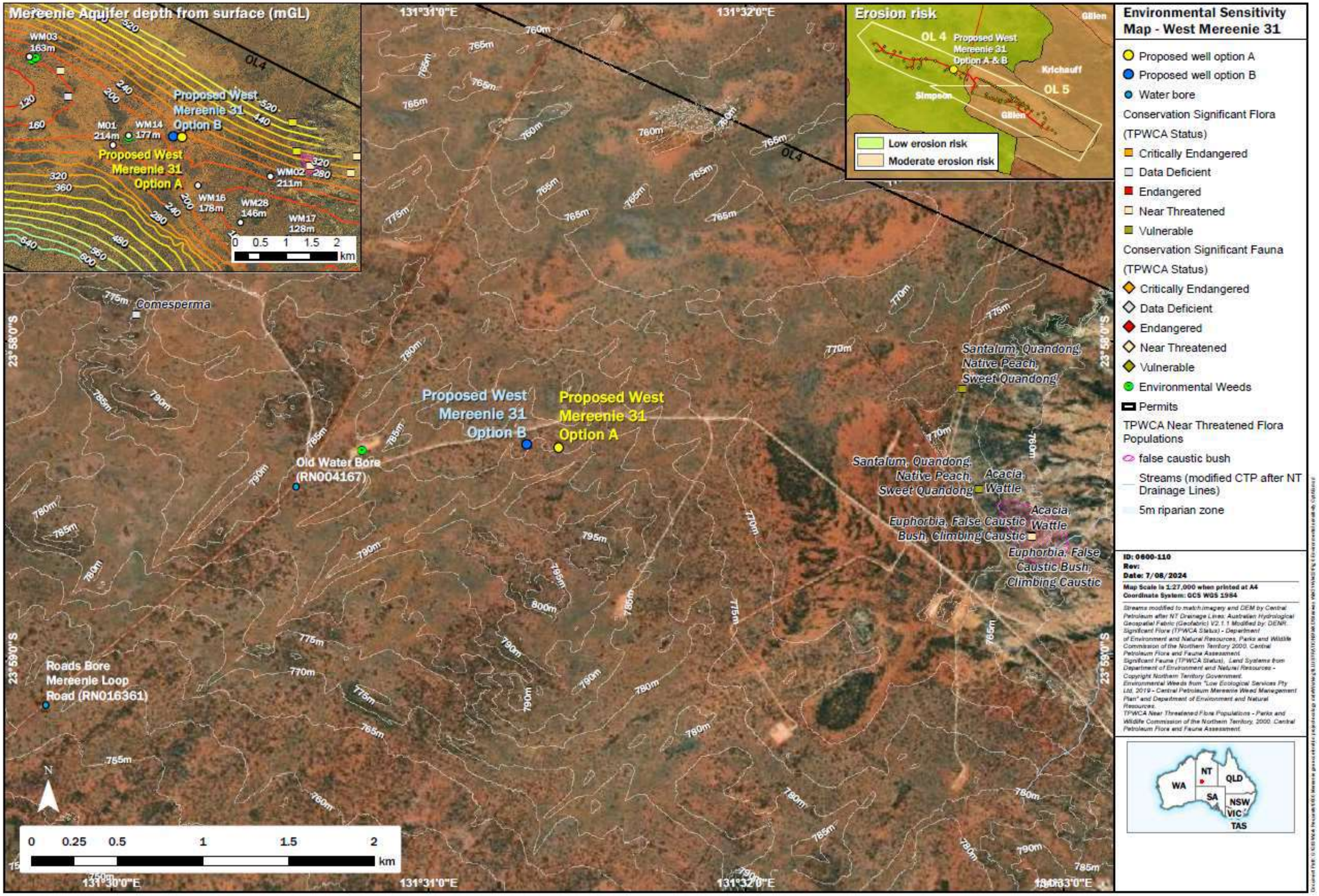


Figure 14: Environmental sensitivity mapping for the WM31 environs

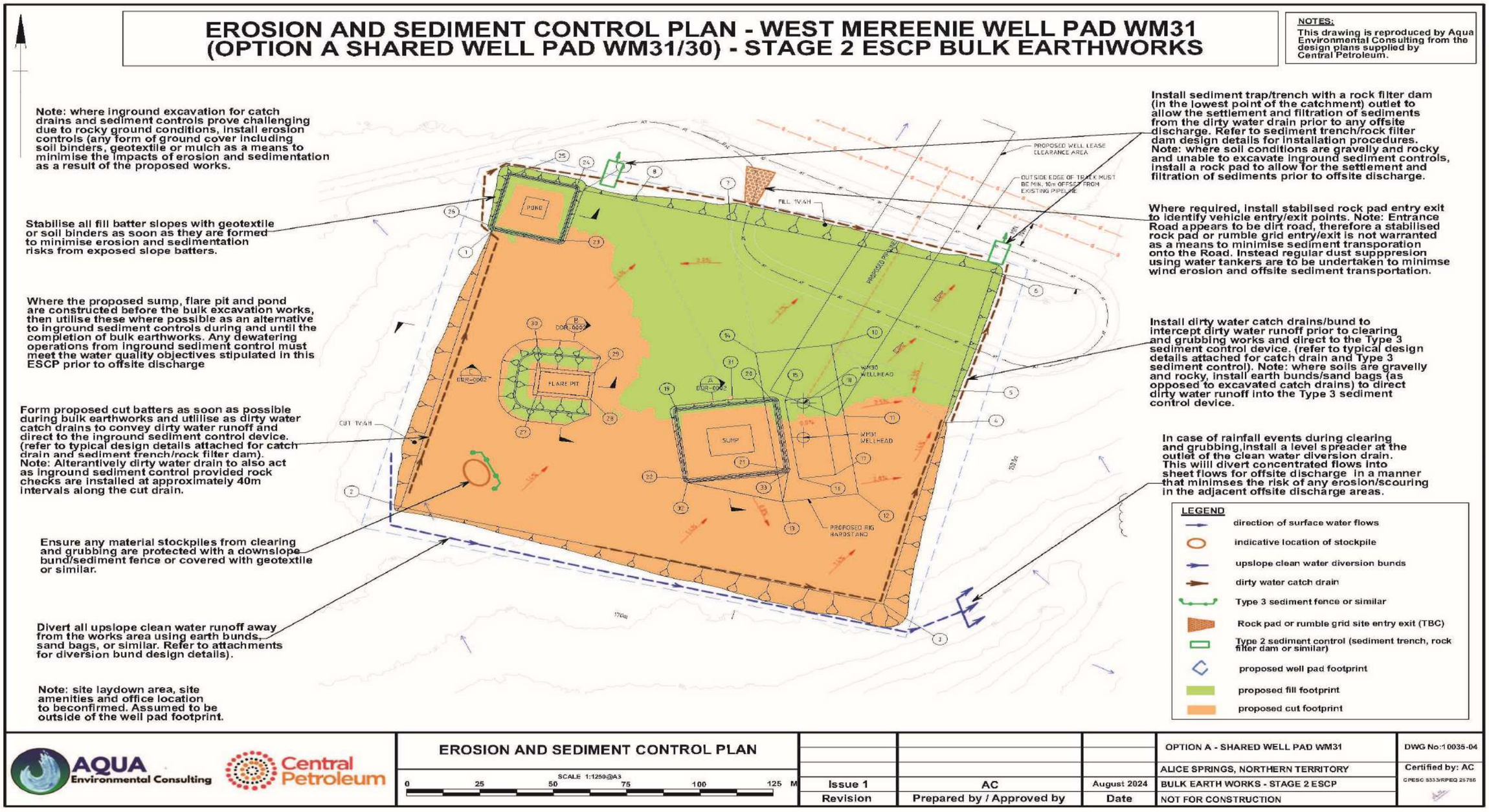


Figure 15: WM31 indicative layout and erosion and sediment controls (Option A)

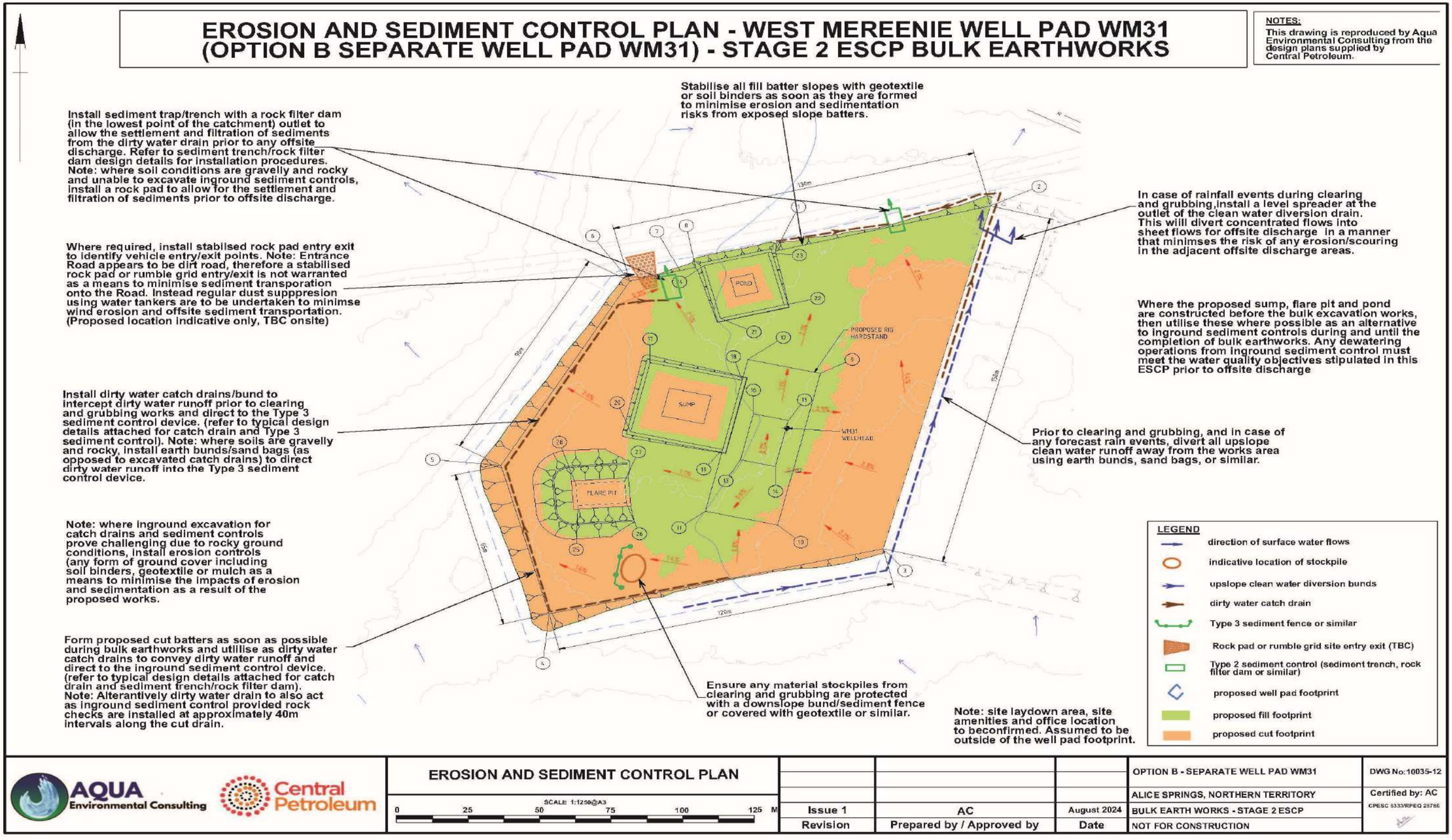


Figure 16: WM31 indicative layout and erosion and sediment controls (Option B)

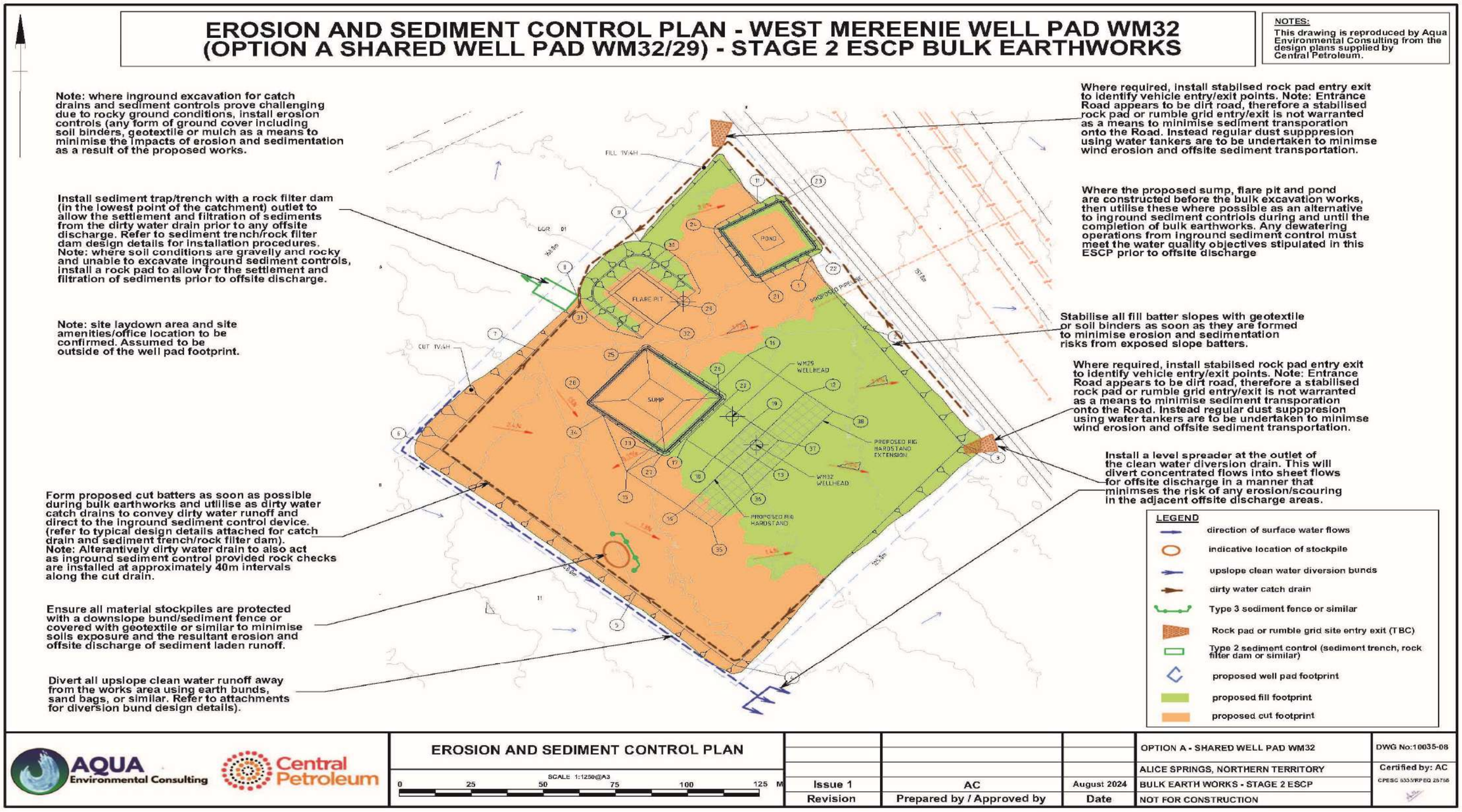


Figure 17: WM32 indicative layout and erosion and sediment controls (Option A)

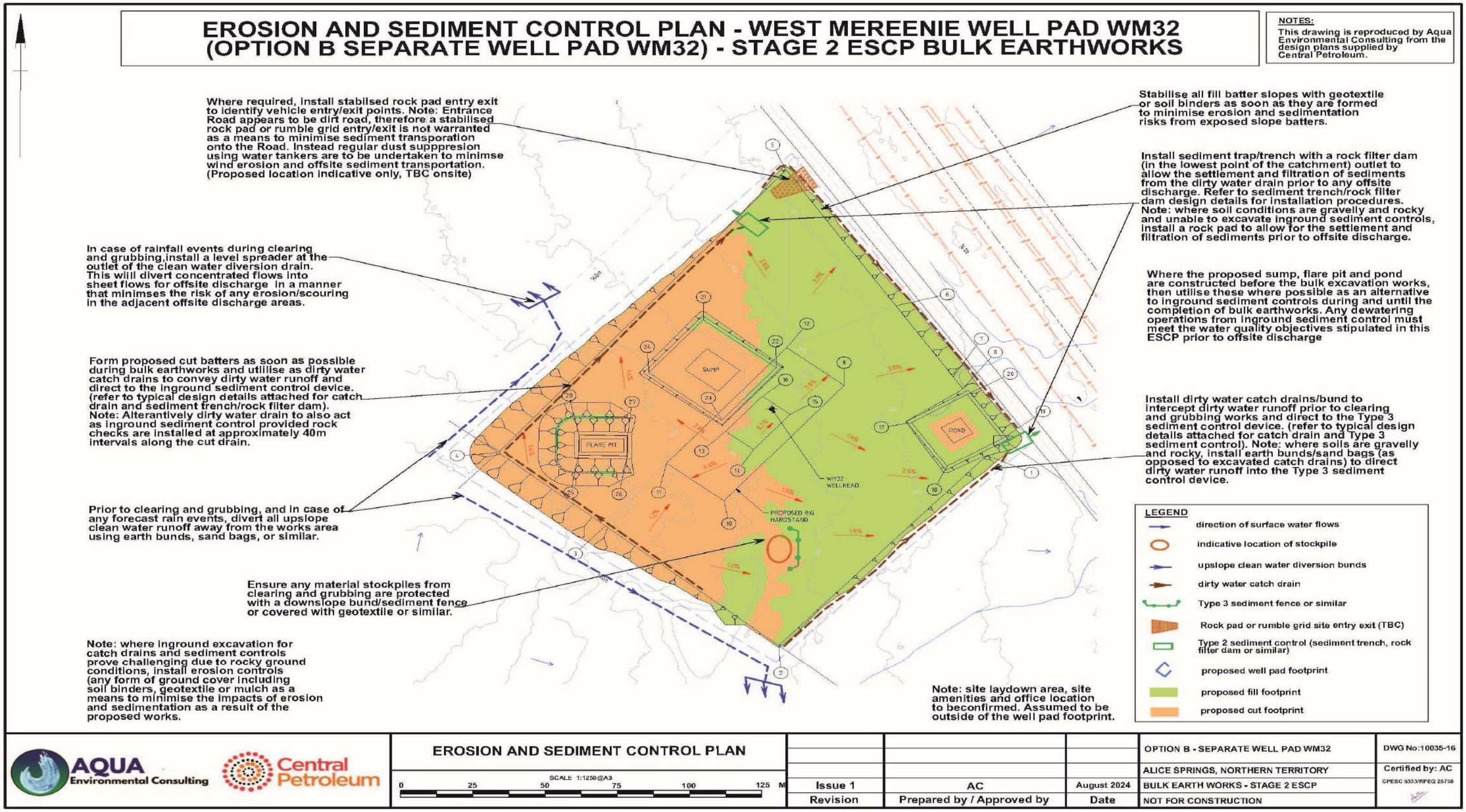


Figure 18: WM32 indicative layout and erosion and sediment controls (Option B)

3.3. Civil Activities

Two options are being considered to ensure that separate permitting processes do not delay WM31 and WM32.

Option A aims to utilise the existing well pads developed for WM29 and WM30, thereby avoiding the typical civil activities associated with developing new well sites and minimise environmental impacts.

The civil activities discussed below are associated with the implementation of Option B. Option B requires the construction of new, separate well sites for WM31 and WM32 and all associated infrastructure, including access tracks, sumps, turkey nests, flare pits, and flow line tie-ins (beyond existing hardstand areas).

3.3.1. Access Tracks

Construction of access tracks will be required for the proposed well sites for WM31 (<100 m length) and WM32 (<200 m length). The indicative width of the access track at each well site will be up to 8 m wide.

The access tracks are designed to be as short as practicable and will connect to the existing Mereenie Field Road directly adjacent to the respective well site boundaries. The tracks will be contoured, graded, compacted and maintained for heavy machinery use, using suitable material excavated from the well site or existing approved gravel pits at Mereenie, where required.

3.3.2. Well Site Construction

The preferred drilling campaign equipment layout for both options is provided in noting existing rig hardstands, well sites, sumps, flare pits and turkeys nests will be reused via option A. The previous design of the infrastructure had previously been oversized to accommodate all potential wells on the site ensuring sufficient capacity and freeboard is maintained. 500mm freeboard will be maintained throughout and this will be checked daily. The civil works required to support the drilling campaign include:

- Removal and stockpiling of topsoil on the well site for subsequent rehabilitation use at the well site and/or Mereenie Progressive Rehabilitation Plan.
- Construction of the preferred well site layout for development well drilling operations.
- Hardstand area levelling and compaction around the wellhead location.
- Extraction of sand/gravel from within the well site clearing footprint to support construction activities. Where insufficient quantities are available on-site, they will be sourced from previously approved gravel pits under the Mereenie Field EMP.
- Construction of temporary 0.8 ML capacity, impervious HDPE-lined turkey nest for freshwater storage for drilling operations.
- Construction of 1.6 ML capacity, with 500 mm freeboard, impervious HDPE-lined drilling sump for containment and permanent isolation of drilling waste (cuttings and residual drilling fluid).
- Construction of temporary 0.6 ML capacity steel-lined, hydrotested flare pit for:
  - containment and use for the temporary storage of drill fluids/cuttings produced during air/mist drilling and which are evaporated during flaring
  - shielded and contained facility for combustion of produced hydrocarbons during drilling and well testing operations
- Machine-compacted and bunded chemical storage area.
- Cellar to house the well head and Blow Out Preventer (BOP).
- Installation of temporary fencing at the well site work area, including drilling sump, flare pit and water storage.

- Installation of a fence around the well when there is no drilling rig on the well site.
- Installation of signage at well sites.
- Temporary fencing for an STP effluent irrigation area at the proposed campsite location (in the event the existing Mereenie camp is not utilised).
- Installation of sediment and erosion controls as per the Erosion and Sediment Control Plan (ESCP) for development well sites at Mereenie (Section 7.2).
- Fire breaks/fire zone management comprises a 10 m perimeter cleared around the well site, perimeter bund, fencing, a 10 m firebreak encompassing a 4 m fire trail, and a 20 m perimeter functioning as a managed vegetation zone. This area comprises an asset protection zone around infrastructure.

Flare pits have been designed to provide a break behind the flare pit wall and aim away from adjacent vegetation to the greatest extent possible.

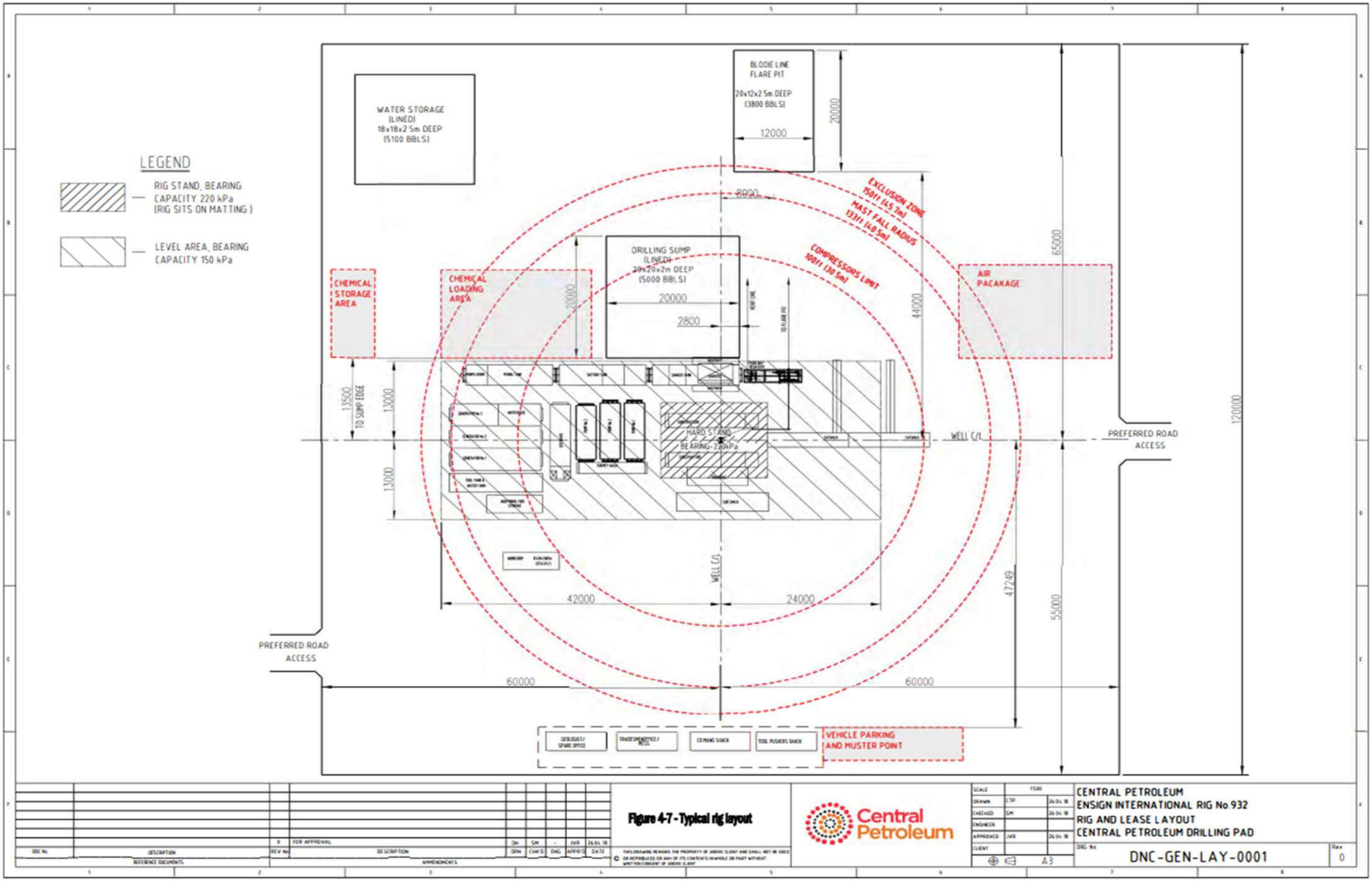


Figure 19: Preferred drilling campaign equipment arrangement for a well site

3.4. Drilling and Completion

3.4.1. Mobilisation and Rig-up

The Mereenie drilling program is scheduled (pending relevant approvals) to commence in the first quarter of 2025 and be completed in the third quarter of 2025 as outlined in project schedule Table 5 (indicative). Long lead items and transportation of well construction materials to each well site will commence prior to mobilisation of the drilling rig to Mereenie Field.

WM31 and WM32 appraisal wells will be drilled consecutively using the same drilling rig and technique.

3.4.2. Constructing the Well and Aquifer Protection

Detailed description of the well design, construction and operation of the wells is provided in the *West Mereenie New Wells Design, Construction, Operation, Intervention and Decommissioning Phases Well Operations Management Plan (WOMP) Production Lease 4, 9950-200-PLN-0006*.

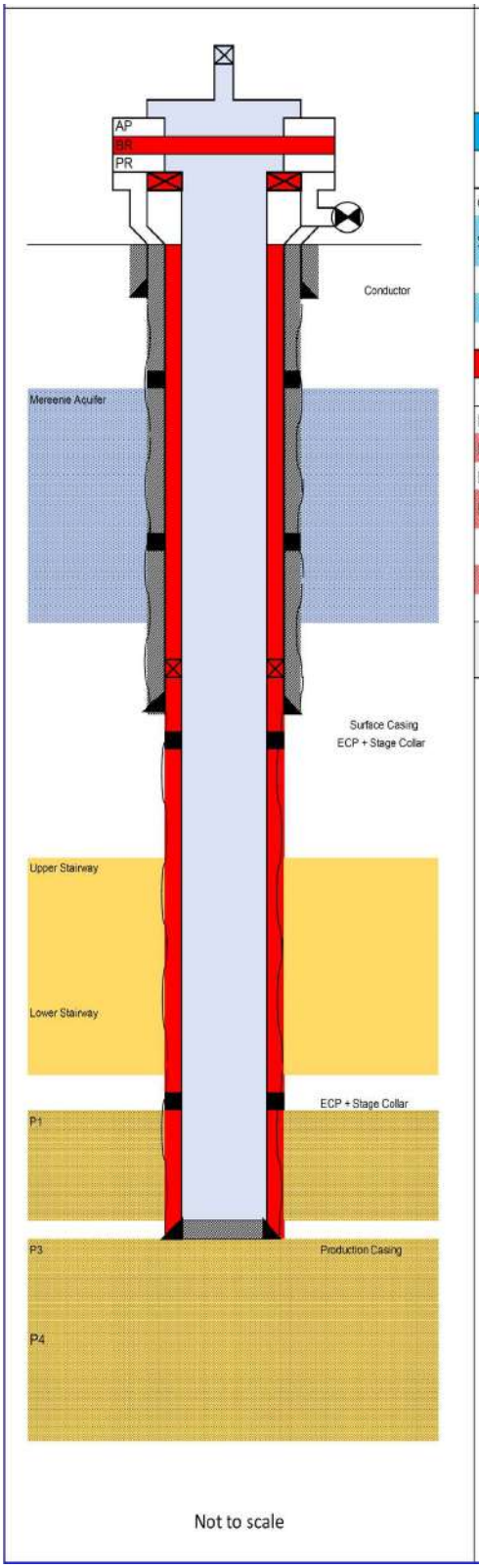
A summary of the well construction process is provided below:

- The drill rig will be set up over the excavated cellar for each well. A conductor pipe will be installed using pilling/auger methods or drilling with a Water-Based Mud (WBM) system. The upper conductor pipe will be set and cemented within a competent formation, isolating the unconsolidated surface sediment.
- A 12-1/4” surface hole will be drilled vertically with either an air-based or WBM fluid system (depending on the quantities of water encountered) while drilling through the Mereenie aquifer. The section will be drilled to a depth ensuring a competent formation below the aquifer is attained for setting the Surface Casing Shoe.
- A 244 mm (9 5/8”) surface casing will be run and cemented in place. A BOP will be installed, and function/pressure tested. The cement and casing will be verified by a Cement Bond Log (CBL) or displacement calculations to ensure the integrity of the surface casing cement job. The casing will be pressure tested to ensure its integrity.
- Once the Surface Casing Shoe is drilled out, a Formation Integrity Test (FIT) or Leak off Test (LOT) will be conducted before drilling deeper to determine the strength and integrity of the open hole below the casing shoe. The FIT/LOT confirms that the formation directly below the Surface Casing Shoe will not break down during a well control event. An 8-1/2” hole (intermediate build section) will then be drilled with either or a combination of an air/N2 based or WBM fluid system which will involve directionally drilling until the Lower Stairway Sandstone formation is intersected horizontally.
- A 178 mm (7”) liner or casing will be run and set from section TD to at least 50 m into the previous set casing string. The liner will be set in place with a liner hanger system and cemented. A 7” tieback string containing a Downhole Deployment Valve (DDV) will be run and connected/sealed into the Polished Bore Receptacle (PBR) above the liner hanger.
- At this point in the well construction, the Mereenie aquifer, deeper potential saline aquifers and the intersected hydrocarbon-bearing zones will be permanently isolated from each other. This design and testing protocol conforms with the regulatory requirements and will be outlined in more detail in the respective WOMP for aquifer protection.
- The 7” casing integrity is verified with a pressure test, and the cement logged and validated to ensure its integrity prior to drilling ahead.
- Following drilling out the liner casing shoe, a FIT or LOT will be conducted prior to drilling further to determine the strength and integrity of the open hole formation below the casing shoe. The test ensures/confirms that the formation directly below the casing string will not break down during a well-control event.

- The 6” production hole will then be drilled horizontally using an Air/N2/Mist/Foam based drilling fluid. Flow tests will be conducted during the production hole drilling to test potential gas flow rates. This process involves a controlled release/flow of hydrocarbon (gas) diverted to a flare pit or flare tank for combustion.
- While drilling the 6” production hole, the well will be fully underbalanced, and as a result, any gas encountered will be immediately brought to the surface, where it will be flared at the end of the blooie line in the flare pit or flare tank. All gas rates (both compressed air in and the flow rates out) will be measured during the drilling of the production hole. If more gas is coming out than in, this indicates gas is flowing to the surface and will be measured prior to the flare. The gas flow rates are measured at various intervals to verify the success of the well. This process involves a controlled release/flow of hydrocarbon (dry gas) diverted to a flare pit or flare tank for combustion.
- Following the results obtained from flow tests (if applicable), a decision will be made to either run a completion or plug back and decommission the Lower Stairway Sandstone with cement plugs. Pending results from the intermediate hole section there may be an option to proceed to sidetrack and horizontally drill the Upper Stairway Sandstone from the original well bore.
- Side-tracking (if applicable) will involve removing the 7” tieback casing and running a whipstock within 9-5/8” casing. A window will be milled in the casing and an 8-1/2” hole (build section) will be directionally drilled with a WBM fluid until the Upper Stairway Sandstone formation is intersected horizontally.
- A 178 mm (7”) liner will be set in place with a liner hanger system and will be cemented into position. A 7” tieback string containing a Downhole Deployment Valve (DDV) will be run and connected/sealed into the Polished Bore Receptacle (PBR) above the Liner Hanger.
- The 6” production hole will then be drilled horizontally using an Air/N2/Mist/Foam-based drilling fluid. Flow tests will be conducted during the production hole drilling to test potential gas flow rates. This process involves a controlled release/flow of hydrocarbon (gas) diverted to a flare pit or flare tank for combustion.
- Following the results obtained from flow tests (if applicable), a decision will be made to either run a completion or plug back and decommission the well per the NT Code requirements.
- Running a completion will involve cementing the 7” tieback assembly in place to the surface, ensuring that 2 x casing strings (barriers) are isolating the Mereenie aquifer. A production tubing string with a completion packer will also be set in place for production operations.
- The Operator commits to no toxic residue in the aquifer until the barriers required by the Code of Practice are installed and validated.

The proposed well design relative to stratigraphy for WM31 and WM32 is provided in Figure 20 and Figure 21, respectively. It shows that there are 2 strings of cemented steel casing across the Mereenie Sandstone and its associated groundwater. The surface casing also extends through the underlying Carmichael Sandstone. Petroleum well construction mandates the implementation of a double-barrier construction, as per the Code. This is necessary to isolate and safeguard aquifers from one another and prevent the potential migration of oil and gas from the deeper target reservoirs.

The Mereenie aquifer is the only aquifer in the MRN as per the definition of aquifer under the Code. The other formations penetrated by the well are not defined as aquifers under the Code in this location.



West Mereenie 31

Production Casing

Primary Barrier Elements		
Element	**Qualification**	**Monitoring**
Overbalanced drilling fluid	Fluid density	Fluid density checks
Shoe track	WAC	Indication of surface pressure

Secondary Barrier Elements		
Element	**Qualification**	**Monitoring**
Production casing	WAC	Results of WAC
Production casing cement	WAC	Results of WAC
Production casing hanger / seals	WAC	Results of WAC
Blind rams	Routine testing	Results of routine testing

Notes:

Casing, Tubing and Open Hole details

13-3/8" 50# K55 25m MDRT
9-5/8" 36# K55 BTC 533m MDRT
7" 26#/32# P110 JFE Bear 1331mMDRT
P3 open hole diameter - 6"

Cement details

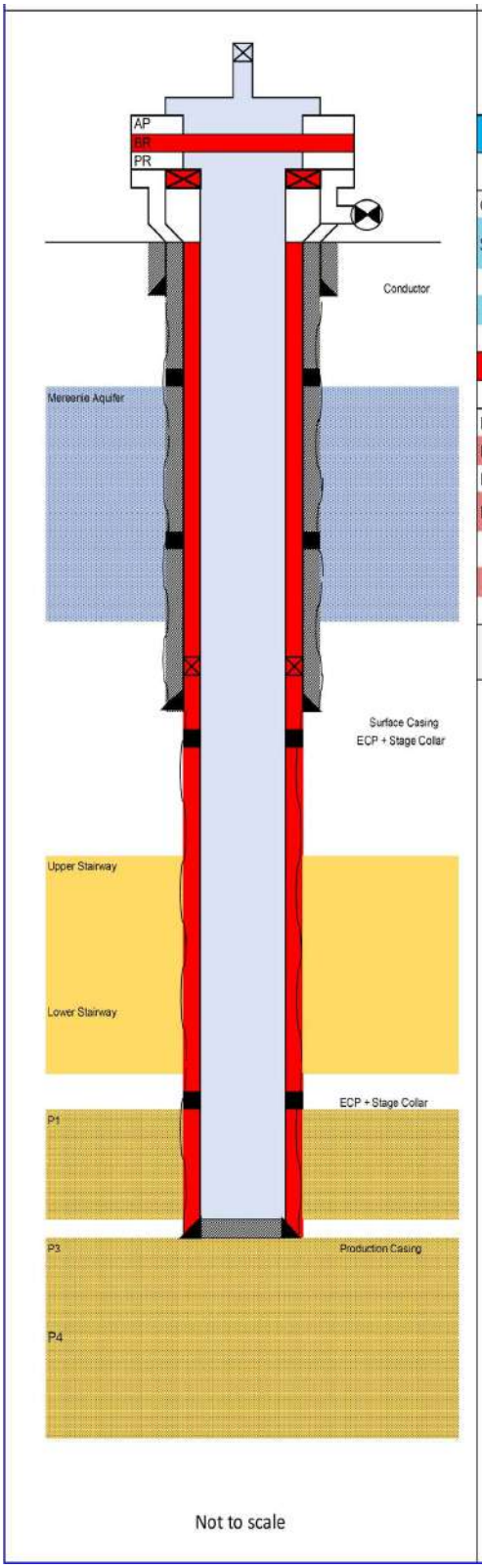
All casing strings planned to be cemented to surface

Formation details

Mereenie Aquifer, 147.3 - 363.8m MD
Carmichael Sandstone, 363.8 - 454.0m MD
Upper Stairway, 783.5 - 988.0m MD
Lower Stairway, 988.0 - 1050.5m MD
P1, 1161.3 - 1285.5mMD
P3, 1332.6m - 1433.5m MD
P4, 1433.5 - 1556.3m MD (note that P4 is a contingency option only)

Figure 20: Indicative schematic of well barriers relative to inferred stratigraphy at WM29[2]

[2] West Mereenie New Wells Design, Construction, Operation, Intervention and Decommissioning Phases WOMP Production Lease 4,



West Mereenie 32

Production Casing

Primary Barrier Elements		
Element	**Qualification**	**Monitoring**
Overbalanced drilling fluid	Fluid density	Fluid density checks
Shoe track	WAC	Indication of surface pressure

Secondary Barrier Elements		
Element	**Qualification**	**Monitoring**
Production casing	WAC	Results of WAC
Production casing cement	WAC	Results of WAC
Production casing hanger / seals	WAC	Results of WAC
Blind rams	Routine testing	Results of routine testing

Notes:

Casing and Tubing details

20" Conductor 25m MDRT
9-5/8" 36# K55 BTC 575m MDRT
7" 26#/29# P110 JFE Bear 1263mMDRT

Cement details

All casing strings planned to be cemented to surface

Key formation details

Mereenie Aquifer, 227.4 - 429.1m MD
Carmichael Sandstone, 429.1 -493.3m MD
Upper Stairway, 811.8 - 1025.2m MD
Lower Stairway, 1025.2 - 1154.6m MD
P1, 1271.7 - 1437.6mMD
P3, 1525.7 - 1644.2m MD
P4, 1644.2 - 1791.3m MD (note that P4 is a contingency option only)

Figure 21: Indicative schematic of well barriers relative to inferred stratigraphy at WM30[3]

[3] West Mereenie New Wells Design, Construction, Operation, Intervention and Decommissioning Phases WOMP Production Lease 4,

3.5. Drill Cuttings

Management of drill cuttings is outlined in Section 3.9.4.

3.6. Well Site Production Equipment and Safety Systems

Activities undertaken as part of the well site production equipment and safety systems installation process include:

- Tie-in to the wellhead, installation of monitoring instruments, control valves and shutdown skids within the existing disturbance footprint of the well site. Figure 22 shows the typical well site production equipment and safety systems layout for a gas well at Mereenie.
- Installation of new gathering/flowlines will be undertaken in accordance with Australian Standard 2885.0:2018 Pipelines – Gas and liquid petroleum - General requirements.

Figure 22: Typical well site layout and above-ground flowline

3.7. Decommissioning

Where a well is to be decommissioned, the activities will be done in accordance with the principles of the Code Section B.4.15.1 and specifically the mandatory Sections B.4.15.2 and B.4.15.3. Moreover, the decommissioning of a well is a regulated activity, and this process will be outlined in an approved Well Operations Management Plan subject to approval by DME.

As per the Code, the two-stage decommissioning process per Table 4 of Section B.4.15.1 will be followed with well integrity maintained as per Section B.4.1; all aquifers will be isolated from each other and the surface by a minimum of one well barrier and from any permeable hydrocarbon-bearing zones by a minimum of 2 well barriers.

The open hole section will be placed to provide cement coverage extending from at least 50 m below the base of, to at least 100 m above the top of, any hydrocarbon-bearing zone or aquifer and between permeable zones of different pressure regimes or salinity. For any cased hole section, the cement plug(s) will be placed adjacent to good annulus cement and provide cement coverage at least 50 m below the base of, to at least 50 m above the top of, any hydrocarbon-bearing zone or aquifer and between permeable zones of different pressure regimes or salinity. A cement plug will be placed to cover at least 50 m above and 50 m below the casing shoe.

A surface cement plug will extend 15 m below the surface to 50 m below the base of the deepest aquifer and be placed in the innermost string of casing that extends to the surface. Following the surface cement plug, the wellhead will be removed, and the casing will be cut 1.5 m below ground and covered with a minimum of 30 cm of cement.

The cement plugs discussed above will be permanently placed in the well and verified in compliance with the Code and WOMP. Before the wellhead is removed, the well will be monitored per the DME-approved WOMP to verify the well barriers, and the decommissioning integrity will be confirmed. Once confirmed, the wellheads will be removed, the final cement plug will be placed, and the casing will be cut 1.5 m below ground level.

Following the removal of the wellhead, a corrosion-resistant alloy or a similar-grade steel marker plate will be installed. Complete and accurate records of the entire decommissioning procedure will be kept and submitted as part of the legislative reporting requirements for decommissioning petroleum wells.

In certain instances, following the decision to commence with drilling of a well, it may also be necessary to abandon a well if it fails to meet the required standards. In such cases, there are two options: repurposing the well for alternative uses, such as an investigative bore, or decommissioning it (as provided above) in accordance with the WOMP and the latest legislation.

3.8. Rehabilitation

Decommissioned wells will be rehabilitated according to the Rehabilitation Management Plan in Section 7.5. Rehabilitation activities will commence as soon as possible but no longer than 12 months following cessation of activities.

Wells that are completed will be transferred to the Mereenie Field EMP, and ongoing production operations will be undertaken in alignment with that plan. All obligations for the well will also be transferred, and this Mereenie Drilling EMP will be closed out.

3.9. Support Activities

3.9.1. Workforce Accommodation Facilities

The mobile accommodation camp will be located on-site and have the capacity to accommodate up to 50 people. Applicable food standards are applied and Camp kitchen approvals and registration to remain current. An indicative layout is shown in Figure 23.

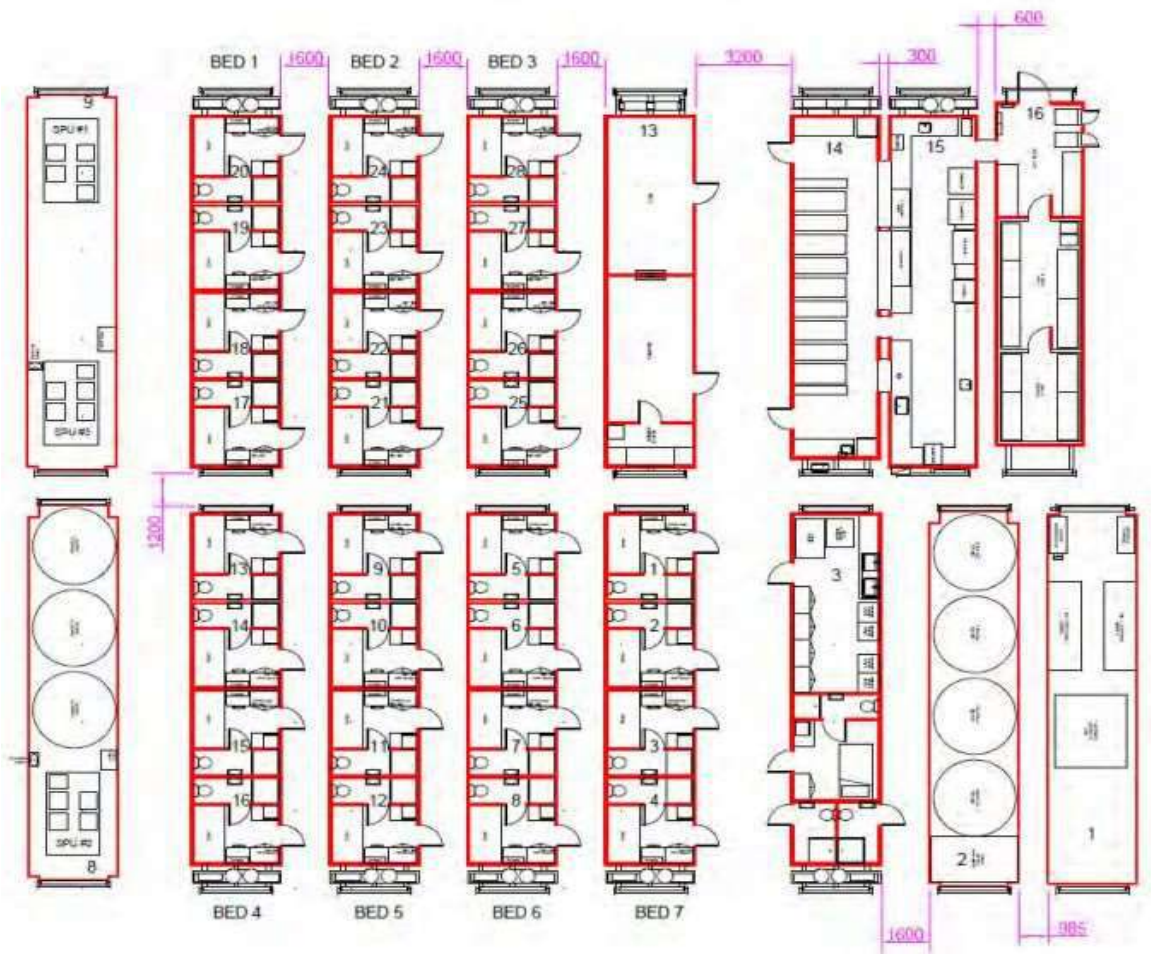


Figure 23: Typical drilling rig camp layout

The camp is sized to accommodate the multiple activities underway simultaneously as part of the campaign (refer to Table 4 above for workforce numbers). Personnel may also be accommodated in the existing Mereenie Field operational camp (as required).

The camp will be registered and equipped with a fully self-contained sewage treatment plant with an irrigation sprinkler system. The camp's small sewage sullage treatment systems and re-use of sewage effluent will be managed in compliance with the Code of Practice for on-site Wastewater Management issued by the Department of Health.

3.9.2. Water Supply

Water required to support the drilling program will be taken under the Mereenie Water Extraction Licence (GWEL) #M10001 (annual volume of 52.8 ML) from existing metred groundwater bores. The annual volume includes the requirements for development drilling at Mereenie.

Table 8 below provides an estimated breakdown of water requirements for the activities at WM31 and WM32. The total estimated ~3.65 ML represents approximately 4.6% of the permitted water extraction per annum under the Mereenie GWEL #M10001.

Table 8: Estimated total water requirements for the regulated activity.

Location	Mereenie bores	Civil (ML)	Drilling (ML)	Camp (ML)	Total (ML)
WM31	RN018955 RN017657 RN017898 RN004620 RN013861	0.075	1.5	0.25	1.825
WM32		0.075	1.5	0.25	1.825

3.9.3. Services

Table 9 below outlines the permanent services that support the conduct of all activities at Mereenie. These services are available to the proposed drilling campaign as needed.

Table 9: Additional permanent support facilities at Mereenie

Activity	Description
Buildings: ▪ administration ▪ warehouse and workshop	▪ Adjacent to Central Treatment Plant (CTP) and houses: main control room, meeting rooms, office and utilities. ▪ Northeast of CTP: houses, storage areas, warehouse, workshop, washdown bay, diesel refuelling bay, designated waste storage area, bunded chemical store.
Workforce and facilities	Temporary camp: ▪ 50-person camp incorporating accommodation, kitchen and mess, recreation areas, communications systems and water and wastewater systems. Permanent camp: ▪ Existing Mereenie Camp (if required).
Procurement	Where available and economical, items/products used at site are locally sourced.
Laydown areas	Cleared areas, including former well sites, used to house materials, temporary camps or machinery.
Airstrip and helipad	▪ fenced airstrip ▪ the emergency helipad is located adjacent to the Mereenie Field emergency vehicles ▪ no aircraft refuelling facilities are provided at either of these locations
Waste services	Licensed waste transporters and disposers provide waste services. Refer to Table 10 for further details.

<table>
<tr><th>Activity</th><th>Description</th></tr>
<tr><td>Traffic and transport</td><td>

Coordinated logistics activities, including the movement of crew and visitors to and from Alice Springs.
The Interest Holder travel approval process is in place to manage all visitors and contractors.
Light vehicles access along the sealed and unsealed Larapinta Drive via Hermannsburg.
Heavy vehicles (and wet weather access) via Stuart Highway, Lasseter Highway and Luritja Road.
An accredited pilot accompanies oversized loads.

Traffic management plans are developed for rig movements to and from the field in consultation with the rig owner, Interest Holder and authorities.
<table>
<tr><th>Travel movements</th><th>Operations (Avg/month)</th><th>Workovers (avg/day)</th></tr>
<tr><td>▪ Light vehicles</td><td>▪ Approx. 40</td><td>▪ <10</td></tr>
<tr><td>▪ Heavy vehicles, including fuel/oil, materials delivery, rig mobilisation and demobilisation, civil plant and machinery delivery</td><td>▪ Approx. 20</td><td>▪ <5 mobilisation/ demobilisation
▪ <2 during workovers</td></tr>
</table>
</td></tr>
<tr><td>Wet weather operations</td><td>

Operations at Mereenie occur 365 days per year. Weather conditions are monitored daily to allow reassessment of operational needs to be addressed.
Refer to the Appraisal Wells Wet Weather Management Plan for applicable wet weather drilling protocols.

</td></tr>
<tr><td>Naturally Occurring Radioactive Materials</td><td>

Interest Holder radiation licence (Permit number: 1902650L).
Previous surveys have indicated that the site emits a negligible radiation hazard.
All works are conducted in accordance with Interest Holder safe work standards, including a NORM (Radiation) Management Plan alongside a Job Hazard Analysis.
Materials with potential NORM exposure from operational activities are tested before storage or disposal via an appropriately licensed transporter.

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</table>

3.9.4. Drilling Waste Management

The drilling of each well will utilise only WBM systems and/or a compressed air and mist drilling fluid. During WBM drilling operations, the drilling fluid is re-circulated down the drill pipe, returning up the hole and bringing drill cuttings to the surface. The cuttings and the drilling fluid are separated by flowing and passing over/through solids control equipment at the surface. The separation seeks to maximise drilling fluid recovery from the cuttings to save on the cost of chemicals and maximise efficiency. The cuttings (and some drilling fluid) will be directed into the drill sump with a capacity of approximately 10,000 bbls (1.6 ML), including a 500 mm freeboard to the top of the lined bund. No liquid hydrocarbons or fluids at a concentration greater than 1% by volume are generated during this phase of the activities.

Drilling fluid is returned to the closed loop mud tank system for re-use in the ongoing drilling operation. During air and mist drilling operations, which are underbalanced, all the cuttings will be directed through a blooie line to the flare pit with a capacity of approximately 0.6 ML. A de-duster will be installed on the blooie line. This device will wet the air stream as the cuttings exit the blooie line, minimising dust output.

The total estimated volume of cuttings and muds removed during the drilling operations of each well (combined mud and air drilling) will be <0.5ML (~0.4 ML) for each well. When drilling and associated activities have been completed, the lined sumps (drill sump) and flare pit are left to dry out. The dried cuttings from the flare pit are transferred to the lined drill sump before the sump and flare pit are backfilled, capped with soil from the site and rehabilitated with vegetation regrowth.

This management system for on-site burial is based on analyses and reporting from Mereenie development wells drilled in previous years at WM27 and WM28 and has been provided to DLPE. The drilling waste report (Appendix A) was prepared in compliance with the Code by suitably qualified third-party assessors. The report confirmed the classification of the Mereenie drilling sump material, which includes cuttings and residual drilling fluid, as General Solid Waste (inert) with no elevated Contaminants of Potential Concern (CoPC).

The Interest Holder will ensure that the drill cuttings and sump are analysed and assessed by a suitably qualified third party to ensure that the material is of suitable quality for disposal. Six (6) month sampling will commence within 6 months after completion of drilling of the wells.

The Mereenie drilling waste is classified as suitable for unconfined burial, i.e., landfill. Given the remoteness of Mereenie and the inert nature of the material, in situ burial of the drilling waste material, capping with topsoil and revegetation at the well site is both the most practicable and ALARP.

3.9.5. Bioremediation (Land Farm)

Approximately 2.6 km southeast of the CTP at Mereenie are the bioremediation pits (‘bio-pits’). This facility comprises 3 cells of approximate dimensions 60 m x 6 m, with a depth of 1–2 m (one active, one suspended from new material, one closed).

3.9.5.1. Freeboard Management

The Code (C.7.1.1) requires an estimate of the 1 in 1000 ARI (0.1% Average Exceedance Probability (AEP)) rainfall rate using Australian Rainfall methodologies (Ball et al., 2019) to maintain a freeboard for drilling sump storage for the critical period resulting in the highest risk of overtopping.

The 1 in 1000 (0.1%) year AEP for a 90-day cumulative rainfall event for Mereenie, based on available historical daily rainfall records at Watarrka covering a period from 1990 to 2022 (BOM Site 015652), is estimated to be approximately 500 mm as shown in Figure 24. The equivalent highly conservative (P10%) evaporation estimate occurring over the same 90-day period is 340 mm, resulting in a calculated freeboard requirement (maximum 90-day potential cumulative net depth increase) of 160 mm, should such an extreme event occur.

The Interest Holders have implemented the maintenance of a conservative freeboard of 500 mm across all the evaporation ponds and drilling sumps at Mereenie. This is good practice to manage the potential risk of overspray from pond wavelets during periods of high winds. This freeboard exceeds the Code requirements based on a 90-day 0.1%AEP for rainfall in the region.

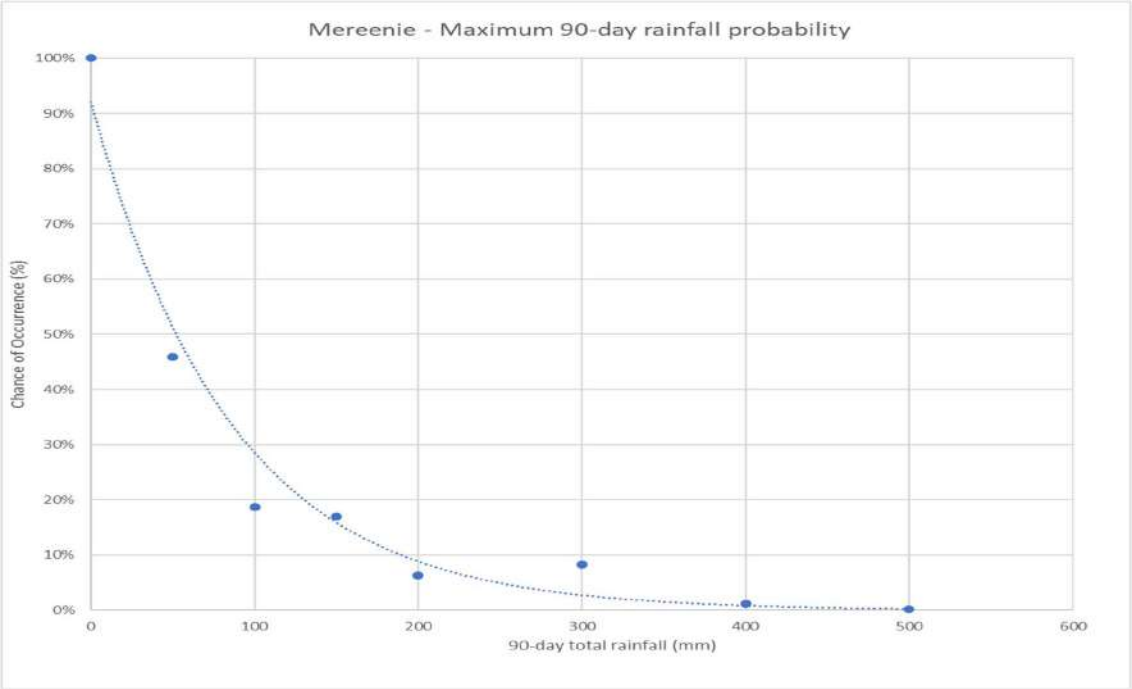


Figure 24: 90-day total rainfall probability estimates for Mereenie

3.9.6. Waste Management

Waste is separated into listed and non-listed at each well site and the accommodation camp. Listed waste is any waste prescribed under the Waste Management and Pollution Control (Administration) Regulations 1998 as a listed waste (refer *https://ntepa.nt.gov.au/your-environment/waste/types-of-waste-defined*), with non-listed waste being waste that is not prescribed under the legislation.

Listed and non-listed wastes are stored in vermin-proof containers at each well site and accommodation camp until they are collected and transported off-site by a licensed contractor and disposed of at an appropriately licensed facility. As part of the removal of any wastewater from each location (in addition to those requirements for being a licensed waste transporter), the following matters are to be recorded:

- volume removed
- composition of wastewater (i.e., the volume of drill fluids included and the volume of drill cuttings)
- destination
- licence number of the waste transporter.

The tracking of wastewater will be done in an auditable chain of custody system and be in accordance with requirements imposed under the *Waste Management and Pollution Control Act 1998* and the *Radiation Protection Act 2004* (if applicable). The typical wastes generated at each well site and accommodation camp are listed in Table 10.

Table 10: Waste type and disposal method

Typical waste	Disposal method
Sewage, grey water	Treatment ▪ Grey water and sewage are treated and disposed of on-site in an approved, portable treatment system as per the Department of Health's Code of Practice for On-site Wastewater Management. ▪ Sludge is transported to an approved disposal facility.
Food, paper, plastics	Disposal ▪ Stored in waste bins for transport and disposal at an approved disposal facility.
Glass, cans, scrap metals	Recycling ▪ Stored in recycling bins for collection and transport to an approved recycling facility.
Empty chemical, dangerous goods containers	Recycled/disposed ▪ Stored in a secure area and either re-used on-site, returned to the supplier via drumMUSTER initiative where possible, or transported and disposed of at an approved disposal facility.
Timber pallets	Recycled/disposed ▪ Stored in a secure area and either re-used on-site, returned to the supplier, recycled or transported and disposed of at an approved disposal facility.
Batteries	Recycled ▪ Stored in a secure area for collection and transport to an approved recycling facility.
Oily rags, oil-contaminated material, filters, greases and any other hydrocarbon-containing material	Recycled/disposed ▪ Stored in a secure area for collection and transport to an approved recycling facility or disposal facility.
Used spill kit materials	Disposal ▪ Stored in a secure area for collection and transport to an approved disposal facility.
Drill fluids/cuttings	Recycled/treatment/disposal ▪ Fluids segregated from muds and cuttings and re-used. The remaining fluids/muds are stored in a lined sump/steel-lined, hydro-tested flare pit. Fluid is then allowed to evaporate. Solids are tested and disposed of either on or off-site, depending on the results of contaminant testing in accordance with the Code.
Spill contaminated soil	Disposal ▪ Stored in waste bins for transport and disposal at an approved disposal facility, or treat the contaminated soil at the bioremediation pits near the Mereenie CTP.
Cement returns	Disposal ▪ Stored in a secure area for collection and transport to an approved disposal facility.
Raw water	Re-use ▪ Excess water at the conclusion of drilling will be used for rehabilitation activities.

3.9.7. Chemical Storage/Use

All chemicals used in Australia must be approved for use by the Commonwealth Government's Department of Health and be listed on the Australia Inventory of Chemical Substances, which is maintained under the National Industrial Chemicals Notification and Assessment Scheme. The Safety Data Sheets (SDS) for all chemicals to be used as part of the drilling campaign will be provided to DME (and can be supplied to DLPE upon request) as part of the drilling applications and will be available on-site.

In addition to the requirements under this EMP, the storage, handling and use of chemicals is to comply with the NT's workplace, health and safety legislation, relevant Australian Standards, the Code (including Clause A.3.8) and the SDS for each chemical. The selection, design, and construction of both well sites aim to minimise the risk of spills and potential run-off from hardstand areas in the event of spills.

Well sites will be constructed to mitigate potential interception of overland flows and constrain erosion in the event of heavy rain, as shown in the civil engineering well site design for WM31 (Figure 8) and WM32 (Figure 9). The well site access track and work area is a compacted hardstand area engineered to have specified compaction/load bearing for the initial well site construction. This well site access track and work area remain and are maintained until the final decommissioning phase of the well.

Regarding secondary containment and the requirements of A 3.8(g) of the Code, for all operational activities, chemicals are stored within designated bunded or enclosed chemical storage areas within the warehouse and production facilities until required for use. All diesel is stored in double-lined tanks.

During well site construction and drilling operations, operators will maintain strict records of names, types and quantities of chemicals utilised during the execution of all regulated activities. All chemicals will be used in accordance with applicable Material Safety Data Sheet (MSDS) requirements. Similarly, all chemical storage on the well site will comply with secondary containment requirements as per A.3.8(g) of the Code and may use the following storage solutions, depending on storage requirements:

- An engineered earth (>30% clay) compacted hardstand bulk bag chemical storage area within the existing well site, including bunding to contain 100% of the largest container stored plus 10%.
- A fully enclosed portable storage trailer is stored in the bunded chemical storage area established at the well site. Absorbent spill mats will be used when the trailer is moved around the well site.
- A fully enclosed chemical container that includes the capacity to contain 100% of the volume of the largest container in the workshop plus 10%.
- Open sumps will have a minimum freeboard provision of 0.5 m, which exceeds the wastewater requirement within the Code based on the regional rainfall design for Mereenie 90-day 0.1% Annual Exceedance Probability (0.1% AEP). This standard operating minimum freeboard has been applied across the Mereenie Field (see Mereenie Field EMP).
- All chemicals and waste generated during civil activities, drilling and maintenance will be stored in designated areas with secondary containment.
- All secondary containment (when in use) will be inspected weekly unless it is being operated through the wet season, during which time it will be monitored daily. Inspection and maintenance records will be kept on secondary containment areas in use.
- All bunded areas used for storing chemicals will be machine-compacted to reduce the permeability and to be able to readily recover contaminated materials if a spill occurs.
- Any spills or other fluids that escape from primary containment or are otherwise spilled onto secondary containment will be cleaned up as soon as possible in accordance with the Spill Management Plan.

- All contractors will be required to comply with the Spill Management Plan and have procedures in place to outline how spills will be prevented, identified and rectified.
- Spill kits and emergency response measures will be deployed at site where chemicals are stored and handled.
- All chemicals transported will comply with relevant SDSs, the NT Dangerous Goods Act, and associated legislation.

In addition to the above, the following considerations will be/ have been applied by the Interest Holder in consideration of lifecycle handling risks associated with chemical storage /use:

- **Risk Assessment and Management:** A thorough risk assessment to identify potential hazards in chemical handling has been undertaken (Refer to Section 6 for Risk Assessment).
- **Balancing Stored Volumes with Transport Requirements:**
    - Strategic Storage Locations: Storage facilities are stored closer to operational sites where possible.
    - Efficient Transport Scheduling: Transport schedules ae well planned to maximize load efficiency and minimize trips and where possible reduce road transport reliance.
- **Regulatory Compliance:** The interest holder ensures adherence to environmental, health, and safety regulations for safe storage, handling, and transportation of chemicals.
- **Emergency Response Planning:** The Interest holder has developed and will implement plans for chemical spills or accidents during storage and transport (Refer to Section 8.4).
- **Training and Awareness:** The operators' policies and procedures outline all personnel's training and competency requirements (staff, contractors and visitors) to ensure they can fulfil their obligations under this EMP including safe chemical handling practices and emergency response procedures.

By incorporating these strategies, the interest holder can effectively manage lifecycle chemical handling risks and enhance the overall safety and efficiency of this project.

3.9.8. Drilling Fluid Chemicals

3.9.8.1. Air and Aqueous

The proposed drilling fluid is predominantly water with the remaining chloride/potassium salt and fluid additives as a Water-Based Mud (WBM) system. Air/mist drilling in the stairway formation will use nitrogen gas and compressed air to carry drill cuttings to the surface.

A list of the potential chemicals used in the drilling fluids for this drilling campaign is provided in Table 11. These drilling fluid chemicals are stored in an enclosed, purpose-built, portable trailer, which keeps the chemicals dry and safe. The portable trailer is located in a designated chemical storage area within the well site that is bunded and can contain greater than 100% of the largest container stored in the area plus 10%.

The bunded area at each well site is compacted to reduce the permeability and readily recover materials if a spill occurs. In addition, the bunded area will be designed to manage clean and dirty water, be compatible with the stored material, and be designed to avoid failure from operational activities. Mixing of the drilling fluid and completion fluid chemicals occurs within steel tanks, which will also be placed within temporary HDPE inflatable bunds to ensure secondary containment of any spills.

The Code requires that chemicals or other substances that could leave a residual toxic effect in the aquifer must not be added to the drilling fluid while drilling through local aquifers. Drilling fluid additives will not contain benzene, toluene, ethylbenzene, or xylene (BTEX).

Table 11: Drilling Fluid Chemicals

Function	Product name	Hazardous substance	Unit/kilogram (kg)	Estimated Quantity (kg)/well	Storage location
Sealant	Mica (F)	No	22.7	872	Well site
Biocide	Nuosept 78	Yes	25	25	Well site
Calcium remover	Sodium bicarbonate	No	25	500	Well site
Complexing agent	GELPLEX (bentonite)	No	22.7	28,330	Well site
Corrosion inhibitor	SAFE SCAV NA	Yes	25	25	Well site
Corrosion inhibitor	SAFE-COR	Yes	189	189	Well site
Defoaming agent	Defoam A25	Yes	20	640	Well site
Filtration control agent	Polypac UL	Yes	25	1000	Well site
Foaming agent	Platinum foam plus	Yes	18.9	1,363	Well site
Lost circulation and weighting materials	Barite	No	1500	220,500	Well site
Lost circulation and weighting materials	Form-A-Blok	No	9	1,746	Well site
Lost circulation and weighting materials	Kwik seal (M)	No	22.7	872	Well site
Lost circulation and weighting materials	Losseal max	No	22.7	454	Well site
Lost circulation and weighting materials	M-I-X II coarse	No	22.7	872	Well site
Lost circulation and weighting materials	Nut plug (F)	No	22.7	872	Well site
Lost circulation and weighting materials	Nut plug (M)	No	22.7	872	Well site
pH control additive	Caustic soda	Yes	25	525	Well site
pH control additive	Citric acid	Yes	25	500	Well site
Primary fluid-loss control additive	FLO-PLEX	No	25	3,675	Well site
Primary fluid-loss control additive	Safe-carb 250	No	22.7	1,317	Well site

Function	Product name	Hazardous substance	Unit/kilogram (kg)	Estimated Quantity (kg)/well	Storage location
Primary fluid-loss control additive	Safe-carb 40	No	22.7	1,308	Well site
Secondary pH control & Ca++ removal agent	Soda ash	No	25	700	Well site
Stabiliser	Potassium chloride	No	25	875	Well site
Thinner and dispersant	SAPP (Sodium Acid Pyrophosphate)	Yes	25	500	Well site
Viscosifier	DRILPLEX	Yes	11.3	2,825	Well site

Batch mixing of the fluid chemicals occurs within steel mud tanks, which will be placed within temporary HDPE inflatable bunds to ensure secondary containment of any spills. Chemicals will be added to the drilling mud (water) using the mixing hopper and returned to the mud tanks. As per Section 3.3.2, a lined drain/trench will also be constructed around the mud tanks to direct potential overflow to the steel-lined, hydrotested flare pit, which has a capacity of 0.18 ML, which is enough to contain 180% of the volume of the mud tanks.

Additional controls are implemented to control spills/leaks from the mud tanks, including regular routine inspection of the tanks during the 12- or 24-hour shift, regular checks of tank fittings and valves, and installation of devices to control the flow of any potential spills/leaks away from water courses, drainage lines or vegetation. Active monitoring of the drilling fluid is critical for success during well drilling operations.

As discussed further below, the depth of the groundwater (more than 100 m) at both well sites also provides additional aquifer protection against contamination from any significant surface-level spills, although it is noted the potential volume is orders of magnitude less than a shale well. In the event of spills occurring at a well site, the potential impact on the soil will be assessed, and any contaminated soils will be removed (and disposed of at an approved facility) or remediated according to the *National Environment Protection (Assessment of Site Contamination) Measure Guidelines 2013* (NEPM).

3.9.8.2. Drilling Chemicals

All chemicals will be stored and utilised in accordance with the approved MSDS and, where required, will be contained in bunded containers or on bunded pallets. Primary chemicals will be stored on the well site, whereas contingent chemicals will be stored in the Mereenie Drilling Storage facility within the field as per the MSDS. Records of the names, types, and quantities of chemicals used during all drilling (and other regulated activities) will be kept and maintained on site.

3.9.8.3. Alternate Drilling Fluids

Should a substitute or alternate drilling fluid or chemical be required at short notice, an internal Management of Change (MoC) process will be undertaken to assess risks associated with the alternate product. This will include:

- **Identifying and assessing risks:** Conduct a thorough risk assessment of the substitute drilling fluid by analysing its chemical composition, environmental impact, compatibility with existing equipment, previous use within the industry and potential health and safety hazards.
- **Engaging stakeholders:** Communicate the change and involve all relevant stakeholders in decision-making. This will include gathering input and feedback from engineers,

health/safety/environment (HSE) staff, management and other affected personnel to ensure a shared understanding of the risks and appropriate mitigation measures.

- **Development of risk mitigation strategies:** Based on the risk assessment and stakeholder input, strategies to mitigate or eliminate identified risks will be developed. This may involve modifying drilling procedures, implementing additional safety/environmental measures, providing training to personnel, or considering further alternative fluid options (if necessary).
- **Monitoring and evaluating:** Continuously monitor the performance of the substitute drilling fluid and assess its impact on drilling operations, safety and environmental aspects. Regularly review the risk assessment and adjust risk mitigation strategies to address emerging issues or optimise performance.
- **Communication and documentation:** Maintain clear and transparent communication channels throughout the change process. Document all risk assessment findings, risk mitigation strategies and implementation plans to ensure a comprehensive record of the change management process.

3.9.9. Other Chemicals

Table 12 provides a summary of the other chemicals that will be stored at each of the well sites during the drilling campaign.

Diesel will be stored in a double-lined tank, while the other chemicals are stored in the workshop area of the well site, which is bunded and can contain greater than 100% of the largest container stored in it, plus 10%.

The portable storage trailer is bunded and can contain more than 100% of the largest container stored in it, plus 10%. The portable storage trailer can be moved around the well site to areas where the chemicals are required.

Table 12: Other chemicals

Product name	Hazardous substance?	Estimated quantity	Container size/type	Storage location
Hydraulic oil	Yes	200L	5–20L/package	Portable storage trailer
Engine oil	Yes	200L	5–20L/package	Portable storage trailer
Transmission oil	Yes	200L	5–20L/package	Portable storage trailer
Coolant	Yes	200L	5–20L/package	Portable storage trailer
Degreasers	Yes	100L	5–20L/package	Portable storage trailer
Diesel	Yes	110–550KL	100KL/tank	Well site – tank

3.9.10. Traffic

The potential traffic-related impacts associated with the Mereenie development drilling program, including civil activities, drilling, well testing and ongoing operations, are not considered significant. Traffic associated with petroleum exploration activities is generally small and of short duration. The majority of equipment to be utilised at each proposed drilling location will be transported via internal private roads at Mereenie once they turn off the primary and secondary state roads.

No upgrades are required to the state roads for the loads to turn off onto the access tracks. The drilling rig makes up most trucked loads, and once the rig is on-site, consumables and staff movements will generate a minor increase in traffic. The peak maximum anticipated traffic flow increase associated with the activities with each proposed drilling location (including civils, drilling, completions and commissioning) will be approximately 20 vehicles per day, with ~40% being heavy vehicles. Movements of civil-related infrastructure are anticipated to be minor. They will be sourced locally, with a peak of 5

vehicle movements (<20% heavy vehicles) for several days during equipment mobilisation and demobilisation (prior to the drilling rig mobilisation).

Average daily traffic additions during the remainder of the project period are likely to be 10-15 movements per day for the first 2 weeks, reducing down to 3–4 movements for the remainder of the period once the wells undergo testing and increasing after the rig demobilises from the Mereenie Field. It is expected that one fuel delivery will occur every 10 days and one water truck delivery every 3 days.

Movement of heavy loads (i.e. drilling rig mobilisation and demobilisation) through regional centres will be avoided. During crew changeover, a bus service will be available to transport the crews (whether FIFO or DIDO) from Alice Springs to site.

3.9.11. Flaring

Gas flaring will occur during the drilling of WM31 and WM32. Gas extracted during the drilling activities will typically be diverted to the in-ground horizontal flare pit or a flare tank for combustion. Flaring may occur intermittently throughout the well site occupation depending on the activity being conducted; however, the main time when the flare will be active is during the drilling of the production holes into the target formations, where the flare may be continuously active for 10–75 hours at a time, depending on the well being drilled.

Flaring may also occur during other activities, such as flow testing and setting of production packers, though these are relatively short duration compared to drilling the production holes. The estimated total duration of flaring (calculated based on the duration of drilling of production holes and other activities in which gas will be flared) and the total volume of gas to be flared at each well are shown in Table 13.

The total volume of gas to be flared at each development well is comparatively modest and of short duration. This is because of accumulated knowledge regarding the target Pacoota reservoir characteristics and ease of tie-in of each well.

3.9.12. GHG Emissions from Flaring

The Northern Territory government requires all flaring activities to be stipulated in the applicable WOMP for the well and approved by the DME. GHG emissions from flaring have been calculated using the assumed maximum forecast gas production rates for each well, multiplied by the total duration of the flare gas generating activity. The recent results from drilling and testing WM27 and WM28 by flaring have validated this flow test assumption.

The estimate of total GHG from flaring is approximately 2,200 tCO2-e (Table 13). This represents approximately 4% of the forecast annual GHG emissions from the Mereenie Field operations.

Table 13: Estimated flaring volumes and tCO2-e

Petroleum well	Total estimated flare duration (days)	Max. gas production (Mmscf/day)	Approx. total (tCO2-e)
WM31	4	5	1092
WM32	4	5	1092
Total	8	10	~2,200

3.9.13. Total GHG Emissions from the Regulated Activity

A summary of the total GHG emissions for the regulated activity is shown in Table 14. The estimate is 3,475 tCO2-e. The forecast total GHG emissions from operations, drilling of new appraisal wells, and well workovers at Mereenie over the next 5 years is 270,700 tCO2e which is split evenly over the 5

years (i.e.54,140 tCO2e/annum[4]). Production and metering improvements, in addition to leak detection and repair programs, are showing an improvement in emissions. Planned projects, including the installation of a flare gas compressor, will also see continued reductions in emissions. This regulated activity makes up less than 7% of Mereenie's total annual GHG emissions and does not represent a material cumulative GHG exceedance risk.

Table 14: Estimated total GHG emissions from regulated activity

Activity	Source	tCO2-e
Civil activities for WM31 and WM32	41,000L diesel	111
Land clearing for WM31 and WM32	5.45ha	616*
Drilling	203,000L diesel	548
Flaring	8 days	2,200
TOTAL GHG (tCO2-e)		3,475

** Emissions were calculated using areas and vegetation data in Table 14 and the Transport Authorities Greenhouse Group (TAGG) GHG Assessment Workbook for Road Projects (2013). The TAGG workbook Appendix E provides a methodology for estimating the loss of carbon sequestration in vegetation at the time of clearing and the potential carbon that could have been sequestered in the future if the vegetation had not been cleared. The methodology is consistent with that used by the Australian Government to estimate Australia's national GHG emissions for reporting under the United Nations Framework Convention on Climate Change. The methodology makes conservative assumptions that all carbon pools are removed as part of the clearance of vegetation (e.g. soil and debris) and that all carbon removed is converted to CO2. Using the land types described in Section 4 of this EMP and Table 1 of the TAGG workbook, Interest Holder has conservatively assumed that all vegetation to be cleared for the drilling program is vegetation class G (Open Shrubland – Acacia Shrubland) (113 tCO2—e), which has a higher emissions factor than other vegetation classes found in the proposed disturbance area such as class F (Mallee and Acacia Woodland and Shrubland - Acacia Open Woodlands) (106 tCO2—e) and class I (Grassland - Tussock Grasslands) (110 tCO2—e).*

4. Description of Environment

The proposed well sites within the Mereenie are indicated in Figure 25 below. WM31 is approximately 1.5 km (+ or – ~100m depending on option A or B) northwest of the original Mereenie-1 discovery well drilled in 1996. Over 20 wells have been constructed west of WM31 on OL4 over the intervening years. WM32 is located approximately 1 km (+ or – ~100m depending on option A or B) northwest of the Central Treatment Plant. Four existing wells on OL4 have been drilled to the east of WM32 on OL4 and many more wells further east in OL5 to sustain gas production from the field.

The subsequent sections of the EMP describe the physical, natural, and socioeconomic environment factors surrounding the areas of interest (AOIs) at well sites WM31 and WM32. The Interest Holder has a demonstrated understanding of the environmental constraints associated with developing the proposed WM31 and WM32 well sites, using a combination of desktop and baseline survey results to develop a description of the current environment and suitable risk mitigation measures. The following baseline surveys have been utilised to verify the desktop findings and develop the mitigation measures contained in this EMP:

- Ecological Assessment: Mereenie Acceleration Project by EcOz Environmental Consultants (June 2022)
- Aboriginal Archaeological Assessment: Mereenie Gas Acceleration by Heritage Management and Planning (September 2022)

Both assessments surveyed 4 different survey areas within the Mereenie Field, which are shown in Figure 26. As a result of the site investigations, WM31 and WM32 were narrowed down and situated within the northern corner of Survey Area 3 and the centre of Survey Area 2, respectively. Consequently, the detailed assessment of the physical environment within this EMP will focus on these

[4] For the 2022 NGER reporting period, greenhouse gas emissions were 56,743 tCO2e. This included a 2 well drilling program that occurred under the NT Drilling Program EMP (EMP CTP3-4). The 2 appraisal wells to be drilled in this regulated activity will have similar emissions and will therefore be below the 100,000 tCo2-e emission threshold.

AOIs and have disregarded survey areas 1 and 4. The findings of each assessment are discussed further in Section 4.2 and Section 4.3.

If the Operator learns of any new information about the existing environment that could affect the risk assessment and mitigation measures outlined in the EMP, a review of the EMP will be conducted.

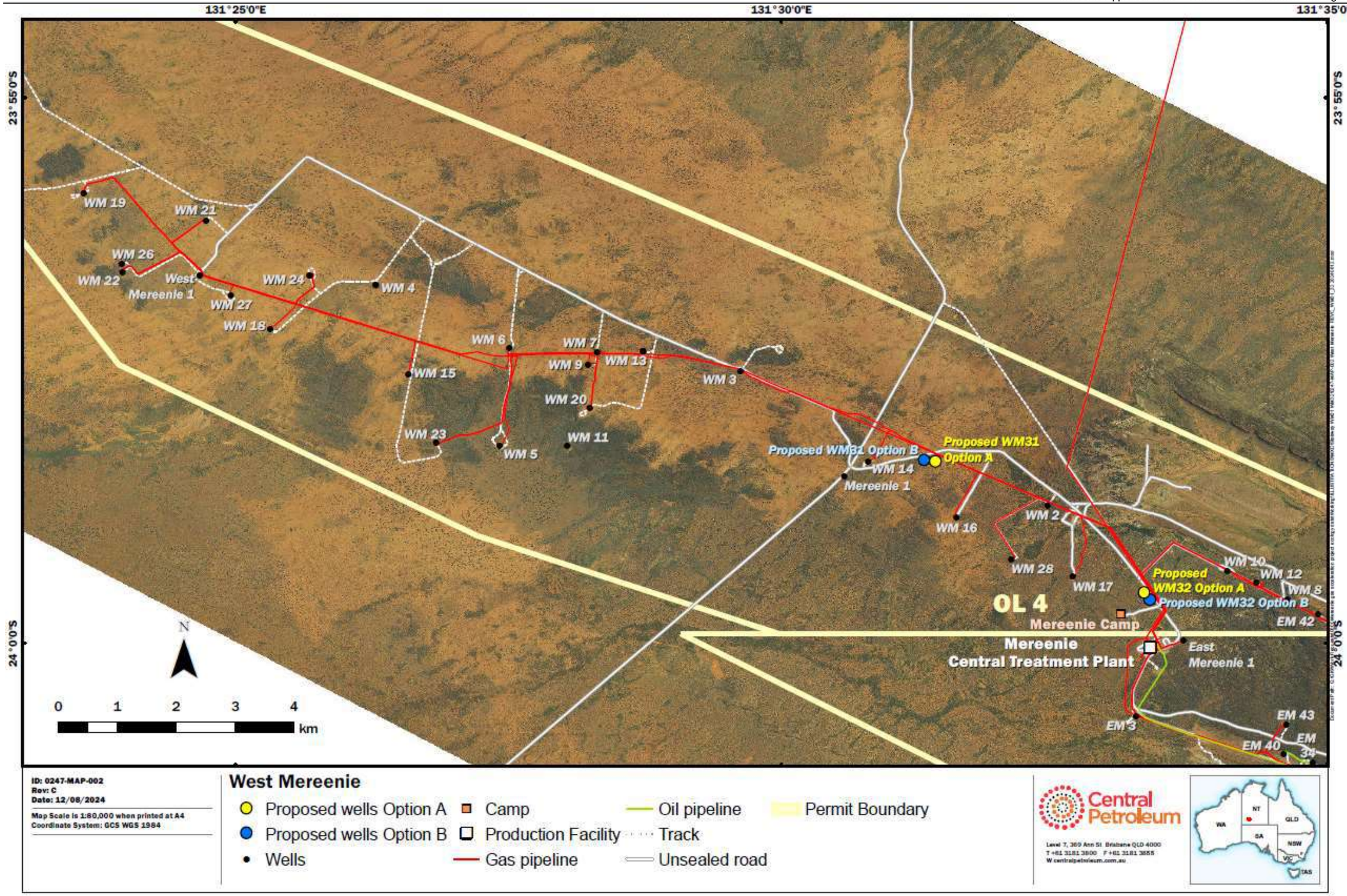


Figure 25: Location of WM31 and WM32 in the Mereenie Field

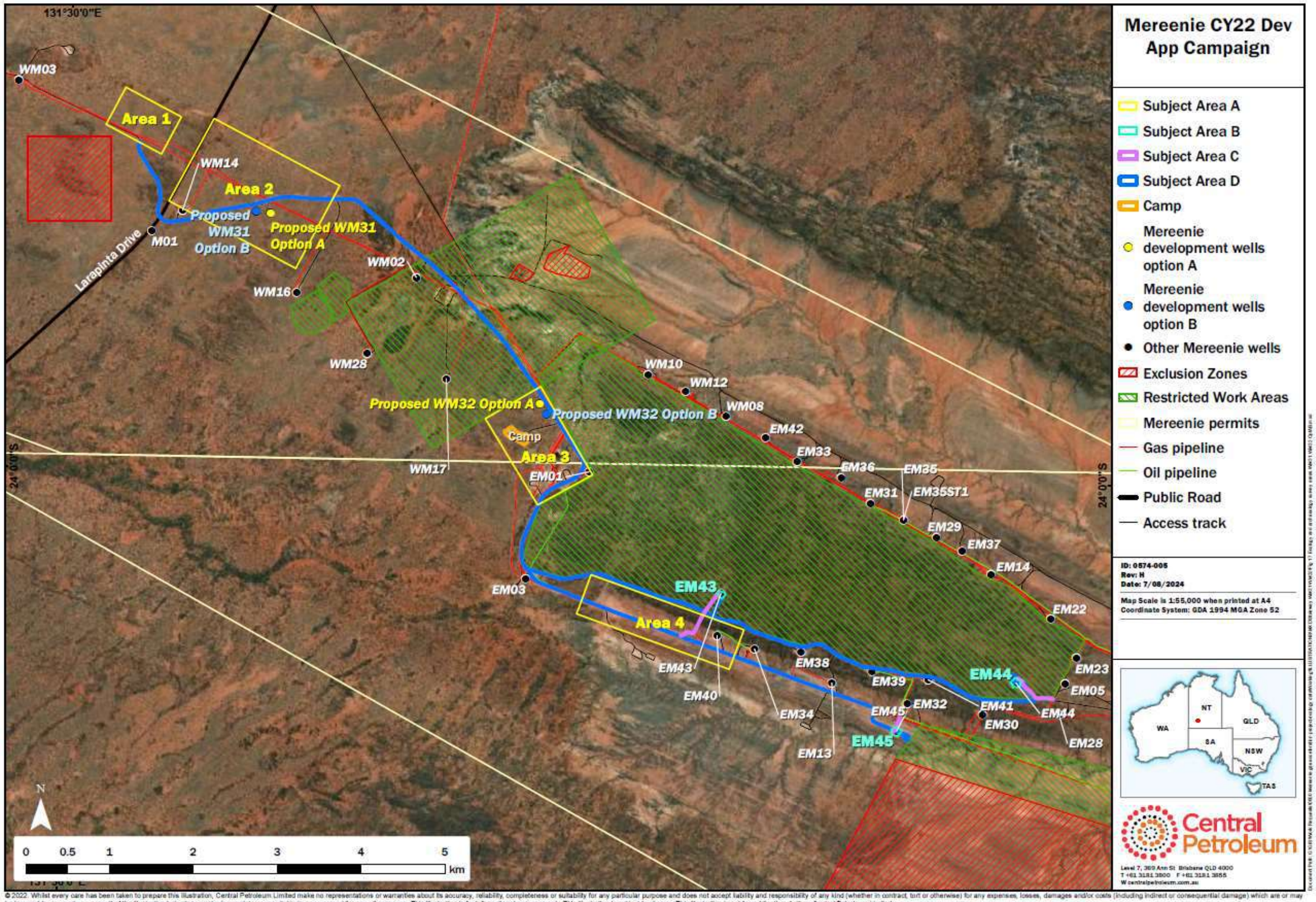


Figure 26: Ecology and archaeology survey areas

4.1. Physical Environment

4.1.1. Climate

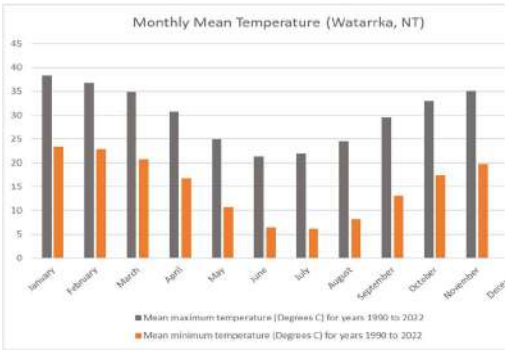
The AOIs are located in an arid to semi-arid climate at the edge of the Simpson Desert, which is characterised by hot, dry summers and cool, dry winters, with a low average annual rainfall total of 310 mm. The closest long-term Bureau of Meteorology weather station is Watarrka (station number 015652), approximately 50 km southeast of the AOI. It is semi-arid to arid, influenced by the monsoonal wet season from November to March, with the highest mean rainfall occurring in January (45.7 mm) and a 30-year annual total average of ~310 mm. The annual total evaporation average is 2,910 mm. This is approximately 10 x annual precipitation, and the consequent aridity profoundly dominates the vegetation and fauna in the region.

The 0.1% AEP for a 90-day cumulative rainfall event for Mereenie is estimated to be approximately 500 mm. The equivalent highly conservative (P10%) evaporation estimate occurring over the same 90-day period is 340 mm, resulting in a calculated freeboard requirement (maximum 90-day potential cumulative net depth increase) of 160 mm, should such an extreme event occur.

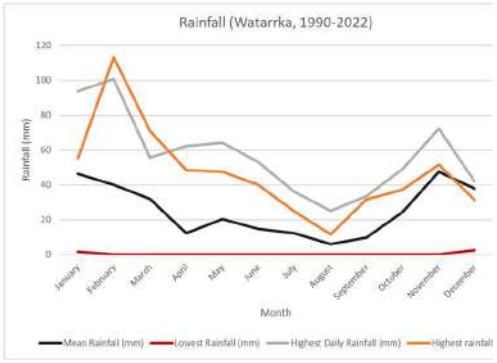
Typically, more rainfall occurs in the summer months, which is associated with monsoonal influences from the north; however, the amount of rainfall in the central arid zone has a history of being highly variable as several continental weather systems influence it. Wind speed can vary significantly, but direction tends to be dominant from the east and from a south-easterly direction in the afternoons.

Average maximum temperatures range from 21.3ºC in July to 38.3ºC in January, and average minimum temperatures range from 6.1ºC in July to 23.4ºC in January. Climate indicators for Mereenie Field are summarised in Figure 27.

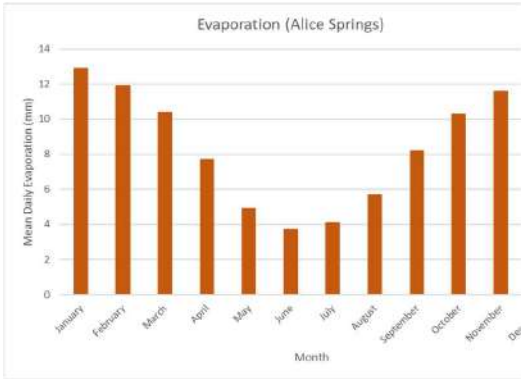
Mereenie average temperatures



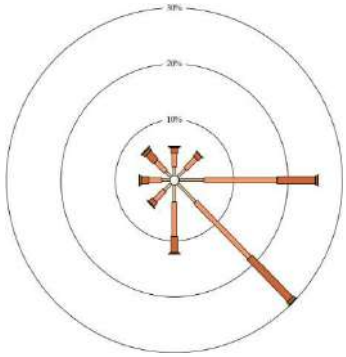
Mereenie average rainfall



Mereenie average evaporation rates



Mereenie prevailing wind conditions



(Source: BOM, 2022)

Figure 27: Climate Indicators for Mereenie Field

4.1.2. Land Systems

A land system is an area or group of areas where a recurring pattern of topography, soil and vegetation occurs (Christian and Stewart, 1968). Land system descriptions (Table 15) provide a general and consistent basis for determining potential habitat types within the region and provide a guide for erosion hazards in the area. The AOIs straddle 2 land systems[5] (described and mapped at a scale of 1:1,000,000 by Perry et al. 1962) (mapped in Figure 28): the Simpson land system to the west and the Gillen land system to the east.

WM31 is in the **Gillen land system**. This land system is characterised by rugged ranges of quartzite, sandstone, and conglomerate and outcropping with shallow, stony, sandy soils and some red sands or red clayey sands. Landforms include ridges, foothill ridges and spurs, benches and mesas, gravel terraces and fans, erosional slopes, colluvial/alluvial fans, floodplains and drainage channels. Vegetation in this land system is variable due to the numerous landforms within this land system. It mostly comprises sparse Acacia shrubs and low trees over spinifex, small areas of *Acacia aneura* and/or *Acacia kempeana* over sparse forbs and grasses, and numerous small treeless or sparsely vegetated areas with tussock or hummock grasses.

[5] A land system as 'an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation' (Christian and Stewart 1968). Land systems have been mapped across the entire NT by the government and at scales that vary from 1:250,000 to 1:1,000,000

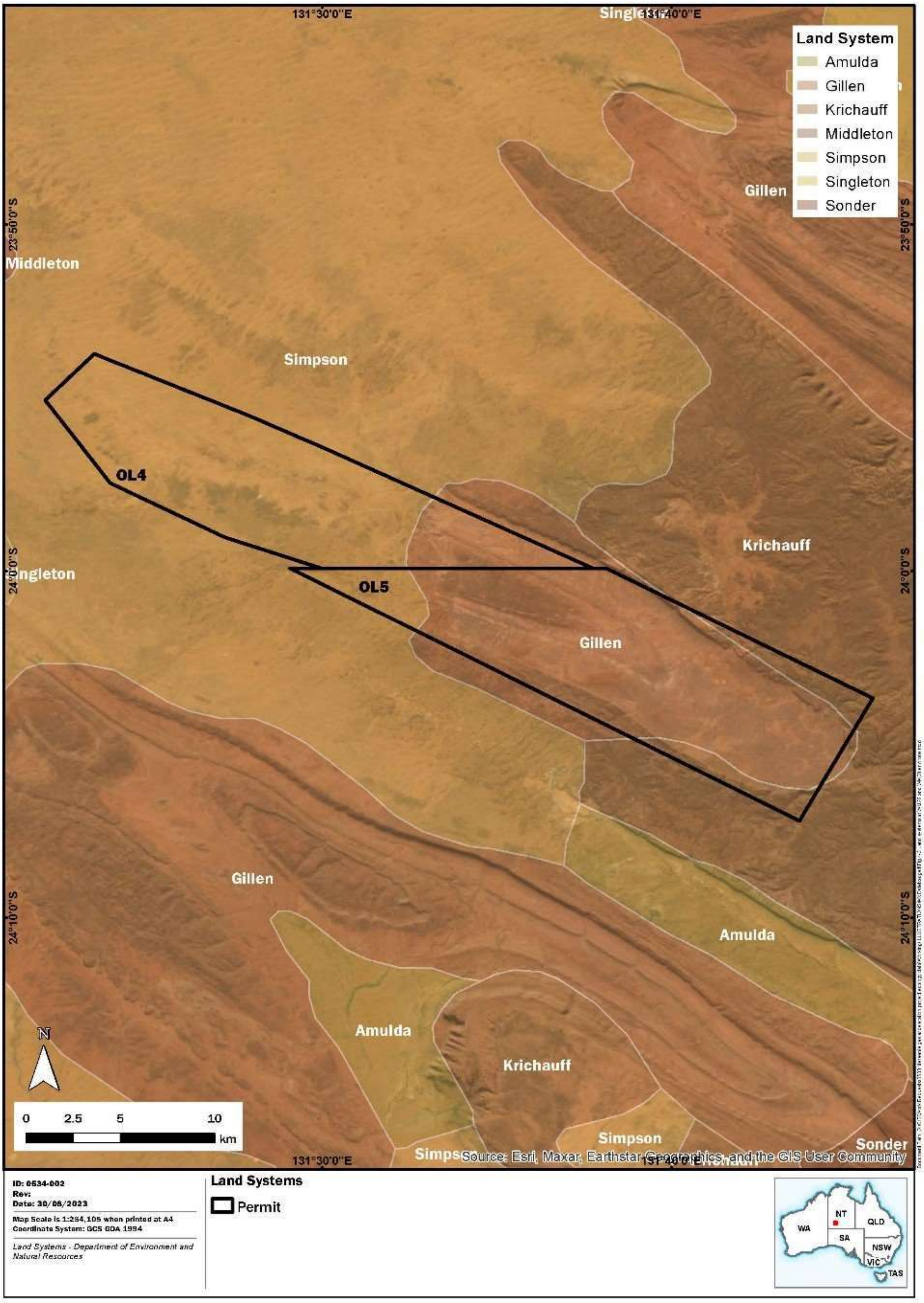


Figure 28: Land systems at WM31 and WM32 environs

WM32 is in the **Simpson land system**.

This land system is characterised by dune fields featuring parallel linear dunes, reticulate dunes, and irregular or aligned short dunes of varying relief. It also includes associated swales between the dunes, with red sands on the dunes and a mix of soil types in the swales, such as red clayey sands, red earths, and calcareous earths. Vegetation in this land system is sparse Acacia shrubs and low trees such as occasional Desert Oak (*Allocasuarina decaisneana*) over spinifex and tussock grasses. Dune crests can support *Zygochloa paradoxa*. Swales can support *Acacia aneura* and *Eucalyptus microtheca* or sparse low trees over samphire and old man saltbush.

Table 15: Description of land systems in the environs of WM31 and WM32

Well site	Land system	Description	Geology	Topography	Soils	Erosion hazard
WM31	Gillen	Sandstone strike ridges and intervening valleys in the southern part of the Mereenie Field	Sandstone mountains with Mulga or Witchetty Bush country	Partially dissected erosional weathered land surface; relief up to 500 ft	Shallow, stony, gravelly soils and red clayey sands	Moderate erosion hazard
WM32	Simpson	Sandstone plateaus, eroded and dissected, forming margins to the south-east part of the Mereenie Field	Extensive dune fields with hard spinifex pastures	Sand dunes of varying height and alignment, up to a maximum of 70 ft in the Simpson Desert section	Red sands to red clayey sands and locally red earths	Low erosion hazard

4.1.3. Vegetation Communities

NVIS vegetation mapping (NVIS 5.1, based on an original dataset from Wilson et al. 1990), indicates that WM31 and WM32 are located within Acacia sparse shrubland (NVIS ID 444), as shown in Figure 29 and Figure 30. No sensitive vegetation types are expected to occur at these well sites. Assessment of the dominant vegetation species in this vegetation type in the vicinity of WM31 and WM32 is shown in Table 16 (EcOz, 2022).

Table 16: Identified vegetation communities

Well site	NVIS ID	Vegetation type	Community Description	Dominant species	Environs
WM31 WM32	444	Acacia sparse shrubland	Upper: Absent	-	Stone mantled plains, plains, red earths
			Mid: Acacia mid-sparse shrubland	*Acacia tetragonophylla, Acacia kempeana, +/- Atalaya hemiglauca*	
			Ground: Salsola low forbland	*Salsola tragus, Thysanotus banksii, Enneapogon cylindricus*	

Well site	NVIS ID	Vegetation type	Community Description	Dominant species	Environs
West of WM31	577	Hummock grassland	Upper: Allocasuarina low open woodland	*Allocasuarina*	Extensive dune fields, infertile red siliceous and clayey, sands
				decaisneana +/-	
				Acacia aneura, +/-	
				Acacia estrophiolata	
			Mid: Acacia mid-sparse shrubland	*Acacia ligulata*	
				Acacia dictyophleba	
				Acacia murrayana	
			Ground: Triodia low hummock grassland	*Triodia basedowii, Triodia pungens, Triodia schinzii*	

The Acacia sparse shrubland ground strata present at WM31 and WM32 are the basis of the pastoral activities conducted in the region. The grassland species in this habitat include tussock grasses such as *Eragrostis eriopoda, Leptosema chambersii, Themeda sp., Aristida holathera, Eriachne aristidea* and in some locations*, Cenchrus ciliaris (Buffel Grass).* Forbs and edible bushes include *Senna pleurocarpa, Salsola tragus, Thysanotus banksii, Enneapogon cylindricus.*

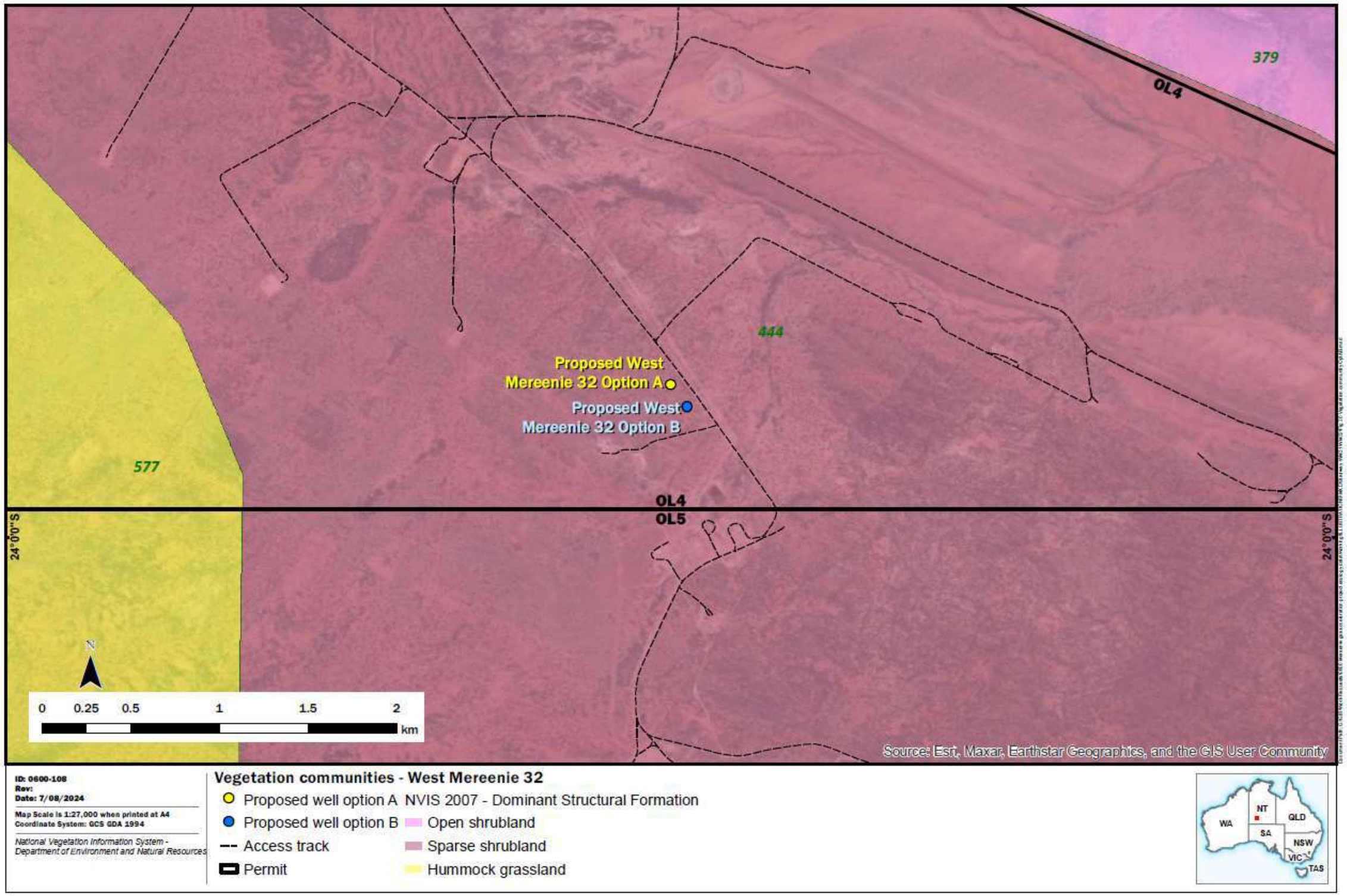


Figure 29: Vegetation community at WM32 environs

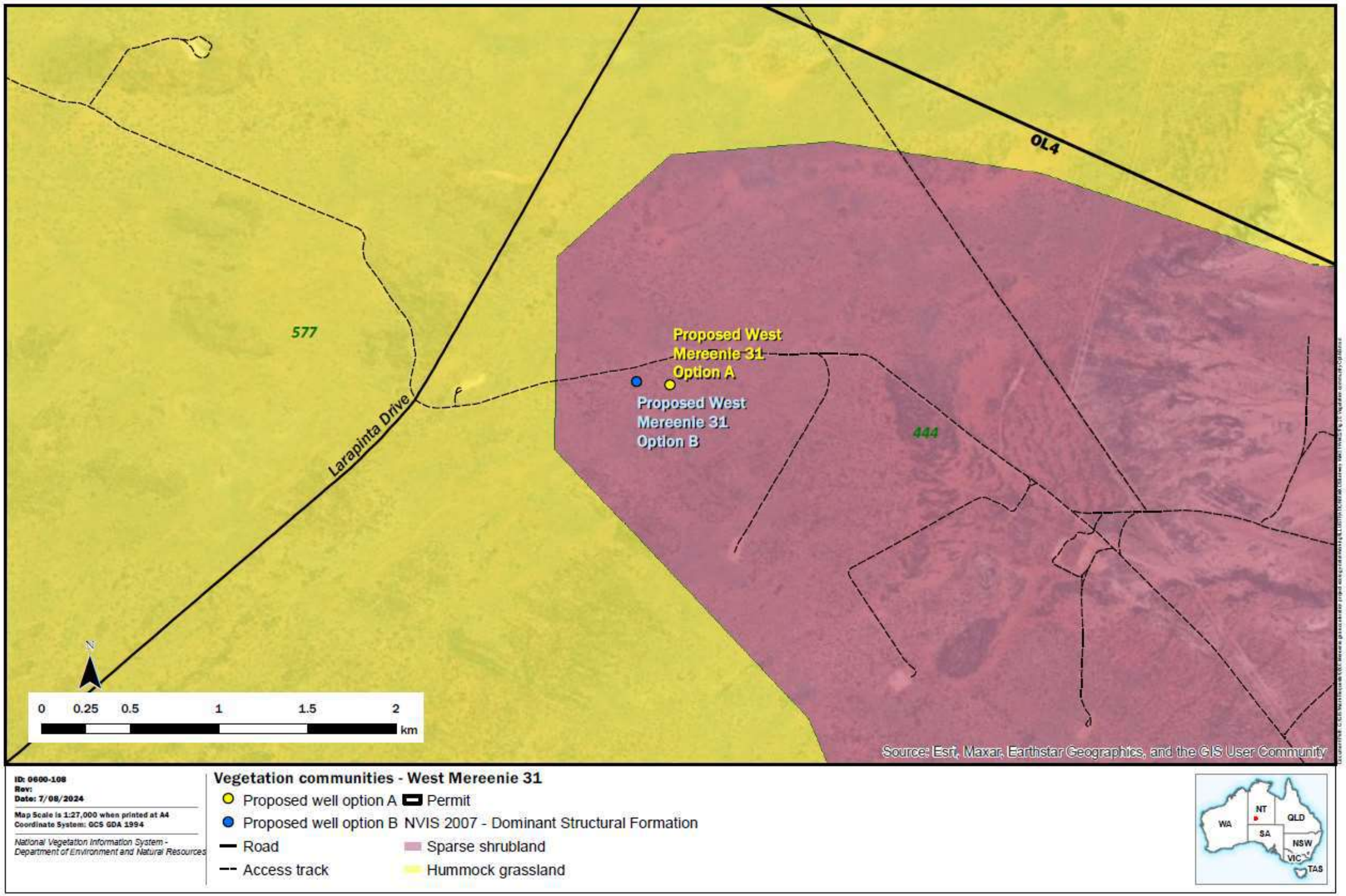


Figure 30: Vegetation community at WM31 environs

Recent drone imagery confirms that the open shrubland vegetation community at each well site (Figure 31 and Figure 32) provide a good understanding of the nature and extent of the vegetation communities in the respective well site environs.

Figure 31: Recent drone imagery of Acacia sparse shrubland near WM32 area at Mereenie

Figure 32: Recent drone imagery of Acacia sparse shrubland near WM31 area at Mereenie

4.1.4. Surface Geomorphology and Catchments

The surface geomorphology near WM31 and WM32 is the interface of 2 regional catchments defined by the sand dune system of the Simpson Desert to the west and the Parke Creek sub-catchment to the east in which WM31 and WM32 are located. This is evident in the emergent outcropping of the Parke Siltstone and older Mereenie Sandstone in Parke Creek.

The surface geology in the vicinity of the wells is characterised by a thin layer of Quaternary dune sands and alluvial sediments. These overlie and interfinger with the Mereenie Sandstone, which outcrops along the exposed hinge of the anticline. Exposures of Parke Siltstone to the northeast of WM31 (Figure 33) occur; however, this formation has been eroded off the hinge of the anticline that underpins the West Mereenie Field. This erosion is evident in the surface geology mapping for WM32, shown in Figure 25.

Most of the WM31 and WM32 areas comprise sandplains or sandy red earth. There are also numerous low rocky ridges, hills and slopes (sandstone dominant, occasional quartzite sandstone). The ridges and outcrop should be treated as a locally important refugial habitat, posing an erosion risk due to sloped terrain (EcOz, 2022). These features have been avoided at WM31 and WM32, as evident in Figure 33 and Figure 34.

The proposed well site layouts show the engineering design detail for the anticipated cut and fill required to level the respective well sites. In keeping with ESCP practice at Mereenie, the respective well site designs provide details for the overland flow path, slope design, well site drainage flow path and diversion bank features to isolate and contain the well site.

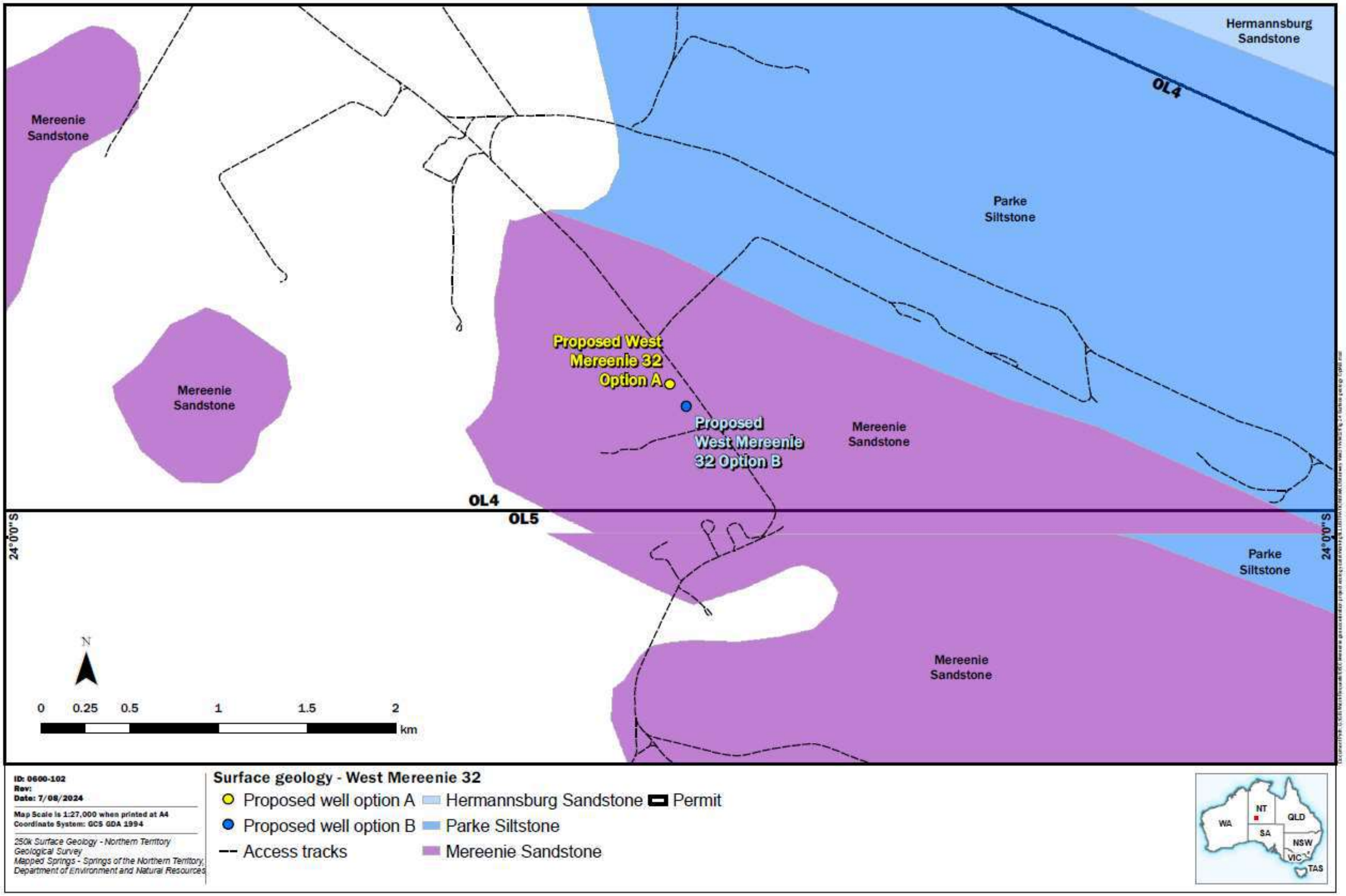


Figure 33: Surface geology at WM32 environs

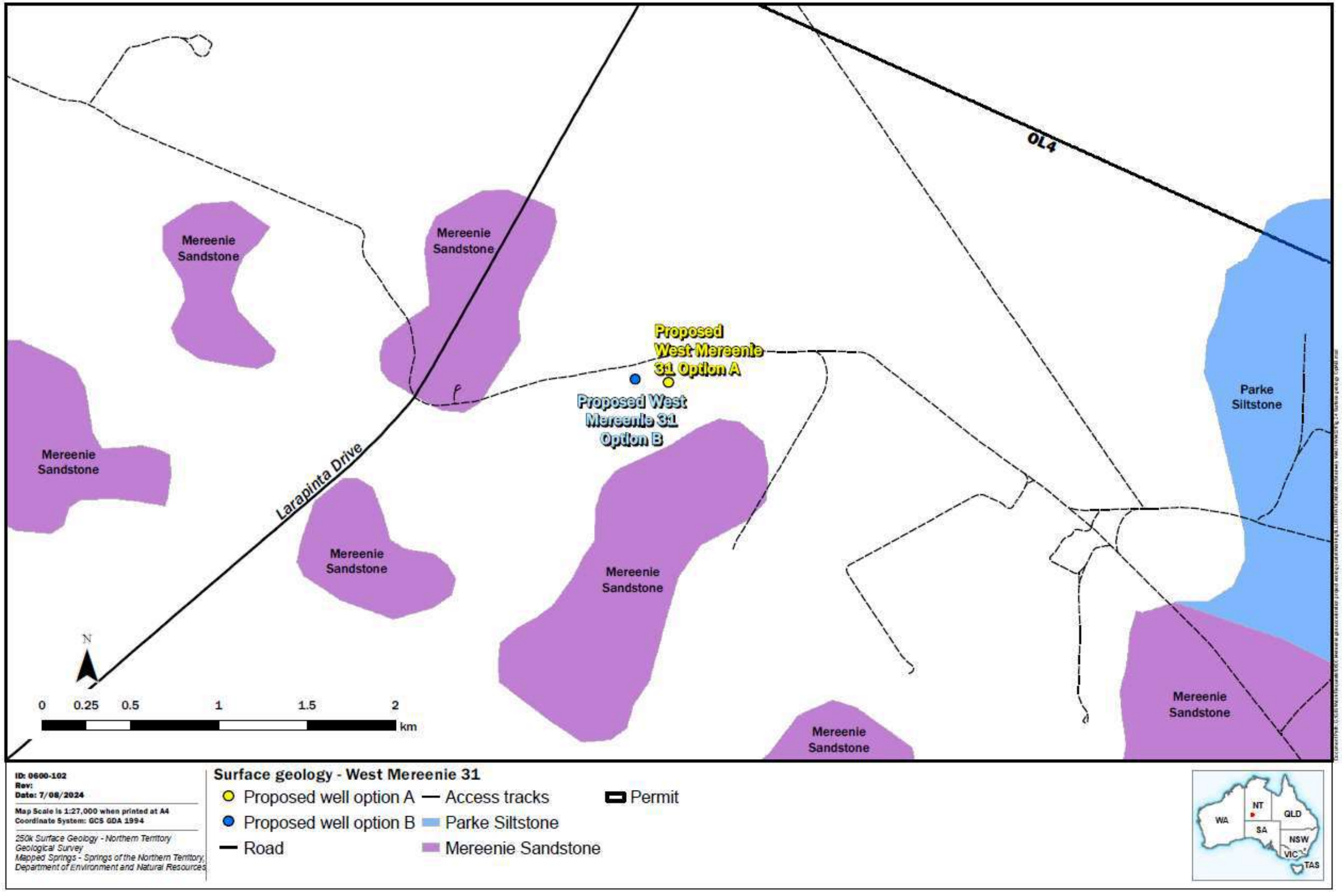


Figure 34: Surface geology at WM31 environs

4.1.5. Surface Hydrology and Catchments

The surface water hydrology in the vicinity of WM32 (Figure 35) and WM31 (Figure 36) is within the upper catchment area of Parke Creek. The Stream Order 1 drainage lines, which cover the immediate area, drain into Parke Creek, which is approximately 755 m AHD in this area, a major drainage line (Stream Order 3) located in OL5 draining to the southeast of the field. These drainage lines are ephemeral and support a low woodland of Acacia aneura (Mulga) over shrubs and tussocks. Two small drainage lines (Stream Order 1) are present east and west, approximately 500 m from the proposed WM32 well site. Red earth plains or depressions also support Mulga stands in the area, but these have been avoided. The modelled flood level in the area is approximately 767 m AHD (Figure 8). The respective WM31 and WM32 well site design elevations are:

- WM31 ~769 m AHD
- WM32~784 m AHD.

The mapping assessment shows:

- WM31 and WM32 are located remote from, and above, the top of the Parke Creek sub-catchment, which flows east within the regional catchment and has a dendritic drainage pattern.
- There are no drainage depressions or intermittent streams near WM31 or WM32, and riparian buffers comply with the Land Clearing Guidelines (LCG), 2021.
- WM32 and WM31 well sites are designed with low slope areas (<1%) in which erosion risk is classified as Low (LCG, 2021).
- WM31 and WM32 are above the predicted 100-year ARI flood line in the local area.

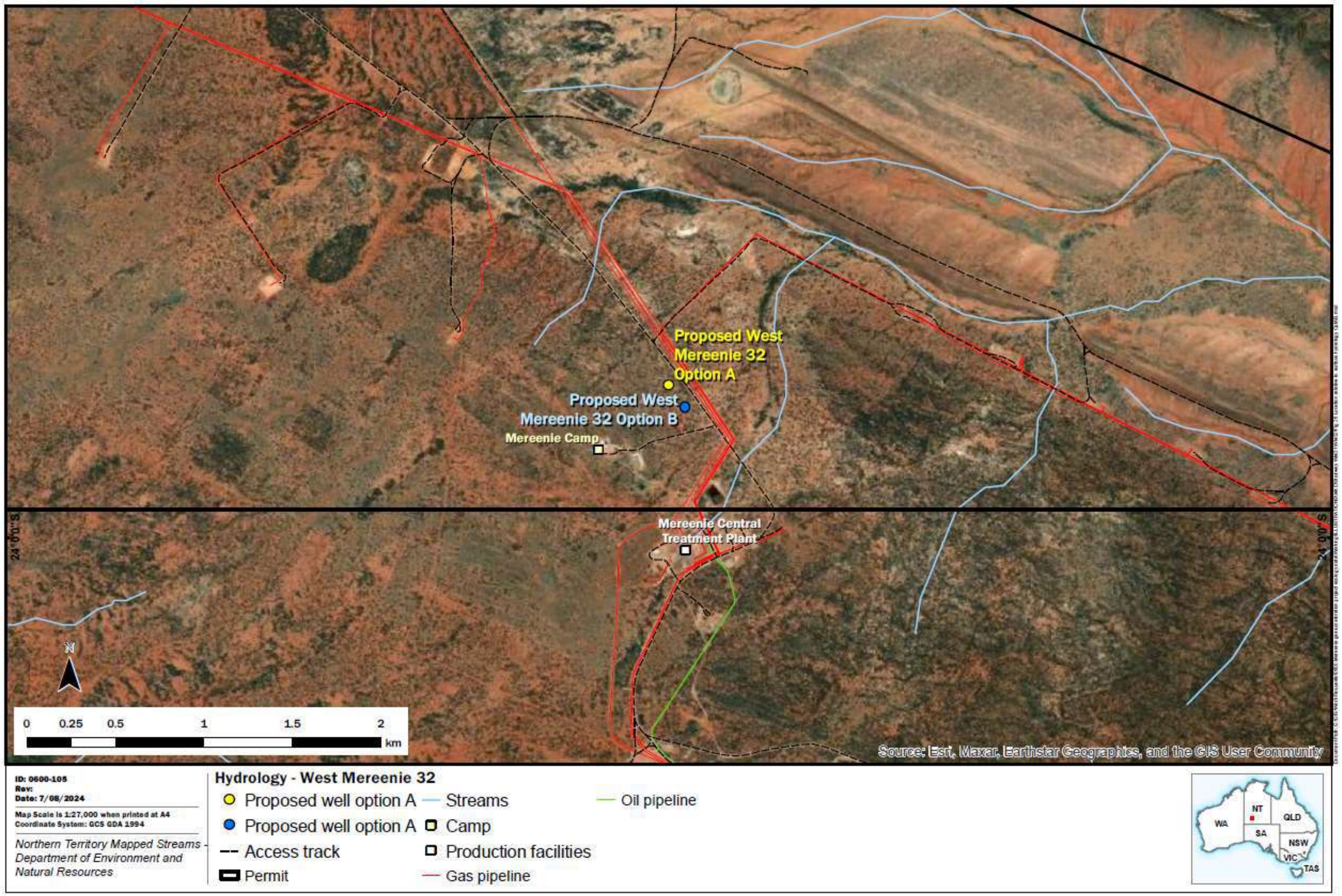


Figure 35: Location of WM32 relative to surface hydrology

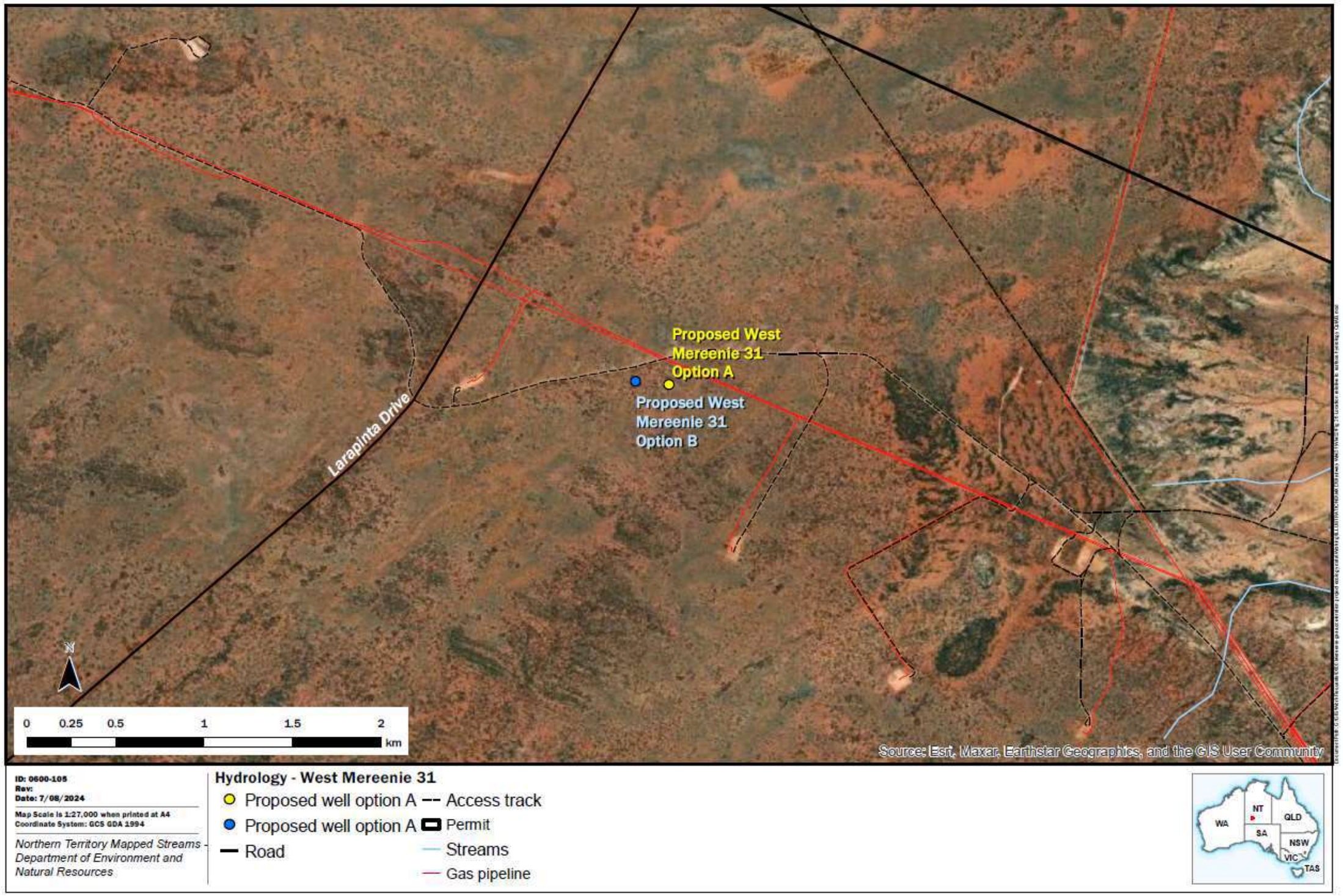


Figure 36: Location of WM31 relative to surface hydrology

4.1.6. Regional Soils at WM31 and WM32

The WM31 well site is in soil type BA28, a shallow stone mantled sandy soil, common across the Mereenie Field east of WM32 (Figure 37). Over 40 wells have been constructed in this soil type east of WM31 over the years.

In contrast, the WM31 (Figure 38) well site is in soil type AB31, a red earthy sand on the plains and swales, common across the Mereenie Field to the west of WM32. Over the years, over 20 wells have been constructed at Mereenie in this soil type west of WM32. Table 17 describes these respective soil types.

Table 17: WM31 and WM32 soil types

Well site	Soil type	Landform	Soils
WM31	AB31	Flat to gently undulating sand plains with some low, broad sand rises and intervening swales, some small alluvial flats, some clay pans and some stone-covered.	Chief soils are red earthy sands on the plains and swales. Red siliceous sands on the sand rises.
WM32	BA28	Bold ranges, ridges, cuestas and hills on sandstones and quartzites.	Chief soils are shallow stony sands.

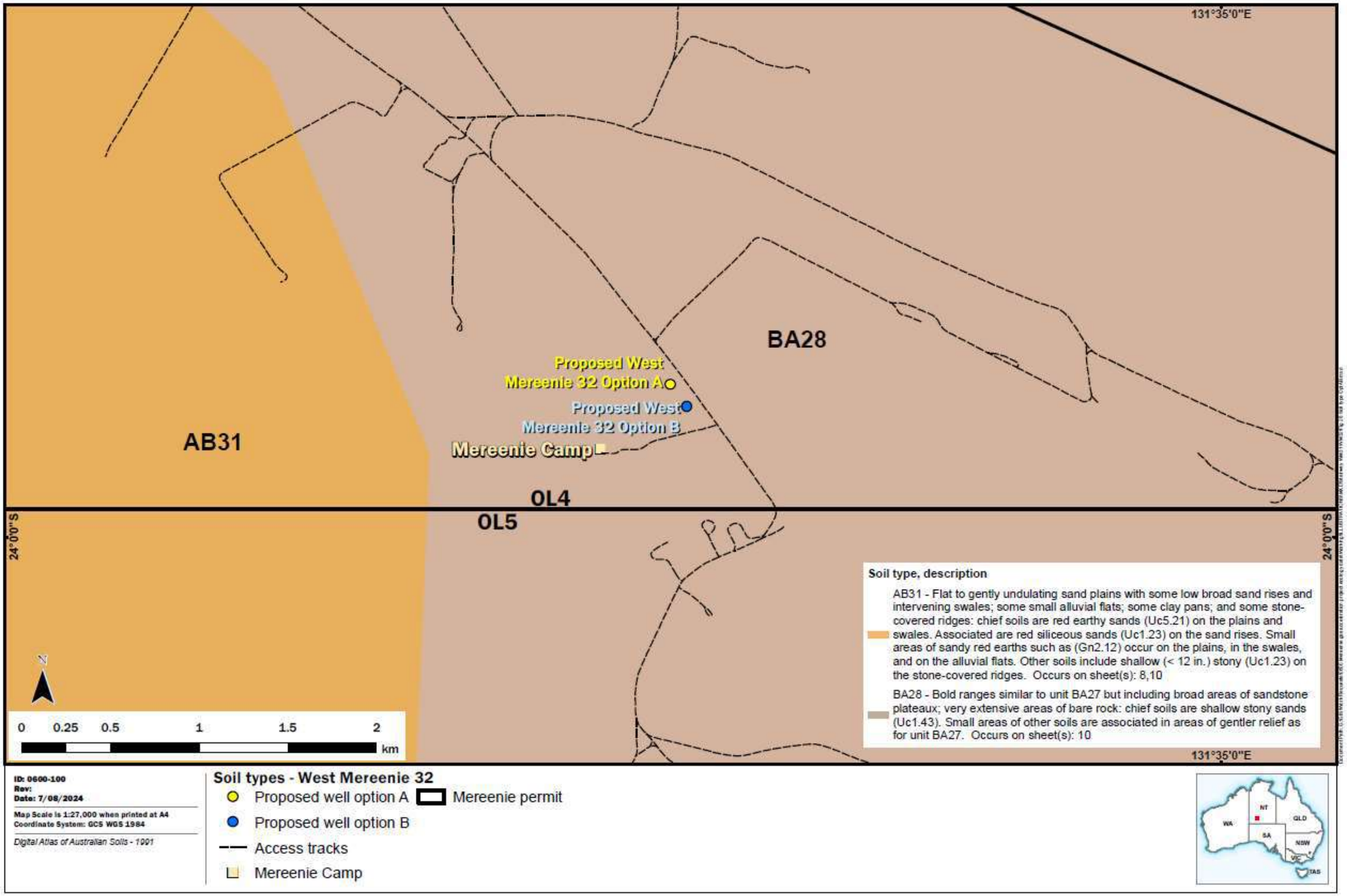


Figure 37: Soil type at WM32 environs

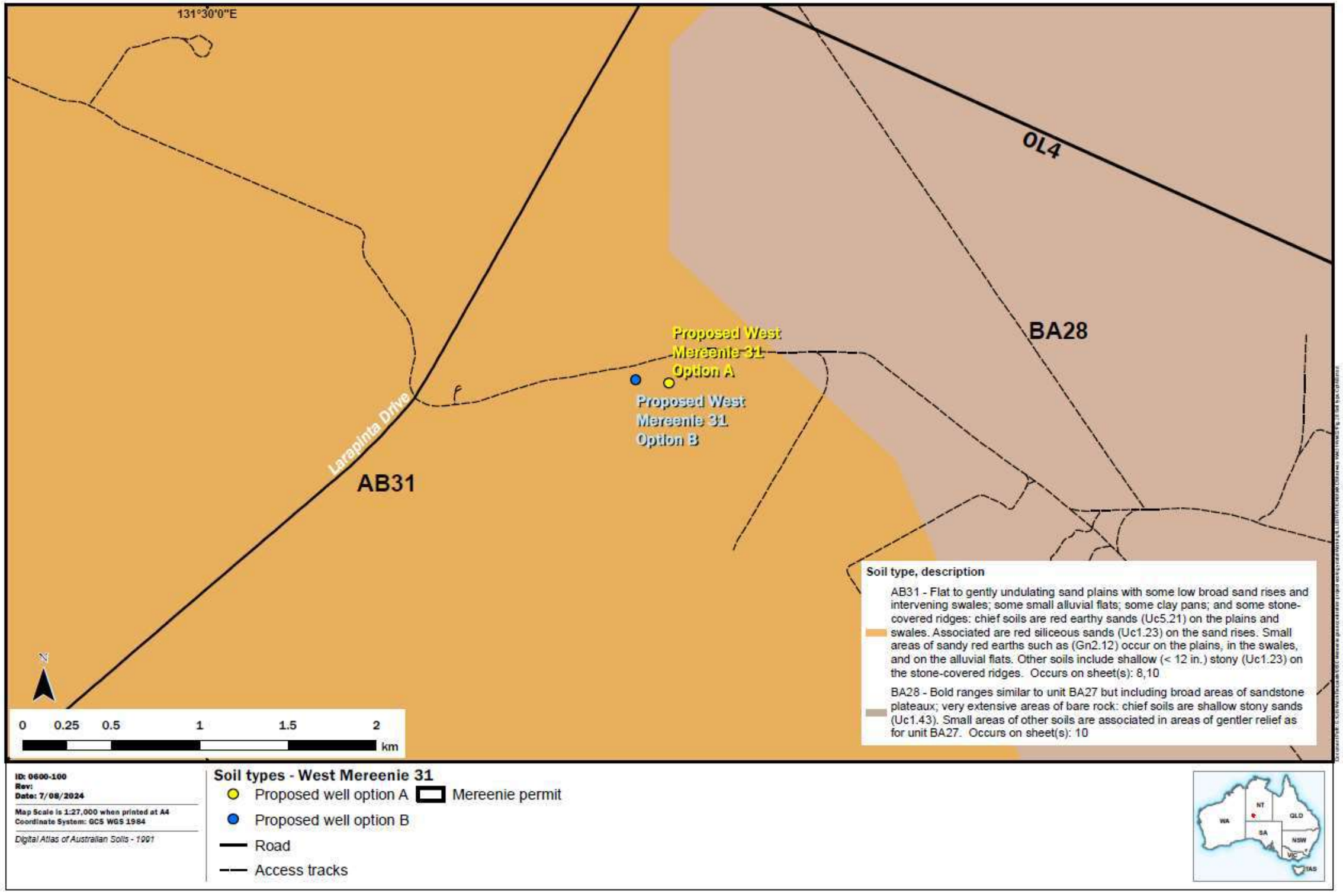


Figure 38: Soil type at WM31 environs

4.1.7. Groundwater

Mereenie is located in the north-central area of the Amadeus Basin, described by Lloyd and Jacobson (1987) as including a series of stacked regional scale formations with good groundwater supply potential. These formations are the Hermannsburg Sandstone (not present at Mereenie), Mereenie Sandstone and the Pacoota Sandstone, as shown in the context of the Amadeus Basin stratigraphy in Table 18. Schematics of prognosed stratigraphy for WM32 and WM31 are shown in Figure 39 and Figure 40.

A potentiometric surface for the Mereenie Sandstone has been generated using available groundwater bore data and water intersections during the drilling of the production wells combined with surveyed elevation data. It is presented as Figure 41.

Table 18: Prognosed stratigraphy at WM31 and WM32

Formation	WM31 (m MD)	WM32 (m MD)	Lithology	Groundwater availability	Water quality^
Mereenie Sandstone	147 - 363	227 - 429	Porous quartz sandstone	Regional aquifer (locally compartmentalised)	Fresh
Carmichael Sandstone	363 - 454	429 - 493	Interbedded sandstone, siltstone and mudstone	Limited	Not known
Stokes Siltstone	454 -783	493 - 811	Claystone, siltstone	Poor (Aquitard)#	Not known
Stairway Sandstone	783 - 1050	811 - 1154	Silty sandstone with interbedded siltstone	Gas reservoir	Not known
Horn Valley Siltstone	1050 - 1140	1154 - 1271	Claystone with interbedded marl and limestone	Poor (Aquitard)#	Not known
Pacoota Sandstone	1160 -1550	1271 - 1791	Quartz sandstone with minor claystone	Oil/Gas reservoir Regional aquifer elsewhere	Saline

^ *Water quality assessment is based on existing bore data and the regional sources*
 # Designation of aquitard based on dominant lithology and presence of hydrocarbon resources beneath

The Mereenie Sandstone is a regionally extensive groundwater resource and is of significance in the northeast of the Amadeus Basin, where it provides the water supply for Alice Springs. The Mereenie Sandstone is the only recognised regional-scale aquifer in Mereenie at WM31 and WM32.

Locally, Jamieson and Wischusen (1998) class the Mereenie Sandstone as having moderate bore yields (1–5 L/s), while Read (2007) reports on a range of 1.5–10 L/s from 15 bores. The water quality of the Mereenie Sandstone is variable but in Mereenie is generally of good potable drinking water quality. Read (2007) suggests that diffuse recharge accounts for the majority of active recharge to the aquifer, and estimated rates are in order of 1 mm/year. Aquifer transmissivities of up to 4,000 m^2/day have been observed in the Mereenie Sandstone, though 600 m^2/day is considered representative at a regional scale (Macqueen and Knott, 1982). The higher transmissivities are likely to relate to fracture-enhanced permeability, whereas the lower transmissivities are more representative of the rock mass's primary permeability. Local flow directions in the vicinity of Mereenie are complex due to the compartmentalisation of the aquifer due to cross-faulting, but with a dominantly easterly flow regionally (Lloyd and Jacobson, 1987).

The Mereenie Sandstone overlies and is in limited hydraulic connection with the Carmichael Sandstone (Lloyd and Jacobson, 1987), which comprises interbedded sandstone (partly calcareous), siltstone and

mudstone. The formation contains limited groundwater resources and is notably lower permeability than the overlying Mereenie Sandstone (Lloyd and Jacobson, 1987). Lau and Jacobsen (1991) indicate that obtaining water supplies from the Carmichael Sandstone is difficult, with an average total bore depth of 175 m across the basin and only 16 bores identified to use the Carmichael Sandstone across the Amadeus Basin. The closest identified bores targeting the Carmichael Sandstone were at Kings Canyon. Airlift yields from the Carmichael Sandstone at Kings Canyon ranged from 0.3 L/s to 15 L/s; however, the high yield was not considered representative of the formation (McDonald et al., 1986).

Underlying the Carmichael Sandstone is the Stokes Siltstone, which is more than 300 m thick locally. The Stokes Siltstone is considered an aquitard. The Stokes Siltstone also forms a reservoir seal that isolates gas resources in the underlying Stairway Sandstone from the Mereenie Sandstone. Hydrocarbon shows have been observed while drilling through the Stairway Sandstone at Mereenie.

The Pacoota Sandstone underlies the Horn Siltstone, which separates it from the overlying Stairway Sandstone. The Pacoota Sandstone is both a gas and oil reservoir within Mereenie. Lloyd and Jacobson (1987) report that saline and overpressure groundwater underlie the oil resources in the Pacoota Sandstone. The Pacoota Sandstone is used to supply water to the Kings Canyon resort; however, there was no evidence of recharge to or flow through the aquifer (McDonald et al., 1986). Most water supplies struck in the Pacoota Sandstone are associated with fractures (McDonald et al., 1986).

The presence of over-pressured oil and gas resources within the Mereenie anticline attests to the effectiveness over the Horn Valley Siltstone and the Stokes Siltstone as reservoir seals/aquitards. Management measures to protect the aquifers present include:

- the drilling, construction and operation of the petroleum wells in accordance with the NT Petroleum Regulations, including operation under a WOMP
- routine groundwater monitoring in accordance with the Mereenie Groundwater Monitoring Plan.

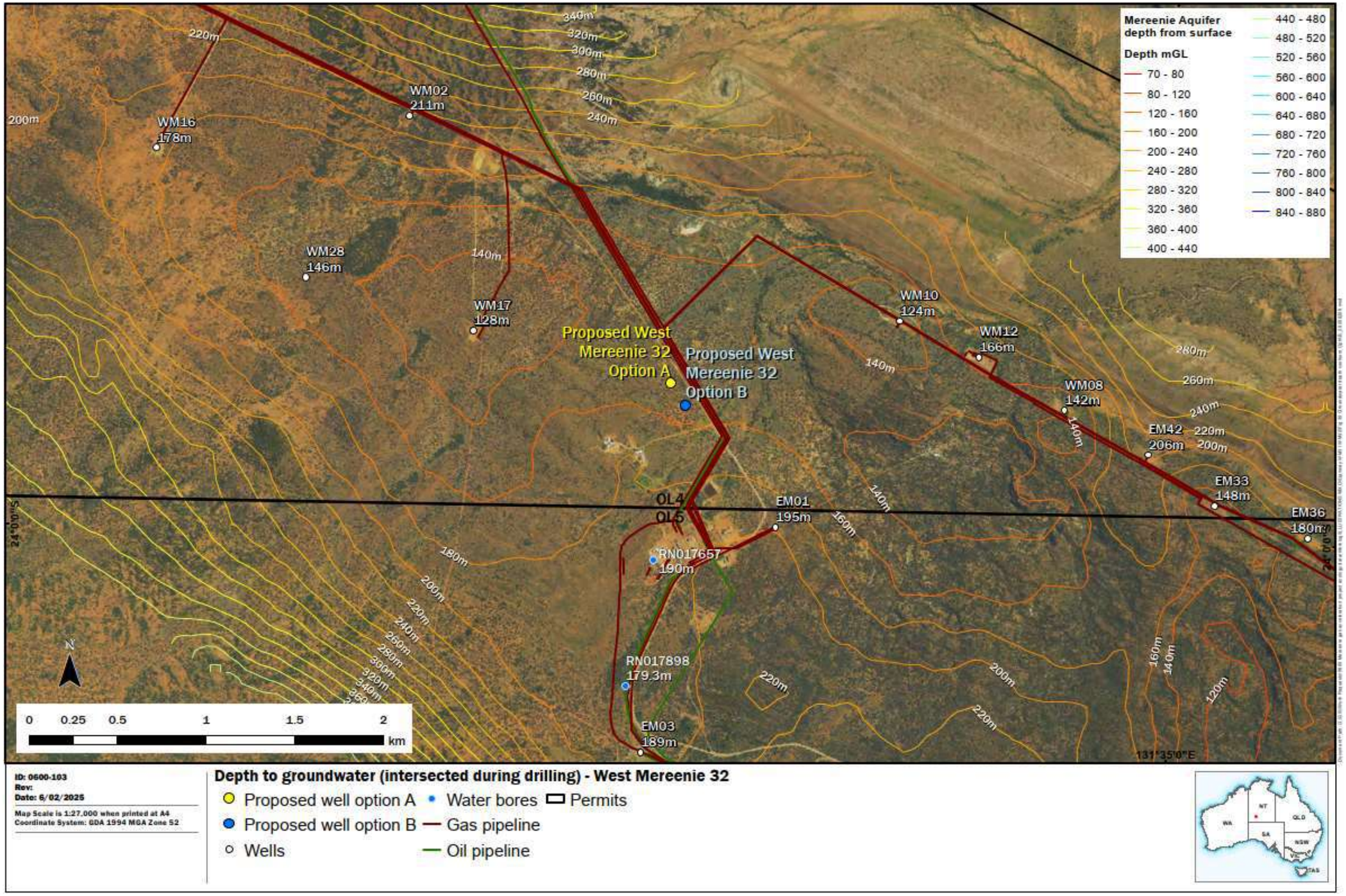


Figure 39: Groundwater depth contours in the vicinity of WM32

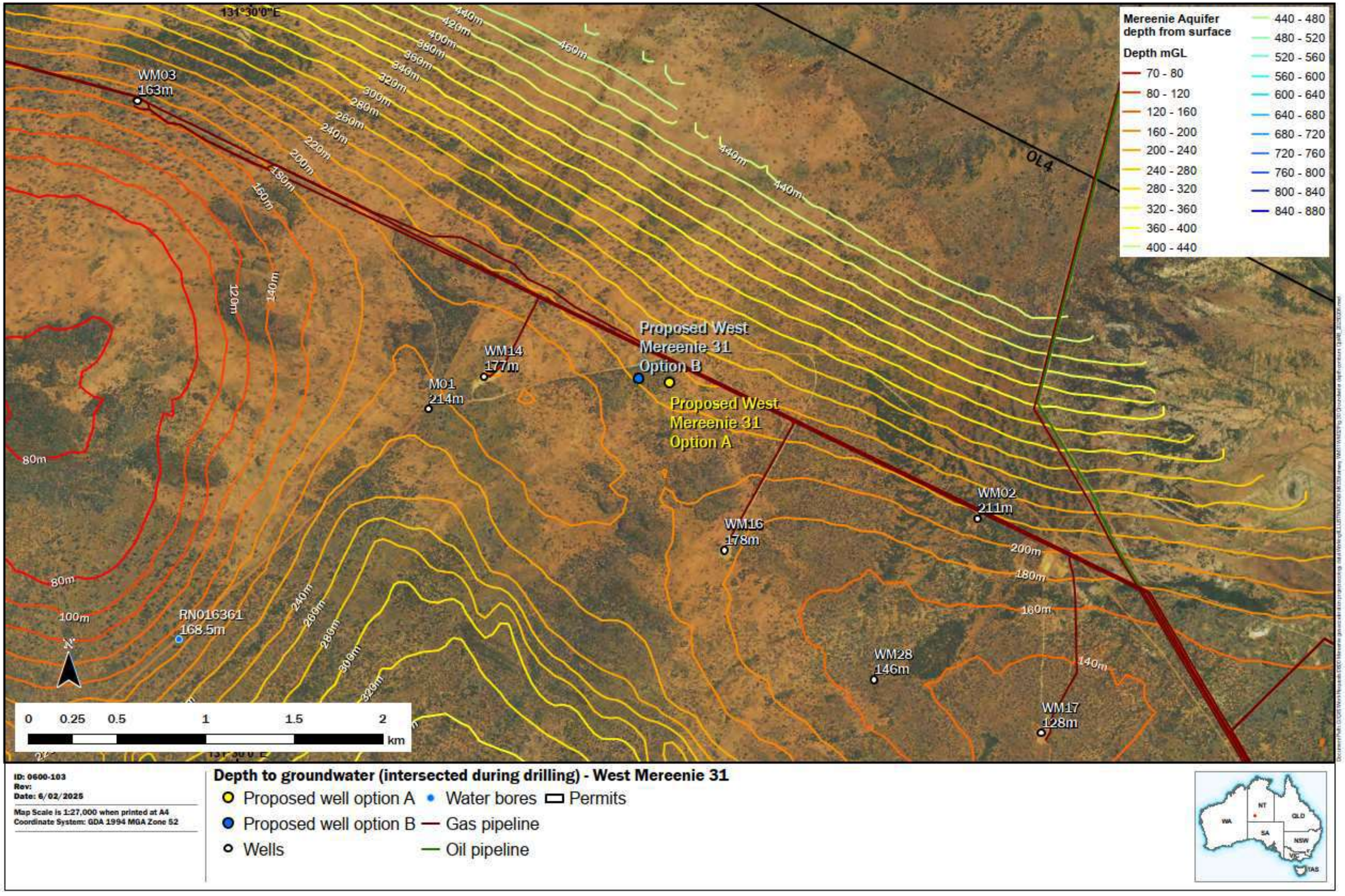


Figure 40: Groundwater depth contours in the vicinity of WM31

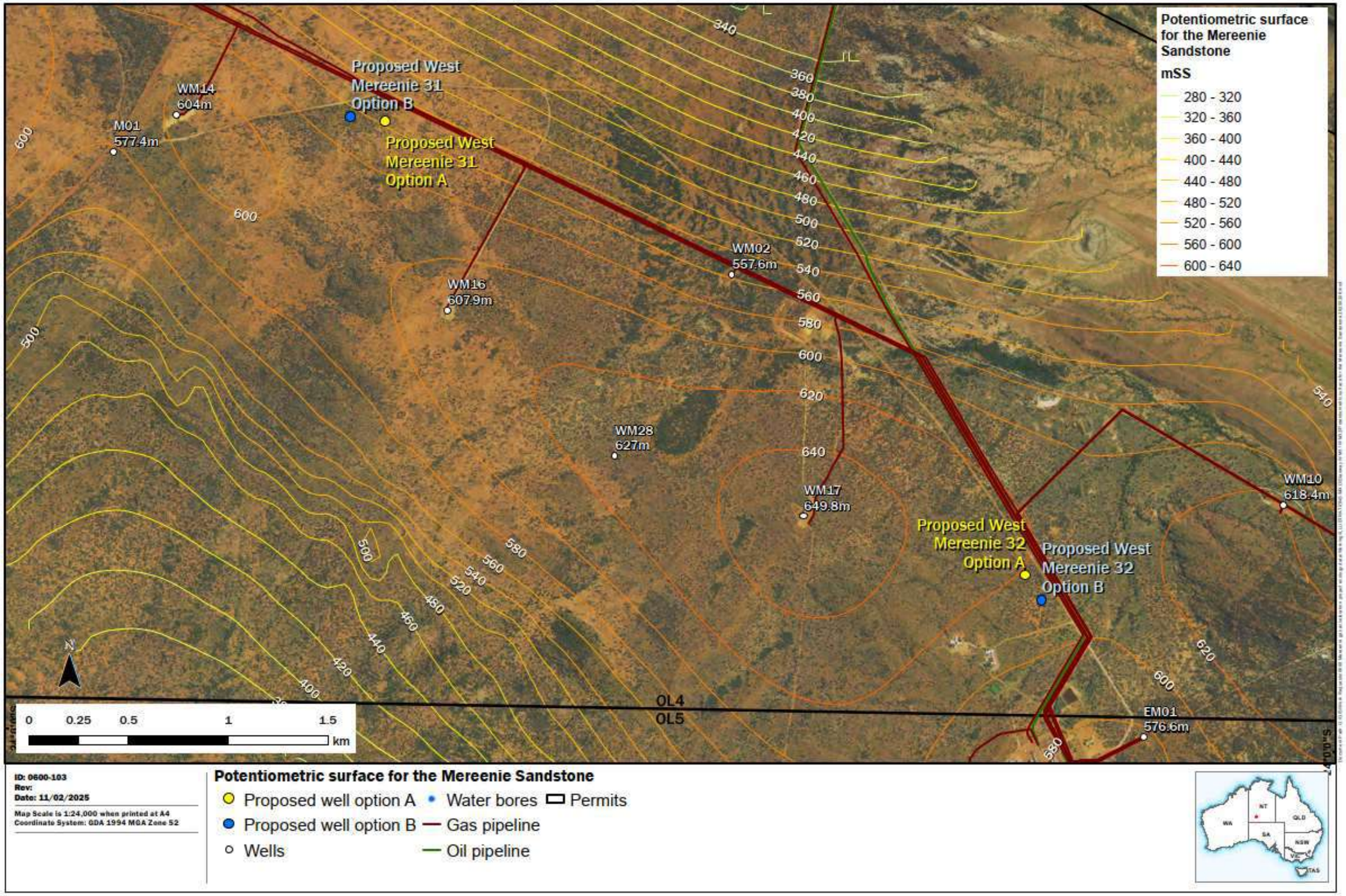


Figure 41: Potentiometric surface

4.1.8. Groundwater Extraction

Water required to support the drilling program will be taken under the Mereenie GWEL #M10001 from existing registered and metred groundwater bores in the AOI (Figure 42 and Figure 43). In accordance with amendments to the *Water Act* 1992, the Operator applied and was granted a GWEL for the Mereenie Oil and Gas Field for a comparatively modest annual volume of 52.8 ML.

This annual volume includes the requirements for development drilling at Mereenie and provides an estimated breakdown of water requirements for the activities at WM31 and WM32. The total estimated volume for the Activity, ~3.65 ML, represents approximately 4.6% of the permitted water extraction per annum under GWEL #M10001.

The current approved Mereenie groundwater monitoring program from RN017657 (CTP bore) and RN017898 (Production bore 2) requires baseline biannual, wet / dry season transition with results reported and published annually to DLPE. Once the baseline testing period is complete and the updated Groundwater Monitoring Guidelines are released, the Operator will update the plan in consultation with a hydrologist.

Table 19: Distance of registered bores within the vicinity of WM31 and WM32 for Option A and B

Well site name	Water bore	Direction	Bearing	Distance (m)	Distance (km)
WM31	RN017657*	SE	135	4514	4.51
WM31	RN017898*	SE	142	4957	4.96
WM31	RN004620	NW	294	8510	8.51
WM31	RN013861	SE	119	14357	14.36
WM31	RN018955	SE	124	14653	14.65
WM32	RN017657	S	184	999	1.00
WM32	RN017898	S	187	1721	1.72
WM32	RN018955	SE	116	10453	10.45
WM32	RN004620	SE	124	10721	10.72
WM32	RN013861	NW	297	12395	12.40

** CTP (RN017657) and Production Bore 2 (RN017898) are utilised for the Mereenie Camp water supply and backup water supply, respectively. The Interest Holder does not utilise all other bores listed and is not included in the current water extraction licence.*

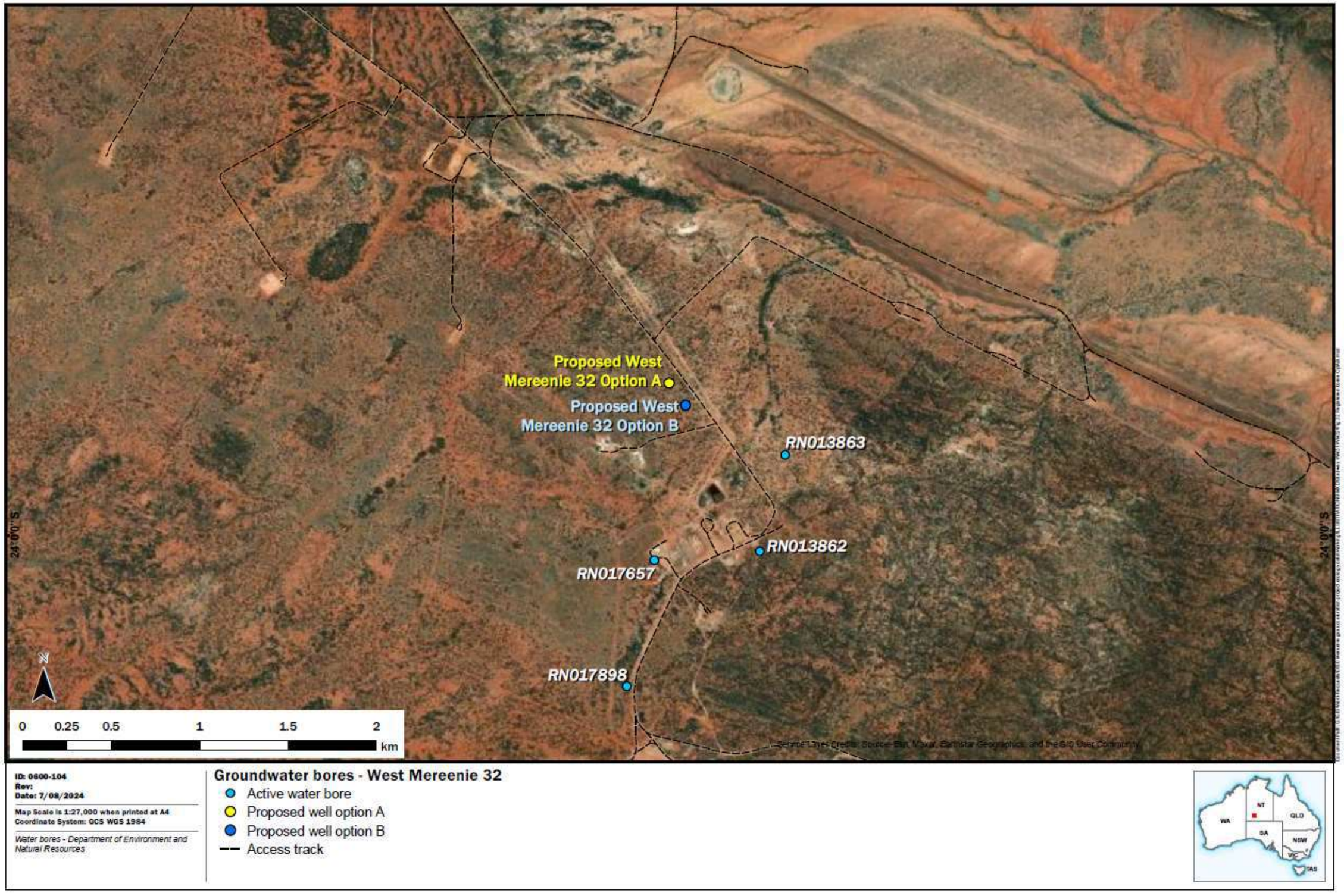


Figure 42: Registered bores near WM32

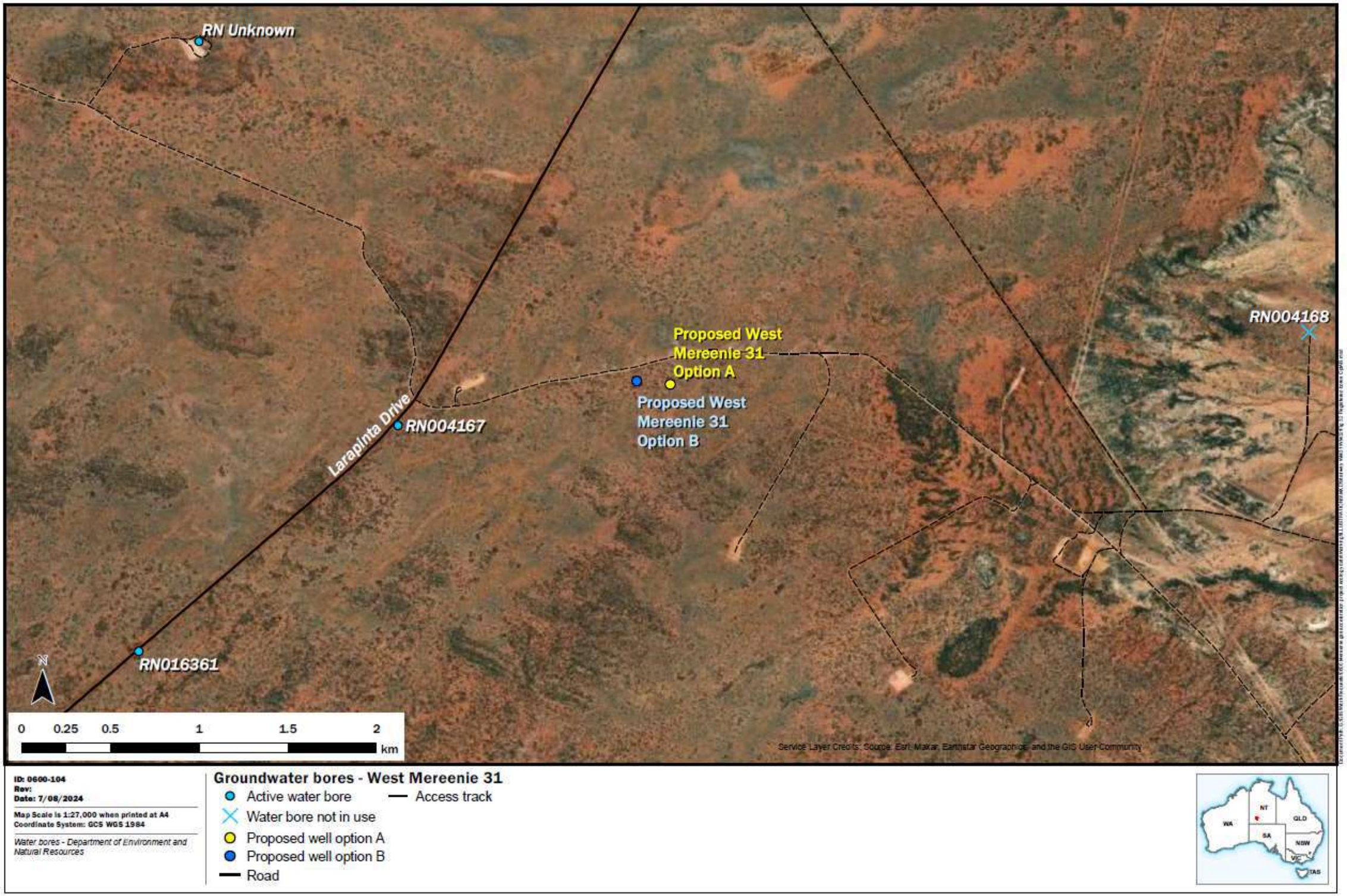


Figure 43: Registered bores near WM31

4.2. Natural Environment

The assessment of potential sites for the proposed WM31 and WM32 well sites was undertaken through an initial desktop assessment of each AOI, followed by a field survey. This survey used the findings of likelihood assessments undertaken during desktop investigations to target flora and fauna species of concern in each area. The field assessment was conducted by 2 experienced ecologists/zoologists from EcOz (Tom Ewers-Reilly and Mark Carter) between the 21st and 23rd June 2022. The following field parameters were surveyed:

- Describe and map land types within each survey area, specifically identifying the presence of sensitive vegetation communities or erosion-prone landforms.
- Assess the presence or potential presence of listed threatened species that are considered to have a moderate-high likelihood of occurring within the survey areas, which include Desert Quandong, Night Parrot, Princess Parrot and Central Australian rock-wallaby. Field records for all flora and fauna species encountered were also collected during this survey.
- Record all weed species observed within the survey areas and describe and map weed infestations where applicable.
- Describe feral animals' presence and associated impact(s) within each survey area.

While 4 survey areas were originally assessed during the ecological investigation, the outcomes indicated 2 preferential areas (Survey Area 3 (WM32) and Survey Area 2 (WM31)). Consequently, only the detailed findings for these 2 survey areas have been presented within this EMP. The findings for the remaining 2 areas can be viewed within the EcOz Ecological Investigation Report.

The relevant sections below present a summary of the desktop and site investigations for threatened flora and fauna.

4.2.1. Bioregions

Both well sites, WM31 and WM32, are located within the MacDonnell ranges bioregion, near its western boundary. The locations of the bioregions relative to WM32 and WM31 are shown in Figure 44 and Figure 45. Table 20 provides generalised characteristics of the 2 bioregions in the area.

Table 20: Bioregions in the environs of WM31 and WM32

Bioregion	Topography	Geology	Soils	Vegetation
MacDonnell Ranges (39,290 km^2) WM31 WM32	High-relief ranges and foothills enclose some broad plains and watercourses.	Mostly sedimentary rocks are found in the Amadeus Basin, and crystalline metamorphic rocks are found in the Arunta Block.	Generally skeletal or shallow sands on the rocky hills with earthy sands and deep loamy alluvium on the lowlands.	Dominant vegetation spinifex hummock grassland, sparse acacia shrub lands and woodlands along watercourses.
Great Sandy Desert (285,000 km^2)	The area is generally flat and arid with few watercourses, although several low ranges exist.	Large expanse of horizontally bedded Mereenie Sandstone and associated Cambrian marine sediments – calcareous.	Predominantly shallow sands, influenced by the presence of saline lakes, where mostly saline loams occur.	Dominated by hummock grassland with areas of tall shrubland or low open woodland, Mulga tall open shrubland and Samphire low open shrubland fringing salt pans.

4.2.2. Sites of Conservation Significance (SOCS)

WM31 and WM32 do not intersect any SOCs[6] (National Parks or conservation reserves). See Figure 44 for WM32 and Figure 45 for WM31.

Additional information is also shown in environmental sensitivity mapping for WM32 (Figure 13) and WM31 (Figure 14).

4.2.3. Sites of Botanical Significance (SOBS)

WM32 occurs within the Mereenie SOBS (160 km^2) (see Figure 44). WM31 is located within the Laycock's Sandplain SOBS (1,854 km^2), which extends west into the Great Sandy Desert bioregion (Figure 45).

Both are classed to have bioregional significance due to the presence of restricted range and near-threatened species. SOBS does not hold any specific legislative obligations; however, it does indicate that there is potential for significant flora species in the area.

Both SOBS are designated as bioregionally significant based on their importance to the evolution of Australian flora, fauna, landscape or climate, geographically and/or ecologically disjunct populations (White et al. 2000). Impacts to the SOBS have been mitigated by undertaking a site-specific ecological assessment and selecting locations for each well site that avoid as much significant flora as possible and minimising the need for reprofiling the local topography to the greatest extent possible.

4.2.4. Threatened Ecological Communities

An EPBC PMST search undertaken by EcOz (APPENDIX B) to support the desktop assessment did not identify any Threatened Ecological Communities (TECs), National Parks or conservation reserves (Figure 50 and Figure 51) within any of the 4 areas surveyed. Additional information on TECs is shown in environmental sensitivity mapping for WM32 (Figure 13) and WM31 (Figure 14).

[6] SOCS are areas highlighted by the NT Government as important sites for biodiversity conservation for the NT. These are described in Harrison et al. (2009). They are not specifically protected under legislation.

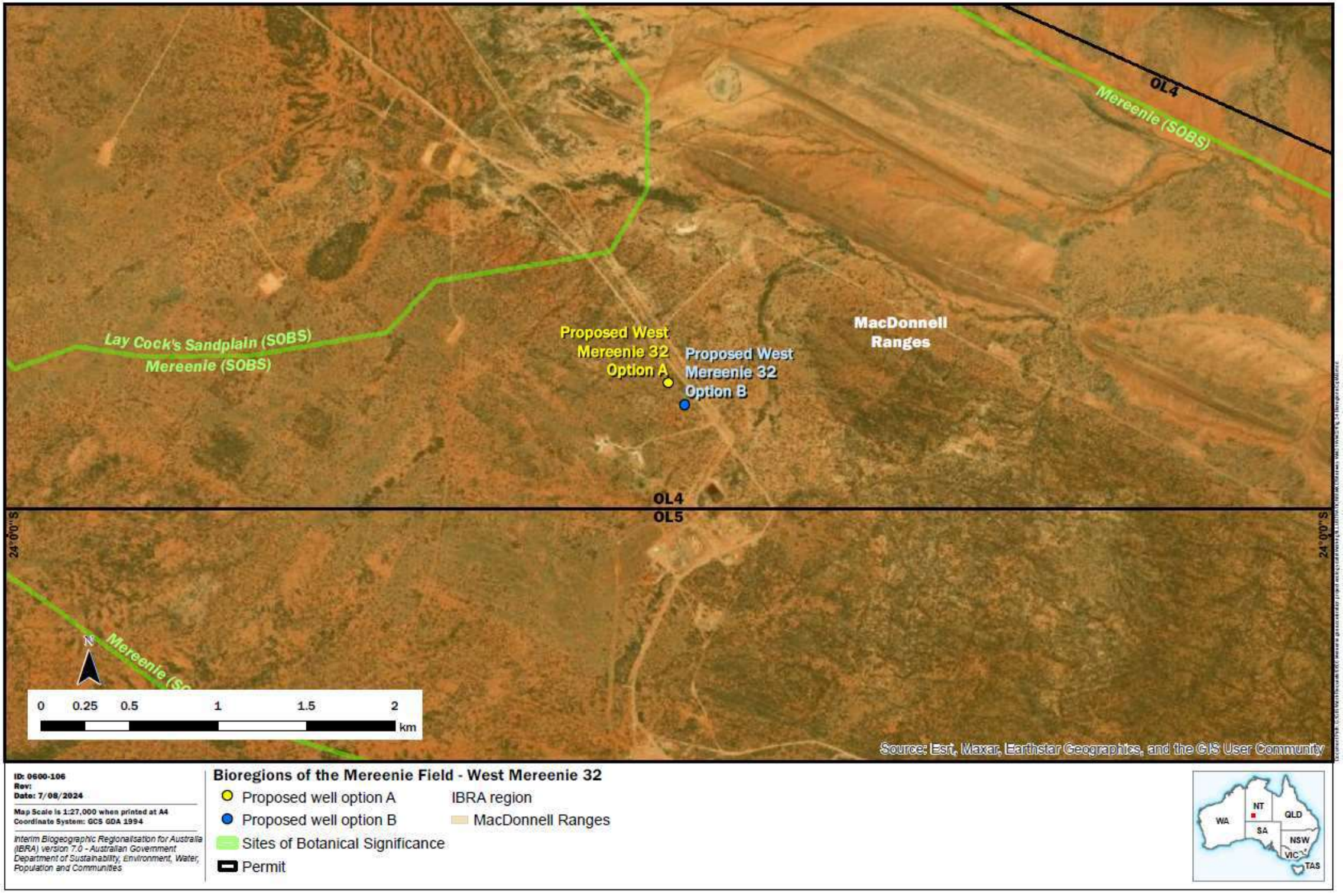


Figure 44: Bioregion in the vicinity of WM32 and SOBS

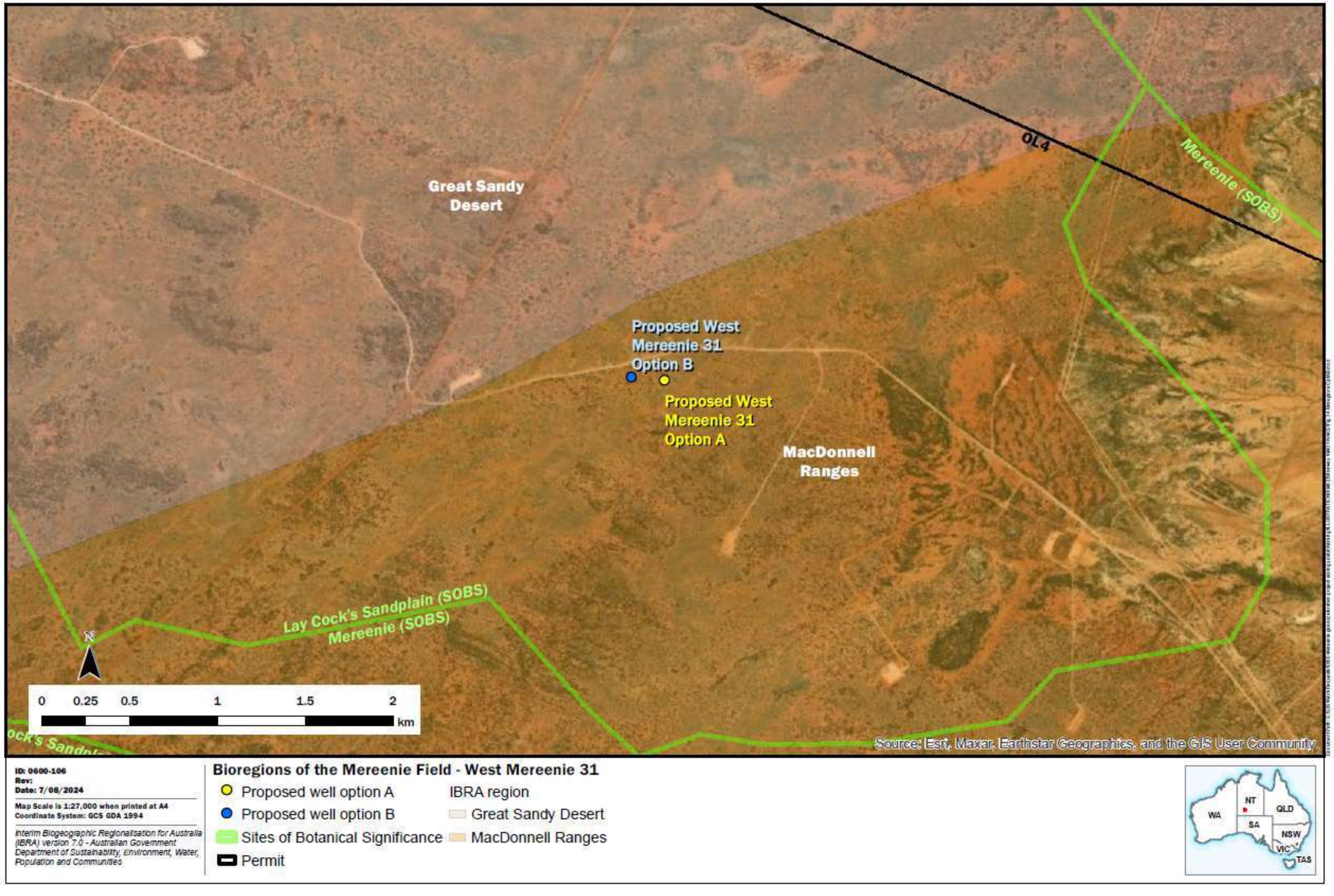


Figure 45: Bioregion in the vicinity of WM31 and SOBS

4.2.5. Conservation Significant Flora

Flora species are considered in this EMP to be of conservation significance if it is listed as threatened species[5] under the TPWC Act and are either:

- recorded in the NT Flora Atlas as being within Mereenie or within 25 km of the site boundary, or
- recorded during field surveys of the NRM.

Listed as threatened species[6] under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and is either:

- identified by a Protected Matters Search Tool (PMST) report within Mereenie or within 25 km of the site boundary, or
- recorded during field surveys of Mereenie.

There have been several flora field surveys across various parts of the Mereenie Field, including:

- Flora and Fauna Assessment, Stage 2 Field Survey by Parks and Wildlife Commission of the Northern Territory
  - A site-wide survey that assessed flora at 17 survey sites representative of the major habitats within Mereenie. The survey found a total of 461 plant species, including 13 conservation significant flora under the TPWC Act (none under the EPBC Act); one vulnerable species (*Santalum acuminatum*), 2 Data Deficient (DD) species (*Acacia nyssophlyllai* and *Comesperma viscidulum*), with the remaining of near threatened status.
  - The study notes that the development at Mereenie has little impact on the area's flora and that most habitats affected by the development are relatively robust and well-represented in the region.
- Flora and Fauna Assessment by Low Ecological Pty Ltd (2017): Survey conducted at WM25 and WM26 locations (noting that these were exploration wells and WM25 was never drilled). No conservation significant flora was identified in the project area.
- Ecological Assessment by EcOz Pty Ltd (2020): Survey conducted at the locations of WM27 and WM28 (wells developed in 2021). *Laxmannia arida* (near threatened under the TPWC Act) was found during the survey, along with 74 species of Least Concern under the TPWC Act.

A likelihood assessment of threatened flora species that appeared in the PMST search undertaken by EcOz Consultants (2022) is presented in Table 21.

Table 21: Likelihood assessment of conservation significant flora species

Likelihood	Common name	Scientific name	Status	
			TPWC	EPBC
MEDIUM	Desert Quandong	*Santalum acuminatum*	VU	-
LOW	Minuria Daisy	*Minuria tridens*	VU	VU
NONE	MacDonnell Ranges Cycad	*Macrozamia macdonnellii*	VU	VU
	Wrixonia	*Prostanthera schultzii*	VU	VU
	George Gill Range Cliff-bush	*Amperea spicata*	VU	-
	Baumea	*Baumea arthrophylla*	VU	-
	Schoenus	*Schoenus centralis*	VU	-

[1] TPWC Status: CR, Critical Endangered; EN, Endangered; VU, Vulnerable; NTD, Near Threatened; DD, Data Deficient as listed under the TPWC Act.

[2] EPBC Status: CR, Critical Endangered; EN, Endangered; VU, Vulnerable as listed under the EPBC Act.

[3] Listed on the EPBC PMST report retrieved for the field and 50km buffer.

[4] Number of records on the NT Flora Atlas for the field and 50km buffer – indicates no record.

[5] Species classified as extinct in the wild (EW), critically endangered (CE), endangered (E) or vulnerable (Vu), near threatened (NTD) or data deficient (DD) under the Territory Parks and Wildlife Conservation Act (TPWC Act)

[6] Species classified as extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent under the EPBC Act.

The outcomes of the likelihood assessment were used to target threatened flora species during subsequent site investigations carried out by EcOz Environmental. These species included the Desert Quandong (*Santalum acuminatum*).

The Minuria Daisy (*Minuria tridens*) was not targeted during the field survey; however, it was opportunistically surveyed in the field to see if a suitable habitat was observed to validate the desktop assessment. The findings of the site investigations are detailed below.

4.2.6. Land Types

Land types are mapping units delineating areas of similar landforms, surface soils and vegetation. Land types were mapped at a scale of 1:5,000 within each survey area to provide a more detailed view of the broader land systems present within each Survey Area for WM32 and WM31 (Figure 46 to Figure 48).

Ground truthing involved walking transects throughout each Survey Area to verify land type boundaries. Data on landforms, soil and vegetation were collected, and GPS waypoints served as checkpoints to validate unit boundaries. The survey process included extensive photographic documentation and descriptions aligned with terminology established by Brocklehurst et al. (2007) and the National Vegetation Information System (NVIS).

Characterisation of drainage features and sensitive vegetation types followed the definitions outlined in the Land Clearing Guidelines (DEPWS (now DLPE) 2020).

4.2.6.1. Survey Area 3 (WM32)

Seven land types occur within the Survey Area 3. Most of this survey area comprises sandplains or sandy red earth plains (land types SA3-A and SA3-B). There are also numerous low rocky ridges, hills and slopes (sandstone dominant, occasional quartzite sandstone) (land types SA3-E) where the existing Mereenie basecamp is located. The ridges and outcrop should be treated as a locally important refugial habitat, which poses an erosion risk due to sloped terrain. A singular sand dune is present near the plant area (land type SA3-C), and red earth plains or depressions support Mulga stands (land type SA3-D).

Two small drainages are present within the survey area; both are ephemeral and support a low woodland of *Acacia aneura* (Mulga) over shrubs and tussocks (see photographs in Figure 48).These drainages are not considered to support significant or sensitive vegetation; however, if disturbance is proposed, drainage management will be a priority.

A summary of flora species identified during the survey is summarised in Table 22.

4.2.6.2. Survey Area 2 (WM31)

Five land types occur within the Survey Area 2. The majority of the survey area supports gently undulating spinifex sandplains with patchy Acacia shrubs and sparse to open *Allocasuarina decaisneana* (Desert Oak) (land types SA2-A and SA2-B), with several low-relief sand dunes or sand hills (land type SA2-C). There are also several patches of *Acacia aneura* (Mulga) and/or *Acacia kempeana* (Witchetty Bush) on red earth soils (land type SA2-D). A low-relief sandstone hill is present in the southern corner (land type SA2-E). One ephemeral drainage line is present, which supports a low woodland of *Acacia aneura* (Mulga) over shrubs and tussocks (see photograph in Figure 49). This drainage is not considered a significant or sensitive vegetation type; however, drainage management will be a priority if disturbance is proposed.

A summary of flora species identified during the survey is summarised in Table 23.

4.2.7. Flora Survey Findings

No Commonwealth or Northern Territory threatened flora species were identified during the flora surveys conducted within Survey Areas 2 and 3. There were instances of preferential habitat noted within Survey Area 3, which are discussed further in Section 4.2.8. Consequently, the risk to threatened flora species posed by the WM31 and WM32 appraisal wells is considered to be negligible.

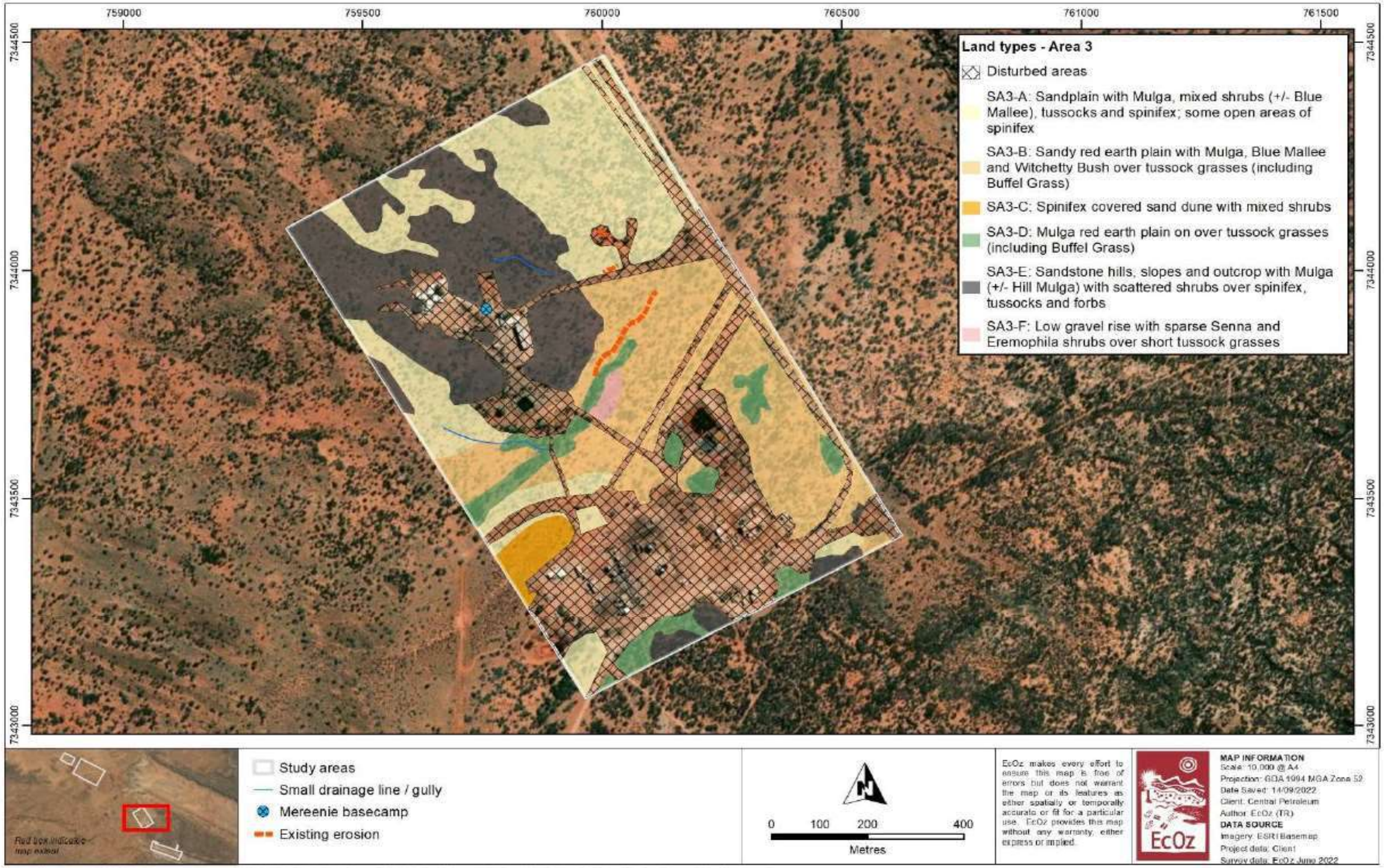


Figure 46: Area 3 (WM32 Survey Area) ground-truthed land types

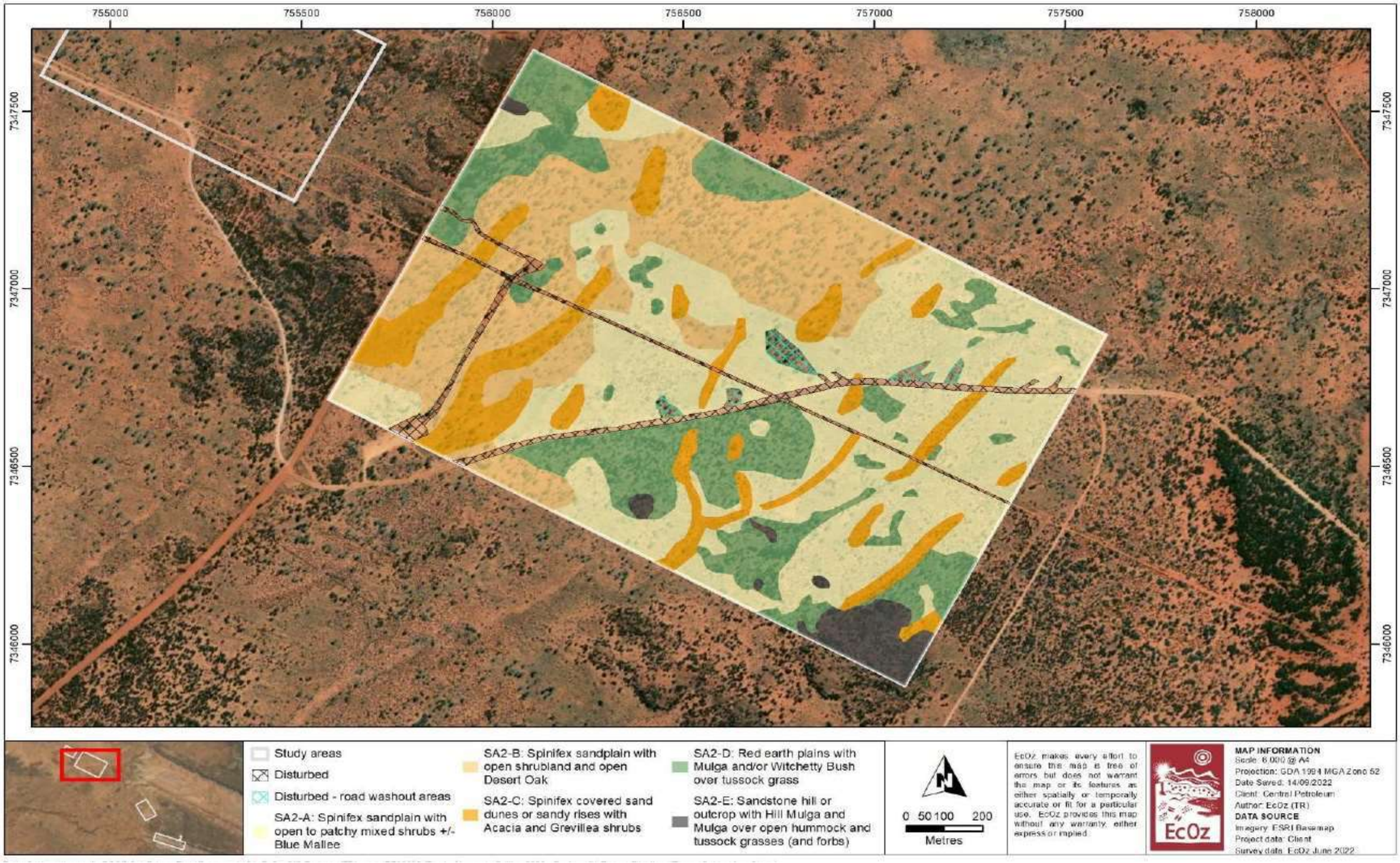


Figure 47: Area 2 (WM31 Survey Area) ground-truthed land types

SA3-A: Sandplain with Mulga, mixed shrubs (+/- Blue Mallee), tussocks and spinifex; some open areas of spinifex

SA3-B: Sandy red earth plain with Mulga, Blue Mallee and Witchetty Bush over tussock grasses (including Buffel Grass)

SA3-C: Spinifex-covered sand dune with mixed shrubs

SA3-D: Mulga red earth plain over tussock grasses

SA3-E: Sandstone hills, slopes and outcrop with Mulga (+/- Hill Mulga) with scattered shrubs over spinifex, tussocks and forbs

SA3-F: Low gravel rise with sparse Senna and Eremophila shrubs over short tussock grasses

Figure 48: Prominent land types and flora species Survey Area 3 (WM32)

SA2-A: Spinifex sandplain with open to patchy shrubland +/- Blue Mallee; occasional Desert Oak

SA2-A: Spinifex sandplain with open to patchy shrubland +/- Blue Mallee; occasional Desert Oak

SA2-B: Spinifex sandplain with open shrubland and Desert Oak

SA2-B: Spinifex sandplain with open shrubland and Desert Oak

SA2-C: Sand dunes and sand hills

SA2-D: Red earth plains with Mulga and/or Witchetty Bush over tussock grass

SA2-E: Sandstone hill or outcrop with Hill Mulga and Mulga over open hummock and tussock grasses

SA2-E: Sandstone hill or outcrop with Hill Mulga and Mulga over open hummock and tussock grasses

Figure 49: Prominent land types and flora species Survey Area 2 (WM30)

Table 22: Land type ground truth survey results (Survey Area 3 – WM32)

Land type	Landform	Soil	Upper strata	Mid-strat	Ground strata
SA3-A Sandplain with Mulga, mixed shrubs (+/- Blue Mallee), tussocks and spinifex; some open areas of spinifex	Sandplain; Flat to gently sloping	Sandy red earth	Isolated emergent low trees only (8 m). ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Eucalyptus gamophylla*	Open to patchy low to tall shrubs (1– 5 m). ▪ Eucalyptus gamophylla ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Acacia kempeana* ▪ *Acacia ramulosa* ▪ *Aluta maisonneuvei* (occasional patch) ▪ *Grevillea eriostachya* ▪ *Eremophila latrobei* ▪ *Psydrax latifolia and P. ammophila* ▪ *Senna artemisioides subsp. artemisioides*	Hummock and tussock grassland. ▪ *Triodia schinzii* ▪ *Aristida holathera* ▪ *Eragrostis eriopoda* ▪ *Aristida inaequiglumis* ▪ *Cenchrus ciliaris* (Buffel Grass)
SA3-B Sandy red earth plain with Mulga, Blue Mallee and Witchetty Bush over tussock grasses (including Buffel Grass)	Sandplain; Flat to gentle slopes	Red earth to sandy red earth	Isolated emergent low trees only (8– 10 m). ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Corymbia opaca*	Open low to mid-tall shrubland (1– 5m). ▪ *Acacia aneura* ▪ *Eucalyptus gamophylla* ▪ *Eremophila latrobei* ▪ *Psydrax latifolia & P. ammophila* ▪ *Acacia ramulosa* ▪ *Senna artemisioides subsp. filifolia* ▪ *Senna artemisioides subsp. artemisioides*	Tussock grassland. ▪ *Eragrostis eriopoda* ▪ *Monachather paradoxus* ▪ *Aristida holathera* ▪ *Aristida inaequiglumis* ▪ *Eriachne helmsii* ▪ *Cenchrus ciliaris (Buffel Grass)* ▪ *Triodia schinzii (patchy only)*
SA3-C Spinifex-covered sand dune with mixed shrubs	Low sand dune	Red siliceous sands	Absent to isolated trees (8 m). ▪ *Hakea lorea* ▪ *Allocasuarina decaisneana*	Open low shrubland (1– 1.5 m). ▪ *Acacia ligulata* ▪ *Senna artemisioides subsp. filifolia* ▪ *Acacia ramulosa* ▪ *Aluta maisonneuvei* ▪ *Acacia melleodora* ▪ *Grevillea stenobotrya* ▪ *Eremophila willsii* ▪ *Eucalyptus gamophylla*	Hummock grassland. ▪ *Triodia schinzii* ▪ *Eragrostis eriopoda* ▪ *Leptosema chambersii* ▪ *Themeda sp.* ▪ *Aristida holathera* ▪ *Eriachne aristidea* ▪ *Senna pleurocarpa*
SA3-D Mulga red earth plain on over tussock grasses (including Buffel Grass)	Plain; Flat to gentle slopes; Minor run-on areas.	Red earths; heavier clay loam at low points	Low woodland / tall shrubland (4–6m). ▪ *Acacia aneura* (i.e. Mulga group)	Sparse shrubs (1– 2 m). ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Psydrax latifolia*	Tussock grasses and forbs. ▪ *Cenchrus ciliaris* (Buffel Grass) ▪ *Eragrostis eriopoda* ▪ *Monachather paradoxus* ▪ *Aristida holathera*
SA3-E Sandstone hills, slopes and outcrop with Mulga (+/- Hill Mulga) with scattered shrubs over spinifex, tussocks and forbs	Low hills, ridgelines, scarp, outcrop area, quartzite present in some areas.	Shallow sandy red earths over sandstone outcrop	Scattered to patchy low trees (6 m) ▪ *Acacia macdonnellensis* (patchy) ▪ *Acacia aneura* (i.e. Mulga group) ▪ Corymbia opaca	Open low shrubland (1– 1.5 m). ▪ *Acacia kempeana* ▪ *Senna artemisioides subsp. artemisioides* ▪ *Senna artemisioides subsp. alicia* ▪ *Eremophila latrobei* ▪ *Eremophila freelingii*	Hummock grassland. ▪ *Triodia brizoides* ▪ *Triodia melvillei* ▪ *Eragrostis eriopoda* ▪ *Monachather paradoxus* ▪ *Eriachne mucronata* ▪ *Aristida holathera* ▪ *Aristida inaequiglumis* ▪ *Sida sp.* (several species) ▪ *Ptilotus obovatus*
SA3-F Low gravel rise with sparse Senna and Eremophila shrubs over short tussock grasses	Low gravelly rise	Surface gravel; shallow skeletal soil	Absent	Scattered low shrubland (1– 1.5 m). ▪ *Senna artemisioides subsp. helmsii* ▪ *Senna artemisioides subsp. filifolia* ▪ *Eremophila duttonii* ▪ *Acacia tetragonophylla*	Sparse tussock grasses ▪ *Aristida contorta* (dominant) ▪ *Eragrostis eriopoda*

Table 23: Land type ground truth survey results (Survey Area 2 – WM31)

Land type	Landform	Soil	Upper strata	Mid-strat	Ground strata
SA3-A Sandplain with Mulga, mixed shrubs (+/- Blue Mallee), tussocks and spinifex; some open areas of spinifex	Sandplain; Flat to gently sloping	Sandy red earth	Isolated emergent low trees only (8m). ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Eucalyptus gamophylla*	Open to patchy low to tall shrubs (1–5 m). ▪ *Eucalyptus gamophylla* ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Acacia kempeana* ▪ *Acacia ramulosa* ▪ *Aluta maisonneuvei* (occasional patch) ▪ *Grevillea eriostachya* ▪ *Eremophila latrobei* ▪ *Psydrax latifolia & P. ammophila* ▪ *Senna artemisioides subsp. artemisioides*	Hummock and tussock grassland. ▪ *Triodia schinzii* ▪ *Aristida holathera* ▪ *Eragrostis eriopoda* ▪ *Aristida inaequiglumis* ▪ *Cenchrus ciliaris* (Buffel Grass)
SA3-B Sandy red earth plain with Mulga, Blue Mallee and Witchetty Bush over tussock grasses (including Buffel Grass)	Sandplain; Flat to gentle slopes	Red earth to sandy red earth	Isolated emergent low trees only (8–10 m). ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Corymbia opaca*	Open low to mid-tall shrubland (1–5 m). ▪ *Acacia aneura* ▪ *Eucalyptus gamophylla* ▪ *Eremophila latrobei* ▪ *Psydrax latifolia & P. ammophila* ▪ *Acacia ramulosa* ▪ *Senna artemisioides subsp. filifolia* ▪ *Senna artemisioides subsp. artemisioides*	Tussock grassland. ▪ *Eragrostis eriopoda* ▪ *Monachather paradoxus* ▪ *Aristida holathera* ▪ *Aristida inaequiglumis* ▪ *Eriachne helmsii* ▪ *Cenchrus ciliaris* (Buffel Grass) ▪ *Triodia schinzii* (patchy only)
SA3-C Spinifex-covered sand dune with mixed shrubs	Low sand dune	Red siliceous sands	Absent to isolated trees (8m). ▪ Hakea lorea ▪ Allocasuarina decaisneana	Open low shrubland (1–1.5 m). ▪ *Acacia ligulata* ▪ *Senna artemisioides subsp. filifolia* ▪ *Acacia ramulosa* ▪ *Aluta maisonneuvei* ▪ *Acacia melleodora* ▪ *Grevillea stenobotrya* ▪ *Eremophila willsii* ▪ *Eucalyptus gamophylla*	Hummock grassland. ▪ *Triodia schinzii* ▪ *Eragrostis eriopoda* ▪ *Leptosema chambersii* ▪ *Themeda sp.* ▪ *Aristida holathera* ▪ *Eriachne aristidea* ▪ *Senna pleurocarpa*
SA3-D Mulga red earth plain on over tussock grasses (including Buffel Grass)	Plain; Flat to gentle slopes; Minor run-on areas.	Red earths; heavier clay loam at low points	Low woodland / tall shrubland (4–6 m). ▪ *Acacia aneura* (i.e. Mulga group)	Sparse shrubs (1–2 m). ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Psydrax latifolia*	Tussock grasses and forbs. ▪ *Cenchrus ciliaris (Buffel Grass)* ▪ *Eragrostis eriopoda* ▪ *Monachather paradoxus* ▪ *Aristida holathera*
SA3-E Sandstone hills, slopes and outcrop with Mulga (+/- Hill Mulga) with scattered shrubs over spinifex, tussocks and forbs	Low hills, ridgelines, scarp, outcrop area; quartzite present in some areas.	Shallow sandy red earths over sandstone outcrop	Scattered to patchy low trees (6 m) ▪ *Acacia macdonnellensis* (patchy) ▪ *Acacia aneura* (i.e. Mulga group) ▪ *Corymbia opaca*	Open low shrubland (1–1.5 m). ▪ *Acacia kempeana* ▪ *Senna artemisioides subsp. artemisioides* ▪ *Senna artemisioides subsp. alicia* ▪ *Eremophila latrobei* ▪ *Eremophila freelingii*	Hummock grassland. ▪ *Triodia brizoides* ▪ *Triodia melvillei* ▪ *Eragrostis eriopoda* ▪ *Monachather paradoxus* ▪ *Eriachne mucronata* ▪ *Aristida holathera* ▪ *Aristida inaequiglumis* ▪ *Sida sp.* (several species) ▪ *Ptilotus obovatus*
SA3-F Low gravel rise with sparse Senna and Eremophila shrubs over short tussock grasses	Low gravelly rise	Surface gravel; shallow skeletal soil	Absent	Scattered low shrubland (1–1.5 m). ▪ *Senna artemisioides subsp. helmsii* ▪ *Senna artemisioides subsp. filifolia* ▪ *Eremophila duttonii* ▪ *Acacia tetragonophylla*	Sparse tussock grasses ▪ *Aristida contorta (dominant)* ▪ *Eragrostis eriopoda*

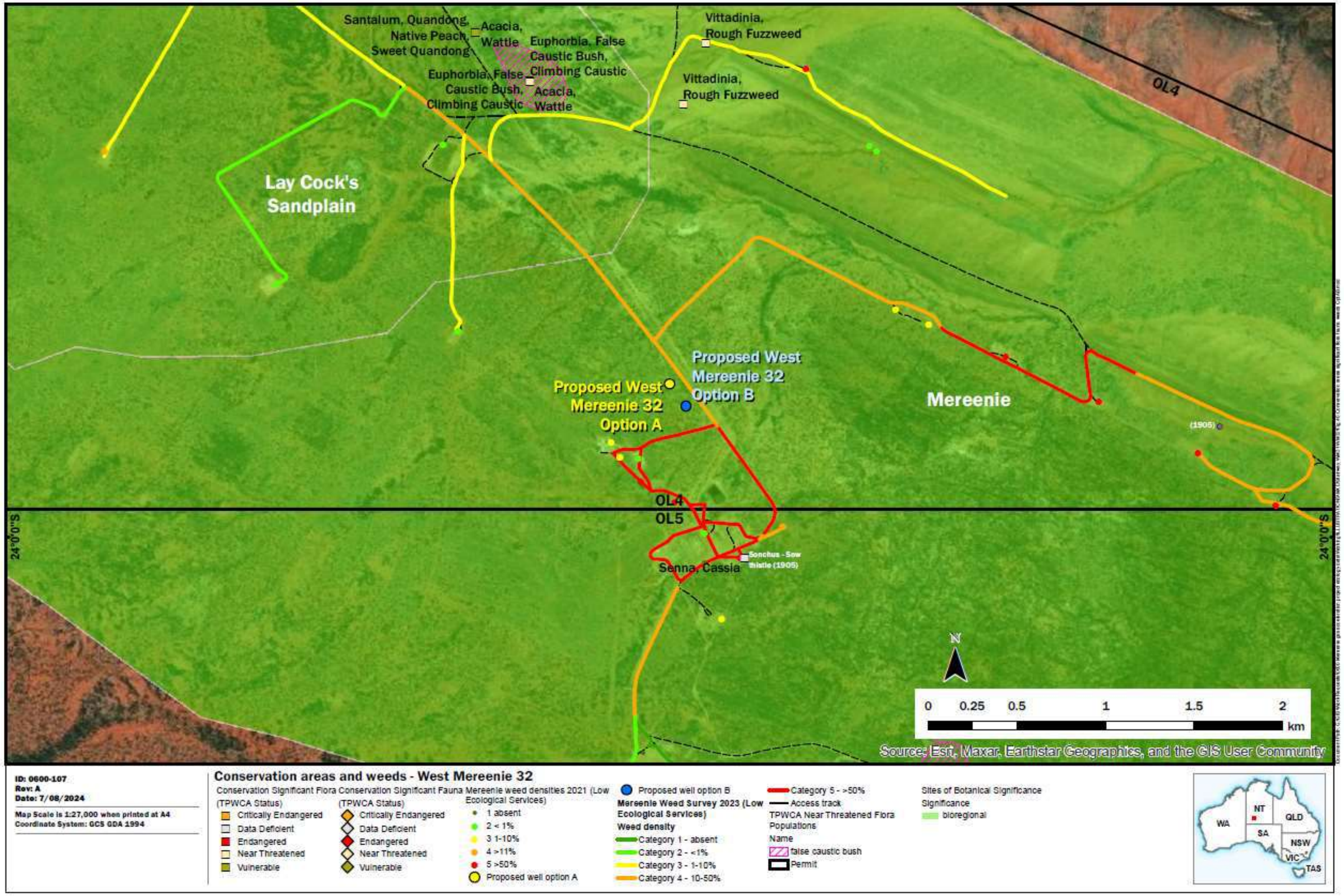


Figure 50: Conservation areas, significant flora and fauna and weeds in the environs of WM32

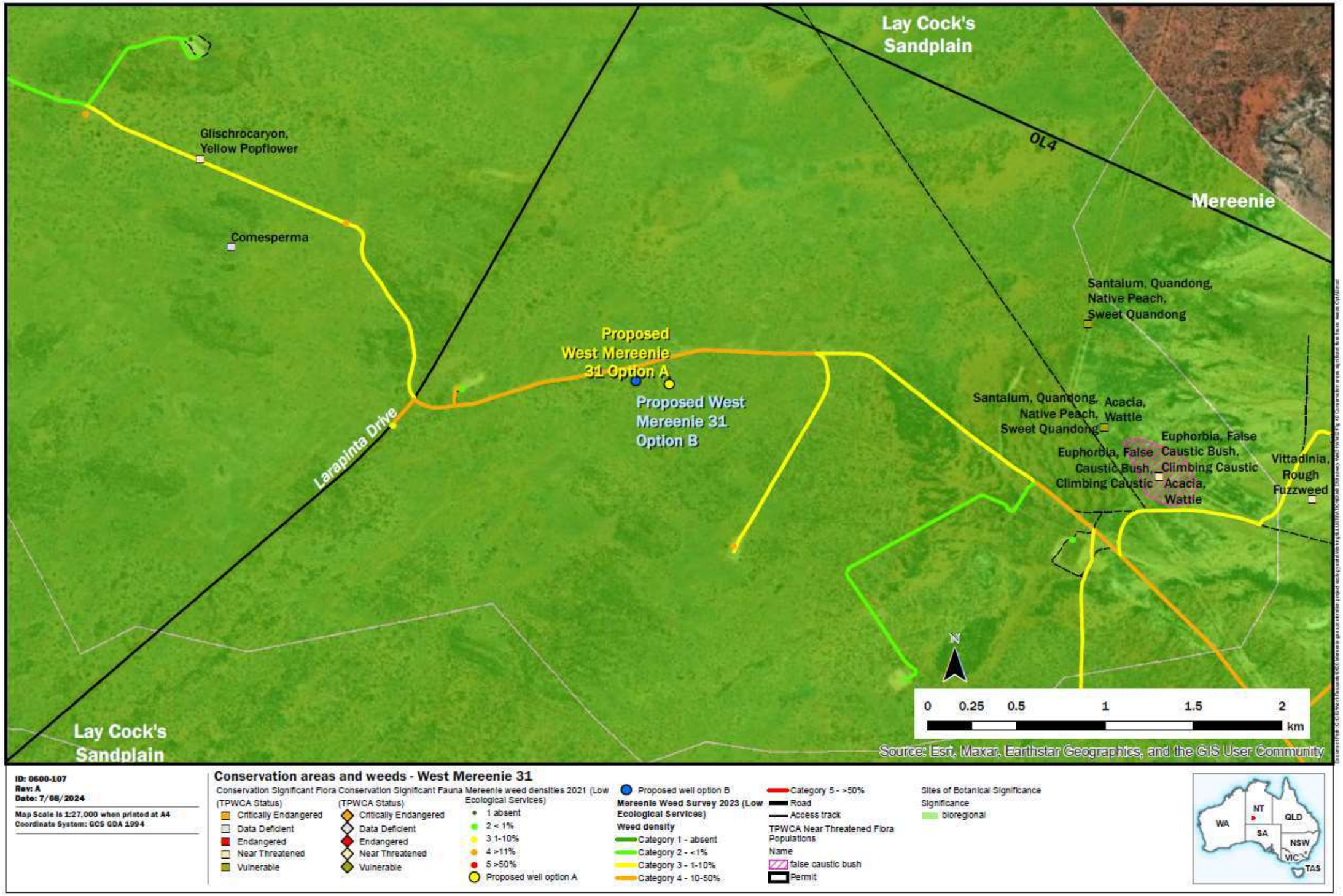


Figure 51: Conservation areas, significant flora and fauna and weeds in the environs of WM31

4.2.8. Conservation Significant Fauna

A fauna species is considered in this EMP to be of conservation significance if it is:

- Listed as a threatened species under the *EPBC Act* and is either:
  - identified by a PMST report within Mereenie or within 25 km of the site boundary, or
  - recorded during an ecological assessment of Mereenie.
- Listed as a threatened spec under the *TPWC Act* and has been either:
  - recorded in the NT Fauna Atlas as being within Mereenie or within 25 km of the site boundary, or
  - recorded during an ecological assessment of MRN.

There have been several fauna field surveys across various parts of the Mereenie Field, including:

- Flora and Fauna Assessment, Stage 2 Field Survey by Parks and Wildlife Commission of the Northern Territory (2000):
  - A site-wide survey that assessed fauna at 12 survey sites representative of the major habitats within Mereenie. The survey recorded 7 frogs, 15 mammals, 53 reptile species, and 96 birds.
  - The only threatened fauna species recorded was the black-footed rock wallaby, classed as NT under the *TPWC Act* and VU under the *EPBC Act*. The extent of the population in Mereenie was not determined as most of the suitable habitats fell within the Aboriginal archaeological places and objects or heritage places or objects exclusion zone. The exclusion zone is also noted to be the preferred habitat for the Central rock-rat (*Zyzomys pedunculatus*), Long-tailed dunnart (*Sminthopsis longicaudata*) and Common brushtail possum (*Trichosurus vulpecula*) which were suggested as possibly occurring within Mereenie.
  - Four NT species under the *TPWC Act*, as well as two MIG / MAR species, were noted as being found at Mereenie during previous surveys.
  - The study notes that the development at Mereenie has little impact on the area's fauna and that most habitats affected by the development are relatively robust and well-represented in the region.
- Mereenie Expansion Fauna Management Report by Resource Environment Strategies (2014):
  - Report from fauna spotter/catchers during installation of new flow lines for the Mereenie expansion project. A total of 98 species were encountered and relocated, including EPBC-listed black-footed rock-wallaby (vulnerable; NTD: near threatened) and TPWC-listed Crest-tailed mulgara (*Dasycercus cristicauda*) (vulnerable).
- A likelihood assessment of threatened flora species that appeared in the PMST search undertaken by EcOz Consultants (2022) is presented in Table 24 below.

Table 24: Conservation significant fauna of Mereenie Field

Likelihood	Common name	Scientific name	Status	
			TPWC	EPBC
HIGH	Central Australian rock-wallaby	*Petrogale lateralis centralis*	NT	VU
MEDIUM	Princess Parrot	*Polytelis alexandrae*	VU	VU
	Night Parrot	*Pezoporus occidentalis*	CR	EN
LOW	Grey Falcon	*Falco hypoleucos*	VU	VU
	Great Desert Skink	*Liopholis kintorei*	VU	VU
	Slater's Skink	*Liopholis slateri*	VU	EN
	Greater Bilby	*Macrotis lagotis*	VU	VU
NONE	Red Goshawk	*Erythrotriorchis radiatus*	VU	VU
	Thick-billed Grasswren (MacDonnell race)	*Amytornis modestus modestus*	EX	VU
	Curlew Sandpiper	*Calidris ferruginea*	VU	CR
	Australian Painted Snipe	*Rostratula australis*	VU	EN
	Crest-tailed Mulgara	*Dasycercus cristicauda*	VU	EN
	Golden Bandicoot	*Isoodon auratus*	EN	VU
	Western Quoll	*Dasyurus geoffroii*	EX	VU
	Central Rock-rat	*Zyzomys pedunculatus*	EN	CR
	Ghost Bat	*Macroderma gigas*	NT	VU
	Brush-tailed Bettong	*Bettongia penicillata*	EX	EN
	Mala	*Lagorchestes hirsutus*	EW	CR
	Sandhill Dunnart	*Sminthopsis psammophila*	DD	EN
	Finke Goby	*Chlamydogobius japalpa*	VU	-
	Common Brushtail Possum (central)	*Trichosurus vulpecula vulpecula*	EN	-
	Alice Springs Squat Snail	*Semotrachia euzyga*	EN	EN
	Palm Valley Rocksnail	*Granulomelon squamulosum*	VU	-
	Bendall's Dwarfmelon	*Sinumelon bednalli*	NT	EN
	Red Centre Pinwheel Snail	*Tateropa aemula*	VU	-
	Krichauff Ranges Squat Snail	*Semotrachia esau*	VU	-
	Illara Waterhole Squat Snail	*Semotrachia illarana*	VU	-

[1] TPWC Status: CR, Critical Endangered; EN, Endangered; EX, Extinct; VU, Vulnerable; NTD, Near Threatened; DD, Data Deficient; LC, Least Concern as listed under the Territory Parks and Wildlife Conservation Act (TPWC).

[2] EPBC Status: CR, Critical Endangered; EN, Endangered; VU, Vulnerable; MIG, Migratory; MAR, Marine; as listed under the Environmental Protection and Biodiversity Act (EPBC).[3] Listed on the EPBC PMST report retrieved for the area for the MRN and 50km buffer

[4] Number of records on the NT Flora Atlas for the MRN and 50km buffer - indicates no record

Fauna species with a 'High' or 'Medium' likelihood rating were subject to targeted field investigations during the EcOz surveys. These included:

- Central Australian rock-wallaby (*Petrogale lateralis centralis*)
- Princess Parrot (*Polytelis alexandrae*)
- Night Parrot (*Pezoporus occidentalis*).

Fauna species with a 'Low' likelihood rating were not targeted during the field survey (listed below); however, they were opportunistically surveyed in the field if suitable habitat was observed to validate the desktop assessment.

- Grey Falcon (*Falco hypoleucos*)
- Great Desert Skink (*Liopholis kintorei*)
- Slater's Skink (*Liopholis slateri*)
- Greater Bilby (*Macrotis lagotis*).

Field surveys focused on assessing habitat suitability, with specific methodologies (i.e. active searching, acoustic recording) occurring for some species where possible. The following subsections describe specific methodology and associated results for each species of interest. All incidental fauna species were recorded as part of targeted species surveys. A summary of the EcOz fauna survey for species considered likely to occur is provided below (EcOz, 2022).

4.2.8.1. Central Australian rock-wallaby

The Central Australian rock-wallaby is a medium-sized wallaby that occurs in rocky ranges, cliffs, gorges, outcrops, rocky steep slopes and boulder fields. They shelter during the day in caves (or equivalent rocky features) and feed in the late afternoon and evening. They are known to occur in ranges within the region; however, there are no records proximate to the survey areas (EcOz, 2022).

Topographical features such as rocky ridges were noted within Survey Area 3 (land type SA3-E); however, the survey did not identify any evidence of Central Australian rock-wallaby. No suitable habitat within Survey Area 2 was noted for Central Australian rock-wallaby. Consequently, the risk of impact from the proposed appraisal wells to the Central Australian rock-wallaby is considered low.

4.2.8.2. Princess Parrot

The Princess Parrot is a medium-sized parrot that occupies dune swales and occasionally slopes and crests of dunes (Pavey 2006). They are known to occur in the region, and there are existing records within and adjacent to Survey Areas 1 and 2. Nesting occurs in hollows in large Eucalypts (River Red Gum/*Eucalyptus camaldulensis* and Marble Gum/*Eucalyptus gongylocarpa*) and Desert Oaks (Pavey 2006). In this region, Marble Gum are the most commonly used nesting tree for the Princess Parrot.

The survey did not detect Princess Parrot; however, other parrot species observed/noted during the survey included Cockatiel, Budgerigar, Galah, Australian Ringneck, Bourke's Parrot, Mulga Parrot and Scarlet-chested Parrot.

No Marble Gum (a preferential roosting tree) was recorded within the survey areas; however, stands of Desert Oak within Survey Area 2 contain some large specimens that have the potential to be used as nesting (although hollows were not clearly visible when inspected). Given that the preferred Marble Gum nesting habitat is located 30 km to the west, the survey areas are more likely to be used as feeding grounds rather than nesting. No stands of tree species known to be used as nesting habitats for Princess Parrot were noted in Survey Area 3 (EcOz, 2022).

In summary, Princess Parrot may occasionally forage within Survey Area 2 (proximate to WM30); however, it is unlikely that these areas will be used for nesting purposes due to the absence of Marble

Gum and low numbers of large hollow-bearing Desert Oaks. Survey Area 3 does not support nesting habitat, nor is it likely to be used for feeding grounds (EcOz, 2022).

4.2.8.3. Night Parrot

The Night Parrot is a medium-sized green and yellow bird with a stocky build and short tail; it is highly elusive and nocturnal (Pavey 2006). Roosting and nesting sites are in clumps of dense vegetation, primarily old and large spinifex hummocks (*Triodia spp*.) that are well protected from fire (Murphy 2015). Little is known about foraging sites, but favoured sites are likely to vary across the range of the species. Little is also known about threats to this species; however, habitat suitability is thought to be degraded by frequent and/or widespread fires, grazing and predation by feral animals, and probably a combination of other factors (Pavey 2006).

The Night Parrot was not detected during the survey, and vegetation surveys confirmed no suitable nesting/roosting habitat was present within either Survey Area 2 or 3.

In summary, it is considered extremely unlikely that Night Parrot will be present within either Survey Area 2 or 3 and the impact on both roosting and/or foraging grounds is expected to be negligible (EcOz, 2022).

4.2.9. Fauna Survey Findings

No sightings of threatened Commonwealth or Northern Territory species were noted during the fauna survey conducted within Survey Areas 2 and 3. Some preferential habitat for the Central Australian rock-wallaby was noted in Survey Area 3; however, there was no evidence of scats, foraging or sheltering found in the area. Ultimately, the risk of the proposed appraisal wells on threatened fauna is considered low (EcOz, 2022).

4.2.10. Introduced Flora (Weeds)

Weeds are an ongoing threat to the natural environment and operations at the Mereenie Field. Weeds managed under this EMP can be categorised via the following:

- Weeds of National Significance (WoNS) – nationally agreed priority flora species for control and management. Weed species are determined based on rankings for invasiveness, potential to spread and impact on socioeconomic and environmental assets.
- Declared Weeds – species identified for control, eradication, or prevention of entry in all or part of the Northern Territory under the *Weeds Management Act 2001*. Declared weeds can be of the following classes:
  - Class A – to be eradicated
  - Class B – growth and spread to be controlled
  - Class C – not to be introduced into the Northern Territory
  - Class D – not to be spread by the actions of persons
  - Unclassified – Declared but not classified as A, B, C or D
- Priority weeds – species that have been identified as a priority or alert weed species within the Alice Springs Regional Weed Strategy 2021-2026 (DEPWS (*now DLPE*), 2021) as follows:
  - Category 1 – priority weeds for eradication: Mesquite (Prosopis spp.), Rope Cactus (*Cylindropuntia* spp) and Prickly pears (*Opuntia* spp.)
  - Category 2 – priority weeds for strategic control: Athel pine (*Tamarix aphylla*), Parkinsonia (*Parkinsonia aculeata*), and Rubber bush (*Calotropis procera*)
- No declared weeds or WoNS were reported in the EPBC PMST in and around (25 km radius) Mereenie. Annual weed surveys within the Mereenie field have identified minor occurrences of the recently declared Buffel Grass (*Cenchrus cillaris*) within each survey area. No other NT Declared

Weeds or Priority or Alert weeds under the Alice Springs Regional Weed Strategy identified in the NT Flora Atlas as being in or within 25 km buffer of Mereenie.

Site-wide weed monitoring occurs on an annual basis under the Mereenie Weed Management Plan (EcOz) as per the Code, and the survey provides the basis for weed control, which aims to occur during periods of active weed growth (i.e. usually after the wet season/large rain events).

Surveys undertaken as part of the appraisal wells ecological assessment confirmed that Buffel Grass (*Cenchrus ciliaris*) is present within each survey area and is commonly established on roadside, disturbed areas, drainage lines and some Mulga vegetation communities. Survey Area 2 currently has very low infestation levels within undisturbed areas, and Survey Area 3 has some more substantial infestations (refer to Table 25 below).

Table 25: Baseline weed survey for Survey Area 2 and 3

Area	Baseline weed summary
2	One weed species was identified – Buffel Grass. Current infestation levels are described below: ▪ It is mainly limited to roadsides and roadside drainage/washout areas. ▪ Currently present at very low levels in undisturbed areas (occasionally under Desert Oak or Blue Mallee canopies or in Mulga stands where there was a high level of horse impact).
3	One weed species – Buffel Grass – was identified, and some substantial infestations were found. Current infestation levels are described below: ▪ Disturbed areas have a high level of infestation, including an edge effect of up to 10 m. ▪ It is common within land types SA3-B and SA3-D, especially under canopies of Blue Mallee and Mulga stands. Occasionally, the dominant ground cover. ▪ It is occasionally present under shrubs or trees within SA3-A. ▪ Occasional patch established within rocky gullies in land type SA3-E.

4.2.10.1. Buffel grass

The current and previous surveys have confirmed the presence of Buffel Grass throughout the Mereenie Field, which has recently been declared under Territory legislation and is covered by an EPBC Threat Abatement Advice (DoE, 2015).

Under the NT Weeds Management Act 2001 Buffel grass is declared as unclassified and is therefore subject to the general duties of the NT Weeds Management Act 2001.

Surveys are conducted annually at Mereenie to monitor the presence of Buffel Grass and other weed species. In addition, the Operator holders have sought the advice of DLPE Officers in Alice Springs to review the presence of this invasive species across the field.

Management strategies across the Mereenie field will be aligned with the objectives outlined in the *Buffel Grass Management Strategy: Central Australia 2024 – 2030* for the applicable land use purpose (i.e. roads/corridors (including gas, power, infrastructure)).

4.2.10.2. Weed Mapping

The location of the environmental weeds found during the 2023 survey and environmental weeds recorded on the NT Flora Atlas are shown in Figure 50 for WM32 and Figure 51 for WM31 environs.

An ongoing eradication and control program is in place, particularly following rainfall events when Buffel Grass and other environmental weeds have a flourish of growth. In addition, discussions are maintained with DLPE Officers to identify new methods for treating and controlling Buffel Grass in the Alice Springs region.

Regular well site inspections are conducted to monitor the spread of weeds after rainfall events and to target physical and chemical weed control activities.

4.2.11. Introduced Fauna (Pests)

Introduced pest species threaten the natural environment and the rehabilitation efforts implemented at the Mereenie Field. In addition, they can cause damage to infrastructure and the safety of personnel. An introduced fauna species is considered in this EMP to be of management concern if it is:

- listed in the NT Fauna Atlas as 'Introduced' and has been recorded at or within a 25 km buffer of Mereenie
- identified as an invasive species/threatening process under the *EPBC Act*
- has been recorded during ecological surveys of the area

The EcOz assessment identified 6 feral animal species present within or proximate to Surbey Areas 2 and 3. These included:

- Horse (*Equus caballus*) – common and widespread within both survey areas (and surrounds), especially within Mulga shrublands and land types with tussock grass-dominated ground layer. Water points present within gas fields (i.e. flares pits, troughs, dams) likely attract and maintain populations within the area.
- Donkey (*Equus asinus*) – infrequently observed and often mixed in with horse herds.
- Rabbit (*Oryctolagus cuniculus*) – observed within Survey Area 3 (i.e. scats, diggings and one warren).
- Cat (*Felis catus*) – tracks infrequently observed in sandplains within Survey Area 2. Likely present (but undetected) within Survey Area 3.
- Camel (*Camelus dromedarius*) – recorded within both survey areas.
- Fox (*Vulpes vulpes*) – track observed within Survey Area 3.

4.2.12. Fire History

Regional fire history and fire scar mapping were obtained through the *Northern Australia and Rangelands Fire Information* website and a general review of Landsat Imagery (using Google Timelapse and VegMachine). The mapping indicates that between 2000–2022:

- WM32 (Figure 52) and nearby vicinity, there were no years in which the land was detected as being burned.
- WM31 (Figure 53) and nearby vicinity, there were 2 years in which the land was detected as being burned. Fire scars were, however, noted recently in November 2023.

Four-metre fire breaks are maintained around infrastructure to assist in managing fires that may occur within the Mereenie Field. In addition, vegetation is managed around wells, flowlines and processing plants to reduce fuel loads should a fire occur in the Mereenie Field.

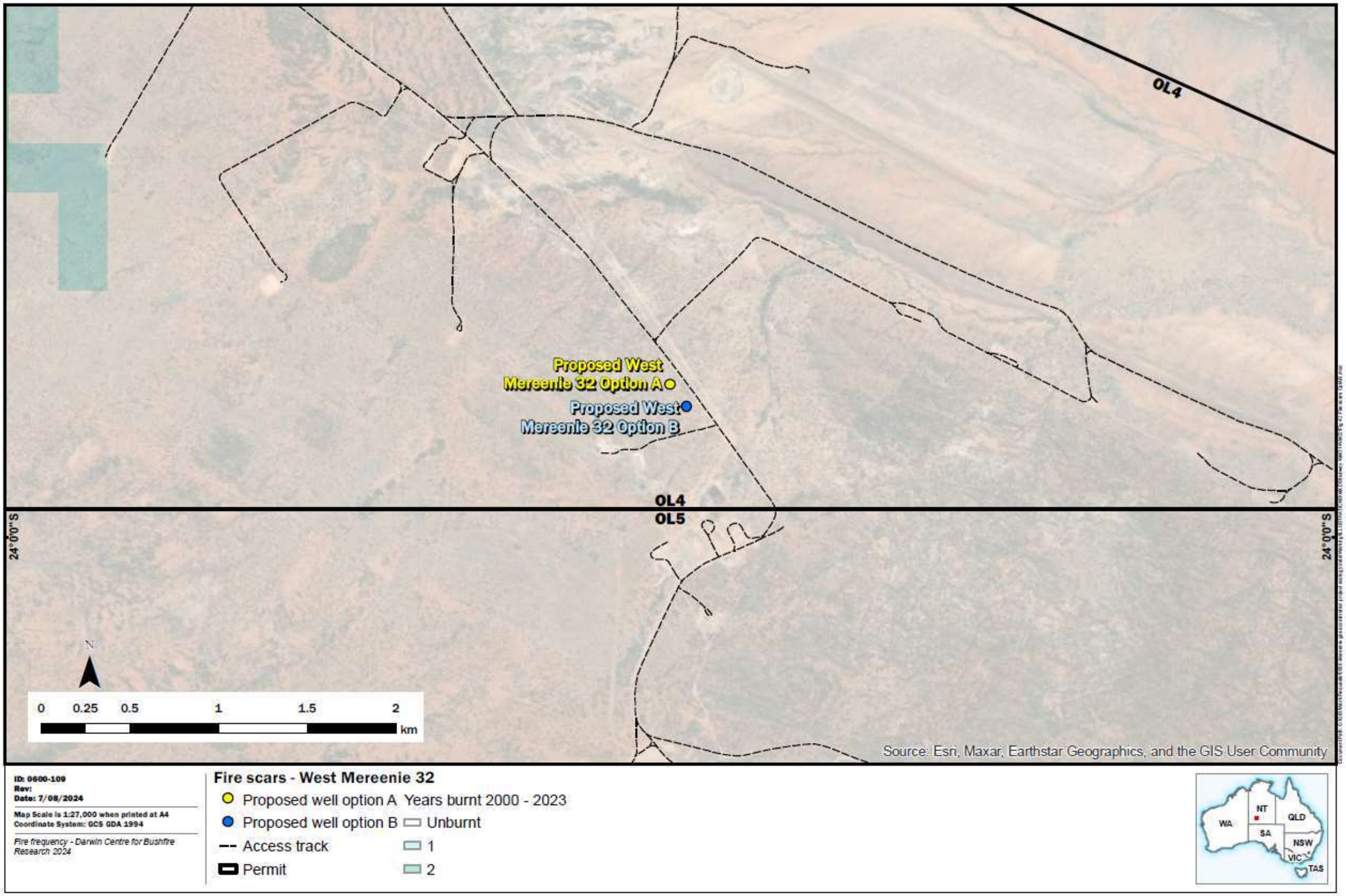


Figure 52: Fire scars in the WM32 environs

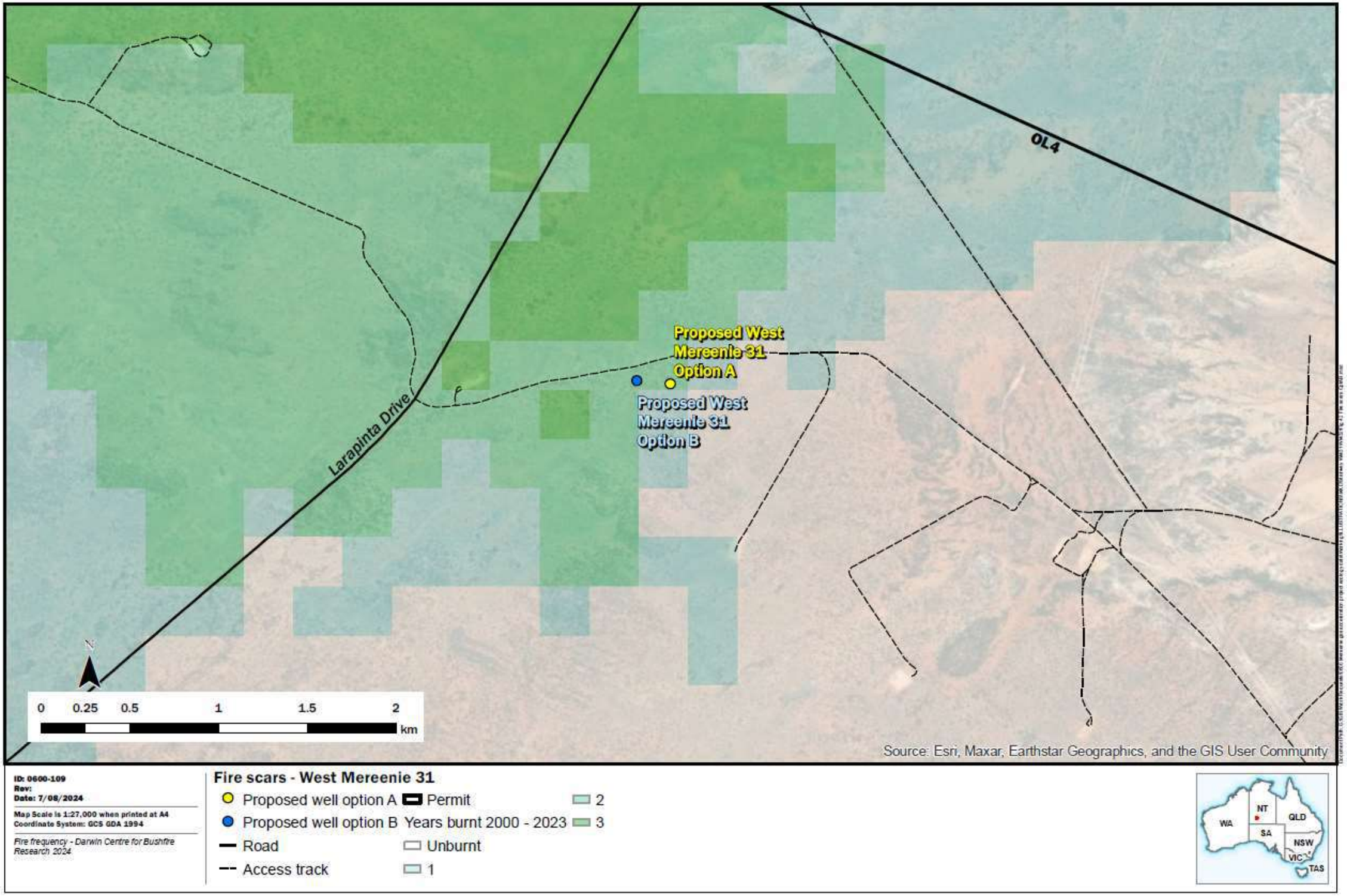


Figure 53: Fire scars in the WM31 environs

4.3. Socioeconomic Environment

4.3.1. Land Tenure and Use

The land on which Mereenie operates is Aboriginal freehold land belonging to the Haasts Bluff Aboriginal Land Trust. Undertakings have been given in the Mereenie Land Use Agreement to maintain the right of the Traditional Owners to move freely throughout Mereenie and use non-operational land within Mereenie for pastoral grazing activities and conservation purposes.

There are a number of national parks and reserves in the wider Alice Springs/Central Australia region, including Finke Gorge National Park, Owen Springs Reserve, Watarrka National Park and the West MacDonnell National Park (Figure 54).

Mereenie is not within or directly adjacent to any Indigenous Protected Areas which form part of the Australian Reserve System. Tourism is notable in the surrounding areas; however, Mereenie operations do not directly overlap with tourist areas.

Mereenie is not within any NT Petroleum reserved blocks, which are areas designated free of petroleum exploration.

4.3.2. Surrounding Populated Places

Mereenie is located in a remote and sparsely populated region, though there are several small Aboriginal communities within proximity or that have strong traditional ties with the surrounding land, including; Kulpidjara, Areyonga, Underana, Undandita, Haasts Bluff, Papunya, Ipolera, Morris Gap, Ulpanvali; Lilla, Wanmarra, Camel’s Hump and Yateman’s Bore.

There is also a community of 600–800 people at Hermannsburg, located 110 km east of Mereenie. The nearest major centre is Alice Springs, with a population of approximately 26,000, located 250 km by road from Mereenie. The locations of the surrounding communities are shown in Figure 54.

As part of stakeholder consultation and requirements under the Mereenie Agreement and Central Land Council (CLC) Sacred Sites Clearance Certificate (SSCC), the Operator has engaged with surrounding stakeholders through CLC-organised liaison committee meetings (LCM) regarding the Mereenie development well drilling program in 2023 (refer to Stakeholder Engagement Schedule in Appendix C).

The Mereenie Field positively impacts these communities' social and economic values through increased workforce participation opportunities, infrastructure development such as water supply and roads/tracks, and rehabilitation works to support Traditional Owners' pastoral land use activities.

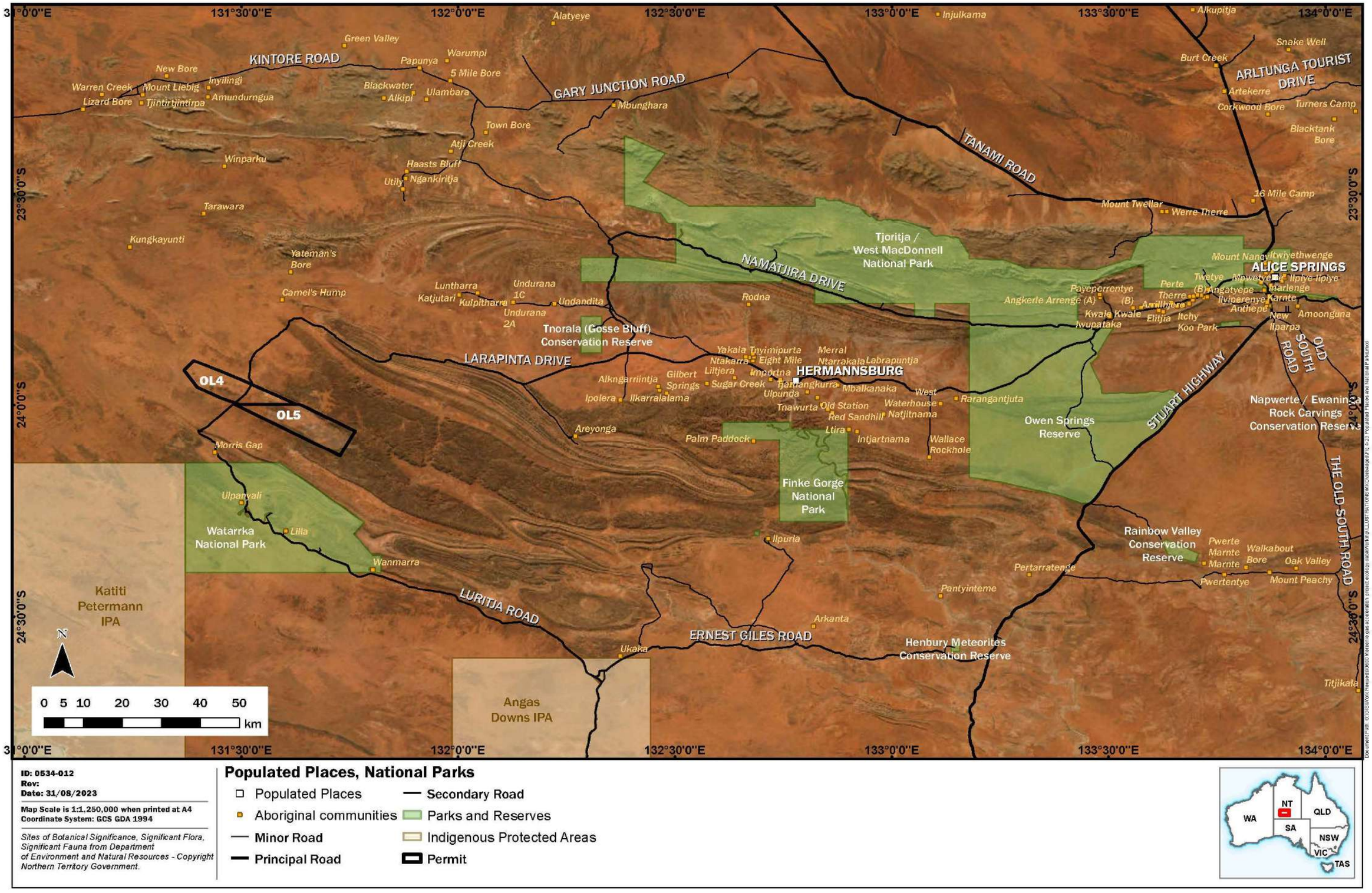


Figure 54: Populated places and National Parks in the region

4.3.3. Noise

As noted in Section 4.3.2, Mereenie is located within a sparsely populated region. No communities within the area are bounded by WM31 and WM32, and the nearest sensitive receptor is approximately 25 km from noise sources across the field.

The Northern Territory *Noise Management Framework Guideline 2018* refers to offensive noise that may cause an environmental nuisance. The offensive noise test described in the NT framework is not relevant, given that the nearest sensitive receptors for noise to the Mereenie Field are at Watarrka (Kings Canyon) National Park, approximately 25 km south of the CTP at Mereenie.

Watarrka (Kings Canyon) National Park is a conservation area with tourist traffic peaking from April to October. No impacts on sensitive receptors are considered likely, given the remote and isolated location of the drilling sites. Noise sources at the Mereenie Field are centred on the CTP and ESS processing facilities. Compressors and power generation units operate at these industrial facilities 24-hours/day.

In the first instance, all facilities and operations at the work site must comply with exposure standards for noise defined in the *Work Health and Safety Regulation 2011*, which provides a much stricter threshold for noise sources, thereby mitigating any potential off-site nuisance noise. The Operator will monitor any complaints regarding noise as part of its stakeholder engagement process.

Given the distance to the nearest receptor and the fact that noise generated within the WM31 and WM32 area will not plausibly exceed 'nuisance noise tests', an assessment described under Section 3.2 of the *Northern Territory Noise Management Framework Guideline 2018* has not been conducted.

4.3.4. Cultural Heritage

4.3.4.1. Historic and Natural Heritage

Mereenie is located within the MacDonnell Shire. An online search of the Northern Territory Heritage Register showed 18 publicly listed heritage sites in the MacDonnell Shire, none within or adjacent to Mereenie. No non-public sites were found through a search request made with the NT Heritage Branch.

EPBC PMST for Mereenie and 50 km buffer wells did not identify any World Heritage Properties, National Heritage Places, Commonwealth Heritage Places or Places on the Register of National Estate.

4.3.4.2. Aboriginal Archaeological Assessment

[redacted] with relative locations shown in Figure 55 and Figure 56. [redacted] which is [redacted]. In either scenario, it will be clearly marked out prior to works commencing to ensure a suitable buffer area is always maintained. The locations of the heritage site will also be clearly communicated during the induction process so site personnel are aware of its location and applicable buffers proposed to be 50 m.

Further to the above management measures, the Archaeological Survey Report recommends the following management measures for the C/3 survey area [redacted]):

Works Approval in accordance with Section 72 of the Heritage Act should be sought for any works that are likely to disturb or damage stone artefact scatters and isolated finds known to occur within the survey areas, with the following conditions:

- pre-works archaeological recording
- supervised relocation to a suitable area away from the works area
- reporting of any new archaeological place locations to Heritage NT.

In the event that works that have the potential to disturb or damage quartzite quarries cannot be avoided, **additional archaeological investigation** is recommended to inform any future Section 72 Works Approval applications. This would include:

- detailed recording and analysis of artefacts
- high-resolution capture of the quarries, including aerial imagery
- consultation with Aboriginal Traditional Owners on the management of the artefacts, including suitable relocation areas.

Unexpected Finds Protocol

Cultural heritage may be discovered even in areas that have been assessed as being free of cultural heritage places and objects.

If a suspected cultural heritage place or object is discovered:

- Refer to Discovery of Potential Human Remains procedure below if the discovery is suspected of being human remains.
- All work within a 50 m radius of the suspected cultural heritage find must cease immediately and the area must be flagged/fenced appropriately to ensure that no further work activities can be undertaken within it.
- The discovery must be reported immediately to the Site Supervisor, who immediately communicates with the Project Manager.
- The Project Manager must notify a Heritage Officer at NT Heritage Branch on 08 8999 5039 or Heritage.Branch@nt.gov.au.
- The Interest Holder must Report in writing as soon as practical, finds that are Aboriginal or Macassan archaeological objects or places, as defined in the Heritage Act 2011 (NT), to the CEO of the Heritage Branch. The report must include:
    - a description of the place or object;
    - its location (including spatial data);
    - the person's name and address; and
    - if known by the person – the name and address of the owner or occupier of the place or place where the object is located.
- Work is not to recommence in the vicinity of the find until direction is provided by the Heritage Branch of the Northern Territory Government.

If works are to continue within the area of a known/identified archaeological place or object, then an Application to Carry out Works must be submitted. The application will go to the Northern Territory Heritage Council for consideration. The Minister will (likely) make the final determination on if the object or place can be moved or destroyed. Works cannot recommence within the area until that determination is made.

Unexpected Finds Protocol: Skeletal Remains

If potential human material is identified:

- All work within a 50 m radius of potentially human material must stop immediately.
- Report the discovery immediately to the Site Supervisor. The Site Supervisor must immediately notify the Project Manager of the discovery. No temporary fencing should be erected unless directed by the police.

- The Project Manager must immediately notify the Northern Territory Police.
- The Police will take control of the site as a potential crime scene.
- If there are reasonable grounds to believe that the remains are:
    - A crime scene – the Police will provide direction on the management of the discovery.
    - If remains are Aboriginal ancestral or historical remains rather than a crime scene, the Project Manager should immediately notify:
        - A Heritage Officer at NT Heritage Branch on 08 8999 5039 or Heritage.Branch@nt.gov.au., and;
        - As soon as practicable after the discovery, write a report to the CEO of the Heritage Branch. The report must include a description of the place or object; its location; the person's name and address; and if known by the person – the name and address of the owner or occupier of the place or place where the object is located.
        - Relevant Traditional Owners (Land Councils and Aboriginal Areas Protection Authority) if finds are Aboriginal or Macassan archaeological objects
- Work is not to recommence in the vicinity of the find until direction is provided by the relevant authorities (Police and Heritage Branch of the Northern Territory Government).

Figure 55: Archaeological survey area in vicinity of WM32 (Hill, 2022).

4.3.5. Sacred Sites

Sacred Sites are identified and administered in central Australia by the Aboriginal Areas Protection Authority (AAPA) and the Central Land Council (CLC). Due to the duplicative nature of Sacred Site clearance processes in the NT, the Operator has the following clearances:

- Central Land Council
  - The Operator has a current sacred sites clearance certificate (SSCC) for operations at Mereenie (SSCC C2022-046, renewed Jan 2023). All regulated activities in this plan are covered under this clearance. All activities are to be conducted within SSCC-assessed areas and in accordance with the SSCC conditions.
- Aboriginal Areas Protection Authority (AAPA)
  - An AAPA Authority Certificate for the works described in this EMP (202305946 – C2023/105) has been granted. The Operator commits to complying with the requirement of the granted Authority.

5. Engagement and Consultation

5.1. Stakeholder Engagement

Interest holders are committed to proactively engaging with a range of stakeholders and other interested parties. We aim to establish and maintain enduring and mutually beneficial relationships with the communities in which we operate, ensuring that our activities generate positive economic and social benefits for and in partnership with these communities.

The stakeholders in relation to this EMP are the Indigenous Traditional Owners represented by the CLC as per the Mereenie Agreement 2003. The activities in the EMP are aligned with the scope, and these have been discussed with identified stakeholders as defined in the NT *Petroleum (Environment) Regulations 2016*.

No consultation with the Commonwealth Government was required as it has been determined that the works are unlikely to cause a significant impact on MNES. Therefore, the *EPBC Act* will not be triggered.

A record of all engagements undertaken with stakeholders is captured in a stakeholder engagement register (Appendix C).

5.2. Traditional Owner(s) Engagement

The Operator undertakes regular consultation with Traditional Owners primarily through annual LCM. As outlined in the Mereenie Agreement, these LCMs will take place annually into the future.

At these meetings, an overview of its ongoing production operations, anticipated field workover programs and other development activities, including the activities under this EMP. An extract from the LCM presentations is attached in Appendix D. At these meetings, we discuss:

- the activities to be undertaken on country and proposed locations
- the understanding of the nature and purpose of activities, which is to be executed by the CLC in accordance with the *Land Rights Act*
- the planned Aboriginal sacred site surveys to be completed as part of this EMP and future planning
- planning and execution of on country meetings to discuss the exploration and drilling program also occurring and complete the Sacred Site Clearance and avoidance surveys of land with the CLC

5.2.1. Assessment of Merit of Stakeholder Objection or Claim

There is an established process for assessing any stakeholder objection/claim that it receives, which includes:

- All stakeholder objections/claims are to be provided to the Chief Operating Officer (COO), who will appoint a person to confirm that the objection/claim relates to the activities under this EMP.
- The COO to notify the stakeholder:
  - If the objection/claim is not related to an Operator and no additional action is required, or
  - If the results confirm that the objection/claim is related to an Operator, an investigation will commence.

In relation to the investigation:

- The COO will appoint a person to investigate the objection/claim.
- The appointed person is to investigate and provide a written report of their findings to the COO.
- Once the report is accepted, a discussion with the stakeholder will take place to communicate the investigation outcomes, including any actions that an Operator has/will undertake to address the objection/claim – if required. Following the discussion, a written response will be provided.

5.2.2. Details of Changes Due to Engagement

Management will consider any proposed changes in operations, policy, or procedures because of stakeholder consultation or other engagement. If any changes for merit are deemed necessary, these changes will follow the approved Management of Change process and be captured in a register.

6. Environmental Impacts, Risks and Mitigation

6.1. Approach

6.1.1. Risk Assessment Methodology

The risk management approach is aligned with all material aspects of ISO 31000, and all environmental risks associated with operations have been:

- identified, analysed and evaluated, including the assessment of critical controls and their effectiveness Table 26)
- recorded in a risk register (Appendix E)
- treated in a manner commensurate with the level of risk
- communicated to key stakeholders
- monitored and reviewed in a manner commensurate with the level of risk

Assessment of risk is completed using a Risk Matrix (Section 6.1.6) to assess and rate risks by assessing the combination of likelihood of occurrence and the severity of the impact/outcome of an event. This allows quantification of the risk, and a determination can then be made about whether the risk is ALARP and acceptable or whether further mitigation is required.

Table 26: Control Effectiveness

Assessment	Description
Effective	Controls are well designed and are operating effectively, and management monitoring and review of controls are established.
Satisfactory	Controls are reasonably well designed, and most aspects are operating effectively, with some minor areas for improvement.
Needs Attention	Certain control/s are not well designed and/or are systematically not operating effectively.
Ineffective	Significant gaps in the design and operation of controls. No confidence that any degree of control is being achieved.

6.1.2. ALARP and Acceptability

As part of the risk assessment process, each risk is mitigated to ALARP. This occurs when all reasonably practicable control measures have been identified and implemented. ALARP involves making a judgement about whether all reasonably practicable measures are in place to control a potential risk or impact, considering the level of consequence and cost, as well as the time and resources involved in mitigating it.

Determining whether potential environmental risks and inputs are 'acceptable' depends on issues such as the nature and scale of impacts and the social or economic benefits. The risk tolerance/acceptance process (Table 27) is utilised to determine whether to accept the assessed residual risk or implement improvement actions.

Table 27: Risk Acceptance/Action Criteria

	Low	Medium	High	Very High
Risk owner/ acceptance	Activity owner	Direct reports to Managers	Managers	CEO/ExCo
Improvement actions identified	Within a reasonable timeframe	3 months	1 month	As soon as practicable

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

- The residual risk is determined to be 'Low' the controls are determined to be effective, and the scientific uncertainty score is A (Low), or
- The residual risk is determined to be either 'High' or 'Medium', the controls are determined to be effective, and the scientific uncertainty score is A (low) as well as ALARP is demonstrated through:
  - alignment with legislative requirements, regulator guidance and stakeholder expectations
  - adoption of regional strategies and plans
  - not compromising ESD Principles
  - limiting the nature and scale of the effect on the environment.

6.1.3. Uncertainty

To enable an accurate assessment of the potential impact and risk of the activities, the risk assessment process considers scientific uncertainty regarding the information available to assess the risk. Uncertainty is high where confidence in the available information is low in identifying risk or the effectiveness of management control. Additional baseline studies or other safeguards may be required to increase an assessment's accuracy and determine a risk's acceptability.

Scientific uncertainty is qualitatively assessed using a generic means of ranking the available data according to the criteria assigned in Table 28. Considerations of scientific uncertainty have been included in the risk assessment.

Table 28: Scientific uncertainty scoring

Category	Description	Decision-making tools
A (Low)	▪ Control/mitigation measures are well understood and established within the industry to ensure the risk is effectively controlled. ▪ Information available to assess the risk is current.	▪ Legislation, codes and standards exist to regulate the activity. ▪ Good industry practice includes additional controls beyond legislation, codes and standards.
B (Moderate)	▪ Control/mitigation measures exist and have been demonstrated to be effective in other industries. ▪ Information used to assess the risk is still valid but is either starting to date or there are information gaps.	▪ Risk-based assessment tools are available for use (e.g. modelling, quantitative risk assessment, cost-benefit analysis, etc.).
C (High)	▪ Scarce or no data available to support the assessment of the risk.	▪ No guidance material available. A precautionary approach to the management of the risk is required.

6.1.4. Risk Assessment Summary

The outcomes of the environmental risk assessment are presented in Table 29, which summarises the residual risks for activities under the Environmental Management Plan. All risks are considered to be as low as reasonably practicable and are accepted.

Table 29: Risk assessment summary

	Residual Risk			
	Low	Medium	High	Very High
Count	31	12	0	0

Residual risk for each environmental strategy outlined within the EMP is considered low (Sections 6.2 – 6.10). The factors below are considered medium risk prior to the implementation of the proposed management measures for each item:

- injury or death of conservation significant flora/fauna from civil works, vehicle movements and earthworks
- increased occurrence of weeds (including weeds of national significance)
- contamination of soil/water/air from contaminant/gas release to grade/ ground/groundwater/air
- loss of places or items of cultural significance from fire as a result of regulated activities under this EMP

6.1.5. Environmental Management Strategy

Based on the risk assessment results and the identification of critical controls, as detailed in Appendix E. The Operator has categorised the Environmental Outcomes and developed performance standards and measurement criteria aligned with the identified critical controls. The Environmental Outcomes, performance standards and measurement criteria are outlined in Sections 6.2 – 6.10. Residual risks have been reported conservatively, stating the risk of the highest-rated issue within each category.

6.1.6. Risk Matrix

Risk Matrix

Impact Type / Impact Level	Health and Safety	Environment	Community	Legal	Reputation	Financial AUD$	Remote	Unlikely	Possible	Likely	Frequent
							Conceivable, but only in extreme circumstances	Event is unlikely to occur during the life-span of a project	Event may occur during the life-span of a project	Event likely to occur during the life-span of a project	Recurring event during the life-span of a project
							<1% chance of occurring within the next year.	>1% chance of occurring within the next year	>10% chance of occurring within the next year	>30% chance of occurring within the next year	>60% chance of occurring within the next year
Extreme	5 or more fatalities or life-threatening injury / illness or total permanent disability.	Extensive permanent impact on / off site or damage to critically endangered species, habitats, ecosystems.	Extensive irreversible impacts to the community or social wellbeing. Long term social unrest. Permanent damage to area/s of cultural significance.	Charges against any director or senior executive involving jail, substantial fine or loss of right to manage the company. Public inquiry – requiring considerable resources and senior executive time. Loss of an asset or loss of licence to operate an asset. Permanent non-voluntary suspension of trading CTP securities on the ASX.	Multiple stakeholder groups confirming coordinated action, as reflected in media channels with significant reach and influence. Negative international or prolonged national media (e.g. 2 weeks).	Loss of value in excess of $20m Cashflow impact in excess of $5m	High	Very High	Very High	Very High	Very High
Critical	1-4 fatalities or life-threatening injury / illness or total permanent or partial disability.	Extensive long term partially reversible impact on / off site or damage to endangered species, habitats, ecosystems.	Extensive reversible impacts to the community or social wellbeing. Prolonged community outrage. Extensive long term partially reversible damage to area/s of cultural significance.	Charges against any director, senior executive or senior manager involving fines, jail or the loss of right to manage the company. Prolonged major litigation – exposure to significant damages, fines or costs. Suspension or restrictions to the benefit of an asset or operate an asset. Prolonged non-voluntary suspension of trading CTP securities on the ASX.	Multiple stakeholder groups mobilising and encouraging other to act, as reflected in media channels with significant reach and influence. Negative media national for 2 days or more.	Loss of value >$10m to $20m Cashflow impact >$1m to $5m	High	High	High	Very High	Very High
Serious	Injury or illness resulting in partial disability, lost time or alternative / restricted duties.	Long term reversible impacts on / off site or to vulnerable or near threatened species, habitats, ecosystems.	Impacts to the community or social wellbeing. High levels of community tension. Long / medium term partially reversible damage to area/s of cultural significance.	Charges against any employee (not described above). Non-compliance with conditions of licence to own or operate an asset or to conduct an activity. Litigation - exposure to damages, fines or costs. Short-term non-voluntary suspension of trading CTP securities on the ASX.	More than one stakeholder group's opinion or view influencing other stakeholders, reported through media channels with some reach and influence. Negative national / state media for 1 day.	Loss of value >$2.5m to $10m Cashflow impact >$500k to $1m	Medium	Medium	High	High	High
Moderate	Injury or illness to 1 or more people resulting in medical treatment.	Medium / short-term impact on / off site or to low risk / least concern / common regional species, habitats, ecosystems.	Small scale impacts to the community or social wellbeing. Isolated examples of community tension. Moderate short-term impact to areas of cultural significance.	Moderate non-compliance with external mandatory obligations or breach of contractual or other legal obligations (not described above). Litigation possible. Non-compliance with internal controls with a moderate impact	A single stakeholder group drawing attention to an incident, issue, or approach conveyed through local media channels.	Loss of value >$500k to $2.5m Cashflow impact >$250k to $500k	Low	Medium	Medium	Medium	Medium
Minor	Injury or illness requiring first aid to 1 or more people, or no treatment recorded.	Minor near source impact on / off site – readily dealt with.	Minor community impact / short-term impact to areas of cultural significance – readily dealt with.	Minor non-compliance with external mandatory obligations or breach of contractual or other legal obligations. Non-compliance with internal controls with a minor impact.	A person or organisation within a stakeholder group signalling an interest in an incident, event or approach, using channels with limited reach or influence. Public concern restricted to local complaints.	Loss of value >$250 to $500K Cashflow impact >$50 to $250k	Low	Low	Low	Medium	Medium

6.2. Biodiversity

<table>
<tr><th colspan="6">Environmental management strategy: Biodiversity</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, fencing, land and vegetation management
▪ Well site operations – surface infrastructure, well site containment facilities (bund areas, drilling sump, water storage), conductor casing, hardstand area, rig-up
▪ Well drilling, logging, casing and cementing, pressure testing
▪ Well testing – flaring
▪ Tie-in to gathering network
▪ Rehabilitation
▪ Support activities – chemical storage, drilling fluid, drilling waste, waste management, logistics transport
▪ Accommodation camp</td></tr>
<tr><td>Residual risk</td><td>Medium</td><td>Code of Practice</td><td>A.3.1; A.3.5; A.3.6; A.3.7, A.3.9</td><td>Uncertainty</td><td>A (Low)</td></tr>
<tr><td rowspan="2">Risk</td><td colspan="2">Consequences</td><td colspan="3">Critical controls</td></tr>
<tr><td colspan="2">▪ Loss of vegetation/fauna habitat values from:
- loss of containment, including spills and leaks, of hydrocarbons, chemicals, drilling fluids, and wastewater, including in wet weather
- storage, handling, use and disposal of fuels, oils and chemicals
- uncontrolled fires from an ignition source
- movement of vehicles and heavy machinery outside of disturbance areas
- spread of weed species
▪ Encouragement of native and pest fauna from poor waste handling and storage
▪ Loss of fauna habitat from lack/failure of rehabilitation
▪ Loss of fauna from:
- vehicle movements and human interaction
- injury or death from access to ponds, pits, sumps, trenches or similar</td><td colspan="3">Engineering
▪ Secondary containment around tanks and chemical storage areas
▪ Lined sumps
Administrative
▪ Well site selection
▪ Weed Management Plan
▪ Progressive Rehabilitation and Closure Plan
▪ Fire Management Plan
▪ Waste Management Plan
▪ Spill Management Plan
▪ Erosion and Sediment Control Plan – well site layouts
▪ Camp STP
Monitoring
▪ Asset/equipment inspection
Personal Protective Equipment (PPE)
▪ Spill response kits at work locations</td></tr>
</table>

Environmental management strategy: Biodiversity			
ALARP and acceptability	The residual risk remains medium based on moderate impacts of the loss of conservation significant fauna. It is considered that the risk has been reduced to ALARP and acceptable based on the following: ▪ Vehicle movements are a necessary part of operations controls that are aligned with industry practice and consistent with ESD principles to coexist without any significant impacts on the local environment. ▪ No WoNS or declared weeds in Mereenie, so the risk of weed spread between well sites is minimised. Best practice weed management practice areas in place and seeks to achieve the requirements of key legislation and strategies as outlined in Section 2. ▪ A field study has confirmed the absence of any threatened flora/fauna in the proposed well site locations.		
Environmental outcome	Environmental performance standard	Measurement criteria	Records
No significant impact on threatened fauna, their habitat and sites of conservation significance	No unauthorised clearing of vegetation or loss of fauna habitat	▪ Area of known threatened fauna will be sign-posted to avoid impacts on threatened fauna or their habitat. ▪ Permit to work specifies area authorised cleared work areas. ▪ The incident management system shows no incidents of unauthorised clearing. ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling, storage and evaporation of wastewater.	Incident records Environmental sensitivity maps Clearing records (geospatial data) Drone imagery
	No introduction of new or spread of existing WoNS, weed listed under NT Legislation or locally significant weed species	▪ Annual weed survey. ▪ No new WoNS, NT declared weeds species or locally significant weed species identified. ▪ Weed certifications from vehicles, equipment and machinery entering from known weed infestation areas. ▪ Weed hygiene training provided within field inductions.	Weed survey report Incident records Weed declaration certificates Induction and register of participants
	Death or injury of conservation significant fauna will be minimised	▪ Inductions present requirements around the protection of fauna, flora, and their habitat, as well as reporting fauna interactions. ▪ No incidents were recorded in the incident management system of driving off designated roads, access tracks and well sites. ▪ No incidents within the incident management system involving vehicle-related fauna strikes with speeds above 70 km/hr.	Incident records Induction and register of participants
	No uncontrolled fires from drilling activities	▪ The incident management system shows no recorded incidents of uncontrolled fires starting because of drilling activities.	Incident records
	Drilling activities will not encourage pest species	▪ The incident management system shows no records of declared pest species interactions with waste or inappropriate waste storage and handling that encourages vermin access.	Incident records Inspection records

Environmental management strategy: Biodiversity	
Environmental monitoring and reporting	▪ Monitoring as per the Rehabilitation Plan, including visual inspection and photo point monitoring (annual) ▪ Weed survey (annual) ▪ Well site area monitoring and inspections (daily, during operation) ▪ Fire break monitoring (annual) ▪ Fire fuel load/mapping review (annual) ▪ Fauna interactions (as required)
Corrective actions	▪ Reinstatement of firebreaks ▪ Reinstatement of fencing, fauna matting or escape points for protection of fauna ▪ Reinstatement of disturbed areas ▪ Removal of new weed infestations

6.3. Land

<table>
<tr><th colspan="6">Environmental management strategy: Land</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, fencing, land and vegetation management
▪ Well site operations – surface infrastructure, well site containment facilities (bund areas, drilling sump, water storage), conductor casing, hardstand area, rig-up
▪ Well drilling, logging, casing and cementing, pressure testing
▪ Well testing – flaring
▪ Tie-in to gathering network
▪ Rehabilitation
▪ Support activities – chemical storage, drilling fluid, drilling waste, waste management, logistics transport
▪ Accommodation camp</td></tr>
<tr><td>Residual risk</td><td>Medium</td><td>Code of Practice</td><td>A.3.1, A.3.4, C.7.1, C.7.2</td><td>Uncertainty</td><td>A (Low)</td></tr>
<tr><td>Risk</td><td colspan="2">Consequences</td><td colspan="3">Critical controls</td></tr>
<tr><td></td><td colspan="2">▪ Soil/land contamination from:
- loss of containment, including spills and leaks, of drilling fluid or hydrocarbons
- storage, handling, use of fuels, oils and chemicals
- drilling waste handling, storage and treatment/disposal
- waste generation, segregation and disposal
▪ Land disturbance and exposure of soils increasing erosion hazard from movement and use of heavy machinery/earthworks
- wet weather, including flooding and high rainfall events resulting
- loss of soil viability and productivity from soil stockpiling or compaction
- failure of rehabilitation</td><td colspan="3">Engineering
▪ Secondary containment around tanks and chemical storage areas
▪ Lined sumps
▪ Design and construction of drilling sump with 500mm freeboard
▪ Wastewater treated at camp STP
▪ Topsoil stockpile management
Administrative
▪ Well site selection
▪ Spill Management Plan
▪ Wastewater Management Plan
▪ Wet Season Management Plan
▪ Erosion and Sediment Control Plan – well site layouts
▪ Rehabilitation Management Plan
▪ Waste segregation and implementation of waste management hierarchy
▪ Job Hazard Analysis/Permit to work systems
▪ Under balanced drilling
▪ Camp STP and wastewater treatment as per Code of Practice for Wastewater Management
▪ Well site selection</td></tr>
</table>

Environmental management strategy: Land			
		▪ Weed Management Plan ▪ Progressive Rehabilitation and Closure Plan ▪ Fire Management Plan ▪ Waste Management Plan ▪ Spill Management Plan ▪ Erosion and Sediment Control Plan –well site layouts **Monitoring** ▪ Implementation of asset management system ▪ Asset/equipment inspection **PPE** ▪ Spill response kits at work locations	
ALARP and acceptability	Residual risk remains as medium due only to the consequence of soil compaction, which is proposed to be mitigated through the steps outlined in the rehabilitation plan. All other risks associated with land-related matters are considered low. Risks have been reduced to ALARP, and no further risk reduction is warranted as: ▪ Well site selection has been optimised. ▪ A strong historical knowledge of the field and drilling of petroleum wells at Mereenie presents a low level of uncertainty. ▪ Operation of well site in accordance with legislative and best practice guides/codes (refer Section 2). ▪ Operation of drilling waste (cuttings and residual drilling fluid) containment and disposal at site as per the Code. ▪ Camp STP will meet NTG/Australian Standards for the treatment of waste to an acceptable standard for localised irrigation. ▪ The Rehabilitation Plan allows for the management of compacted soils through ripping and rehabilitation of surrounding flora species.		
Environmental outcome	Environmental performance standards	Measurement criteria	Records
No significant long-term impacts on soil stability, soil quality and land formations from drilling activities	Erosion and sediment controls in place, including wet weather response	▪ Records show that erosion and sediment control measures are being implemented. ▪ Records show inspections of erosion and sedimentation issues after daily inspections during the wet season (Oct to Apr) or after significant rainfall events outside wet season (May to September). ▪ Records show all active work sites inspected for evidence of erosion and sedimentation, and that where erosion/sedimentation is identified, remedial actions are taken. ▪ The incident management system shows no incidents relating to the failure of ESCP controls (within the design parameters).	▪ Inspection records ▪ Incident records ▪ Weather records

Environmental management strategy: Land			
		▪ Records show restricted use of roads and tracks to operational safety activities across the field after significant rainfall events (>10 mm in 24 hours)	
	Disturbance of land remains within approved and existing cleared/operational areas	▪ Records show that earthworks and upgrade/project activities remain within previously disturbed/EMP-approved areas. ▪ Records show vehicles and machinery remain within designated areas. ▪ Records show that personnel, visitors and contractors are aware of designated work areas.	▪ Incident records ▪ Induction records ▪ Permit to work records ▪ Drone monitoring
	No releases of contaminants (including wastes, chemicals, chlorides, hydrocarbons or drilling fluids) resulting in long-term contamination of the soil	▪ Records show all spills were remediated immediately on discovery, and where necessary, contamination assessment was undertaken. ▪ The incident management system indicates no incidents of contaminant released related to wet weather operations. ▪ The incident management system indicates no releases from drilling fluids' re-use, recycling, treatment, handling or storage. ▪ The incident management system indicates no long-term impacts due to spills, per the Spill Management Plan. ▪ Records show an Emergency Response Plan implemented in the event of a reportable spill or leak.	▪ Incident records ▪ Soil monitoring results ▪ Inspection records ▪ Wet weather records
	Land no longer required for active operations is stabilised and progressively rehabilitated	▪ Records show full rehabilitation has been initiated for areas no longer required for drilling activities. ▪ Records show progressive rehabilitation has been initiated to reinstate/reduce areas that are no longer required.	▪ Rehabilitation success monitoring ▪ Incident records
Environmental monitoring and reporting	▪ Visual site inspection to ensure appropriate erosion and sediment control measures implemented (civil activities – daily). ▪ Soil contamination assessment incorporating sampling following any recordable/reportable spills or spills outside well site footprints (as required). ▪ Rehabilitation success monitoring – land stabilisation (annual). ▪ Weather and road conditions (daily during the wet season). ▪ Chemical and waste storage areas/tanks or similar (daily).		
Corrective actions	▪ Revisit rehabilitation strategy where revegetation does not meet specified criteria. ▪ Revegetate areas where natural revegetation is not occurring. ▪ Reinstate eroded areas, particularly following wet weather events. ▪ Isolate spill or leak area for at least 100 m in all directions to prevent the spread of spilled product (if the situation requires- i.e. block drains, dam ditches, boom watercourses, close water intakes).		

Environmental management strategy: Land	
	▪ Attempt to collect spilled and ponding hydrocarbon and return product to safe containment. ▪ Stored in waste bins for transport and disposal at an approved disposal facility or treat contaminated soil at the bioremediation pits located near the Mereenie CTP.

6.4. Surface Water

Environmental management strategy: Surface water					
Activities	▪ Civil and project activities – earthworks, fencing, land and vegetation management ▪ Well site operations – surface infrastructure, well site containment facilities (bund areas, drilling sump, water storage), conductor casing, hardstand area, rig-up ▪ Well drilling, logging, casing and cementing, pressure testing ▪ Well testing – flaring ▪ Tie-in to gathering network ▪ Rehabilitation ▪ Support activities – chemical storage, drilling fluid, drilling waste, waste management, logistics transport ▪ Accommodation camp				
Residual risk	Low	Code of Practice	A.3.4, A.3.8, C.3, C.4.1, C.4.2, C.5, C.7.1, C.7.2	Uncertainty	A (Low)
Risk	Consequences		Critical controls		
	Surface water contamination from: ▪ Loss of containment, including spills and leaks, of hydrocarbons, drilling fluids, and wastewater from assets, including during wet weather ▪ Spill or leak from the storage, handling, use of fuels, oils and chemicals ▪ Flooding from significant rainfall events ▪ Earthworks/civil activities, including heavy machinery use ▪ Poor waste handling and disposal		**Engineering** ▪ Secondary containment around tanks and chemical storage areas ▪ Lined sumps ▪ Design and construction of drilling sump with 500mm freeboard ▪ Wastewater treated at camp STP **Administrative** ▪ Well site selection ▪ Spill Management Plan ▪ Wet Season Management Plan Monitoring ▪ Asset management system ▪ Asset/equipment inspection **PPE** ▪ Spill response kits at work locations		

ALARP and acceptability	Risks have been reduced to ALARP, and no further risk reduction is warranted as: ▪ Well site selection has been optimised. ▪ A strong historical knowledge of the field and drilling of petroleum wells presents a low level of uncertainty. ▪ Operation of well site in accordance with legislative and best practice guides/codes. ▪ Operation of drilling waste (cuttings and residual drilling fluid) containment and disposal at site as per the Code. ▪ Camp STP will meet NTG/Australian Standards for the treatment of waste to an acceptable standard for localised irrigation.

Environmental management strategy: Surface water			
Environmental outcome	Environmental performance standards	Measurement criteria	Records
No significant impact on surface water quality from drilling activities	No release of contaminants resulting in long-term contamination of surface waters, including during wet weather operations	▪ Records show all spills were remediated immediately on discovery, and where necessary, contamination assessment was undertaken. ▪ The incident management system indicates no release of contaminant incidents related to storage, handling, use or disposal of chemicals, fuels, and wastes. ▪ The incident management system indicates no release of contaminant incidents related to wet weather operations. ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling or storage of wastewater. ▪ The incident management system indicates no release of contaminant incidents related to a control failure of the Wastewater Management Plan. ▪ The incident management system indicates no long-term impacts due to the failure of the Spill Management Plan. ▪ Records show an Emergency Response Plan implemented in the event of a reportable spill or leak.	▪ Inspection records ▪ Incident records ▪ Chemical register
	Erosion and sediment controls in place	▪ Records show the Erosion/Sediment Control Plan implemented. ▪ Records show all active work site inspected for evidence of erosion and sedimentation, including after significant rain events, and that remedial actions are taken where erosion/sedimentation is identified. ▪ The incident management system shows no incidents relating to the failure of ESCP controls (within the design parameters).	▪ Inspection records ▪ Incident records ▪ Job hazard analysis
	No long-term impacts on surface water from the operation of drilling sump	▪ Records show that the freeboard is maintained. ▪ No incidents of overtopping from drilling sump were recorded within the incident management system. ▪ Records show inspections of integrity are maintained.	▪ Inspection records ▪ Daily production reports ▪ Incident records

		▪ Records show production needs to consider available holding capacity within the drilling sump, particularly during wet weather.	
Environmental monitoring	▪ Water sampling, where available following a recordable/reportable spill, to determine the extent of contamination of surface water and following removal of contamination source (as required as part of recordable/reportable spill response). ▪ Drilling sump: freeboard levels and fauna interactions (daily). ▪ Visual monitoring of erosion and sediment controls (civil activities – daily).		
Environmental management strategy: Surface water			
Corrective actions	▪ Isolate spill or leak area for at least 100 m in all directions to prevent the spread of spilled product (if the situation requires- i.e. block drains, dam ditches, boom watercourses, close water intakes). ▪ Attempt to collect spilled and ponding hydrocarbon and return product to safe containment. ▪ Treat potentially contaminated soil at the bioremediation pits located near the Mereenie CTP. ▪ Review of wet weather procedures and response. ▪ Review of storage and handling practices of contaminants. ▪ Increased awareness and training.		

6.5. Groundwater

<table>
<tr><th colspan="6">Environmental management strategy: Groundwater</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, fencing, land and vegetation management
▪ Well site operations – surface infrastructure, well site containment facilities (bund areas, drilling sump, water storage), conductor casing, hardstand area, rig-up
▪ Well drilling, logging, casing and cementing, pressure testing
▪ Well testing – flaring
▪ Tie-in to gathering network
▪ Rehabilitation
▪ Support activities – chemical storage, drilling fluid, drilling waste, waste management, logistics transport
▪ Accommodation camp</td></tr>
<tr><td>Residual risk</td><td>Medium</td><td>Code of Practice</td><td>B.4.1, B.4.2, B.4.17</td><td>Uncertainty</td><td>A (Low)</td></tr>
<tr><td rowspan="2">Risk</td><td colspan="3">Consequences</td><td colspan="2">Critical controls</td></tr>
<tr><td colspan="3">▪ Contamination of groundwater resources from:
▪ Subsurface loss of contaminants during drilling.
▪ Well integrity failure.
▪ Spill or leak from the use, transportation, treatment, handling and storage of drilling fluids, wastewater, diesel, fuel, oils and chemicals - during the wet season.
▪ Loss of containment from wastewater ponds.
▪ Reduced groundwater availability for the wider community from the use of groundwater resources to support drilling activities.</td><td colspan="2">Engineering
▪ Secondary containment around tanks and chemical storage areas
▪ Lined sumps
▪ Design and construction of drilling sump with 500mm freeboard
▪ Wastewater treated at camp STP
▪ Wells constructed and managed in accordance with DME-approved WOMPs
Administrative
▪ Groundwater extraction licence (M10001)
▪ Asset management system
▪ Implement Emergency Response Plan
▪ Spill Management Plan
▪ Groundwater Monitoring Plan
Monitoring
▪ Asset/equipment inspection
PPE
▪ Spill response kits at work locations</td></tr>
<tr><td>ALARP and acceptability</td><td colspan="5">Residual risk is considered medium due to the serious consequences associated with groundwater impacts. These risks are considered extremely remote; however, they still result in a medium residual risk as a result of the potential consequences. The identified risks have been reduced to ALARP, and no further risk reduction is warranted based on the following:
▪ Well drilling and completion operations will be conducted using extensive best practice controls as outlined in the DME-approved WOMPs for each well. Multiple well barriers are used across aquifers to isolate and protect any aquifers that are encountered.</td></tr>
</table>

Environmental management strategy: Groundwater			
	▪ The depth of the groundwater (more than 100 m) at both well sites also provides additional aquifer protection against contamination from any significant surface-level spills, although it is noted the potential volume is orders of magnitude less than a shale well. In the event of spills occurring at a well site, the potential impact on the soil will be assessed, and any contaminated soils will be removed (and disposed of at an approved facility) or remediated according to the National Environment Protection (Assessment of Site Contamination) Measure Guidelines 2013 (NEPM). ▪ WM31 and WM32 well construction will include 2 strings of cemented steel casing that meet the Code requirements for barrier testing to permanently protect and isolate aquifer(s) that may be present at a well site. ▪ A strong historical knowledge of the field and drilling of petroleum wells presents low uncertainty. ▪ Operation of well site in accordance with legislative and best practice guides/codes (refer Section 2). ▪ Operation of drilling waste (cuttings and residual drilling fluid) containment and disposal at site as per the Code. ▪ Camp STP will meet NTG/Australian Standards for the treatment of waste to an acceptable standard for localised irrigation. ▪ The residual risk has been reduced to the greatest extent possible due to the consequence of impacts on groundwater from subsurface losses remaining as serious if an event did occur. We consider that this risk has been reduced to ALARP, and no further risk reduction is warranted.		
Environmental outcome	Environmental performance standards	Measurement criteria	Records
No significant impact on groundwater quality, levels and availability as a result of activities	No releases of contaminants (wastewater, wastes, chemicals, hydrocarbons or drilling fluids) resulting in long-term contamination of groundwater resources	▪ Records show all spills were remediated immediately on discovery, and where necessary, contamination assessment was undertaken. ▪ The incident management system indicates no incidents of contaminant released related to wet weather operations. ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling or storage of wastewater. ▪ The incident management system indicates no releases of contaminant incidents related to a control failure of the Wastewater Management Plan. ▪ The incident management system indicates no long-term impacts due to spills as per the Spill Management Plan. ▪ Records show an Emergency Response Plan implemented in the event of a reportable spill or leak. ▪ Groundwater Management Plan will be implemented.	▪ Groundwater monitoring results ▪ Incident records

Environmental management strategy: Groundwater			
	Groundwater extraction does not reduce groundwater availability to surrounding users	▪ Records indicate that only existing bores are used to extract groundwater as per the approved groundwater extraction licence (M10001). ▪ Records indicate no exceedance of the groundwater extraction volume approved in the extraction licence.	▪ Water extraction records
	Wells are managed under a Well Operations Management Plan to monitor integrity and potential for impact on groundwater.	▪ Records show that a DME-approved WOMP is implemented for each well. ▪ Records indicate that BOPs and well control equipment are installed, maintained and routinely tested on drilling and completion rigs. ▪ Records of ongoing maintenance, monitoring and testing processes as specified in WOMPs.	▪ Well Barrier Integrity Verification reports ▪ Inspection records ▪ Incident records
Environmental monitoring and reporting	▪ Groundwater monitoring program with results reported annually. ▪ Groundwater extraction volumes as per extraction licence M10001 (quarterly). ▪ Well monitoring, surveillance and reporting as per DME-approved WOMPs. ▪ Calibration of in situ water meter at least once prior to use within the Mereenie Field.		
Corrective actions	▪ Remediate spills and leaks where possible to reduce groundwater impact. ▪ Conduct workover to improve the integrity of wells, thereby reducing the potential for groundwater interaction. ▪ Review opportunities for water reduction across field operations and subsequent groundwater extraction reduction.		

6.6. Air and Noise

<table>
<tr><th colspan="6">Environmental management strategy: Air and noise</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, fencing, land and vegetation management.
▪ Well site operations – surface infrastructure, well site containment facilities (bund areas, drilling sump, water storage), conductor casing, hardstand area, rig-up.
▪ Well drilling, logging, casing and cementing, pressure testing.
▪ Well testing – flaring.
▪ Tie-in to gathering network.
▪ Rehabilitation.
▪ Support activities – chemical storage, drilling fluid, drilling waste, waste management, logistics transport, and accommodation camp.</td></tr>
<tr><td>Residual risk</td><td>Medium</td><td>Code of Practice</td><td>A.3.3, B.4.8, B.4.9, B.4.14 D.5*</td><td>Uncertainty</td><td>A (Low)</td></tr>
<tr><td rowspan="2">Risks</td><td colspan="3">Consequences</td><td colspan="2">Critical controls</td></tr>
<tr><td colspan="3">Release of contaminants to air environment through:
▪ Loss of containment (gas)
▪ Fugitive emissions/leaks from wells, flowlines and processing equipment
▪ Air emissions from the combustion of fuel/gas
▪ Flaring and venting of gas and processing by-products
▪ Emission from the release of chemicals and/or hazardous substances into the atmosphere
▪ Vehicle and heavy machinery movements
▪ Explosion or fire from drilling activities</td><td colspan="2">Engineering
▪ Flaring in designated and restricted areas
▪ Active dust suppression
Administrative
▪ Well site selection
▪ Emergency Response Plan
▪ Methane Emissions Plan/Leak Detection Program
▪ Well Operation Management Plan
▪ Job Hazard Analysis and Permit to Work systems
Monitoring
▪ Asset integrity and maintenance systems</td></tr>
<tr><td>ALARP and acceptability</td><td colspan="5">The Code dictates methane emissions for onshore shale gas fields (Clause D.2). Mereenie is a conventional gas operation but adheres to these requirements as far as practical as outlined in the Methane Emissions Management Plan. The residual risk has been reduced to the greatest extent possible; therefore, we consider this risk ALARP and acceptable.</td></tr>
</table>

Environmental management strategy: Air and noise			
Environmental outcome	Environmental performance standards	Measurement criteria	Records
Drilling's activities do not create a measurable decrease in air quality at sensitive receptors	No release of air contaminants resulting in long-term impact on sensitive receptors	▪ Records indicate regular inspections are conducted in line with Well Operations Management Plan and asset maintenance systems. ▪ Records of inspection identify asset integrity systems and processes that are being implemented. ▪ Records show that safety-critical processes and procedures are in place.	▪ Inspection records ▪ Process/metering records ▪ Incident records ▪ Calibration records
	No fire or explosion from drilling activities	▪ Records show that safety-critical processes and procedures are in place . ▪ Incident management system shows that the Emergency Response Plan is implemented.	▪ Inspection records ▪ Incident records
Greenhouse gas emissions are minimised	Venting to be eliminated as far as reasonably practicable	▪ Incident management system records unplanned venting of gas not related to safety or emergency situations. ▪ Daily reports confirm all technically recovered hydrocarbons sent to the flare are metered and recorded. ▪ Calculation of greenhouse gas emissions in accordance with the NGER Measurement Determination.	▪ Incident records ▪ NGER Report ▪ Venting and flaring records
	All leaks detected and repaired as per the Code	▪ Records show Methane Emissions Management Plan implemented. ▪ The incident management system shows a log of all reported leaks. ▪ Fugitive emissions are accounted for in NGER calculations and reporting.	▪ Incident records ▪ Leak detection records ▪ NGER Report
Environmental monitoring and reporting	▪ Routine testing, inspection and maintenance for assets, including wells, flowlines, and processing plant equipment ▪ Leak detection monitoring program (annual) ▪ Recording of unplanned venting events (as required) ▪ Pressure monitoring of flowlines and MASP (continuous) ▪ Hydrotest monitoring of assets prior to commissioning (as required) ▪ Well head pressure (monthly) ▪ Flaring volumes		

Environmental management strategy: Air and noise	
	▪ Drilling and completions (wells) (daily) ▪ Calibration records for plant/well metering and measurement as per Asset Management System/Measurement Scheme ▪ Calibration of metres used for leak detection prior to use within Mereenie Field ▪ Clean Energy Regulator – National Greenhouse and Energy Reporting Scheme (NGERs) (annual) ▪ Supply of NGERs outcomes to the Northern Territory Government (as requested)
Corrective actions	▪ Repair of leaks. ▪ Implement corrective maintenance via incident and maintenance systems where regular inspections identify potential asset failure.

** The scope of Section D applies only to 'onshore shale gas fields' as specified in Clause D.2 of the Code; Interest holders are working to meet the requirements of Section D of the Code where relevant to our operations.*

6.7. Hazards

<table>
<tr><th colspan="6">Environmental management strategy: Hazards</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, fencing, land and vegetation management
▪ Well site operations – surface infrastructure, well site containment facilities (bund areas, drilling sump, water storage), conductor casing, hardstand area, rig-up
▪ Well drilling, logging, casing and cementing, pressure testing
▪ Well testing – flaring
▪ Tie-in to gathering network
▪ Rehabilitation
▪ Support activities – chemical storage, drilling fluid, drilling waste, waste management, logistics transport
▪ Accommodation camp</td></tr>
<tr><td>Residual risk</td><td>Low</td><td>Code of Practice</td><td>B.4.16</td><td>Uncertainty</td><td>A (Low)</td></tr>
<tr><td>Risk</td><td colspan="2">Consequences</td><td colspan="3">Critical controls</td></tr>
<tr><td></td><td colspan="2">▪ Ignition sources present from drilling activities causing fire and loss of areas/items of cultural significance.
▪ Daily operations activities during or following intense weather events (flooding, wind, lightning).
▪ Naturally Occurring Radioactive Materials (NORMS).</td><td colspan="3">Engineering
▪ Flare pit design (ensure steel-lined and hydrotested)
▪ Vegetation stockpile management
▪ Fire breaks around assets
Administrative
▪ Well site selection
▪ Spill Management Plan
▪ Erosion and Sediment Control Plan
▪ Implement Bushfire Management Plan
▪ Implement Emergency Response Plan/actions
▪ Methane Emissions Management Plan
▪ Wet Season Management Plan
▪ Asset Management System
▪ Waste management hierarchy implementation
PPE
▪ Firefighting equipment available at work locations</td></tr>
</table>

Environmental management strategy: Hazards			
ALARP and acceptability	▪ Based upon the risk being ranked as a low, the controls being assessed as effective, and a scientific uncertainty score outcome of low, the risk is determined to be ALARP and 'acceptable'. ▪ The activities under this EMP have been occurring for over 40 years at Mereenie, and we are experienced with operating in climatic and environmental conditions. Systems and controls are in place to manage operations effectively in the event of natural hazards such as bushfires, wet weather and the occurrence of NORMS. ▪ Fire could spread to culturally significant areas if started by drilling activities. This presents a risk of a serious nature for the loss of culturally significant areas, but through the implementation of control measures outlined within the Bushfire Management Plan we consider that this risk has been reduced to lowest possible and is ALARP and acceptable.		
Environmental outcome	Environmental performance standard	Measurement criteria	Records
Bushfires are not started from the conduct of the regulated activity, and infrastructure is protected from fires started outside of the OL areas	No uncontrolled bushfires caused by drilling activities	▪ The Incident Management System shows no fires resulting from drilling activities. ▪ Records show annual fire scar mapping, annual fire load estimates and maintenance of firebreaks are undertaken. ▪ Records show an Emergency Response Plan implemented in the event of a fire. ▪ Records show emergency response drills are conducted. ▪ Records show weather conditions, including current fire danger, are reviewed as part of pre-start/toolbox/Job Hazard Analysis/Permit to Work processes. ▪ Records show Northern Australia Fire Information (NAFI) fire tracking maps are reviewed daily as part of operations where a high fire danger is present.	▪ Incident records ▪ JHA records ▪ Daily reports
No significant impact on the natural environment from drilling activities in association with weather events	No releases of contaminants resulting in long-term contamination of surface waters	▪ The incident management system indicates no releases of contaminant incidents related to wet weather operations. ▪ Incident management system indicates no incidents relating to the failure of ESCP controls (within design parameters).	▪ Incident records ▪ Post-wet weather inspection records ▪ Daily reports ▪ Inspection records
	Erosion and sediment controls are in place where required and working as designed	▪ Records show ESCP is being implemented. ▪ Incident management system indicates no incidents relating to the failure of ESCP controls (within design parameters). ▪ Weather conditions, including current fire danger, are reviewed as part of pre-start/toolbox/Job Hazard Analysis/Permit to Work Processes.	▪ Incident records ▪ Post-wet weather inspection records ▪ Inspection records

Environmental management strategy: Hazards			
The extraction of subsurface equipment, hydrocarbons and water does not result in human health impacts	No impacts from the presence of NORMs on the environment or human health	▪ Records indicate that NORMS levels are within acceptable limits prior to handling and disposal. ▪ Records show licensed waste contractors are used to move waste materials.	▪ NORMS testing records ▪ Incident records ▪ Waste tracking records
Environmental monitoring and reporting	▪ Monitor long-term and short-term weather forecast (daily) ▪ Measure rainfall (daily) ▪ Inspect firebreaks (annual) ▪ Inspect fire equipment functionality (biannual, prior to high fire danger season) ▪ Monitor freeboard on drilling sump (daily) ▪ Inspect chemical, fuel and oil storage areas at well site daily ▪ Emergency Response Drills (at rig-up and reviewed daily in toolbox meetings during drilling) ▪ Waste tracking (monthly)		
Corrective actions	▪ Maintain capacity in bunds/secondary containment devices ▪ Manage freeboard within drilling waste storage ▪ Replace defective fire equipment ▪ Reinstate fire breaks ▪ Reinstate/repair erosion and sediment control devices		

6.8. Heritage

Environmental performance measures: Heritage					
Activities	Civil and project activities – earthworks, land and vegetation management, site mobilisation/demobilisation, borrow pits Rehabilitation				
Residual risk	Medium	Code of Practice	A.3.1, A.3.7, A.3.5, A.3.8	Uncertainty	A (Low)
Risk	Consequences		Critical controls		
	Loss of heritage values or items of significance from: ▪ disturbance/exposure of heritage sites/artefacts of cultural significance ▪ ignition sources present from drilling activities causing fire and loss of areas/items of cultural significance ▪ unauthorised access to the field by public ▪ unauthorised access to restricted work areas/no-go zones		**Administrative** ▪ Well site selection ▪ SSCC Certificates/CLC permits in place ▪ Site inductions (cultural awareness) ▪ Access to site pre-approved under CLC permit ▪ Activities remain within previously disturbed areas ▪ Implement unexpected finds protocol and ensure works areas avoid known heritage places		
ALARP and acceptability	▪ Activities are not being conducted in the Aboriginal archaeological places and objects or heritage places or objects sensitive areas (exclusion zones), though there is a remote likelihood of disturbance to items or places of significance from operational activities, ranking this as a medium risk. Works remain within previously disturbed areas and are under the permission of CLC (SSCC C2022-046) and AAPA (certificate number 202305946 – C2023/105).				
Environmental outcome	**Environmental performance standard**	**Measurement criteria/monitoring**		**Records**	
No impact to Aboriginal Sacred Sites and no impact on heritage places or objects (including Aboriginal archaeological places or objects).	No non-compliance with AAPA Sacred Site Certificates or CLC permits	▪ The Incident Management System shows no recorded incidents involving non-compliance with AAPA and CLC permits. ▪ Personnel inductions include cultural and heritage awareness, including exclusion zones and unexpected finds procedures.		▪ Incident records ▪ Induction (Heritage and Cultural Awareness) ▪ Reporting to the NT Heritage Branch	
	No unauthorised disturbance of Aboriginal archaeological places/objects and/or Aboriginal Sacred Sites	▪ Incident Management System show no recorded incidents involving damage to known Aboriginal archaeological places/objects and/or Aboriginal Sacred Sites.		▪ Incident Records ▪ Communication with CLC ▪ Reporting to the NT Heritage Branch	

Environmental performance measures: Heritage			
		▪ No impact to heritage places or objects (including Aboriginal archaeological places and objects) without an approved Application to Carry Out Works from the NT Heritage Council.	
Environmental monitoring and reporting	▪ Notify AAPA./CLC of approval and permit breaches as per conditions (as required) ▪ Reporting to the NT Heritage Branch ▪ Review of registers and records (annual)		
Corrective actions	▪ Consult with Traditional Owners/CLC ▪ Consult with the NT Heritage Branch ▪ Investigate incidents and review and revise procedures		

6.9. Community

Environmental management strategy: Community					
Activities	▪ Civil and project activities – site mobilisation/demobilisation ▪ Well operations -surface infrastructure				
Residual risk	Medium	Code of Practice	A.3.1, A.3.7	Uncertainty	A (Low)
Risk	Consequences		Critical controls		
	▪ Ignition sources present from drilling activities causing fire and loss of areas/items of cultural significance. ▪ Increased traffic during works programs. ▪ Increased waste generation impacts regional landfill capacity and disposal of listed wastes.		**Administrative** ▪ Well site selection ▪ All activities remain within approved SSCC and APPA areas ▪ Site induction ▪ Bushfire Management Plan ▪ Methane Emissions Management Plan ▪ Emergency Response Plan ▪ Traffic Management Plan and logistics coordination ▪ Implementation of waste hierarchy in operations and program planning		
ALARP and acceptability	▪ The residual risk is considered medium due only to the serious consequence of a reduction in the productivity of the land. This is considered a remote likelihood of occurring due to the proposed Rehabilitation Plan and success outcomes for rehabilitation. All other risks are considered low. ▪ Based upon the risk being ranked as low, the controls being assessed as effective, and a scientific uncertainty score outcome of low, the risk is determined to be ALARP and 'acceptable'. ▪ The activities under this EMP have been occurring alongside the owners of the land under agreement for over 40 years. The Operator maintains relationships with the community to ensure that the risk of operations remains low and that the protection of social and economic sustainability values remains.				

Environmental management strategy: Community			
Environmental outcome	Environmental performance standard	Measurement criteria	Records
Drilling activities minimise the following: ▪ Reduction in capacity of road infrastructure up to and within Mereenie ▪ Maintain and enhance community relationships ▪ Safety risks to the community	No complaints from stakeholders	▪ Records of approved journey management plans. ▪ Records show Traditional Owners are able to access field in liaison with the Production Supervisor/Person in Charge. ▪ Contact information is provided to local communities and stakeholders to facilitate communication. ▪ No recorded incidents of work being conducted beyond approved operational areas.	▪ Stakeholder communication log ▪ Journey management system ▪ Incident records
	No disturbance to surrounding land uses/access from drilling activities	▪ The incident management system shows no record of complaints regarding surrounding land use, access, amenity, noise or nuisance ▪ No recorded incidents against traffic management plans for drilling activities	▪ Stakeholder communication log ▪ Journey management system ▪ Incident records
	No impact on regional waste resources and services	▪ Records show that only licensed waste contractors are used for waste handling, treatment and/or disposal	▪ Waste tracking register
	Visitors and contractors are aware of environmental requirements	▪ All visitors and contractors are approved for access and inducted according to their visit requirements.	▪ Induction records ▪ Incident records
Environmental monitoring and reporting	▪ Waste tracking (monthly) ▪ Waste storage (weekly) ▪ Community complaints (as required) ▪ Traffic changes (weekly)		
Corrective actions	▪ Drive to conditions on unsealed private and public roads to minimise nuisance and safety risks. ▪ Communicate with Traditional Owners/CLC where incidents occur beyond operational areas. ▪ Investigate incidents and review and revise procedures. ▪ Reinstate areas disturbed beyond approved boundaries.		

6.10. Cumulative Impacts

The Mereenie Field is presently the major onshore-producing gas field in the Northern Territory, located in the remote region of the Amadeus Basin. Together with Palm Valley and Dingo Gas Field, the projected average production over the next 5-year period is 35–40 TJ per day (natural gas) and 140k bbls (oil) per annum. The NT, on average, presently consumes approximately 50 TJ/day of natural gas, and this energy source makes up approximately 85% of NT electricity production [DISER, 2021].

Mereenie Field is comprised of OL4 and OL5 tenement areas (123 km^2 and 158 $km^{2,}$ respectively) and contains a fleet of multiple conventional wells. A total of 73 wells have been drilled in the field and are maintained based on the needs of the field and the domestic market. Wells may be active, shut-in, converted to reinjection wells, suspended or decommissioned. An active ongoing drilling program is required to sustain supply to the NT gas market. The drilling program has been in operation at Mereenie since the field was established in the 1960s. The Mereenie Field drilling program is undertaken to meet the following objectives:

- maximise petroleum production so that the optimum value of the resource is returned to the Territory (*Petroleum Act 1984 [NT])*
- minimise the disturbance footprint and resources required to undertake the activity in accordance with ESD principles (*Environment Protection Act 2019 [NT])*

Safe and reliable production of the hydrocarbon resources present at Mereenie is facilitated via the Mereenie Field Environment Management Plan with the following infrastructure:

- permanent wellhead facilities for producing and suspending wells
- approximately 200 km of flowlines and pipelines
- Central Treatment Plant (CTP) and Eastern Satellite Station (ESS) for processing
- separation, gas dehydration, compression, low-temperature separation and liquid hydrocarbon stabilisation at the CTP and ESS
- water treatment and evaporation ponds at the ESS and CTP
- liquid hydrocarbon storage facilities at the CTP and ESS
- gas reinjection facilities
- roads, access track, water bores, camp, workshops and an airstrip
- export sales receiver to APA gas transmission flowline

Crude oil and condensate produced in the field are transported via road tanker trucks to a third party for customer sale. Formation water is a by-product of oil and gas extraction. Formation water and gas are comingled and flowed via flowlines to the CTP and ESS, where any produced fluids are separated into gas, formation water and oil. Oil and formation water are separated, and the formation water is piped to a solar evaporation pond treatment system for final precipitation. Oil is separated from the formation water and collected to be stored with the oil and condensate before shipping out to the market.

The approved Mereenie Field EMP Rehabilitation Management Plan addresses the rehabilitation of decommissioned areas/wells and the progressive rehabilitation of areas in OL4 and OL5, where the disturbance footprint can be reduced without impacting the daily operations of the area.

The cumulative impacts associated with the proposed construction of 2 additional wells on OL4 have been assessed as low (Table 30). In the event of a successful case at each proposed well, the wells will be commissioned and linked to the existing gas gathering line network for supply to the Central Treatment Plant. The Mereenie Field has been part of the local community since the mid-1980s and has also supported the Traditional Owners through the provision of infrastructure to support their pastoralist activities.

Table 30: Cumulative impacts based on Option B

Aspect	Residual Risk rating*	Summary
Biodiversity	Medium	Both wells are located within OL4, an existing oil and gas field that has been in operation since 1984. No additional land clearing will be undertaken at WM31 and WM32. To reduce the risk to ALARP the following will be implemented: ▪ Monitor and manage vehicle movements to prevent long-term impacts on the local environment. ▪ Best practice weed management to prevent or minimise the risk of weeds spreading between well sites. ▪ Inspect secondary containment (when in use) weekly unless it is being operated through the wet season, during which period it will be monitored daily.
Land	Medium	The following practices will reduce the risk to ALARP: ▪ A strong historical knowledge of the field and the environmental response will limit impacts to land disturbance, erosion and contamination events. ▪ Assets are operated in accordance with legislative and best practice guides/codes.
Surface water	Low	▪ No surface water will be taken, and no surface water extraction licences exist for the area. ▪ No release to surface water is proposed.
Groundwater	Medium	▪ No impacts were identified on surrounding users. ▪ Traditional Owners have full access to water supplies via stock dams and water storage across Mereenie Field. ▪ Water is managed under licence M10001.
Air and noise	Medium	▪ Drilling operations are scheduled to be completed within 60 days at each well. ▪ Air and noise impacts are short-term.
Hazards	Low	▪ The Interest Holder has operated OL4 for over 40 years and is experienced in local climatic and environmental conditions. ▪ Systems and controls are in place to manage operations effectively in the event of natural hazards such as bushfires, wet weather and the occurrence of NORMS.
Heritage	Medium	▪ Activities are not being conducted in the Aboriginal archaeological places and objects or heritage places or objects sensitive areas (exclusion zones). However, there is a remote likelihood of disturbance to items or places of significance from operational activities, ranking this as a low risk. Works are remaining within previously disturbed areas and under permits from CLC and AAPA. ▪ Fire could spread to culturally significant areas if started by the Interest Holder activities. This presents a risk of a serious nature for the loss of culturally significant areas. Still, through the implementation of control measures outlined within the Bushfire Management Plan, the Interest Holder considers that this risk has been reduced to the lowest possible and is ALARP and acceptable.

Aspect	Residual Risk rating*	Summary
Greenhouse gas emissions	Medium	▪ For the 2022 NGER reporting period, greenhouse gas emissions were 56,743 tCO2e. This included a 2 well drilling program that occurred under the NT Drilling Program EMP (EMP CTP3-4). The 2 appraisal wells to be drilled in this regulated activity will have similar emissions. ▪ The GHG emissions from this regulated activity are estimated to be ~4,093 tons CO_2-e, which is <10% of the total estimated Mereenie GHG emissions for 2023. ▪ Production and metering improvements, in addition to leak detection and repair programs, are showing an improvement in emissions. Planned projects, including the installation of a flare gas compressor, will see continued reductions in emissions. ▪ Current emissions levels do not trigger the Northern Territory Government's Large Emitters Policy 2021.
Community – traffic	Low	▪ An additional 20 vehicles per day accessing Mereenie are anticipated during specific work programs such as the well integrity and intervention programs. This is above the current traffic volumes accessing the Mereenie Field for the last 40 years. ▪ Journey Management Planning and personnel awareness through daily pre-start meetings of increased traffic during peak tourist periods and maintaining safety for crews and tourists alike is a priority.
Community – tourism	Low	▪ Tourism activities have worked near Mereenie for the life of the field. With the isolated location of the wells and supporting infrastructure and no other resource or industrial projects in the area, the impacts of activities will be low.
Community – amenity/visual impact	Low	▪ The majority of infrastructure in each field is not visible or accessible.
Rehabilitation – final land use	Medium	▪ Successful rehabilitation depends on the vegetation type, soil type and moisture content in the soil, which, in turn, depends on the timing and amount of rainfall in the region after earthwork restoration commences. ▪ Continued rehabilitation in other parts of the Mereenie Field will work to offset the cumulative impacts of the wells currently operating in the field and the clearing required for WM31 and WM32.

**It should be noted that residual risk ratings align with the highest risk associated with numerous activities under each element. In most cases, medium residual risk ratings are attributed to a single medium residual risk, while all other risks are considered low. In such cases, the corresponding actions detailed in the relevant Management Plan(s) reduce that risk to ALARP.*

7. Management Plans

7.1. Wet Season Management Plan

All activities conducted at the Mereenie Field are conducted on a continuing daily basis, 365 days per year, 24 hours per day. This means that works occur during the wet season. A Wet Season Management Plan (Table 31) has been developed and presented below to address the risks and management measures put in place to ensure operations can continue with little impact on gas production or the environment.

7.2. Erosion and Sediment Control Plan

The Code requires an Erosion and Sediment Control Plan (ESCP) for the activities to be developed by a suitably qualified person in accordance with the relevant guidelines, including IECA Best Practice Guidelines. The detailed ESCP for WM31 and WM32 is detailed in Table 32.

7.3. Weed Management Plan

The Code requires a Weed Management Plan (WMP) to be developed in accordance with the requirements of the NT Weed Management Planning Guideline: Onshore Petroleum Projects. The Weed Management Plan is provided below in Table 33.

7.4. Bushfire Management Plan

The Bushfire Management Plan for the Mereenie Field is provided in Table 34 and has been based on the Bushfire Management Planning Guide: Onshore Petroleum Projects (DENR (now DLPE), 2020) and the Code.

7.5. Rehabilitation Management Plan

The Rehabilitation Management Plan (Table 35) addresses the rehabilitation of decommissioned areas/wells and the progressive rehabilitation of areas where the disturbance footprint can be reduced without impacting the daily operations of the area.

7.6. Wastewater Management Plan

The Wastewater Management Plan (WWMP) is provided in Table 36. The Wastewater Management Plan focuses only on wastewater as per the definition in the Code. The management of sewage and grey water from camp and administration facilities is not covered in the WWMP.

7.7. Spill Management Plan

The Code requires a Spill Management Plan (SMP) that assesses and manages the risks posed by potential spills of waste, wastewater, produced oil or condensate, fluids and any chemicals used or stored as part of petroleum activities and addresses the requirements of the Code is presented in Table 37.

7.8. Methane Emissions Management Plan

The Methane Emissions Management Plan (MEMP) aims to reduce emissions in the gas field via emissions detection and management. Monitoring and measurement are undertaken to quantify and reduce fugitive methane emissions from the activities. The Plan is presented in Table 38.

Table 31: Wet Season Management Plan

Mereenie Appraisal Wells
Wet Season Management Plan 2024

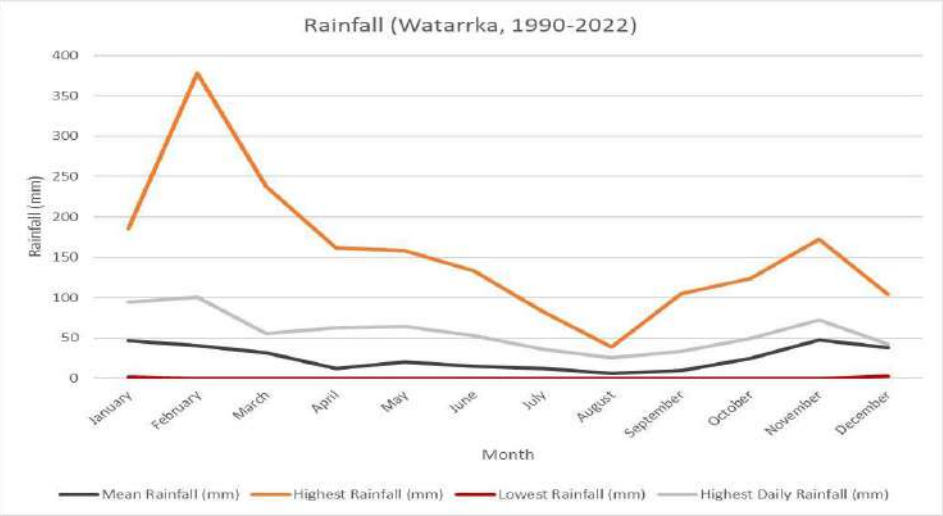
CENTRAL PETROLEUM MEREENIE FIELD	
Property land uses	CP operates the WM31 and WM32 under OL4
Site Description	WM31 and WM32 are located within the existing Mereenie field (OL4)
Wet Season Management Plan	
Purpose	To respond to the risks associated with wet weather on daily operations.
Objectives	Ensure that all drilling activities can continue to be undertaken safely and with minimal risk to the environment during the wet season.

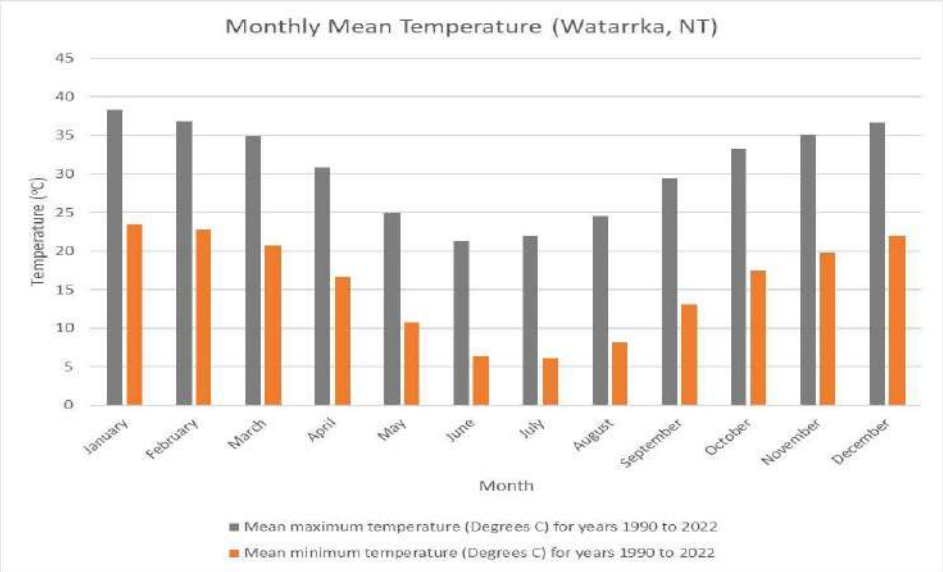
WET SEASON RISKS	
Key Risks	**Controls**
Flooding within the operational areas	• Operations are shut down during significant wet weather or flooding and only restarted once potential for extensive damage has passed. • Following shut down due to flooding or inundation the risk assessment will be revisited to ensure controls are still appropriate to manage risk to ALARP. • All chemicals and hydrocarbons are stored within vehicles or suitable containers to prevent rain ingress and overflows where possible.
Erosion/damage to access tracks and roads	• Any unsealed roads will be inspected daily during the wet season to ensure they are safe for vehicles. • Earthworks will not occur during rainfall events. • Erosion & Sediment Controls will be examined after a significant rain event and repairs.

Clearing during wet season	• Clearing is undertaken:
	  ○ at the start of the wet season after the first intense storms have stopped and before the monsoon arrives
	  ○ or at the end of the wet season, after the monsoon has passed.
	• Minimise time soil is exposed by implementing suitable erosion control ground cover.

Transport of chemicals and wastewater on unsealed roads during the wet season	• Implement a seven-day activity forecast for the duration of the activity during the wet season. • Risk assess transport of chemicals and wastewater on unsealed roads in the wet season on a case by case basis. • Store sufficient volumes of chemicals on site during the wet season to enable drilling to continue, if required. Transport, handling, storage and use of chemicals is to be undertaken in accordance with the Code.

	Plan Owner	Implementation
Contact	HSE Manager	Mereenie Site Supervisor





WET SEASON MONITORING		
Monitoring	**Information location/Action**	**Frequency**
Weather forecast	http://www.bom.gov.au/nt/	Daily
Road conditions	https://roadreport.nt.gov.au/home	Daily during wet season
Internal roads and access tracks	Visual monitoring for erosion	After significant rainfall event

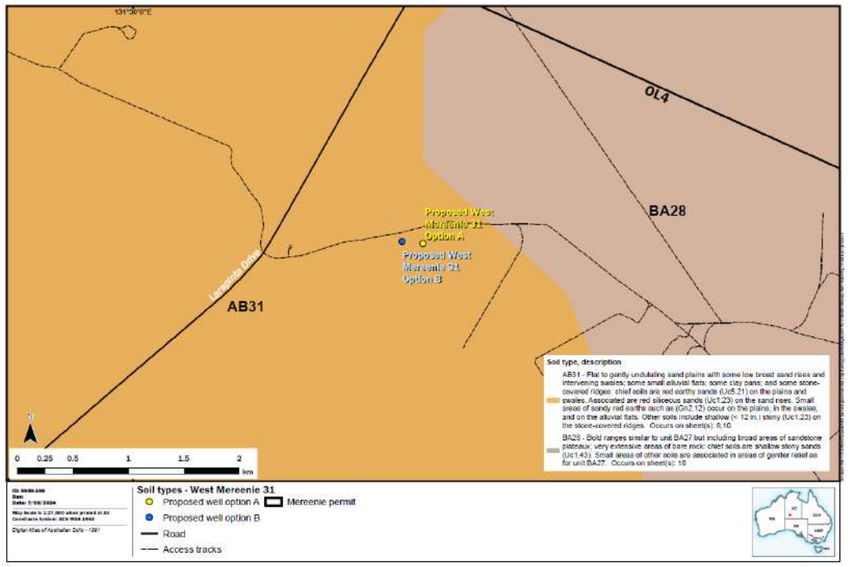
Table 32: Erosion and Sediment Control Plan

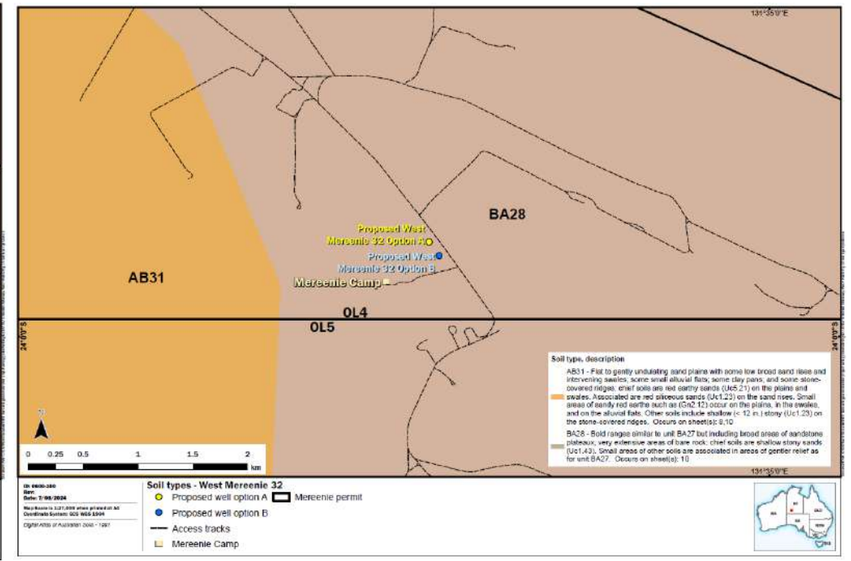
Mereenie Appraisal Wells EMP –
Erosion and Sedimentation Control Plan 2024

	Owner	Field Implementation
ESCP	Central Petroleum's Site Supervisor	Central Petroleum's HS&E Team
Developed By	Aqua Environmental on behalf of Central Petroleum — Anila Biju Cletus RPEQ and Certified Professional Erosion and Sediment Control (CPESC)	

Central Petroleum EP 115	
Property land uses	CP operates the WM31 and WM32 under OL4
Objectives	To minimise land and water impacts in relation to well activities by preventing erosion and controlling sediment discharge.

EROSION AND SEDIMENTATION RISKS	
Key Risks	**Controls**
Arid to semi-arid climate, hot dry summers and cool dry winters with a low average annual rainfall. More rainfall occurs in the summer months associated with monsoonal influences; but the amount of rainfall in the arid zone is highly variable.	
Earthworks	• Install erosion and sediment control structures (e.g. berms, sediment fences) using best practice guidelines by DEPWS and IECA where required • Clear vegetation only within approved and existing disturbance areas • Stockpile top soil separately in low profile mounds • Conduct Job Hazard Analysis for any new task or new use of equipment to identify correct control measures • Encourage surface vegetation where possible • Avoid driving after significant rainfall events • Conduct works during daylight hours • Keep construction operation and level of final constructed surface above 1 in 100 year flooding events • Inspect flowline/pipeline easements regularly for erosion and repair where detected • Carry out earthworks in accordance with CP standards and procedures • Monitor integrity of installed control devices after every significant rainfall events
Movement of heavy machinery and vehicles	• Avoid driving after significant rainfall events • No driving beyond access tracks/well pads • Personnel access to the facility and any site/area by permit approved by the CLC
Significant rainfall events	• Operations are shut down during significant wet weather or flooding and only restarted once potential for extensive damage has passed. • Following shut down due to flooding or inundation the risk assessment will be revisited to ensure controls are still appropriate to manage risk to ALARP. • After a rain event any unsealed roads will be inspected to ensure they are safe for vehicles. ▪ Earthworks will not occur during rainfall events. • Erosion & Sediment Controls will be examined after a significant rain event and repairs undertaken if required.





EROSION AND SEDIMENTATION MONITORING PROGRAM			
Mitigation Measure	**Measurement Criteria**	**Monitoring frequency**	**Record**
Access track	• Rehabilitate existing sections of the track exhibiting erosion issues. • Reprofile to prevent concentration of sheet flow. • Install erosion controls to redirect water from the track. • Install erosion controls upstream to reduce erosion and lower water velocities in some locations. • No windrows. • No work during wet weather events.	• Visual inspections of affected areas to ensure that a stable landform is being maintained. • Inspections after significant rainfall events (e.g., greater than 15mm in 24hrs). • Drone footage and photographic images will be recorded prior to and post program.	Rehabilitation report: • Area of disturbed land available for rehabilitation at the start of the reporting period • Area of disturbance that occurred during the reporting period • Area where rehabilitation commenced during the reporting period • Area of disturbed land (if any) remaining to be rehabilitated at the end of the reporting period • Drone and photographic monitoring point GPS locations and results of monitoring undertaken during the reporting period • Monitoring of progressive rehabilitation, including flora type and density, fauna activity and soil stability • Any erosion and sedimentation issues • Any stakeholder consultations and results of discussions related to rehabilitation • Any issues that may affect the rehabilitation success factors and remedial actions taken or required to be undertaken to allow the success factor to be realised • Monitoring of contaminated sites (if any) • Weed monitoring
Well pad	• Install erosion controls to redirect water from the well pad. • Install erosion controls upstream to reduce erosion and lower water velocities in some locations. • No work during wet weather events		
Flowline easement	• Reprofile to prevent concentration of sheet flow. • Install erosion controls to redirect water from the track. • Install erosion controls upstream to reduce erosion and lower water velocities in some locations. • Ensure breaks in windrows. • No work during wet weather events		

LIKELY IMPACTED AREAS	
Disturbance areas	• Existing track • Well pad • Flowline easements

Land Systems					
Land System	**Description**	**Geology**	**Topography**	**Soils**	**Erosion Hazard**
Gillen	Sandstone strike ridges and intervening valleys in the southern part of the Mereenie Field	Sandstone mountains with mulga or witchetty bush country	• Partially dissected erosional weathered land surface • Relief up to 500ft	Shallow stony gravelly soils and red clayey sands	Moderate erosion hazard
Simpson	Desert Dunefields	• Spinifex-covered sand dunes. • Dunefields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes. • Variable relief. • Associated swales in between dunes. • Red sands on dunes and a variety of soil types in swales- such as red clayey sands, red earths, and calcareous earths.	Sand dunes of varying height and alignment, up to a maximum of 70ft in the Simpson Desert section	Red sands to red clayey sands and locally red earths	• Low risk from drilling activities. • Primary risk is from rainfall over the survey location.

TYPICAL EROSION AND SEDIMENTATION CONTROL DEVICES*		
Type	**Use**	**Example**
Fibre rolls	• Fibre rolls consist of small-diameter, biodegradable straw/coir-filled logs. • Can be used as check dams in wide, shallow drains so long as the logs can be anchored to prevent movement. • Best used in locations where it is desirable to allow the log to integrate into the vegetation, such as in vegetated channels.	
Cross ban (whoa boy) drainage	• Divert water off tracks • Collect and divert sheet flow off roads and tracks	
Devices will be as per the design standards of *IECA Best Practice Erosion and Sediment Control Guidelines Source: *Erosion and Sediment Control- A Field Guide for Construction Site Managers, Version 5, 2012, Catchments & Creeks Pty Ltd*		

Table 33: Weed Management Plan

Mereenie Appraisal Wells
Weed Management Plan 2024

	Contact Details	Name
Dedicated weed officer	EcOz Environmental Consultants, on behalf of CP	Tom Reilly
Developed by	EcOz Environmental Consultants	

CENTRAL PETROLEUM MEREENIE FIELD	
Property land uses	CP operates the WM31 and WM32 under OL4
Site Description	The Mereenie field is an oil and gas field located west of Alice Springs in a remote part of the Northern Territory. These wells will add to the existing field which commenced production in the 1984.

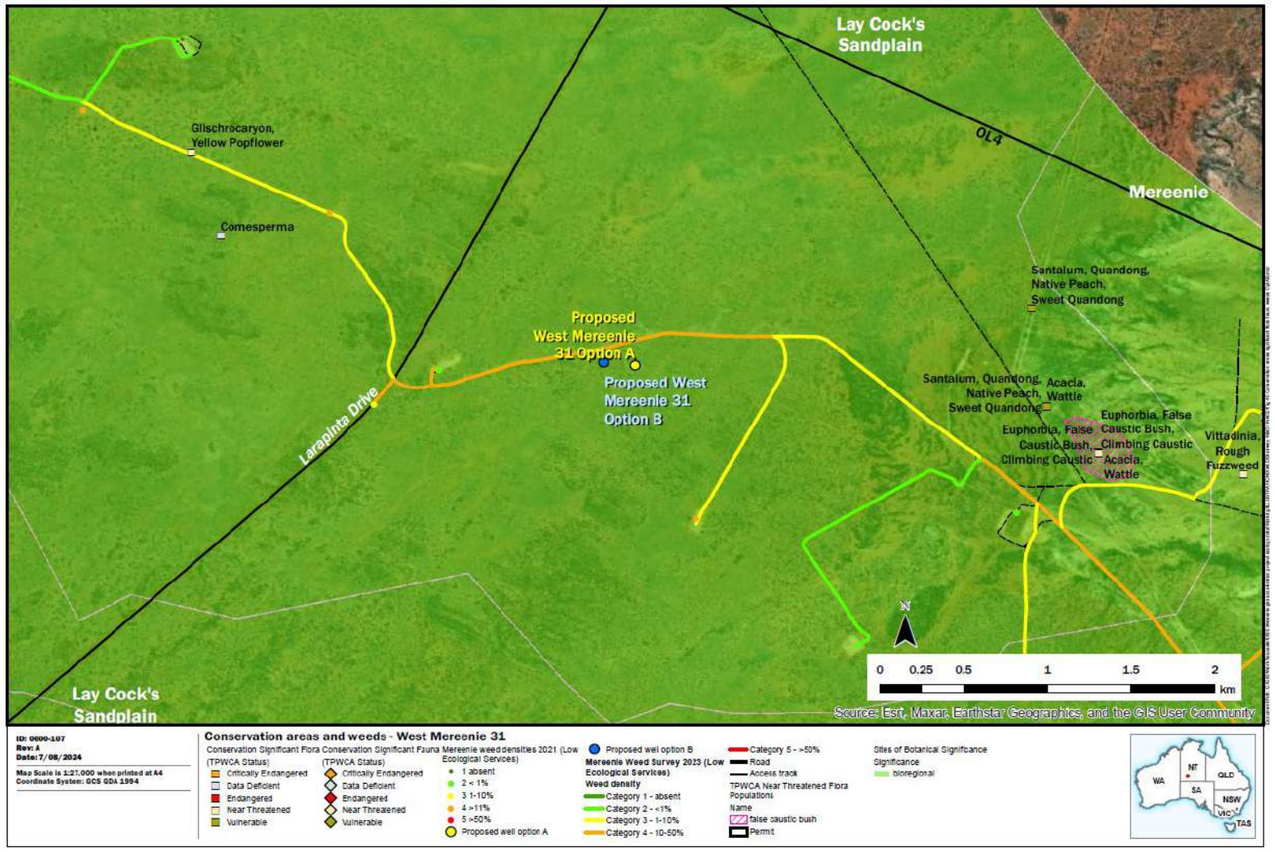
Weeds Management Plan	
Purpose	To prevent and control new and existing weed species within the operating licence areas.
Objectives	To prevent weeds through the following process steps: 1. Identification 2. Prevention 3. Control 4. Disposal

NOTIFICATION, RECORDING AND REPORTING	
Aspect	**Action**
Notification	• Notify the Weed Management Branch within 48 hours of the discovery of a new declared weed species (i.e., not previously identified in weed surveys or recorded in the NR Maps system) within the drilling locations. • Initial notification will be by telephone with follow up written notification provided within seven (7) working days. • Written notification is to include a preliminary species identification and location (easting and northing).
Recording	• Weed surveys is undertaken by the Weeds Officer. • Data on weed distribution will be maintained in CP's geographical information system and be provided to the NT government as part of the annual report on performance against the WMP, or when requested by the Weeds Management Branch.
Reporting	• A report on the performance against this WMP will be submitted to DEPWS as part of EMP reporting .

RISKS AND MANAGEMENT CONTROLS	
Key Risks	**Management Controls**
Machinery and equipment from weed infested locations – potential for introduction and spread of weeds	• Machinery wash down prior to entering site. • If coming from known weed-infested areas or interstate, vehicles should have a weed-free certificate issued. • Compulsory site inductions provided to all personnel, contractors, and visitors prior to entering the site.
Spread of weeds due to driving vehicles and trucks along tracks	• Machinery washdown prior to entering and after leaving the site. • Location of weeds reported to dedicated weed officer when observed by workers. • Avoid driving through areas of high infestation to low infestation where possible.
Insufficient survey effort Weeds present on site not identified during survey	• Case of NTG spatial data sets to find areas of weed infestations within close proximity to the site. • Completion of a site survey prior to commencing work in new areas.

MANAGEMENT PROCESS			
Process Step	**Objective**	**Actions**	**Frequency**
Weed Identification	Weed species and area of infestation are identified and monitored	• Weed surveys undertaken annually by dedicated weed officer • Photograph weed species identified (and/or areas of infestation recorded with GIS and mapped) • Report to the CP HSE Team and included within weed survey report • Weed survey findings used to determine control programs in consultation with CP or suitable contractors • CP site staff to be trained in identification of weeds, particularly Declared Weeds and WoNS. CP staff should familiarise themselves with declared weeds that have potential to enter the site (e.g. Athel pine)	• Weed survey, as determined by dedicated weed officer
Weed prevention	No new declared weeds, WoNS or environmental weed individuals or infestations	• Vehicles and/or equipment coming from an area with Declared Weeds should be cleaned and obtain a weed free • certificate from qualified personnel before entry • If areas containing weeds are accessed, clean all equipment and machinery. Wash or blow down vehicles to prevent • transfer of weeds to uncontaminated areas • No unnecessary clearing to minimise ground disturbance • Road grading in areas of weeds should start from the outside of the infestation towards the centre of the infestation • No off-road driving • Monitor operational areas and 'hotspots' continually • Report weed sightings to the dedicated weed officer ·	Ongoing as part of activities
Weed Control	Existing weeds are controlled using effective methods Personnel and infrastructure are protected from increased fire risk due to weed infestations No spread of weeds No new weed species present	• Use the correct control and/or removal method selected by trained personnel/contractor based on species present and extent of infestation • Plan a rapid response to seasonal changes to maximise the effectiveness of control activities • Engage local traditional owners, rangers or contractors to assist with mechanical and chemical control of weed species at the site • CP staff will also undertake weed control when they are available during normal operations • Control activities are mapped using the same methods as undertaken in past surveys undertaken by CP to ensure consistent capture of information. This will enable the dedicated weed officer to be more aware of the spread or containment of existing weeds and the effectiveness of weed control	Control/removal scheduled to occur prior to weed seeding where practicable - timing with seasons and predicted rainfall (Usually Nov-March)
	Weed control methods result in no environmental harm	• Only suitably trained personnel will use chemicals and herbicides, in accordance with CP's chemical handling and storage procedures • Relevant stakeholders will be consulted prior to chemical herbicide being used • Assess areas outside of operational areas prior to weed control to identify conservation-listed flora. • Ensure non-target conservation-listed species are not impacted by weed control • Minimise drift by spraying on low-wind days • No use of residual herbicide pellets within 2-3 canopy diameters of trees or shrubs • Follow-up surveys will refine the impacts of weed removal of the potential for future vegetation re-growth	During weed control activities as part of operational procedures Prior to weed control in areas outside of operational area.
Disposal of weeds and chemicals	Weeds disposed of in environmentally friendly manner No further weed spread from disposal Correct disposal of chemical containers	• Weed plant material (leaves, seeds, flowers, branches etc.) that are physically removed will be buried on site • It is illegal to transport declared weeds. If declared weeds enter the site, these should be buried on site at a depth sufficient to prevent emergence of seeds or seedlings • Chemical containers disposed of correctly e.g. disposed/recycled via drumMuster initiative	On completion of weed control activities
Reporting	Compliance with NTG requirements	• Annual update provided to DEPWS to include weed control activities, updated locations of weed spread.	Annual survey report provided to DEPWS

IDENTIFIED WEEDS SPECIES			
Common Name	**Scientific Name**	**Image**	**Description**
Buffel grass	*Cenchrus ciliaris*		• Long lived dense tussock grass with deep tap-root system up to 1m tall. Stalks are tough and branched with swollen bases. Leaves are produced at the basal and higher nodes. Rhizomes up to 0.5 m long. • Flower- varies in colour from straw to purple. Long cylindrical, dense, spike-like, 2.5–15 cm long. Leaves- blueish-green, hairy with pointed tips, flat or folded. Seed heads- Dense, hairy, cylindrical spike up to 15 cm long and 2 cm wide. Seeds enclosed in a cluster of bristles, giving 'fluffy' appearance.
Gomphrena Weed	*Gomphrena celosiodes*		• Prostrate and mat-forming to ascending or erect 7 -30 cm tall Leaves narrowly oblong to oblong-elliptic or oblanceolate. Papery white flower heads.
Spiked Malvastrum	*Malvastrum americanum*		• Erect, annual, or short-lived perennial herb to 1m tall. Most parts with short, scattered, stellate hairs, dense on young growth. • Leaves ovate to lanceolate. Flowers in a dense terminal spike, yellow to orangish yellow. Can produce root suckers
Caltrop	*Tribulus terrestris*		• A low-lying, hairy herb or vine with yellow, five-petalled flowers that form sharp spiny burrs. • It has a long, slender, branched, woody taproot and many fibrous laterals that extend up to 2,600 mm deep.
Ruby dock	*Acetosa vesi-caria*		• A short-lived plant with numerous upright stems that are hollow and slightly fleshy. • Leaves are slightly fleshy, triangular, arrow-shaped or sometimes heart-shaped. • Its flowers are initially quite inconspicuous and borne in upright branched clusters at the tips of the stems. • Its very conspicuous immature fruit are inflated or bladdery in nature and range from pink to bright red or purplish in colour. • Its mature fruit are papery and pale brown or dark brown in colour.



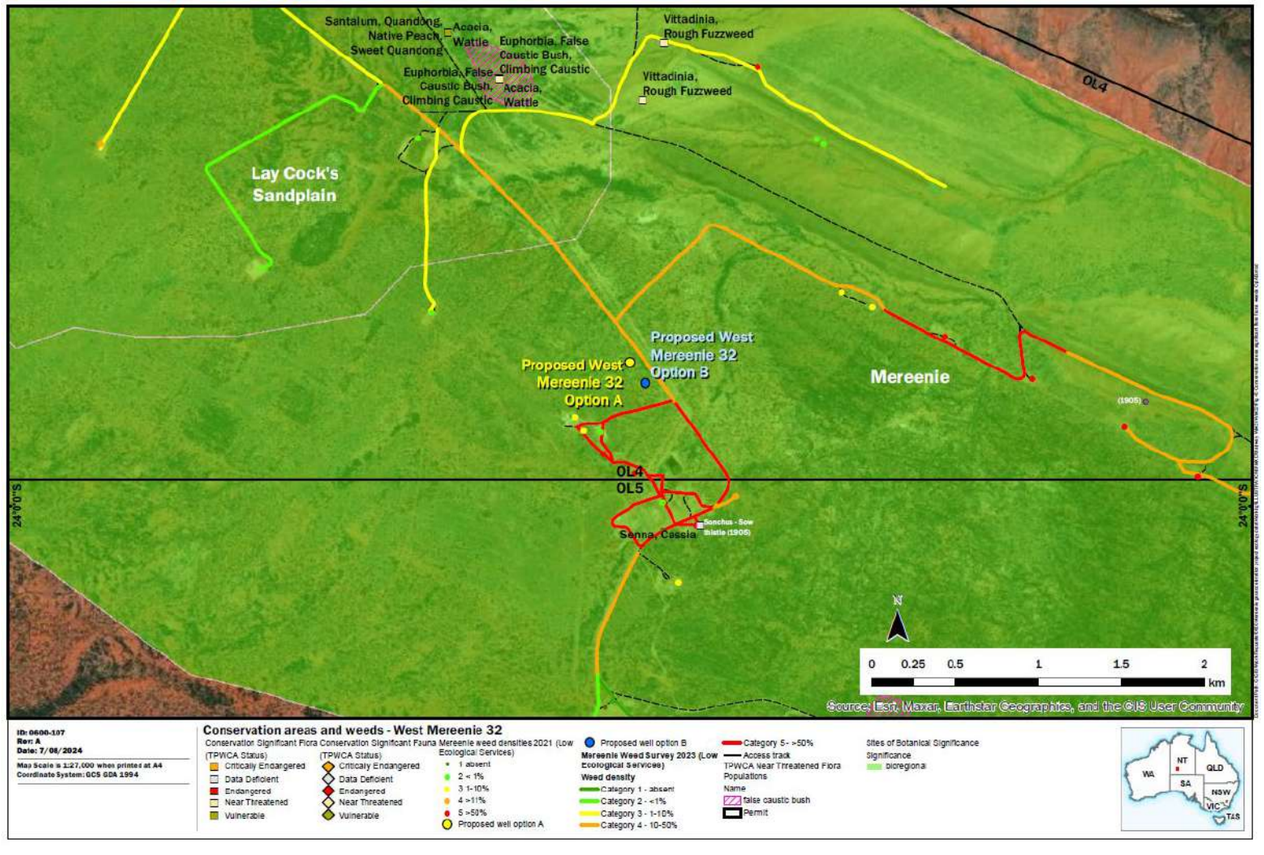


Table 34: Bushfire Management Plan

Mereenie Appraisal Wells EMP –
Bushfire Management Plan 2024

Central Petroleum Mereenie Field	
Property land uses	CP operates the WM31 and WM32 wells under OL4
NT Fire Management Zone	Alice Springs
NT Fire Protection Zone	OL4 is not located within a NT Fire Protection Zone
Aim	To minimise the potential and impact of fires from CPs activities to people, environment, culturally significant sites, public infrastructure and community lands.
Objectives	Minimise the risk of causing bushfires from CP's activities and to prevent accidental fire risk and ensure safe storage of chemicals
Plan Owner	Risk and HSE Manager

	Contact Details	Name
Bushfire Officer	Onsite Company Representative	TBD upon contractor selection

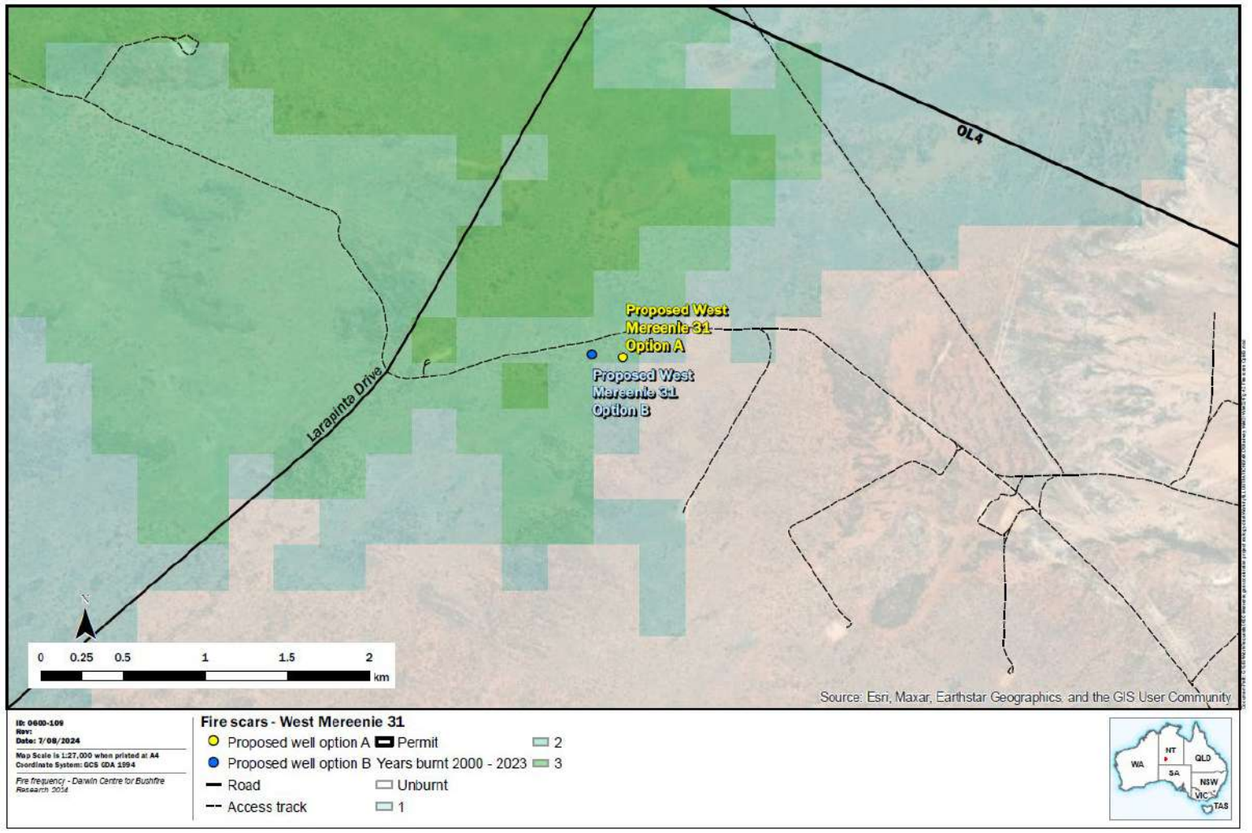
Stakeholders	Contact Details
Emergency	000 0r 112 from mobile
Bushfire NT	08 8922 0840 (head office) 088952 3066 (Alice Spring) Bushfires.nt@nt.gov.au
NAFI	www.firenorth.org.au/nafi3/
Bureau of Meteorology	www.bom.gov.au
NT Fire Incident Map	www.pfes.nt.gov.au/incidentmap/
Secure NT	securent.nt.gov.au/alerts
Central Land Council	08 8951 6211
Haasts Bluff Aboriginal Land Trust	08 8962 2343

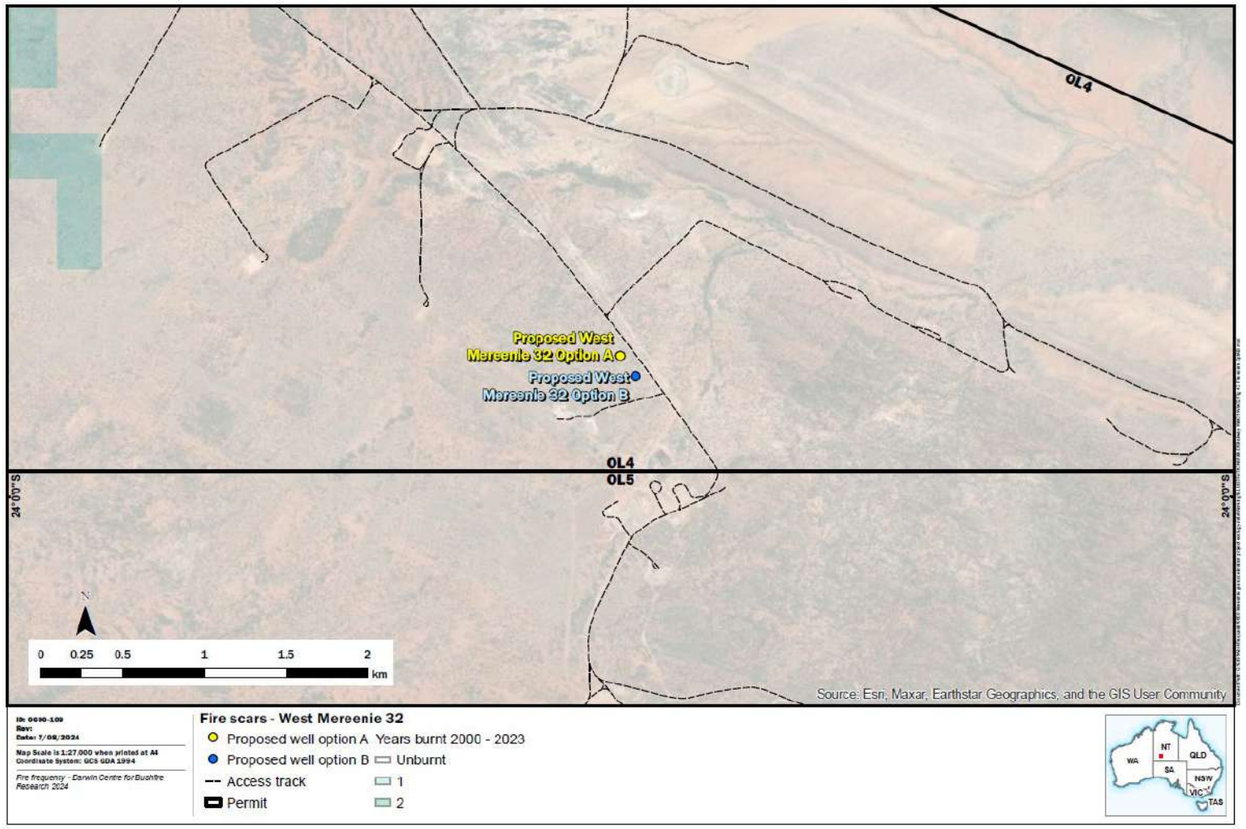
BUSHFIRE MANAGEMENT ACTIONS	
Activity	**Management Controls**
Drilling program	• Fire extinguishers to be available within vehicles • Designated smoking areas provided • Ignition sources to be managed • Onsite risk assessment to be conducted each day • No open fires permitted
General	• Staff members responsible for managing bushfire risk to be competent in the role they perform • Daily monitoring for fire alerts to be undertaken • Emergency response plans to include response requirements for fires • Inductions to include bushfire risks, hazardous zones, controls, and emergency response procedures • Storage of chemicals to be in accordance with the relevant Australian Standards • Sufficient water to be available onsite to enable CP to provide an initial response to an accidental fire • If unable to control fire notify Bushfires NT and properties where spread is likely to go

BUSHFIRE ALERTS	
Advice	Areas which have either a small fire which is controllable, planned fuel reduction burning or an area likely to be affected by smoke
Watch and Act	An area that has a bushfire approaching a community, changing with conditions or will threaten property or life if not controlled
Emergency Warning	An area that is in immediate danger from the bushfire and you must act now to protect your life
BUSHFIRE RESPONSE—ERP	
Actions	
Move Away	• Move yourself and others away from danger
Raise Alarm	• Raise alarm on field radio UHF Channel 1 / SOS alarm on tracker / phone • Notify emergency services • Activate alarms and muster, as required
Gather Information	• Fire location • Wind direction • Wind strength • Size of fire • Type of fire • Any injured/missing personnel
Mobilise SERT	• Mobilise Site Emergency Response Team (SERT) if additional resources are needed • Control bushfire if it is within the site boundaries • If fire breaks are crossed, the SERT leader shall review what plant must be shut down or additional fire breaks be prepared
Notify	• Neighbours in surrounding properties
Monitor	• Weather information • Wind direction • Local fire information/NAFI • Road condition reports
Record and Report	• All fire incidents, near misses and potential hazards are logged through • CPs incident reporting system for further investigation and initiating corrective actions

SEASONAL BUSHFIRE RISK CALENDAR			
Month	**Bushfire risk**	**Month**	**Bushfire risk**
Jan	**High**	**Jul**	**Low**
Feb	**High**	**Aug**	**Low**
Mar	**High**	**Sep**	**Low**
Apr	**Medium**	**Oct**	**Medium**
May	**Medium**	**Nov**	**Medium**
June	**Low**	**Dec**	**High**

FIRE DANGER RATINGS	
Rating	**Trigger points**
No rating	• Minimal risk
Moderate	• Plan and prepare • Stay up to date and be ready to act if there is a fire
High	• There is a heightened risk. Be alert for fires in your area • Decide what you do if a fire starts • If a fire starts, life and property may be at risk • Avoid bush fire risk areas • Check if fire danger period is in force
Extreme	• These are dangerous fire conditions • Check the bush fire plan and that the property is fire ready If a fire starts, take immediate action. • If not prepared to the highest level, go to a safer location well before the fire arrives • Reconsider travel through bush fire risk areas • Check if fire ban is in force
Catastrophic	• These are the most dangerous conditions for a fire • Your life may depend on the decisions you make, even before there is a fire. • Stay safe by going to a safer location early in the morning or the night before. • Homes cannot withstand fires in these conditions. • You may not be able to leave and help may not be available • Check if fire ban is in force





FIRE HISTORY ANALYSIS (2000—2022)	
Activity	**Management Controls**
WM31	• There were no years in which the land was detected as being burnt
WM32	• There were two years in which the land was detected as being burnt. • Fire scars were, however, noted recently in November 2023.

Table 35: Rehabilitation Management Plan

Mereenie Appraisal Wells

Rehabilitation Management Plan 2024

Location of the Mereenie Field	
Property land uses	CP operates the WM31 and WM32 under OL4
Climate	In general, OL4 experience an arid to semi-arid climate, which is characterised by hot dry summers and cool dry winters with a low average annual rainfall. Typically, more rainfall occurs in the summer months associated with monsoonal influences; however, the amount of rainfall in the arid zone has a history of being highly variable.
Site Description (pre-disturbance)	WM31 and WM32 have the following land systems: • Gillen — Sandstone strike ridges and intervening valleys in the southern part of the Mereenie Field • Simpson — Sandstone plateaus, eroded and dissected, forming margins to the southeast part of the Mereenie Field

Environmental Strategies and timing		
Activity	**Strategies**	**Timing**
Analogue sites	Identify appropriate analogue sites for each of the disturbance areas	After the first wet season in conjunction with the first monitoring event
Land use	• The disturbed areas will be returned to the original land use.	Commence post drilling activities (To commence ASAP or no longer than 12 months following cessation of activities)
Soil Stability	Remove any flow concentration points that may block overland sheet flow Re-instate natural drainage channels (i.e. removal of bunds and structures that temporarily altered flow paths) Return soil profile with topsoil replaced as final layer where possible Ensure all cleared areas have a rough surface to aid in water, seed and litter catchment Erosion and sedimentation devices installed and maintained	Commence post drilling activities (To commence ASAP or no longer than 12 months following cessation of activities)
Contaminated soil	Undertake remediation of contaminated soil in accordance with spill management plan / emergency response plan	Remediation of contamination to be undertaken immediately.
Revegetation	Revegetation of disturbed areas is undertaken post soil stability. Where possible natural regeneration of areas will be promoted. If there is limited materials to promote regeneration then seeding a cover crop may be used to assist in soil stability until pioneer species emerge. Where natural regeneration requires assistance seeding of native plants will be undertaken.	Commence post drilling activities (To commence ASAP or no longer than 12 months following cessation of activities)
Monitoring	All monitoring to be undertaken by a suitably qualified person and in accordance with this Plan	Refer to the rehabilitation measurement criteria and monitoring program

CP Rehabilitation Officers	Contact Details	Name
	EcOz Environmental Consultants / Central Petroleum Environmental Specialist	**Tom Reilly**—Lead Consultant, Central Australia (16 years ecological experience in Central Australian plant, animal identification, ecological assessment and restoration) **Stuart Lyman**—Central Environmental Specialist (16 years environmental management experience including environmental offset calculation, implementation and management)

Rehabilitation Objectives	Actions for successful Rehabilitation
The objectives of this rehabilitation management plan are to: • Minimise disturbance as far as reasonable practicable • Progressively rehabilitate significantly disturbed land which is not required for ongoing activities • Return all disturbed areas to a safe and stable landform as close as possible to the surrounding environment • Ensure significantly disturbed land is re-established to its pre-disturbed condition and land use • No residual contamination • No land management issues for future land managers.	Prior to and during operations, activities are undertaken to improve the success of rehabilitation these include: • Utilisation of a multi-criteria assessment (inclusive of rehabilitation objectives) to select a preferred location • Completion of pre-disturbance surveys • Preparation of maps defining boundaries of different rehabilitation management areas or zones and infrastructure • Topsoil is stockpiled onsite around the edges of the lease in low profile mounds (<2m) to preserve the biological activity • Vegetation stockpiled separately on the edge of the lease preserved for seed bank, habitat and erosion protection • Erosion and sediment devices are put in place as per the ESCP • All wastes managed per the EMP • Weed management plan implemented.

Rehabilitation Risks	
Key Risks	**Controls**
Drought — impacting the establishment of rehabilitated vegetation	• Time rehabilitation actions to coincide with the beginning of the wet season, to ensure access to the site and maximise the establishment period of vegetation over the wet season • Re-spread topsoil across the site to utilise the local seed bank • Ongoing monitoring to identify if further seed inputs are required • Collection of seed from the local area to ensure seed stock is suited to the climatic conditions of the site.
Fire—impacting revegetation	• Establish a mix of perennial and annual grass species • Ongoing monitoring to determine fire impacts on revegetation. • Ongoing monitoring to determine if further seed inputs are required
Grazing —impacting revegetation	• Establish a mix of perennial and annual grass species • Re-spread timber with top soil • Ongoing monitoring to determine grazing impacts on revegetation. • Ongoing monitoring to determine if further seed inputs are required • Ongoing monitoring to determine if fencing is required
Lack of topsoil and soil inversion—impacting rehabilitation success	• Soils are to be returned to pre-disturbance soil profiles • Topsoil spread over the entire lease evenly. • Topsoil may need to be made or brought in if there is a lack of topsoil
Exposed Ground — leading to an increase in weed establishment and/or erosion	• Remove windrows and topsoils • Respread of topsoil and vegetated matter across the site • Annual weed surveys of rehabilitated area once rehabilitation is established Control of any weed incursions

Seasonal Rehabilitation Calendar					
Mo	**Season**	**Activities**	**Mo**	**Season**	**Activities**
Jan	**Wet**	• Revegetation • Broadcasting seeds • Collection of seeds	**Jul**	**Dry**	• Decommission and remove non-essential infrastructure • Install ESC for new infrastructure • Establish analogue sites for new infrastructure
Feb	**Wet**	• Revegetation • Broadcasting seeds • Collection of seeds	**Aug**	**Dry**	• Decommission and remove non-essential infrastructure • Install ESC for new infrastructure • Establish analogue sites for new infrastructure
Mar	**Wet**	• Revegetation • Broadcasting seeds • Collection of seeds	**Sep**	**Dry**	• Decommission and remove non-essential infrastructure • Install ESC for new infrastructure Establish analogue sites for new infrastructure
Apr	**Wet**	• Repair ESC controls • Weeds survey and management • Collection of seeds	**Oct**	**Dry**	• Decommission and remove non-essential infrastructure • Install ESC for new infrastructure • Establish analogue sites for new infrastructure • Prepare rehabilitation areas for wet season
May	**Wet**	• Repair ESC controls • Weeds survey and management • Collection of seeds • Complete rehabilitation annual monitoring	**Nov**	**Transition**	• Check ESC controls • Prepare rehabilitation areas for wet season
June	**Transition**	• Repair ESC controls • Monitor and prepare for bushfires	**Dec**	**Wet**	• Revegetation • Broadcasting seeds • Collection of seeds

Decommissioning and Rehabilitation Process		
Asset	**Specific activities to the asset**	**General activities across all assets**
Lease pad and well-head	• All decommissioning activities will be conducted in accordance with the Code compliant and accepted WIMP and WOMPs for each well. • The wellhead is removed, the casing cut per the Code of Practice: Surface cement plug detailed in B.4.15.3: Cement plug requirements and validation methods. A steel marker plate installed to identify the well and details per the Code of Practice.	• Any imported gravel material is removed and returned to the source quarry or utilised elsewhere on CP operational sites • The site is re-contoured as close as possible to the pre-existing natural landscape • Hardstand is deep ripped to relieve compaction, encourage infiltration and water retention • Topsoil is respread evenly over the lease area and lightly scarified to encourage moisture retention and seed capture • Vegetation is respread over the lease, this acts as erosion control, provides habitat and promotes natural revegetation • Any weeds or invasive species are managed per the weed management plan during the rehabilitation process • Temporary erosion and sediment controls to support the rehabilitation designed and installed where required • All waste removed from site • If natural revegetation success is low, seeding may be required, this will be assessed through the monitoring program.
Sumps	• Remove the contents of the sump to a licenced facility (on-site or offsite) • Fill in the void utilising stockpiled materials	
Pipelines (aboveground)	• Aboveground steel pipelines are recycled • Cement pilings for aboveground pipelines are recycled or disposed of • properly	
Camps (contracted)	• All services are blinded and left safe or removed • Sewage treatment facility is removed • Temporary fence around the irrigation area removed • Camp units are removed	

CP Rehabilitation Officer	Contact Details	Name
	EcOz Environmental Consultants / Central Petroleum Environmental Specialist	**Tom Reilly**—Lead Consultant, Central Australia (16 years ecological experience in Central Australian plant, animal identification, ecological assessment and restoration) **Stuart Lyman**—Central Environmental Specialist (16 years environmental management experience including environmental offset calculation, implementation and management)

Acceptability Criteria				Annual Monitoring Program			Corrective Actions
Rehabilitation Outcome	**Endpoint(s) / Performance Standards**	**Measurement Criteria**	**Rational**	**Frequency**	**Proposed Methodology (adaptive depending on seasonal conditions)**	**Rational**	
• The vegetation composition (e.g. type, density and maturity) of the rehabilitation is recognisable as the target vegetation community and indistinguishable from the surroundings. • The vegetation structure of the rehabilitation is recognisable as, or is trending to- wards the target plant community. • No adverse erosion	• Dominant species in analogue sites are represented in rehabilitated areas • Community structure is substantially the same as the analogue site/s groundcover, shrubs and trees • Perennials have established, stabilising soils and reducing erosion potential • Habitat structures and habitat quality are substantially similar to analogue sites, creating connection to the adjacent landform and vegetation allowing for fauna re-use of the site • Completely stable (or in dynamic systems such as dunal landforms, same degree of stability as surrounding terrain)	• Ground cover - 70% foliage cover and density of the analogue site • Perennial Cover- recruitment of woody perennial species achieves 70% of the analogue site • Plant species richness and abundance achieves 70% of the analogue site • Compliance with weed management strategies under the Northern Territory Weeds Management Act • 50% of the organic litter and coarse woody debris of the analogue site • No evidence of soil subsidence and <2% erosion across the site (qualitative – photo evidence of scar- ring, rill/sheet erosion)	• Cover equivalent to 70% of the analogue site/s is likely to self-sustain over time and rehabilitated areas become ecologically integrated with surrounding areas • Species richness shows the rehabilitation site is able to support the full complement of species from analogue sites, even if not all species are yet at the same abundance, noting that in an arid environment, species such as spinifex grow extremely slowly • In arid regions soil stability is critical for the success of rehabilitation	• Annually, commencing after the first wet season, and noting the following: • The Amadeus Basin is located in an arid region and establishment of vegetation generally is slower than areas with higher rainfall. Therefore, it is unlikely that quantitative assessments will provide meaningful data to determine rehabilitation success in years 1, 2 and 3 • In year 1 the analogue sites will be set up, the photo monitoring points will be established and the permanent woody species transect will be established. The site will be assessed for stability and any weed issues. • 2 and 3, if there is no evidence of vegetation regeneration but the sites appear to be stable, and free from erosive forces or fire effects, a visual assessment only of cover and structure will be made. • In year 4, and year 5 monitoring against endpoints will be undertaken. An adaptive approach will be taken year on year for the monitoring. A suitably qualified person may adapt the monitoring based on the seasonal conditions (i.e the wet season). This will be documented in the annual rehabilitation report. • Post 5 years the EMP will need to be updated and the data collected will be used to update the new rehabilitation plan.	**Year 1** • 2 or more analogue sites in nearby undisturbed vegetation community and landforms as per the analogue definition and selected by a suitably qualified person • Establish permanent 100x4m woody species transects • Establish photo monitoring and collect photos • Record any weather events during the period Check for subsidence across the rehabilitated area • Assess the % of erosion across the rehabilitated area. • Check for any loss of topsoil through erosion and map areas of concern • Check for soil inversion issues and map areas of concern • Weed Survey **Year 2 and Year 3** • Check for integrity of works and ability for future rehabilitation success • Record any weather events during the period • Photo monitoring • Check for subsidence across the rehabilitated area • Assess the % of erosion across the rehabilitated area. • Check for any loss of topsoil through erosion and map areas of concern • Check for soil inversion issues and map areas of concern • Weed survey **Year 4** • Woody species transects from the permanent 100x4m • Collect 1x1 m ground cover quadrants every 10m along a transect. Transect to be randomly selected • Photo monitoring collected • Record any weather events during the period • Check for subsidence across the rehabilitated area • Assess the % of erosion across the rehabilitated area. • Check for any loss of topsoil through erosion and map areas of concern • Check for soil inversion issues and map areas of concern • Weed survey **Year 5** • Woody species transects from the permanent 100x4m • Collect 1x1 m ground cover quadrants every 10m along a transect. Transect to be randomly selected • Photo monitoring collected • Record any weather events during the period • Check for subsidence across the rehabilitated area • Assess the % of erosion across the rehabilitated area. • Check for any loss of topsoil through erosion and map areas of concern	• As per the Code of Practice A3.9 (b) the rehabilitation plan should be appropriate to the scale and nature of the activity. In CPs experience operating in the Amadeus Basin, which is an arid region the establishment of vegetation takes time. In CP experience it takes 10+ years for sites to reach the rehabilitation outcomes. The rehabilitation plan has been developed to meet the scale and nature of the rehabilitation (i.e. size of the disturbance and the time to rehabilitation). • As per the Code of Practice A3.9 (e) Regular maintenance and at least yearly monitoring of rehabilitated areas must take place to measure compliance with the Rehabilitation Plan. Rehabilitation success relies on good site preparation and rainfall and an adaptive approach for monitoring is required to take in the seasonal conditions. This will rely on a suitably qualified person to assess the seasonal variations and match the appropriate monitoring to undertake each year. This could include the use of technical advances like drones, satellites, remote sensing and lidar to assess the site stability and vegetation cover. • The quantitative data is of significant value as the rehabilitation matures and reaches the acceptability criteria. In addition, the year on year growth in an arid environment is slow and therefore yearly monitoring of all parameters is not necessary. The key is to assess if the site is on the right trajectory to achieve the acceptability criteria, which aligns with the adaptive management approach. and vegetation cover. • The quantitative data is of significant value as the rehabilitation matures and reaches the acceptability criteria. In addition, the year on year growth in an arid environment is slow and therefore yearly monitoring of all parameters is not necessary. The key is to assess if the site is on the right trajectory to achieve the acceptability criteria, which aligns with the adaptive management approach.	• Weeds impacting revegetation success – implement the weed management plan Pest species impacting the rehabilitation success – Identify the pest species and put in place measures to protect the rehabilitated areas (e.g. fencing) • Poor vegetation germination/re-growth is limited in richness/ or community structure inconsistent with the analogue site – Infill seeding and/or top dress with a soil additive/topsoil or fertilise • Erosion and sediment control remediation of failed erosion and sediment controls • Review the re-profiling of the site to address any stabilisation issues. Undertake earthworks for re-profiling as necessary

Table 36: Wastewater Management Plan

Mereenie Appraisal Wells
Wastewater Management Plan 2024

WWMP Owner	Drilling & Completions Manager
CENTRAL PETROLEUM WM 29 & WM30	
Property land uses	WM31 and WM32 are located in Central Petroleum's OL4 petroleum lease
Site Description	The Mereenie field is an oil and gas field located west of Alice Springs in a remote part of the Northern Territory. These wells will add to the existing field which commenced production in the 1984.
Wastewater Management Plan	
Purpose	To manage the wastewater to minimise environmental risks and impacts
Objectives	To manage wastewater in the following hierarchy: 1. Avoid: Eliminate or substitute an activity that results in wastewater 2. Reduce: lower the generation of wastewater as part of a process or activity 3. Reuse: beneficial re-use of wastewater for another purpose without treatment, or with minimal treatment 4. Recycle – recover resources from a waste 5. Treat: bring wastewater back into use through treatment to improve water quality or to make quality suitable for disposal 6. Dispose

ESTIMATED WASTEWATER QUANTITY AND QUALITY

Wastewater Type	Estimated Quantity (ML)/ well	Expected Quality
Civil	0.075	• pH range 6-10.5 • EC < 20,000 µS/cm • Chloride < 8,000 mg/L • Metals - As per COP: Onshore Petroleum
Drilling	1.5	
Hydrotest	0.1	• As per source water quality

1 IN 1000(0.1%) YEAR AEP FOR RAINFALL INTENSITY AT MEREENIE

Location	0.1% AEP Rainfall	Rainfall (mm)
Mereenie	90 day	500

The sumps will be designed to contain the volume of the 1:1000 ARI 90 day rainfall event. The 1 in 1000 (0.1%) year AEP for a 90 day rainfall event based on the Watarrka station data (WATARRKA 015652). The inlet structure to the sump will be designed to convey the 1:1000 ARI 1hr event to allow intense peak discharge to enter the structure without overflow.

The equivalent highly conservative (P10%) evaporation estimate occurring over the same 90-day period is 340 mm, resulting in a calculated freeboard requirement (maximum 90-day potential cumulative net depth increase) of 160 mm, should such an extreme event occur. A 500m freeboard will be maintained, providing a conservative buffer to prevent over-topping within evaporation ponds.

WASTEWATER MANAGEMENT HEIRARCHY

Wastewater Type	Avoid	Reduce	Reuse	Recycle	Treat	Dispose
Drill Fluid	• Non aqueous drilling mud will not be used. • Air / mist drilling also to be Performed	Recycle fluids as much as possible - reduces consumption of additives and production of waste	• Transfer recycled fluids between wells where applicable. • Treat fluid to avoid bacteria and prolong operational lifespan	• Recycle fluids as much as feasible with available solids control equipment	Not possible	At the end of the campaign, drilling fluids will be evaporated in the sump and mix buried covered if it meets the criteria for burial
Cuttings	Not possible	Mud weights designed for gauge wellbore. This will minimise excess cuttings	Not possible	Not possible	Separate fluids from cuttings as much as possible to maximise recycling of fluid	At the end of the campaign, completion fluids will be evaporated in the sump and mix buried covered if it meets the criteria for burial
Completion Fluid	Not possible	Volumes required are the minimum to safely allow the completion to proceed	Not possible	Not possible	Not possible	At the end of the campaign, completion fluids will be evaporated in the sump and mix buried covered if it meets the criteria for burial
Hydrotest Water	Not possible	Volumes required for the test are the minimum to allow the test to be performed	At completion of the hydrotest, hydrotest water will be tested prior to use for irrigation for progressive rehabilitation or dust suppression	Not possible	Not possible	If hydrotest water is not suitable for irrigation or dust suppression or not needed it will be either: • evaporated in the flare pit or • the evaporation ponds at Mereenie and Palm Valley Fields will be used to dispose the it

WASTEWATER RISKS

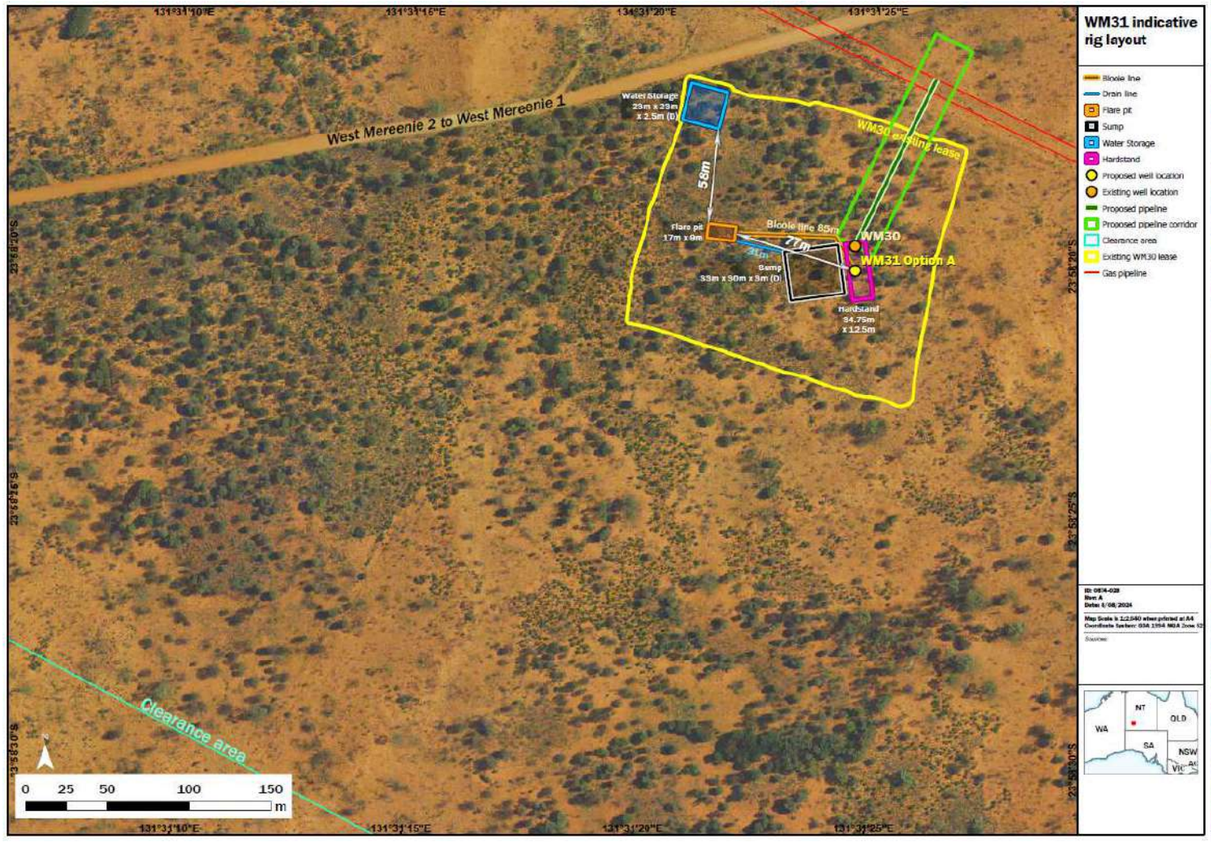
Key Risks	Controls
Spill or leak from the use, transportation, treatment, handling and storage of, drilling/completions/hydrotest fluids and wastewater	• Store liquid wastes (other than drilling/completion fluids) in a secured container within a bunded area • Monitor sumps/tanks daily or once per 12 hour shift • Promptly repair drips and leaks • Transport hazardous material within the NT by a licensed NT EPA contractor • Where applicable, place pumps, tanks and transfer lines within suitably bunded areas

Loss of containment (including spills, leaks or seepage), including during wet season	• Maintain freeboard of 500mm
	• Asset integrity management system which includes:
	  ○ Leaks/spills inspections and repairs when detected
	  ○ Check and maintain fittings and equipment
	  ○ Report spills, leaks or points of excessive wear, for maintenance and repairs
	• Provide portable spill containment equipment and response (e.g. spill trays) where appropriate

Loss of containment from sump	• Lined sump • Daily monitoring of minimum freeboard—500mm • Daily monitoring of inflows from drilling campaign
Fauna death or injury	• Limit fauna interaction through installation of fencing to prevent large fauna access • Installation of temporary fencing at wellsite work area including drilling sump, flare pit and water storages • Installation of a fence around the well when there is no drilling rig on lease • Temporary fencing for an STP effluent irrigation area at the campsite clearance area • Fauna egress matting provided for each sump • Visual monitoring for evidence of fauna access

WASTEWATER MONITORING PROGRAM AND RECORDS				
Type	**Requirements**	**Frequency**	**Parameters**	**Records**
Cuttings	• Radioactivity to determine if the waste is classified under the Radiation Protection Act 2004 (NT) • Testing to classify the waste • Provide cutting sampling results to the regulator prior to disposal	• Quantity – Prior to disposal • Quality - every major source rock interval	• Naturally occurring radioactive materials (NORMs) • Schedule 2, Waste Management and Pollution Control (Administration) Regulations 1998 (NT)	• Details of licensed waste transporters (if transported offsite for disposal)
		• Prior to decision on disposal method	• Leachability (as per AS4439.2 and 44396.3 and CoP C.4.1.2 (e))	• Quantity of cuttings
Stored water	• Measure groundwater volume extracted from bores via flowmeter • Measure groundwater quality from bores • Third party supplied water – volume and quality to be supplied by provider	**From Bore** • Volume – as extracted • Quality – minimum one sample prior to use **Third party supplied** • Prior to delivery	**From Bore** • Volume • Quality – as per Table 6 of the Code **Third party supplied** • As required by supplier	• Groundwater volume extracted • Groundwater quality analysis data • Third party supplied water – volume and quality
Drilling /completion fluid	• Measure quantity • Measure quality	• Prior to disposal • Available freeboard of sump, daily	• Volume • Available freeboard of sump	• Wastewater volumes / quality generated during drilling If wastewater to be transported and disposed of offsite • Wastewater volume spilled (as required) • Wastewater tracking are to be reported to the Minister annually
Rig tanks capacity / integrity	• Analysis of available freeboard within the tank • Visual inspection of integrity of tank	• Every time wastewater is transferred • Daily during drilling • Monthly or after significant rainfall event until rehabilitated	• Volume available freeboard of sump • Tank integrity visual inspections • Available freeboard	• Wastewater volumes / quality transferred to tanks • Tank integrity visual inspections including freeboard availability • Wastewater tracking is to be reported to the Minister annually
Wildlife / stock / human interactions	• Inspect control measures at sumps	• Daily	• Sump has fauna egress escapes • Flare pit – temporary fencing intact or fauna egress escapes	• Number of wildlife/stock interactions

OPTION A



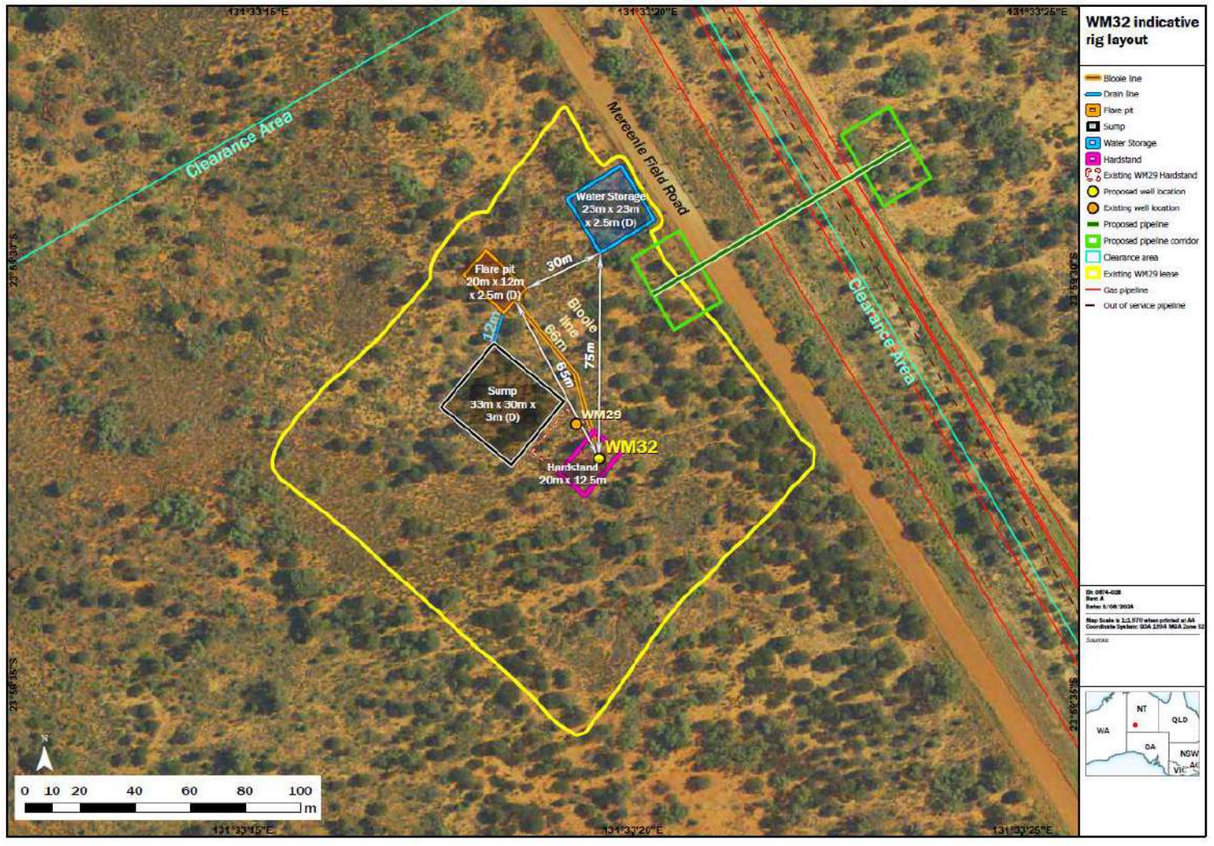


Table 37: Spill Management Plan

Mereenie Appraisal Wells
Spill Management Plan 2024

SPILL RISKS	
Key Risks	**Controls**
Contamination of groundwater **Contamination of surface waters**	• All chemicals, hazardous substances and dangerous goods stored in bunded areas • Drill sump to be lined • Chemical mixing area and drilling fluid tanks will be surrounded by a drain that terminates in the lined drill sump • Spill kits are available where hazardous materials are used and personnel trained in their correct use • Any spills will be addressed immediately
Contamination of soil	• Undertake remediation of contaminated soil in accordance with spill management plan / emergency response plan • Remediation of contamination to be undertaken immediately

Product Name	Hazardous Substance	Estimated Quantity (kg) / well	Unit Size (kg)	Storage Location
Mica (F)	No	872	22.7	Well site
Nuosept 78*	Yes	25	25	Well site
Sodium bicarbonate	No	500	25	Well site
GELPLEX (bentonite)	No	28,330	22.7	Well site
SAFE SCAV NA	Yes	25	25	Well site
SAFE-COR	Yes	189	189	Well site
Defoam A25	Yes	640	20	Well site
Polypac UL	Yes	1000	25	Well site
Platinum foam plus	Yes	1,363	18.9	Well site
Barite	No	220,500	1500	Well site
Form-A-Blok	No	1,746	9	Well lease
Kwik seal (M)	No	872	22.7	Well lease
Losseal max	No	454	22.7	Well lease
M-I-X II coarse	No	872	22.7	Well lease
Nut plug (F)	No	872	22.7	Well lease
Nut plug (M)	No	872	22.7	Well lease
Caustic soda*	Yes	525	25	Well lease
Citric acid	Yes	500	25	Well lease
FLO-PLEX	No	3,675	25	Well lease
Safe-carb 250	No	1,317	22.7	Well lease
Safe-carb 40	No	1,308	22.7	Well lease
Soda ash*	No	700	25	Well lease
Potassium chloride	No	875	25	Well lease
SAPP (Sodium Acid Pyrophosphate)	Yes	500	25	Well lease
DRILPLEX	Yes	2,825	11.3	Well lease
Hydraulic oil*	Yes	200L	5-20L	Portable storage trailer
Engine oil	Yes	200L	5-20L	Portable storage trailer
Transmission oil	Yes	200L	5-20L	Portable storage trailer
Coolant	Yes	200L	5-20L	Portable storage trailer
Degreasers	Yes	100L	5-20L	Portable storage trailer
Diesel*	Yes	110–550KL	110KL tank	Well site – tank

* Denotes chemicals that *MAY* cause environmental harm if released to the environment (generally aquatic environments). Oils and fuels are considered low risk as these will be within machinery or stored bunded areas and corrosive chemicals (e.g. caustic soda) will be diluted to levels which will not be harmful and when stored will be in bunded areas.

CENTRAL PETROLEUM WM31 & WM32	
Property land uses	CP operates the WM31 and WM32 under OL4
Aim	To minimise the potential impact of spills from CPs activities to people, environment, culturally significant sites, public infrastructure and community lands.
Objectives	Operate with due care to prevent loss of containment, ensure safe storage and handling of potentially contaminating substances and undertaking effective spill clean-up

PILL SCENARIOS AND MANAGEMENT

Activity	Activity Duration	Mechanism	Location	Type / Quality	Approximate	Key Management Control
Chemical storage	Drilling	• Container rupture • Lids / taps not fitted • Spill during chemical handling and mixing	• Portable chemical storage trailer • Well lease	• · General use chemicals (e.g. oil, diesel, hydraulic • oils degreasers) as per SDS • · Well drilling chemicals · Well drilling fluids	IBCs (1,000L)	• Daily visual checks of the chemical storage area • Secondary containment / bunding • Remove materials that escape primary containment or are otherwise spilled onto secondary containment as soon as possible • Spill kits available • Minimise quantity of chemicals at well site
Containment of wastewater within sumps and/or flarepits	Drilling	• Loss of containment of wastewater within sumps or flarepit • Failure of base of flarepit • Failure of liner in sump	• Within sump • Within flarepit • Well lease	• General use chemicals (e.g. oil, diesel, hydraulic oils degreasers) as per SDS • Well drilling chemicals • Well drilling fluids	~0.18ML (180,000L)	• Ensure sumps are double lined with HDPE liners • Ensure flarepit is steel lined and hydrotested • Ensure daily checks of sumps and flarepits - monitoring freeboard levels, volumes of wastewater generated and evaporated • Remove materials that escape primary containment or are otherwise spilled onto secondary containment as soon as possible • Ensure any containment failures are rectified immediately—prior to work recommencing.
Handling / mixing of chemicals	Drilling	• Poor handling / mixing practices • Poor transfer into tanks • Overtopping of tanks	• Portable chemical storage trailer • Well lease	• General use chemicals (e.g. oil, diesel, hydraulic • oils degreasers, pesticides) as per SDS • Well drilling chemicals • Well drilling fluids	IBCs (1,000L)	• Handling / mixing performed by a competent person • Visual assessment during mixing / transfers • Daily visual checks of the chemical storage and loading areas • Compacted lease and work areas • Temporary HDPE inflatable bunds (or similar) are utilised for secondary containment. • Spill kits available • Remove materials that escape primary containment or are otherwise spilled onto secondary containment as soon as possible
Truck and / or rig refuelling	Drilling	• Incorrect refuelling set-up • Poor refuelling practices	• Rig fuel tanks	• General use chemicals (e.g. oil, diesel, hydraulic • oils degreasers, pesticides) as per SDS • Well drilling chemicals	100L	• Operators maintain visual contact whilst re-fuelling • Spill kits available • Remove materials that escape primary containment or are otherwise spilled onto secondary containment as soon as possible
Chemical transportation to / from location outside of OL4	Drilling	• Incorrect storage • Incorrect loading / unloading technique • Traffic incident	• Vehicle	• General use chemicals (e.g. oil, diesel, hydraulic • oils degreasers, pesticides) as per SDS • Well drilling chemicals	100—200L Traffic incident— up to 20,000kg	• Visual assessment during loading and unloading • Spill kits available • Emergency response in the event of a traffic incident • Remove materials that escape primary containment or are otherwise spilled onto secondary containment as soon as possible
Chemical transfers between tanks and rigs on the well lease	Drilling	• Coupling, hosing and pipe failures	• Chemical loading area • Pipework	• General use chemicals (e.g. oil, diesel, hydraulic oils degreasers) as per SDS • Well drilling chemicals • Well drilling fluids	100L	• Real time monitoring of tank volumes • Daily visual checks during activities • Well lease compacted • Spill kits available • Remove materials that escape primary containment or are other- wise spilled onto secondary containment as soon as possible
Storage of drilling fluid in tanks on the well lease	Drilling	• Container rupture • Lids / taps not fitted correctly	• Drilling fluid tanks	• Well drilling fluids	Mud tanks volume is ~100,000L	• Remove materials that escape primary containment or are other- wise spilled onto secondary containment as soon as possible • Compacted well lease
Transfer of produced formation water from the wellhead to evaporation ponds at the CTP via truck	Drilling	• Coupling, hosing and pipe failures	• Truck	• Produced formation water	Up to 10,000L	• Remove materials that escape primary containment or are other- wise spilled onto secondary containment as soon as possible • Compacted well lease

Mereenie Appraisal Wells

Spill Management Plan 2024

Page 2

SPILL RESPONSE Actions		

Stop		• Request assistance if needed
		• Ensure all personnel are safe and clear of area -Stay clear of vapour, fumes, smoke and spills
		• Evacuate and muster (if necessary)
		• If safe to do so:
		  ○ Remove any potential escalation factors (e.g. ignition sources etc)
		  ○ Isolate the spill source
		• For larger incidents, emergency services may be mobilised to assist under the Emergency Response Plan (ERP)

Contain		• Review SDS • If safe to do so, contain the spill using containment resources • Distribute spill control and absorbent material around and over the entire spill area, working from the outside to inside
Report		• Report the spill and notify as per spill incident reporting requirements • Gather as much information about the spill as you can including spill source and location, type of waste/chemical, spill area, volume released • Notify neighbours in surrounding properties if required under the ERP

Clean-up		• Remove/clean-up spill as soon as possible
		• Clean-up the spill using clean-up equipment (e.g. spill kit materials etc) by:
		  ○ Recover free liquid
		  ○ Remove contaminated material and store in the waste storage area
		• Dispose clean-up materials at licenced waste disposal facility
		• If clean-up takes longer than one day, use fencing to prevent access by personnel, livestock, and terrestrial fauna
		• Develop a remediation management plan for contaminated sites
		• Store contaminated soils in waste bins for transport and disposal at an approved disposal facility or treat at the bio-remediation pits located near the Mereenie CTP

Manage / Improve		• Investigate the root cause of the spill and implement management actions

Definitions of Environmental Harm under the NT Petroleum Act 1984

Increasing Severity of Impact

Environmental Harm	Any harm to or adverse effect on the environment, or any potential harm (including the risk of harm and future harm) to or potential adverse effect on the environment, of any degree or duration and includes environmental nuisance Environmental nuisance, in relation to land, means an adverse effect on the amenity of the land caused by noise, smoke, dust, fumes or odour, or (b) an unsightly or offensive condition on the land
Material Environmental Harm	Environmental harm that is not trivial or negligible in nature, or consists of an environmental nuisance of a high impact or on a wide scale, or results, or is likely to result, in not more than $50,000 being spent in taking appropriate action to prevent or minimise the environmental harm or rehabilitate the environment, or results in actual or potential loss or damage to the value of not more than $50, 000
Serious Environmental Harm	Environmental harm that is more serious than material environmental harm and includes environmental harm that is irreversible or otherwise of a high impact or on a wide scale, or damages an aspect of the environment that is of a high conservation value, high cultural value or high community value or is of special significance, or results or is likely to result in more than $50,000 being spent in taking appropriate action to prevent or minimise the environmental harm or rehabilitate the environment, or results in actual or potential loss or damage to the value of more than $50 000

Recordable Incident **(refer to full definition below)**	• ERP not triggered
	• Quarterly recordable incident report— Recordable and Reportable Incident Reporting for Onshore Petroleum Activities Guideline , DEPWS, 28 October 2021
	• Incident report should contain the following:
	  ○ the name of chemical (and relevant SDS)
	  ○ the volume spilled
	  ○ the location of the spill and likely impact on sensitive receptors a timeline of the events
	  ○ weather conditions at the time of the spill and a forecast of future weather conditions
	  ○ the actual consequence of the spill event

Reportable Incident **(refer to full definition below)**	• Potential for or has caused environmental harm, material environmental harm or serios environmental harm • ERP triggered • Reportable incident—As soon as practicable but not later than 2 hours after the incident first occurred or at the time the interest holder became aware of the reportable incident • DEPWS can be notified via 1800 413 567 • Any verbal report to DEPWS must be followed up by a written report from the Project Manager within 24 hours • Initial report (in writing) to be provided as soon as practicable but not later than 3 days after the reportable incident first occurs • Interim reports (in writing) to b e provided at least every 90 days, starting on the day on which the initial report was given • Final report (in writing) to be provided no later than 30 days after clean up or rehabilitation of affected area

Types of Incidents*

Recordable Incident — an incident arising from a regulated activity that:

- has resulted in an environmental impact or environmental risk not specified in the current plan for the activity; or
- has resulted in a contravention of an environmental performance standard specified in the current plan for the activity; or
- is inconsistent with an environmental outcome specified in the current plan for the activity; and
- is not a reportable incident.

All recordable incidents shall be reported within 15 days of end of each reporting period (every 90 days after EMP approval). The report shall contain:

- a record of all recordable incidents that occurred during the reporting period; and
- 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
- any action taken to avoid or mitigate any environmental impacts and environmental risks of the recordable incidents; and
- the corrective action that has been taken, or is proposed to be taken, to prevent similar recordable incidents.

Reportable Incident — an incident, arising from a regulated activity, that has caused or has the potential to cause environmental harm, material environmental harm or significant environmental harm (refer to definition of **environmental harm / material / serious environmental harm** below).

All reportable incidents shall provide notice of the incident within 2 hours (once the interest holder becomes aware of the incident) orally or in writing outlining:

- the contact details of the interest holder; and
- all material facts and circumstances about the reportable incident that the interest holder knows or is able, by reasonable search or enquiry, to find out; and
- information about any action taken to avoid or mitigate material environmental harm 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.

If notification is provided orally, the interest holder must, not later than 24 hours after giving oral notice, give the Minister a written notice about the reportable incident specifying all the matters mentioned above.

An initial report about the reportable incident shall be given to the Minister within 3 days of the incident first occurring and shall include:

- 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.
- A final report about the reportable incident shall be given 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. The final report will include a root cause analysis of the incident.

***NB: All incidents are to be recorded and reported in accordance with the DEPWS Onshore Petroleum Incident Reporting Guideline (2023)**

Table 38: Methane Emissions Management Plan

Mereenie Appraisal Wells

Methane Emissions Management Plan 2024

MEMP Owner	Operations Manager
MEREENIE FIELD	
Property land uses	CP operates the WM31 and WM32 under OL4
Site Description	The Mereenie field is an oil and gas field located west of Alice Springs in a remote part of the Northern Territory. These wells will add to the existing field which commenced production in the 1984.
Methane Management Plan	
Purpose	To monitor and reduce fugitive methane emissions from drilling activities.
Objectives	To reduce fugitive methane emissions through effective detection and management practices across operations activities.

LEAK MONITORING

Inspection Frequency

- If a leak is detected at a particular asset the frequency of inspections for the asset will be re-assessed and may be increased based on a risk assessment
- Field Operator visits and leak detection: as required as per Asset Management System and Permit to Work requirements (varies from daily to monthly)
- Specialist technician inspection of systems for leaks as follows:
  - Well pad equipment: 6 monthly
  - Low pressure pipelines and fittings: annually
  - Plant including compressors: quarterly
- Leak detection is only undertaken by appropriately trained and competent personnel
- All gas containing equipment will be inspected for leaks within 48 hours of recommissioning / commissioning

Leak Detection Instruments

Field: Dräger X - am 2500 detector, which features:

- Detection of flammable gases and vapours, as well as O2, CO, NO2, SO2 and H2S; and
- Detection of methane as low as 500ppm (1% of the lower explosive limit (LEL)).
- Calibration as per CP Standard Operating Procedure (bump test prior to use (daily))

Specialist Technician:

- Monitored following USEPA Method 21. Monitoring and analysis of leaks conducted using flame ionization (FID) technology and where possible Optical Gas Image (OGI)
- Calibration annually by manufacturer and daily by specialist technician

Leak Detection Procedure

Leak detection is undertaken in accordance with the USEPA Method 21. The procedure is as follows:

- Prior to commencing monitoring, calibrate and bump test the gas detector according to manufacturer's recommendation
- Monitoring is carried out at each well site, along the gathering system (vents, drains, metering instruments, manifolds) and within CTP/ESS:
  - Place the probe at the surface of the component interface where leakage could occur
  - Move the probe along the interface periphery while observing the instrument readout
  - Locate the maximum reading by moving the probe around the interface (note that where a leak is detected the operator is to make a determination as to whether it is safe to remain in the area to continue monitoring
  - Keep the probe at the location of the maximum reading for 2 times the response factor - Record the reading and source of the leak (if a leak is detected)
- If a leak is detected also record whether it is a minor or significant leak and implement corrective actions
- If a liquid petroleum leak is detected and it is safe to do so, record the estimated volume of leaked liquid and the source of the leak.

RISKS AND MANAGEMENT CONTROLS

Key Risks	Management Controls	Actions
Fugitive methane emissions during drilling leading to health and safety hazard including adverse environmental impacts	• Wells and associated surface infrastructure is designed to mitigate leaks in accordance with the following standards: ○ ISO 16530-1-2017 Petroleum and natural gas industries - Well Integrity - Life cycle governance ○ API SPEC 5CT 2016 Casing and Tubing ○ API RP 59 2012 Well control operations ○ API SPEC 6A 2016 Wellhead and Christmas Tree equipment ○ NORSOK Standard D-010, Well integrity in drilling and well operations ○ Leak detection implemented consistent with the Code of Practice. ○ Ongoing well maintenance as per the Well Operations Management Plan.	• During drilling, gas will be flared at the wellsite at a maximum rate of approximately 5 mmscf per well per day over four days. • All residual gas is to be flared and no planned venting is to occur during drilling. • There is no planned flaring or venting needed during surface facility activities as gas will bleed to into the gathering lines. • Planned and emergency flaring and emergency venting is recorded in the Daily • Production Report, which is then included in the Monthly Production report submitted to DPIR .
Fugitive methane emissions during operations leading to health and safety hazard including adverse environmental impacts	• All assets to be managed in accordance with the following to mitigate and response to fugitive emissions and leaks: ○ Permit to work procedure ○ Asset maintenance system ○ Pipeline Integrity System ○ Standard Operating Procedure (Isolations) ○ Monitoring as per Code of Practice	No entry to hazardous areas without portable gas detector. Specialist monitoring of assets on annual basis including: • Valves, flanges and connectors >10mm ND • Pumps, pressure safety valve (PSV) • Except where inaccessible due to work safety

EMERGENCY RESPONSE		
Actions	**Gas Leak (Minor)**	**Gas Leak (Major)**
Move Away	• Move yourself and others away from danger • Establish a perimeter around the affected area, evacuate or restrict access • Arrange for the safe shutdown of plant, equipment, vehicles in the affected area	• Move yourself and others away from danger • Establish a perimeter around the affected area, evacuate or restrict access • Arrange for the safe shutdown of plant, equipment, vehicles in the affected area • The ESD systems provide the main control mechanism for all gas escapes. Do not attempt to disperse or extinguish a gas cloud or fire
Raise Alarm	• Raise alarm on via radio, SOS tracker, phone or in person • Activate alarms and muster, as required	• Raise alarm on via radio, SOS tracker, phone or in person • Activate alarms and muster, as required
Gather Information	• Identify the location of the leak and isolate the affected section of the pipeline, suspend operations if necessary • If a liquid petroleum leak is detected and it is safe to do so, record the estimated volume of leaked liquid and the source of the leak • Establish gas or other testing protocols prior to entering the area or introducing any potential ignition sources e.g. equipment	• Identify the location of the failure and isolate the affected section of the leak, suspend operations if necessary • If a liquid petroleum leak is detected and it is safe to do so, record the estimated volume of leaked liquid and the source of the leak
Mobilise Site Emergency Response Team (SERT)	• Mobilise SERT if additional resources are needed • Determine if any outside assistance is required	• Mobilise SERT if additional resources are needed • Determine if any outside assistance is required
Notify	• Land owner or occupier of the property must be notified • if the leak cannot be repaired immediately (from COP)	• Department of Primary Industry and Resources' emergency hotline number 1 300 935 250 within 24 hours (from COP) • Land owner or occupier of the property must be notified if the leak cannot be repaired immediately (from COP)
Monitor	• Weather information • Wind direction • If safe to do so, monitor the concentration of methane at the surface of the component for a sustained period of approximately twice the response time of the instrument in accordance with USEPA Method 21 (from COP)	• Weather information • Wind direction • If safe to do so, monitor the concentration of methane at the surface of the component for a sustained period of approximately twice the response time of the instrument in accordance with USEPA Method 21 (from COP)
Repair leak	• Make emergency repairs to eliminate gas escaping from the affected area • Prepare a Permit and work order to finalise after immediate repairs undertaken • All minor leaks must be documented and repaired as soon as practicable, but in any event within 30 days of identification. (COP)	• If repairs are possible – undertake using caution • The gas leak must be isolated, repaired if possible, contained or otherwise made safe within 72 hours of detection of the leak (from COP) if the risks of immediately repairing a leak exceed the risk posed by the leak, an extension of the 72-hour deadline may be sought if provided that other measures to mitigate the risk are undertaken (from COP) • If finalising the remediation is delayed more than 7 business days from the identification of the leak an update must be submitted on that day. The final close out report shall be provided when all work is completed (from COP)
Incident report	• Prepare and enter information to Incident Management System • Estimate the likely amount of release • If the 30 day deadline being unachievable, the Minister must be notified within the 30 days and provided with the reason for the delay and a target date for completion of the work (from COP)	• Assign a team member to gather and record information about the leak and the incident timeline • Determine the likely leak volume • A written close-out report must be submitted within 5 business days of the remediation of the leak, specifying the date of identification, nature and level of leak, location and name of the operating plant, and the rectification actions taken (from COP) • CP will cooperate fully with the relevant regulators (from COP)

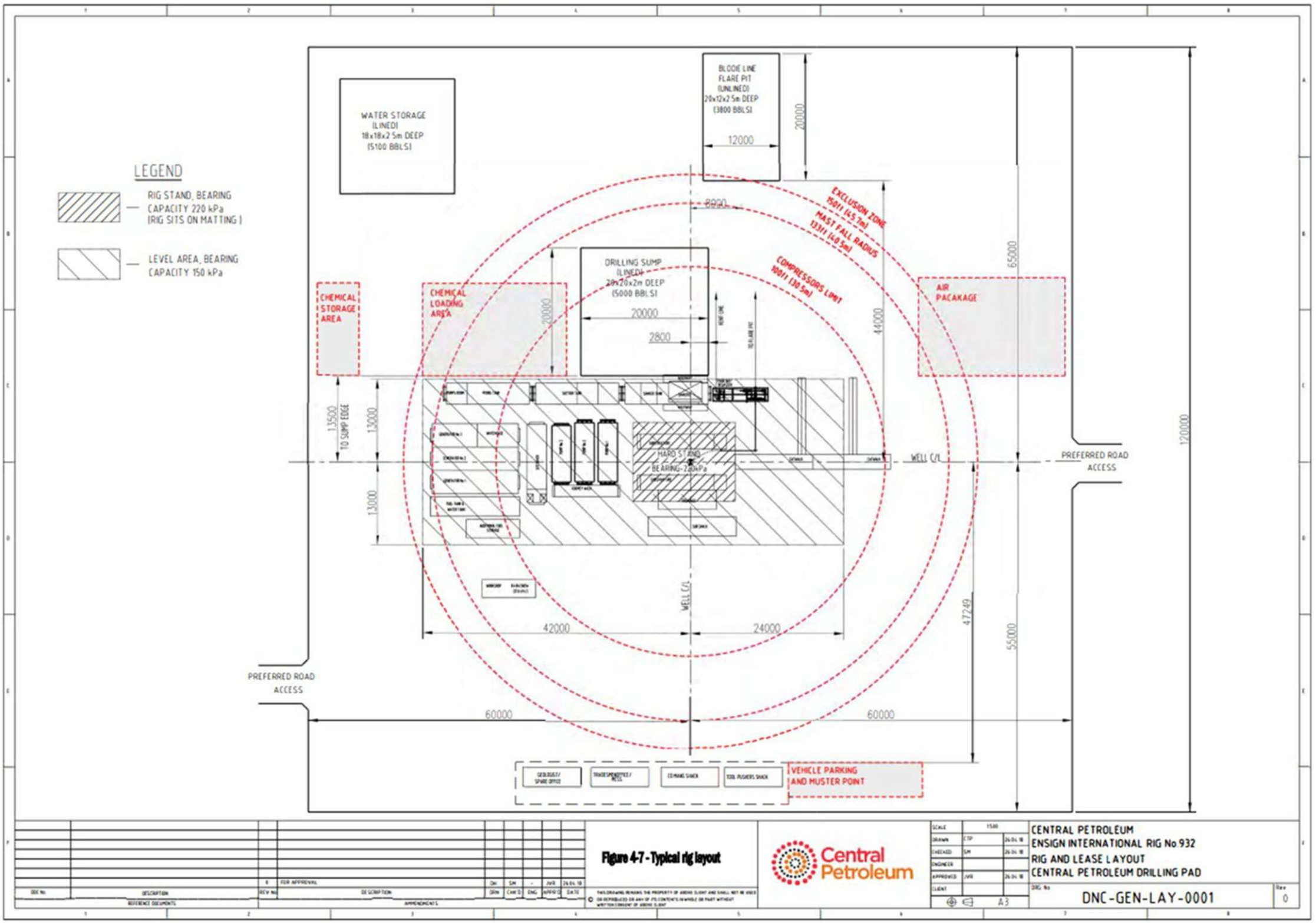


Figure 4-7 - Typical rig layout

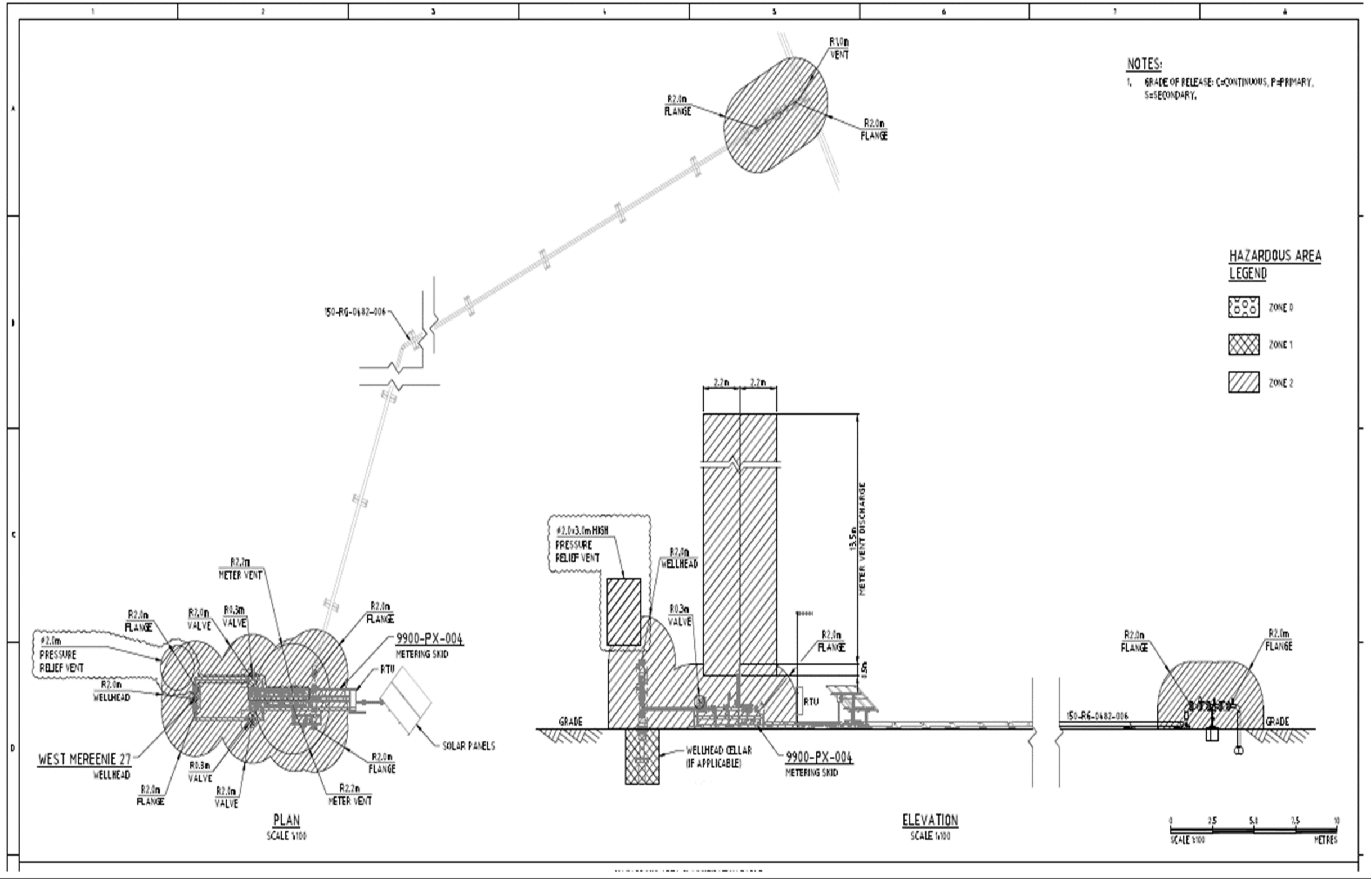
SCALE	1:500
DRAWN	CTP 26.04.18
CHECKED	SM 26.04.18
ENGINEER	
APPROVED	JVR 26.04.18
CLIENT	
	A3

CENTRAL PETROLEUM
ENSIGN INTERNATIONAL RIG No 932
RIG AND LEASE LAYOUT
CENTRAL PETROLEUM DRILLING PAD

DRG No: DNC-GEN-LAY-0001
Rev: 0

0 FOR APPROVAL DH SM - JVR 26.04.18
DESCRIPTION DRN CHKD ENG APPRD DATE

EXAMPLES OF HAZARDOUS AREAS FOR OPERATOR LEAK DETECTION



8. Implementation Strategy

This Section covers the wider context of the EMP implementation and the common requirements across all environmental and operational aspects of the Mereenie Field. Consistent with our values, the Operator is committed to conducting its operations in an environmentally responsible and sustainable manner aligned with community/social expectations. We believe that achieving and maintaining good Environmental Outcomes is critical to the success of our business.

Details regarding the implementation of environmental management aspects, including specific monitoring and records management, are provided in Section 7.

8.1. Management system

The Operator utilises an HSE Management System (HSE MS), which contains the policies, procedures, standards and plans that are in place to manage and minimise the impact of its activities. In addition to meeting legal requirements, all activities are also governed by several additional risk-focused policies and procedures designed to ensure appropriate industry standards are in place.

8.2. Roles and Responsibilities

The Operator utilises the following management structure (Figure 57), with responsibilities aligned with specific roles detailed in Table 39. However, all personnel have a responsibility to operate in a safe and environmentally responsible manner.

Figure 57: Management structure

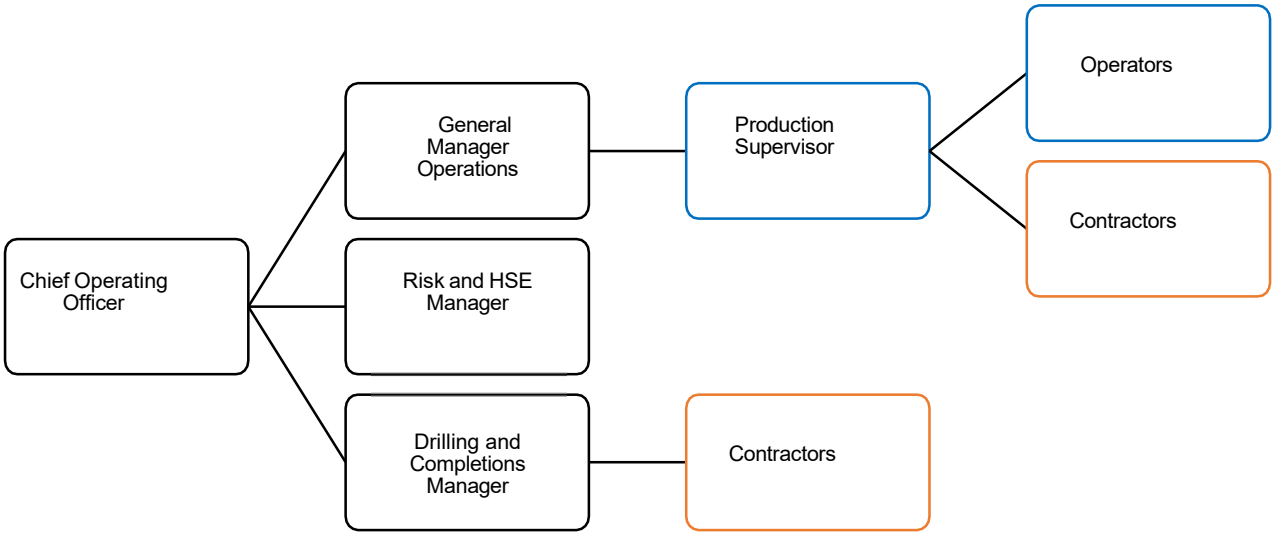


Table 39: Roles and responsibilities

Role	Responsibilities	Activities
Chief Operating Officer	Overall operation of activities.	All
General Manager Operations	Nominated Liaison Officer.	Production operations, civil and project activities, support
Drilling and Completions Manager	Project managing EMP activities.	Drilling and civil project activities
Risk and HSE Manager	Providing systems, processes, and advice to site personnel on risk management and the environment.	All

Role	Responsibilities	Activities
Production Supervisor	Person in charge of operating facilities on-site in a safe, responsible manner.	All
Operators	Safe operation of the field and infrastructure.	Production operations
Contractors	Deliver projects in line with scope and requirements.	Civil and project support

8.3. Training and Awareness

The operators' policies and procedures outline all personnel's training and competency requirements (staff, contractors and visitors) to ensure they can fulfil their obligations under this EMP. This enables them to work effectively in developing and promoting measures to ensure high HSE knowledge and compliance. The key systems and processes to manage compliance with our standards are:

- compulsory site and HSE inductions
- contractor pre-qualification processes
- contractor management system and processes
- task-specific work instructions and competency requirements
- a register of training and competencies for all personnel, contractors and visitors is maintained for compliance purposes.

Key requirements of the EMP are included in the training and induction materials. A copy of the EMP is available on-site and online to all employees, contractors and visitors.

A toolbox meeting will be held daily, designed for personnel and contractors to discuss tasks, the HSE controls and specific requirements for the day's operations. In addition, given ongoing operations, the Operator has implemented a suitable handover procedure for shift changes and crew changes to ensure that relieving personnel are fully aware of their responsibilities and work status. Shift change handovers include the completion of checklists and other specified documentation.

8.4. Emergency Preparedness and Response

An Emergency Response Plan (ERP) covering the Mereenie Field is in place (Appendix F). The ERP provides a broad framework for managing potential emergency incidents to minimise the potential risk to human safety and the environment and includes:

- decision trees and escalation points
- emergency contacts
- emergency action guides
- details of emergency response personnel, equipment and facilities.

For the proposed appraisal wells, a program-specific ERP will be completed in conjunction with the project contractors; however, all minimum standards from the field ERP are carried over.

The Operator will ensure all personnel, contractors, and visitors are aware of the emergency response framework and are trained in emergency response procedures relevant to their role/position.

The Operator's emergency management framework is reviewed and updated as part of continuous improvement processes to incorporate the latest information arising from incidents, near misses and emergency simulation training sessions.

8.5. Contractor Management

Most of the work undertaken under this EMP will be performed by specialist contractor personnel using standard work instructions. However, operations will undertake some scopes of work. Efforts are therefore focused on effective contractor management to ensure third parties comply with the relevant EMP commitment and contractual requirements.

The contract and scope of work are the key mechanisms the Operator uses to manage contractors and outline compliance requirements for the contracted activity. Contractors are also provided with:

- key compliance and system documents
- a list of compliance commitments and the responsible person for a specific activity
- a list of inspections, procedures and other tools required to implement the content of the EMP
- monitoring and reporting requirements
- hold points that require a deliverable to be completed prior to entry into a new activity phase (i.e. prior to mobilisation, operation and demobilisation)
- maps illustrating the approved work zones and any restricted areas
- assurance over contractor performance is undertaken prior to, during, and post the scope or activities.

8.6. Monitoring and Reporting

8.6.1. Monitoring

Environmental monitoring conducted specific to each environmental aspect is outlined in Sections 6.2 to 6.9. Table 40 details the records and monitoring requirements according to the environmental aspects.

Any incident identified from our monitoring activities will be captured in the incident reporting system, and actions will be taken to rectify the incident and prevent its reoccurrence. If incident thresholds are reached, a more formal investigation will be conducted. All personnel must proactively report all incidents and identify potential hazards no matter how minor to act as an alert and maintain a continual improvement program.

All sampling and analyses carried out to meet the EMP and the Code requirements will be conducted by suitably qualified and competent persons. Instruments and measuring and metering devices will be maintained and calibrated to be ready for use in accordance with the manufacturer's specifications.

The calibration of equipment will be prompted and managed via our asset management system, which will maintain records and evidence or currency. In addition, as per the Code, laboratory analyses will be conducted by a laboratory with National Association of Testing Authorities (NATA) accreditation for such analyses and tests where available or using duplicate samples across independent laboratories where not available and in accordance with the Code.

8.6.2. Reporting

All reporting under the Code, *Petroleum (Environment) Regulations 2016, NT Waste Management and Pollution Control (WMPC) Act 1998*, and other relevant legislation related to this EMP will be provided as per the requirements stipulated within. Any ad hoc reporting, such as reportable incidents and requests for prescribed documents, will be provided as per relevant regulations and the obligations committed to in the Spill Management Plan within this EMP.

Prior to the commencement of activities, notice will be provided to the Minister, occupier of the land and owner of the land on which the activity is to be carried out.

In addition, reporting is prepared to support national reporting requirements that also support the EMP and the Code requirements, including the *National Greenhouse and Energy Reporting Act* and the *National Environmental Protection Measure* (National Pollutant Inventory).

Table 40 details the reporting requirements according to the environmental aspects.

Table 40: Reporting Requirements

Record(s) / Report(s)		Parameters	Frequency
BIODIVERSITY			
Record(s):	▪ Incident records ▪ Environmental sensitivity maps ▪ Weed declaration certificates ▪ Induction and register of participants ▪ Fauna interactions ▪ Well site area monitoring and inspections ▪ Geospatial records of clearing undertaken ▪ Annual Environmental Performance Report (AEPR)	-	▪ As event occurs for all items, however, well site area monitoring and inspections are undertaken daily during drilling activities. ▪ Clearing geospatial records to be submitted to the Minister annually ▪ The AEPR is to be submitted annually to DME / DLPE.
Report(s):	▪ Rehabilitation report	▪ Visual inspection and photo point monitoring ▪ Weed survey ▪ Fire break monitoring ▪ Fire fuel load/mapping review ▪ Fire scar mapping	Annually
LAND			
Record(s):	▪ Inspection records ▪ Weather records	▪ Visual site inspection on Erosion and Sediment Control (ESC) measures implemented (civil activities). ▪ Weather and road conditions. ▪ Records show that earthworks and upgrade/project activities remain within previously disturbed areas. ▪ Records show vehicles and machinery remain within designated areas. ▪ Records show that personnel, visitors and contractors are aware of designated work areas.	▪ ESC checked daily during drilling and after significant rain events (>10 mm in 24 hrs). ▪ Daily inspection of weather, works areas during drilling operation for clearing and locations of machinery/vehicles. ▪ Inductions undertaken as required for new personnel.
	▪ Incident records	▪ Soil contamination assessment incorporating sampling (as required) following any recordable/reportable spills or spills outside well site footprints (as required).	As event occurs/as soon as the Operator becomes aware of the incident.
	▪ Permit to work records	-	As event occurs

Record(s) / Report(s)		Parameters	Frequency
Report(s):	▪ Rehabilitation report	▪ Rehabilitation success monitoring – land stabilisation	Annually
	▪ Notification of commencement of drilling	-	Prior to the commencement of drilling activities, the Minister, occupier of the land and owner of the land on which the activity is to be carried out is to be notified.
SURFACE WATER			
Record(s):	▪ Daily production reports		▪ Daily during drilling ▪ ESC to be inspected daily during operational periods and after significant rain events (>10 mm in 24 hrs)
	▪ Inspection records	▪ Drilling sump: freeboard levels and fauna interactions ▪ Visual monitoring of erosion and sediment controls (civil activities)	
	▪ Incident records	▪ Water sampling, where available, following a recordable/reportable spill to determine the extent of contamination of surface water and following removal of contamination source (as required as part of spill response).	As event occurs/as soon as the Operator becomes aware of the incident.
	▪ Chemical register		Daily during drilling
GROUNDWATER			
Record(s):	▪ Groundwater monitoring ▪ Incident records ▪ Inspection records ▪ Calibration of in situ water metre	-	▪ Biannual (May and October) ▪ Quarterly ▪ Daily ▪ Prior to biannual sampling
	▪ Incident records	-	As event occurs/as soon as the Operator becomes aware of the incident.
Report(s):	▪ Well barrier integrity verification (WBIV) reports	-	Annually or as required by DME
	▪ Groundwater monitoring report (as part of Mereenie Field EMP).	*Table 2 – Required Analytes, Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-Basin, DEPWS (now DLPE) November 2018*	Annually
	▪ Groundwater extraction volumes as per extraction licence M10001 (as part of Mereenie Field EMP)	Volume of water utilised.	Quarterly

Record(s) / Report(s)		Parameters	Frequency
	▪ Well monitoring, surveillance and reporting as per DME-approved WOMPs		Annually or as required by DME
AIR AND NOISE			
Record(s):	▪ Inspection records	▪ Routine testing, inspection and maintenance for assets, including wells, flowlines, and processing plant equipment (as per Asset Management System). ▪ Hydrotest monitoring of assets.	▪ Daily during drilling ▪ Hydrotesting to be undertaken prior to the commissioning of assets (as required).
	▪ Process/metering records	▪ Venting and flaring records ▪ Flaring volumes ▪ Where venting is the only technically feasible option for managing produced gas, the technical considerations preventing the use of the recovered gas must be recorded. ▪ National Pollutant Inventory (NPI) reporting ▪ National Greenhouse and Energy Reporting (NGERs).	▪ As event occurs/as soon as the Operator becomes aware of the incident. ▪ Technical considerations preventing the use of the recovered gas to be reported annually. ▪ NPI reporting to be undertaken annually. ▪ NGERs reporting to be undertaken annually.
	▪ Incident records	▪ Recording of unplanned venting events	As event occurs/as soon as the Operator becomes aware of the incident.
	▪ Calibration records	▪ Calibration records for plant/well metering and measurement ▪ Calibration of metres used for leak detection	Prior to the use of metering equipment
	▪ Drilling and completions (wells)	-	Daily during drilling
	▪ Well head pressure	-	Monthly
	▪ Pressure monitoring of flowlines and MASP	-	Continuous
Report(s):	▪ Leak detection monitoring program ▪ National Greenhouse and Energy Reporting Scheme (NGERs) ▪ Supply of NGERs outcomes to the Northern Territory Government.	▪ Volumes of gas released	Annually (supply of NGERs outcomes to NT Government as requested)

Record(s) / Report(s)		Parameters	Frequency
HAZARDS			
Record(s):	▪ JHA records ▪ NORMS testing records	-	Daily during drilling
	▪ Incident records	Recordable and reportable incidents	▪ Recordable incidents are to be collated and reported quarterly. ▪ Reportable incidents are to be raised within 2 hours of the interest holder becoming aware of the incident (further reporting requirements after initial notification are detailed in the Spill Management Plan).
	▪ Daily reports	▪ Inspect chemical, waste, fuel and oil storage areas and secondary containment at well sites ▪ Monitor freeboard on drilling sump ▪ Monitor long-term and short-term weather forecast ▪ Measure rainfall ▪ Post-wet weather ▪ Emergency response drills (at rig-up and reviewed daily in toolbox).	▪ Secondary containment of chemical, waste, fuel and oil storage areas to be (when in use) inspected weekly unless it is being operated through the wet season, during which time it will be monitored daily. ▪ All other parameters - daily during drilling.
	▪ Waste classification	▪ Naturally occurring radioactive materials (NORMs). ▪ Schedule 2, *Waste Management and Pollution Control (Administration) Regulations 1998* (NT).	▪ Quantity and quality of cuttings generated. ▪ Details of licensed waste transporters (if transported off site for disposal).
	▪ Waste tracking records	▪ Volumes of waste disposed of ▪ Types of waste disposed of	Monthly
Record(s)	▪ Inspect firebreaks/review of Fire Management Plan	-	Annually
	▪ Inspect fire equipment functionality	-	Bi-annually (prior to high fire danger season).
	▪ General weather conditions	▪ Risk of fire, rain or other inclement weather ▪ Rainfall	Daily during toolbox and JHAs.

Record(s) / Report(s)		Parameters	Frequency
	▪ Inspect Northern Australia Fire Information (NAFI) fire tracking maps where a high fire danger is present	-	Daily during high fire danger.
Record(s):	▪ Wastewater volumes generated	▪ Wastewater quantity and quality generated during drilling (to include and provide detail on drill fluid volumes and drill cutting volumes). ▪ Volumes of water transferred into each tank. ▪ Estimates for evaporation rates from each tank. ▪ Volumes of water planned to be, and ultimately, re-used in petroleum operations, including drilling. ▪ Volumes of water used for other purposes, including dust suppression and construction water. ▪ Volumes of water and wastewater removed from site and its destination (whether by vehicle or pipeline), including details of the waste transporters' licence number. ▪ Volumes of any spills of wastewater. ▪ Drilling/completion fluid tanks and secondary containment.	▪ Quantity and quality – Prior to disposal (regardless of whether on site or off site). ▪ Spills involving wastewater will be managed as event occurs/as soon as the Operator becomes aware of the incident. ▪ Secondary containment is to be (when in use) inspected weekly unless it is being operated through the wet season, during which time it will be monitored daily.
Record(s)	▪ Drilling chemicals	▪ Names of chemicals being used ▪ Types of chemicals being used ▪ Volumes of chemicals being used	▪ Daily during drilling
Report(s):	▪ Wastewater tracking documentation	▪ Waste classification ▪ Wastewater volumes generated during drilling (to include and provide detail on drill fluid volumes, drill cutting volumes) ▪ Volumes of water transferred into each tank ▪ Estimates for evaporation rates from each tank ▪ Volumes of water planned to be, and ultimately, re-used in petroleum operations, including drilling ▪ Volumes of water and wastewater used for other purposes, including dust suppression and construction water ▪ Volumes of water and wastewater removed from site and its destination (whether by vehicle or pipeline), including details of the licence number of any licensed waste transporters ▪ Volumes of any spills of water or wastewater	Annually reported to Minister

Record(s) / Report(s)		Parameters	Frequency
HERITAGE			
Record(s):	▪ Incident records ▪ Induction (Heritage and Cultural Awareness)	-	▪ As the event occurs / as soon as the Operator becomes aware of the incident ▪ As required for the induction of new personnel
	▪ Communication with CLC ▪ Communication with NT Heritage Branch	-	As required or as event occurs/as soon as the Operator becomes aware of the incident.
Report(s):	▪ Notify AAPA./CLC and NT Heritage Branch of approval and permit breaches as per conditions	-	As event occurs/as soon as the Operator becomes aware of the incident.
	▪ Review of registers and records	-	Annually
COMMUNITY			
Record(s):	▪ Waste tracking records	▪ Quantities of waste being disposed	Monthly
	▪ Waste storage	▪ Quantities of waste being stored on site	Weekly
	▪ Stakeholder communication log	▪ Community complaints	As event occurs/as soon as the Operator becomes aware of the incident.
	▪ Traffic changes	Monitor traffic impacts associated with works	Weekly

8.7. Records Management

As per standard practice, all prescribed environmental records required under this EMP will be maintained in accordance with the Petroleum (Environment) Regulations 2016 and other relevant legislation. Details of specific records captured to address environmental risks and performance standards are presented in Sections 6.2 to 6.9.

8.8. Management of Change

A Management of Change (MoC) process is in place to ensure any changes to activities are appropriately accessed and communicated and that no additional unintended risks or impacts are introduced.

The MoC process will only be used when optimising environmental outcomes or improving operational efficiency where no new regulated activity, risk (including risk level), or impact is introduced. Where a new regulated activity, risk (including risk level) or impact is introduced, then a modification revision of the EMP is required under the Regulations.

8.9. Auditing and Assurance

In addition to regular monitoring as set out in this document, audits assessing compliance with the plan will be undertaken.

Any non-compliance arising from regulated activities will be recorded, and corrective actions will be undertaken to address the gaps. These non-compliances and corrective actions will be tracked and reported as required.

8.10. Corrective Action, Review and Continuous Improvement

The Operator's incident management procedures and systems are part of our HSE management systems and are designed to:

- ensure all incidents and hazards are reported in a standard format so that consistency and accuracy of the process are maintained
- identify the underlying and basic causes of all incidents and hazards
- implement corrective/improvement actions to prevent the recurrence of similar incidents and hazards
- provide information to prepare the incidents and hazard statistics and identify potential trends
- identify potential suitable corrective actions

All corrective/improvements associated with incidents, hazards, and assurance activities are recorded, tracked and reported. Any overdue actions are followed up and escalated as required.

8.11. Review and Continuous Improvement

Implementation of this EMP will be continually assessed and revised as required based on monitoring and assurance results, feedback, changes to the proposed work program, or a material increase in risk level. A formal review and resubmission of this EMP will be undertaken every 5 years.

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10. Glossary and abbreviations

Abbreviation	Details
AAPA	Aboriginal Areas Protection Authority
AHD	Australian Height Datum
ALARP	As Low As Reasonably Practicable
BOP	Blow Out Preventer
CBL	Cement Bond Log
CE	Critically Endangered
CLC	Central Land Council
Competent person	Means a person who has the necessary ability, knowledge and relevant experience to conduct the task or activity
DD	Data Deficient
DEPWS	Department of Environment, Parks and Water Security
DLPE	Department of Lands, Planning and the Environment
DME	Department of Mines and Energy
ESCP	Erosion and Sediment Control Plan
EMP	Environment Management Plan
EN	Endangered
EPA	NT Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
ESD	Ecologically Sustainable Development
GIS	Geographic Information System
ha	Hectare
HDPE	High-density polyethylene
HSE	Health, Safety and Environment
HSE MS	Health, Safety and Environmental Management System
ISO	International Standards Organisation
kg	Kilogram
LCM	Liaison Committee Meetings
Long-Term	**Land/Surface/Groundwater water contamination:** 'No long-term impact' is defined as having a Monitoring/Remediation Plan in place (in consultation with a contaminated land/ecologist SQP) which can provide evidence of continued improvement in contaminant levels associated with a regulated activity linked to this EMP with a view to achieving commercial/industrial land use NEPM guideline contaminant levels within 10 years. **Air and noise contamination**: 'No long-term impact' is defined as having no linked air or noise quality impacts associated with a regulated activity linked to this EMP on sensitive receivers for more than 7 consecutive days (based on received complaints). **Community:** 'No long-term impact' is defined as having no instances of ongoing nuisance associated with a regulated activity approved by this EMP on neighbouring communities for more than 7 consecutive days (based on received complaints).
m	Metre
mm	Millimetre
ML	Megalitre

Abbreviation	Details
MCA	Multi-Criteria Analysis
MNES	Matters of National Environmental Significance
NAFI	Northern Australia Fire Information
NTD	Near Threatened
NT	Northern Territory
OL4	Operating Licence 4
OL5	Operating Licence 5
Operator	Central Petroleum
PMST	Protected Matters Search Tool
PPE	Personal Protective Equipment
SDS	Safety Data Sheet
Significant impact	**Threatened fauna/flora:** An impact that results in the long-term decrease in the size or viability of a threatened species population. **Soil stability/quality/landform:** An impact that creates an irreversible impact on soil stability, quality or landform. **Aboriginal/non-Aboriginal artefacts:** An impact that results in the destruction of a known Aboriginal or non-Aboriginal artefact. **Natural environment in association with weather events:** No linked exacerbation of extreme weather events (e.g. flood/fire risk) linked to a regulated activity approved by this EMP resulting in irreversible damage to the environment
SOBS	Site of Botanical Significance
SOCS	Site of Conservation Significance
SSCC	Sacred Sites Clearance Certificate
Suitably Qualified Person (SQP)	A person who has the professional qualifications, training, skills or experience relevant to the nominated subject matter or task and can give authoritative assessment, advice and analysis about performance relevant to the subject matter using relevant protocols, standards, methods, literature, or conduct tasks in accordance with requirements
TPWC Act	Territory Parks and Wildlife Conservation Act
VU	Vulnerable
WM	West Mereenie
WoNS	Weeds of National Significance