Amadeus

Environment Management Plan

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Document control

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CTP8-1	Initial submission	Environmental Specialist/ Enviro-Value	Risk and HSE Manager	08 December 2023
CTP8-2	Revision per DEPWS Reg 10 and 11 comments	Environmental Specialist/ Enviro-Value	Risk and HSE Manager	30 April 2024
CTP8-3	Revision per DEPWS Reg 10 and 11 comments	Environmental Specialist	Risk and HSE Manager	13 June 2024
CTP8-3	Administrative Update	Environmental Specialist	Risk and HSE Manager	27 June 2025

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This is a Central Petroleum Limited (the Operator) document and it has been prepared using the skill and care expected from persons who have 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.

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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; and
- 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.

Executive Summary

Central Petroleum operates the following assets within the Amadeus Basin on behalf of the listed interest holders (see Table 2).

- Operating Licence 3 (OL3) the Palm Valley Gas Field (PVGF)
- Production Licence 7 (L7) the Dingo Gas Field (DGF)
- and Production Licence 6 (L6) the Surprise Oil Field (SOF).

This EMP relates to the continuation of production activities from existing wells using the gathering networks, processing facilities and associated infrastructure already established. In addition, it includes the ongoing workover program within the field, including the upgrade of above-ground infrastructure with new wellhead equipment, safety systems and gathering lines to be replaced or installed where none currently exist. All works covered under this EMP are within existing disturbance footprints. No clearing of native vegetation outside of the existing disturbance footprint is proposed.

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 (ESD)
- Comply with regulatory obligations including requirements of the *Code of Practice: Onshore 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's nominated liaison of the PVGF, DGF and SOF, is the Chief Operating Officer who can be contacted via mail: 7/369 Ann Street, Brisbane QLD 4000, phone: +61 (0)7 3181 3800 or email: info@centralpetroleum.com.au.

Description of the activity

PVGF and DGF are operating gas fields. SOF is presently in suspension. The EMP covers the activities required to operate the respective fields in a safe and responsible manner as outlined in Table ES- 1.

Table ES- 1 Activities proposed where applicable under this EMP at PVGF, DGF and SOF

Activity	Brief description
Civil and project activities	Includes maintenance of firebreaks, well pads, roads and access tracks, and repair of ESC devices. Also includes installation of new equipment and the development of evaporation pond(s) and production facility upgrades within previously disturbed areas.
Well operations	All activities required to produce the resource (oil and/or gas) from the reserves below ground and process the product for transport and sale.
Production facilities	All activities associated with the gathering and processing of hydrocarbons for processing to sales point.
Well workovers	Well maintenance to ensure production of the wells can be operated safely and the integrity well is maintained.
Wellhead equipment, safety systems and gathering line replacement	Installation of upgraded wellhead equipment, safety systems and infield flowlines to improve safety and operability controls systems.
Storage of hazardous fluids chemicals	All chemical and hazardous materials are stored in compliance with their respective safety data sheets (SDS). SDS are kept on-site for any chemical or hazardous material stored, handled or used on-site by the Operator staff and contractors.
Wastewater management	At PVGF, the construction of a solar evaporation pond treatment system (PV-12), within existing disturbance footprint and subsequent decommissioning and rehabilitation of PV-09. Formation water from the DGF is managed at the existing Brewer Estate City Gate Gas (BECGS) Facility. At SOF no water is being produced.

Activity	Brief description
Progressive rehabilitation	Rehabilitation of previously disturbed areas and removal of/or make safe infrastructure no longer required for production operations. This includes rehabilitation of the existing PVGF solar evaporation pond, PV-09.
Greenhouse Gas (GHG) mitigations	Develop petroleum production so that the optimum value of the resource is returned to the Territory, while applying the principles of ESD underpinning this EMP: ▪ Prioritise supply of low GHG emissions natural gas/oil to the NT energy market ▪ No unplanned flaring at any of the fields during routine operations. Limited flaring may occur during workovers. ▪ In-field solar evaporation for treatment of formation water at PVGF ▪ Strict bushfire surveillance and management controls in OL3 ▪ PVGF has natural gas-powered electrical generation facility. ▪ Containment integrity management controls for methane specified in this EMP. ▪ Remote wellheads powered from 24V direct current (DC) solar panels located adjacent to the wellhead controller with battery backup. ▪ Bus service for workers from Alice Springs ▪ The Operator's travel approval process in place for managing all visitors and contractors ▪ Planned logistics supply trips to/from Alice Springs to reduce transportation fuel consumption. ▪ On-site accommodation for workers and service providers ▪ Solid waste disposal service ▪ No proposed clearing of vegetation ▪ Active progressive rehabilitation and closure plan (PRCP)
Support activities	Includes the activities required to support the Operator's activities at each site including accommodation, waste and wastewater handling, power generation, water supply, chemical storage and handling, environmental monitoring, and groundwater monitoring.
Activities not within scope	▪ Planned venting. ▪ Native vegetation clearing outside of existing cleared/disturbed areas

Description of the environment

A summary of the physical and social environment for the PVGF, DGF and SOF field is provided in the respective tables Table ES- 2 to Table ES- 4 below.

Table ES- 2 PVGF Summary of the environment

Attribute	Description
Climate Palm Valley BOM 15633	▪ Annual total average rainfall = 303 ± 201mm ▪ 1 in 1000 (0.1%) year annual exceedance probability (AEP) 90-day cumulative rainfall = 380mm ▪ Annual total average evaporation = ~2900mm ▪ $10\%_{ile}$ evaporation_90 days = 340mm ▪ Average daily max temperature = 29.8ºC, unchanged over the past 40 years ▪ Influenced by monsoonal wet season occurring November to March.
Geology	Located in the north central part of Amadeus basin on an east-west arcuate anticline, convex to the north and about 45 kilometres long. The outcropping rock in the Krichauff Range on which OL3 is sited, is the Hermannsburg Sandstone of Devonian to Carboniferous age. The main target reservoir is in the Pacoota (P1 Sandstone) formation located approximately 2km below ground level (BGL).
Regional soils	Chief soils are shallow stony sands on sandstone plateaux. Large areas of bare rock. Small areas of other soils are associated in areas of gentler relief.
Land systems	Krichauff land system (covers 80% of OL3 and 100% of PVGF disturbance area) The operational areas of the OL3 are all within "Sandstone Hills". Stony plateau of sandstone, siltstone, quartzite and conglomerate.

Attribute	Description
Groundwater	▪ No surface water is used at PVGF. Potable water for personnel and operations is trucked in from Alice Springs. This water is stored on-site in three separate purpose-built tanks. ▪ Additional water bore(s) are proposed for PVGF and have been included in the Authority Certificate application. Until the bore(s) have been drilled, potable water will continue to be trucked to site. ▪ Existing bores along the north flank of the Krichauff Range are in Hermannsburg Sandstone aquifers where the sandstone is fractured or fissured, extensive and of low to moderate flow rate in wells. This is several kms outside OL3. ▪ The Parkes siltstone provides a ~30m thick aquitard between the Hermannsburg sandstone and deeper Mereenie sandstone. ▪ Below the Mereenie sandstone, the deeper Stokes siltstone (1100m to ~1400m) provides an impermeable seal between the upper freshwater sandstones and the underlying target Stairway and Pacoota formations, which contain the gas and brackish to saline formation water.
Surface water	OL3 area is situated at the top of the Finke River catchment which is connected to the Lake Eyre Basin. The Finke River runs out into Lake Eyre during extreme events. There are several major ephemeral streams that join the Finke and Palm Creek from the OL3 area. Ellery Creek and the Finke River, both ephemeral with long lasting water holes, run through the eastern third of OL3; Ellery Creek joins up with the Finke River south of OL3 in the headwater gorge system.
Bioregion	MacDonnell Ranges
Sites of Conservation Significance/Sites of Botanical Significance	▪ OL3 is located within the Greater MacDonnell Ranges Site of Conservation Significance (SoCS) which covers an area of 31,395km^2 in the Northern Territory. ▪ PVGF is also within a Site of Botanical Significance (SoBS), Palm Valley. ▪ The Finke River headwater gorge system is nationally recognised as a significant site, due to the abundance of conservation significant and endemic species. The rock holes and water springs at Palm Valley are within the protection of the Finke Gorge National Park and include the red cabbage palm (*Livistona mariae ssp. Mariae).*
Conservation Significant Fauna	60 conservation significant fauna species, identified in database searches as potentially occurring within the Palm Valley Field, three of which have been confirmed during PVGF site surveys: Black-footed rock wallaby (*Petogale lateralis);* King brown snake (*Pseudechis australis);* Slater's skink (*Liopholis slateri).*
Conservation Significant Flora	17 conservation significant flora species identified in database searches as potentially occurring within the region, two of which have been confirmed at PVGF during site surveys, *Eucalyptus lucens* and *Stenanthemum centrale.*
Weeds/Pests	During the recent 2024 PVGF weed survey several weeds were observed on-site. Caltrop (*Tribulus terrestris)*, a class B listed weed was identified in areas associated with recent disturbance. Non-listed weeds identified during the survey included *Eragrostis barrelieri*, domestic tomato (*Solanum lycopersicum)*, Sowthistle (*Sonchus oleraceus)* associated with recent disturbance and Buffel Grass (*Cenchrus ciliaris)*, which is the predominant introduced species across the site. No Weeds of National Significance (WoNS) were identified.
National Parks and Reserves	Finke Gorge National Park.
Fire history	Fire breaks were established by Tjuwampa Rangers under training by BFC, south of the main east west access road southwest of the Gas Plant to Palm Paddock in Finke Gorge National Park in 2007/08 and by NT Parks and Wildlife Rangers in 2018. Fire breaks continue to be monitored and maintained on an annual basis by the rangers. Small fires occurred in OL3 in 2015 and 2020.
Surrounding land tenure/Use	The Palm Valley and the Finke River areas southeast of PVGF are part of the Finke Gorge National Park and have a rich cultural history. PVGF lies on Aboriginal land of the Western Arrernte People. The PVGF lies within Aboriginal freehold land administered by the Central Land Council (CLC).
Surrounding populated places	Populated areas close to PVGF are: ▪ Ntaria (Hermannsburg), 14km to the northeast ▪ Glen Helen Resort, 35km to the north

Attribute	Description
	▪ Aeryonga community, 40km west ▪ Alice Springs, approximately 130km to the east. Key topographic features of the area include: ▪ Mount Hermannsburg 1.2km northeast of the PVGF ▪ Finke Gorge National Park to the south of the PVGF and has overlapping boundaries with OL3 ▪ Finke River to the east.
Roads/Traffic	Access to PVGF from Alice Springs is via a network of sealed and unsealed public and private roads, heading west from Alice Springs along Larapinta Drive/Red Centre Way to Hermannsburg, then turn left 6.5km past the Finke River crossing.
Heritage Areas identified EPBC Protected Matters Search Report	An EPBC PMST retrieved for the OL3 area identifies one National Heritage Place, The Hermannsburg Historic Precinct, which is located approximately 25km from OL3.
Archaeological surveys	No additional surveys are required as all activities are within existing, surveyed disturbance areas. There is no work in mapped cultural heritage exclusion or restricted work zones.
CLC Sacred Sites Clearance Certificate (SSCC)	The Palm Valley Field is operated under and in compliance with SSCC C2020-061 and PV-12 (SSCC-C2017-171).
Aboriginal Areas Protection Authority (AAPA) Certificate	The Palm Valley Field is operated under AAPA Authority Certificate 202408607 (C2025/036)

Table ES- 3 DGF Summary of the environment

Attribute	Description
Climate Alice Springs BOM 41106	▪ Annual total average rainfall = ~280 ± 150mm ▪ 1 in 1000 (0.1%) year AEP_ 90-day cumulative rainfall = 320mm ▪ Annual total average evaporation = ~2970mm ▪ 10%ile evaporation_90 days = 325mm ▪ Average daily max temperature = 28.8ºC, unchanged over the past 140 years ▪ Influenced by monsoonal wet season occurring November to March.
Geology	DGF is located within the north-central area of the Amadeus Basin. This area has broad folding associated with extensive and mappable sandstone aquifers. Beds of sandstone at the base of the Arumbera sandstone formation, at depths of approximately 2,800m–3,000m BGL, form the reservoir of the DGF.
Regional soils	Mx25 – Alkaline and neutral red earths, with lesser areas of deep sands. Sandy plains with low sandy rises and scattered dunes. Small areas of rugged rocky hills are included locally. Alkaline and neutral red earths, with lesser areas of deep sands.
Land systems	DGF is in the Simpson Land System which is characterised by long parallel sand dunes that run orthogonal to prevailing winds from the southeast; fringing dune fields; extensive sandplains; dry watercourses and saltpans. The arid dune fields and sandplains support sparse shrubland and spinifex hummock grassland, with cane grass on deep sands along dune crests. The swales of claypans and stony plains support a sparse shrubland of acacias, and coolabah woodlands fringe the creeks and flood outs.
Groundwater	Local aquifers in L7 environs are typically discontinuous. Several current bores within 10km of the southern edge of the DGF provide water for stock watering on Orange Creek and Deep Well stations. The regional Mereenie Sandstone aquifer is at depths in excess of 600m BGL in this area.
Surface water	Situated within both the Finke River and Todd River Basins, both of which are within the Lake Eyre catchment.
Bioregion	Finke

Attribute	Description
Vegetation Communities	Predominately Hummock Grasslands
Sites of Conservation Significance/Sites of Botanical Significance	None are located within the field. The closest is the Greater MacDonnell Ranges located to the south-west
Conservation Significant Fauna	Thirty-one species of Fauna of Conservation Significance may be present within the DGF
Conservation Significant Flora	Six flora of Conservation Significance may be present in the DGF
Weeds/Pests	The DGF 2023 weed survey identified one class B weed, Caltrop (*Tribulis terrestris*). Other non-listed weeds identified during the survey included Paddy Melon (*Cucumis myriocarpus*), Feathertop Rhodes Grass (*Chloris virgata*), Stinky Love Grass (*Eragrostis barrelieri*) and Buffel Grass (*Cenchrus ciliaris*).
National Parks and Reserves	Finke Gorge National Park to the north-west.
Fire history	Fire frequency in DGF area is low with last fire in 2011 which burned most of L7.
Surrounding land tenure/Use	Pastoral – Deep Well Station and Orange Creek Station.
Surrounding populated places	▪ Alice Springs, 60km to the north ▪ Santa Teresa, 40km to the east ▪ Titjikala (Maryvale), approximately 40km to the south ▪ Ntaria (Hermannsburg), 100km to the west
Roads/Traffic	Access to DGF from Alice Springs is 60km south via Maryvale Road South.
Heritage Areas identified EPBC Protected Matters Search Report	No National Heritage Places
Archaeological surveys	No additional surveys are required as all activities are within existing, surveyed disturbance areas. There is no work in mapped cultural heritage exclusion or restricted work zones.
CLC SSCC	The Dingo Field is operated under the following SSCC C2020-001.
Aboriginal Areas Protection Authority (AAPA) Certificate	The Dingo Field is operated under AAPA Authority Certificate 202408607 (C2025/036)

Table ES- 4 SOF Summary of the environment

Attribute	Description
Climate BOM1664 Warlungurru	▪ Annual total average rainfall = 268 ± 145mm ▪ 1 in 1000 (0.1%) year AEP for a 90-day cumulative rainfall = 600mm ▪ Annual total average evaporation = ~2960mm ▪ 10%$_{ile}$ evaporation_90 days = 340mm ▪ Average daily max temperature = 32.8ºC, unchanged over the past 20 years ▪ Influenced by monsoonal wet season occurring November to March.
Geology	The geology surrounding the SOF area comprises extensive sand sheets and parallel dune fields running orthogonal to prevailing southeast winds, sometimes with plains and calcrete rises, and minor areas of sandstone or siltstone ridges and hills in the south. Oil production occurs from the Stairway Sandstone The SOF supported two wells, with only one well producing oil into a small tank farm located on the site. The field commenced production in March 2014, producing approximately 87,000 barrels of oil until 30 June 2015. In August 2015, the decision was taken to shut-in oil production from this field.

Attribute	Description
Regional soils	AB56 – Plains covered with longitudinal dunes, some hilly residuals with rock outcrops. Chief soils are red earthy sands on interdune plains and red siliceous sands on dunes.
Land systems	DGF is in the Simpson Land System which is characterised by long parallel sand dunes that run orthogonal to prevailing winds from the southeast; fringing dune fields; extensive sandplains; dry watercourses and saltpans. The arid dune fields and sandplains support sparse shrubland and spinifex hummock grassland, with cane grass on deep sands along dune crests. The swales of claypans and stony plains support a sparse shrubland of acacias, and coolabah woodlands fringe the creeks and flood outs.
Groundwater	Water is either bought to site by personnel or sourced from a local Operator bore (RN018851) used for bi-annual groundwater monitoring, for the camp water supply at SOF. Groundwater bore (RN014297), located approximately 10km north-west of the SOF is a water supply bore for an indigenous outstation at Nguman. The target SOF reservoir is the Stairway Sandstone formation approximately 2,450mBGL. It is permanently isolated from the overlaying Mereenie Sandstone aquifer by the Stokes Siltstone, a 170m thick seal/aquitard.
Surface water	No major watercourses in the area.
Bioregion	Great Sandy Desert
Sites of Conservation Significance/Sites of Botanical Significance	None are located within the Surprise field. The closest is the Cleland Hills and Surrounds located to the east.
National Parks	None
Conservation Significant Fauna	Eighteen species of Fauna of Conservation Significance may be present within the SOF.
Conservation Significant Flora	Flora of Conservation Significance considered unlikely to be present within the operational areas.
Weeds/Pests	Buffel Grass (*Cenchrus ciliaris*) is present in operational areas. No declared weeds have been detected within 20km of the SOF.
Fire history	Fire occurred in the north of the SOF area in 2022, and southern portion in 2021.
Surrounding land tenure/Use	Haasts Bluff Aboriginal Land Trust
Surrounding populated places	▪ Kintore, 80km to the north-west ▪ Alice Springs, 450km to the west
Roads/Traffic	Access to SOF from Alice Springs is 450km via a network of sealed and unsealed public and existing access roads constructed by the Interest Holder during exploration of the area.
Heritage Areas identified EPBC Protected Matters Search Report	No National Heritage Places
Archaeological surveys	No additional surveys are required as all activities are within existing, surveyed disturbance areas. There is no work in mapped cultural heritage exclusion or restricted work zones.
CLC SSCC	The Surprise Field is operated under the following SSCC clearance certificate 2014-029.
Aboriginal Areas Protection Authority (AAPA) Certificate	The Surprise Field is operated under AAPA Authority Certificate 202408607 (C2025/036)

Risk assessment summary

The Interest Holder 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. For residual risks that have a risk score of 'Low' these are considered as low as reasonably practicable and acceptable. For residual risks that have a risk score that is not 'Low' the risk assessments have included discussions on whether these are as low as reasonably practicable. Table ES- 5 provides a summary of the residual risks for activities across all fields under the environmental management plan. All risks are considered by the Operator to be as low as reasonably practicable and are accepted.

Table ES- 5 Risk assessment summary

	Low	Medium	High	Very High
Count	24	12	0	0

The 'Medium' residual risks for activities under this environment management plan 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 release of hydrocarbons and formation water, including wastewater to ground
- Loss of places or items of cultural significance from fire as a result of activities under this EMP
- Subsurface loss of contaminants during workovers contaminating surface water and/or groundwater and reducing groundwater pressure.

Environmental outcomes

The Environmental Outcomes of the regulated activities include:

- No significant impact1 to threatened fauna, their habitat and sites of conservation significance
- No significant impacts on soil stability, soil quality and land formations
- No long-term impact 2on surface water quality
- No long-term impact on groundwater quality, levels and availability
- Drilling's activities do not create a measurable decrease in air quality at sensitive receptors
- Greenhouse gas emissions are minimised
- Bushfires are not started from 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 operational activities in association with weather events
- No significant impact to indigenous and non-indigenous artefacts, Aboriginal Sacred Sites and non-indigenous heritage sites
- No long-term impact to 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.

Stakeholder consultation

Consultation with the Central Land Council who are the only stakeholders as per the stakeholder definition in the *Petroleum (Environment) Regulations 2016* for the field operations is undertaken annually by the Interest Holder at the Liaison Committee Meetings last held in November 2024.

Under the SSCC and land access agreements, Formal Liaison Committee Meetings are the method by which the Central Land Council and traditional owners are to be engaged.

- [1] Refer to glossary for measurable definition of 'significant impact'.
- [2] Refer to glossary for measurable definition of 'long-term impact'.

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1 Introduction

Central Petroleum (the Operator) operates the Palm Valley Gas Field (PVGF), Dingo Gas Field (DGF) and Surprise Oil Field (SOF) in the Amadeus Basin in Northern Territory, Central Australia under Operating Licence 3 (OL3), Production Licence 7 (L7) and Production Licence 6 (L6) respectively (Figure 1).

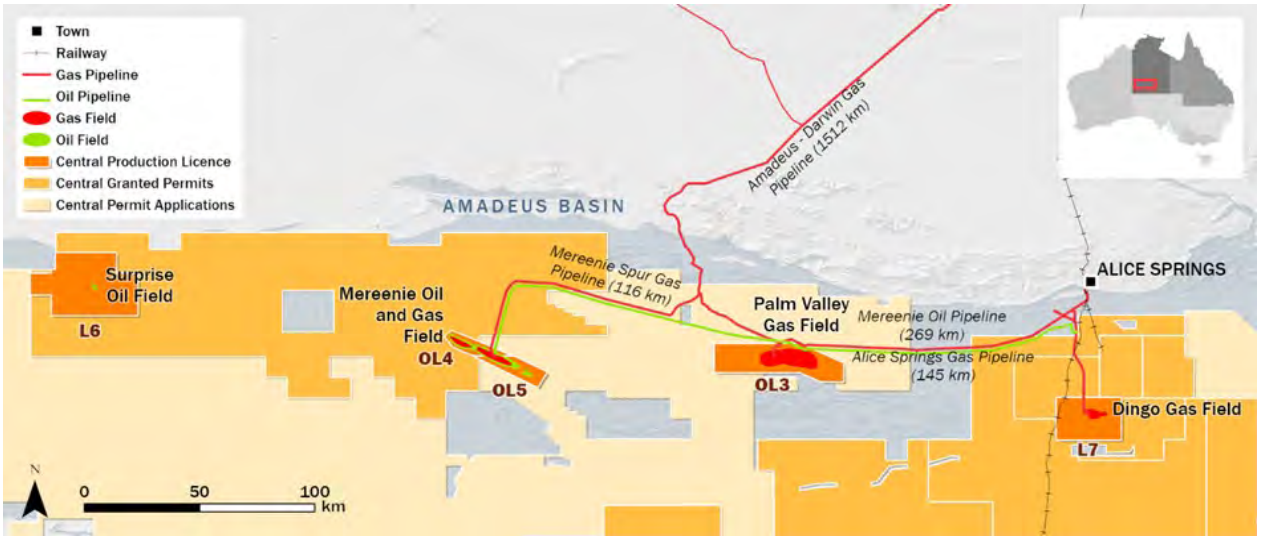


Figure 1: Geographic location of PVGF, DGF and SOF

This Environment Management Plan (EMP) relates to the:

- Continuation of production activities at PVGF and DGF from existing wells using the gathering networks, processing facilities and associated infrastructure already established.
- Ongoing workover program within respective fields, including the upgrade of above-ground infrastructure with new wellhead equipment, safety systems and gathering lines to be replaced or installed where none currently exist.
- Care and maintenance of SOF which is presently shut in.
- Related civil works including those required for care and maintenance at respective fields.

All works covered under this EMP are within existing disturbance footprints. No clearing of native vegetation outside of the existing disturbance footprint is proposed.

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 underpin the *Code of Practice for Petroleum Activities in the Northern Territory* (the Code).

1.1 Amadeus Basin

The three petroleum field details covered by this EMP are located in the Amadeus Basin. The Amadeus Basin is an east-west trending sedimentary basin extending across the southern part of the Northern Territory and into Western Australia (see Figure 1) and a known hydrocarbon and groundwater resource. The complexity of the basin has resulted in a large variety of attractive petroleum prospects. The basin covers approximately 170,000km^3 and a maximum sediment thickness of 14,000m. The first sediments deposited were Neoproterozoic sands laid down by a marine transgression across a stable epicontinental shelf more than 500 million years ago.

The Mereenie Aquifer System is the major regional aquifer located in the Amadeus Basin. Fractures are the primary pathway for groundwater movement through the aquifer, which is predominantly to the east with an average flow rate of 0.1m per annum, and computed groundwater residence time of about four hundred thousand years. Deep within the Amadeus Basin, groundwaters in the Mereenie Sandstone at Palm Valley were sampled from petroleum exploration drilling and the average chlorinity of the deep groundwater samples is up to double that of the synclinal margin groundwater.

The climate of the Amadeus Basin is classified as Arid zone with 40-year average total annual rainfall >250mm and average total annual evaporation > 2,870mm. Evaporation is approximately 10X annual precipitation and the consequent aridity profoundly dominates the vegetation and fauna in the region. Typically, more rainfall occurs in the summer months 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 it is influenced by several continental weather systems. This high inter-annual variability in total rainfall, compared to less arid regions, results in extended periods of low rainfall and occasionally experiences heavy downpours, years of such massive totals that they push up the mean despite their infrequency. A precipitation event triggers a pulse of activity like growth of vegetation. The magnitude of the pulse varies as a function of the size of the "trigger event", duration of the trigger event, and season of the year.

The dominant vegetation in the arid Amadeus Basin is open spinifex hummock grassland. Spinifex (or porcupine grass) is a common name applied to a group of grasses with tightly curled leaves that are spine-like in appearance and effect. The main species found at each field are *Triodia basedowii, Triodia pungens*, and *Zygochloa paradoxa*. Typically, shrubs and low open woodlands with life spans of a few decades or more (e.g. desert oaks), populate arid soil areas that are more stable in the mosaic of the local vegetation community; and on erosional surfaces that are less stable or have exposed subsoil, are populated by grasses and herbaceous plants. The desert grassland is topographically flat with sandy soils. The soils have high infiltration characteristics and limited potential for run-off or run-on. On this type of landscape unit, the timing and quantity of rainfall are the important determinants of productivity. The temporal pattern of rainfall determines which group of species responds. At a broad scale, soil is the foremost determinant of vegetation type (Whitford and Duval, 2020).

1.2 Petroleum Fields

Locational details of the three petroleum fields are provided in Table 1 below.

Table 1: Petroleum field locational details

Field	Tenement	Area	Location	Status
PVGF	OL3	616km^2	154km west of Alice Springs	In production
DGF	L7	469km^2	60km south of Alice Springs	In production
SOF	L6	929km^2	450km west of Alice Springs	Care and maintenance

1.2.1 Palm Valley Gas Field

PVGF has been operated by the Interest Holder since 2015. Thirteen wells have been drilled on PVGF since operations commenced in 1983, currently four are producing commercial sales gas. Aggregate gross field capacity of PVGF in June 2023 was approximately 10 TJ/d or roughly 3.5 petajoules (PJ) per annum. PVGF supplies natural gas to the Northern Territory market. The Alice Springs to Palm Valley Gas Pipeline connects to the 1,512km Amadeus Gas Pipeline to Darwin.

1.2.2 Dingo Gas Field

DGF commenced in 2015 and currently supplies gas to the Owen Springs Power Station via the Brewer Estate City Gate Gas (BECGS) treatment facility. It can also feed into the 145km Alice Springs to Palm Valley Gas Pipeline.

BECGS is an integrated treatment plant linked to DGF via the 50km Dingo pipeline (Pipeline Licence 30). It contains pipeline inlet facilities, low temperature separation, methanol dosing, gas compression, sales gas metering, condensate storage, flare / condensate load out and an evaporation pond for treatment of any residual formation water.

Four wells have been drilled at Dingo of which two are presently in production and one is suspended. The fourth well has been decommissioned. The DGF was developed and designed to produce and treat up to 2.0 (PJ) of gas which is equivalent to 36,082 tonnes per year. This is expected to supply over half of Alice Springs's current energy demand of 3.3 PJ per annum for the next 20 years, depending on sales demand.

1.2.3 Surprise Oil Field

SOF supported two wells, Surprise 1 Re-entry H ST1 (S-1) and Johnstone West-1 (JW-1). Only one well (S-1) produced oil into a small tank farm located on the site. The field commenced production in March 2014, and produced approximately 87,000 barrels of oil until 30 June 2015. The SOF has been in a care and maintenance regime since that SOF oil well was "shut-in" (suspended) in August 2015.

1.3 Interest Holder

Table 2 provides details of the registered OL3 (PVGF), L6 (DGF) and L7 (SOF) titleholder, and the titleholder's nominated liaison person. The Interest Holder is the operator of all three fields and the nominated liaison is the Chief Operating Officer who can be contacted via mail as per below:

Table 2: Interest holders for PVGF, DGF and SOF

OL3 Titleholder – PVGF	Nominated Liaison
Name: Central Petroleum PVGF Pty Ltd **ABN**: 95 009 718 183 **Website:** www.centralpetroleum.com.au **Name**: Echelon Palm Valley Pty Ltd **ABN:** 66 650 386 397 **Website:** www.echelonresources.com **Telephone:** +64 21 22 42 700 **Name;** Cue Palm Valley Pty Ltd **ABN:** 79 650 385 541 **Website:** cuenrg.com **Telephone:** +61 3 8610 4000	Position – Chief Operating Officer Company – Central Petroleum Limited Address: 7/369 Ann Street, Brisbane QLD 4000 Phone: +61 (0)7 3181 3800 E-mail: info@centralpetroleum.com.au
L7 Titleholder – DGF	**Nominated Liaison**
Name: Central Petroleum Pty Ltd **ABN:** 95 009 718 183 **Website:** www.centralpetroleum.com.au **Name**: Echelon Dingo Pty Ltd **ABN:** 17 650 385 756 **Website:** www.echelonresources.com **Telephone:** +64 21 22 42 700 **Name**: Cue Pty Ltd **ABN:** 96 650 386 020 **Website:** www.cuenrg.com **Telephone:** +61 3 8610 4000	Position – Chief Operating Officer Company – Central Petroleum Limited Address: 7/369 Ann Street, Brisbane QLD 4000 Phone: +61 (0)7 3181 3800 E-mail: info@centralpetroleum.com.au
L6 Titleholder – SOF	**Nominated Liaison**
Name: Frontier Oil and Gas Pty Ltd **ABN:** 91 103 194 136 **Website:** www.centralpetroleum.com.au	Position – Chief Operating Officer Company – Central Petroleum Limited Address: 7/369 Ann Street, Brisbane QLD 4000 Phone: +61 (0)7 3181 3800 E-mail: info@centralpetroleum.com.au

1.4 Purpose

The purpose of this EMP is to demonstrate how the Operator will conduct its 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 (ALARP) levels.

More specifically, this EMP aims to:

- Provide a framework for daily production operations across the wells and processing facilities in the respective fields.
- Provide a framework for well workovers and wellhead equipment, safety systems and gathering line activities at existing production well sites in each field.
- Assess key risks quantitatively.
- Specify controls in place to mitigate environmental risks and GHG emissions.
- Address regulatory requirements.
- Provide impact management strategies to assist the Operator in maintaining a positive position in the local community during operation and maintenance of the relevant oil and gas resources.
- Provide a systematic description of the existing environment (physical, biological and social) in each field.
- Be a practical and usable document, with environmental management principles that are easily implemented and effective.

1.5 Scope

This EMP covers all aspects directly associated with the day-to-day operations and maintenance of the PVGF, DGF and SOF including campaign activities associated with well workover, upgrade of wellhead equipment, safety systems, in-field wastewater solar evaporation systems, and gathering lines. The detailed 'Description of Activity' is listed in Section 3. Geographic location of the individual fields maps are provided below for PVGF, DGF and SOF in Figure 2, Figure 3 and Figure 4 respectively.

1.6 Organisation of EMP

This EMP is organised in the following manner:

- Section 1 Introduction
- Section 2 Environmental legislation and other requirements
- Section 3 Description of Activity
- Part A: PVGF:
    - Section 4 Existing environment
    - Section 5 Socio-Economic environment
    - Section 6 Engagement and consultation
    - Section 7 Environmental impacts, risks and mitigation
    - Section 8 Management plans
- Part B: DGF:
    - Section 4 Existing environment
    - Section 5 Socio-Economic environment
    - Section 6 Engagement and consultation
    - Section 7 Environmental impacts, risks and mitigation
    - Section 8 Management plans
- Part C: SOF:
    - Section 4 Existing environment
    - Section 5 Socio-Economic environment
    - Section 6 Engagement and consultation
    - Section 7 Environmental impacts, risks and mitigation
    - Section 8 Management plans

- Section 9 Implementation strategy
- Section 10 References
- Section 11 Glossary and abbreviations
- Appendices

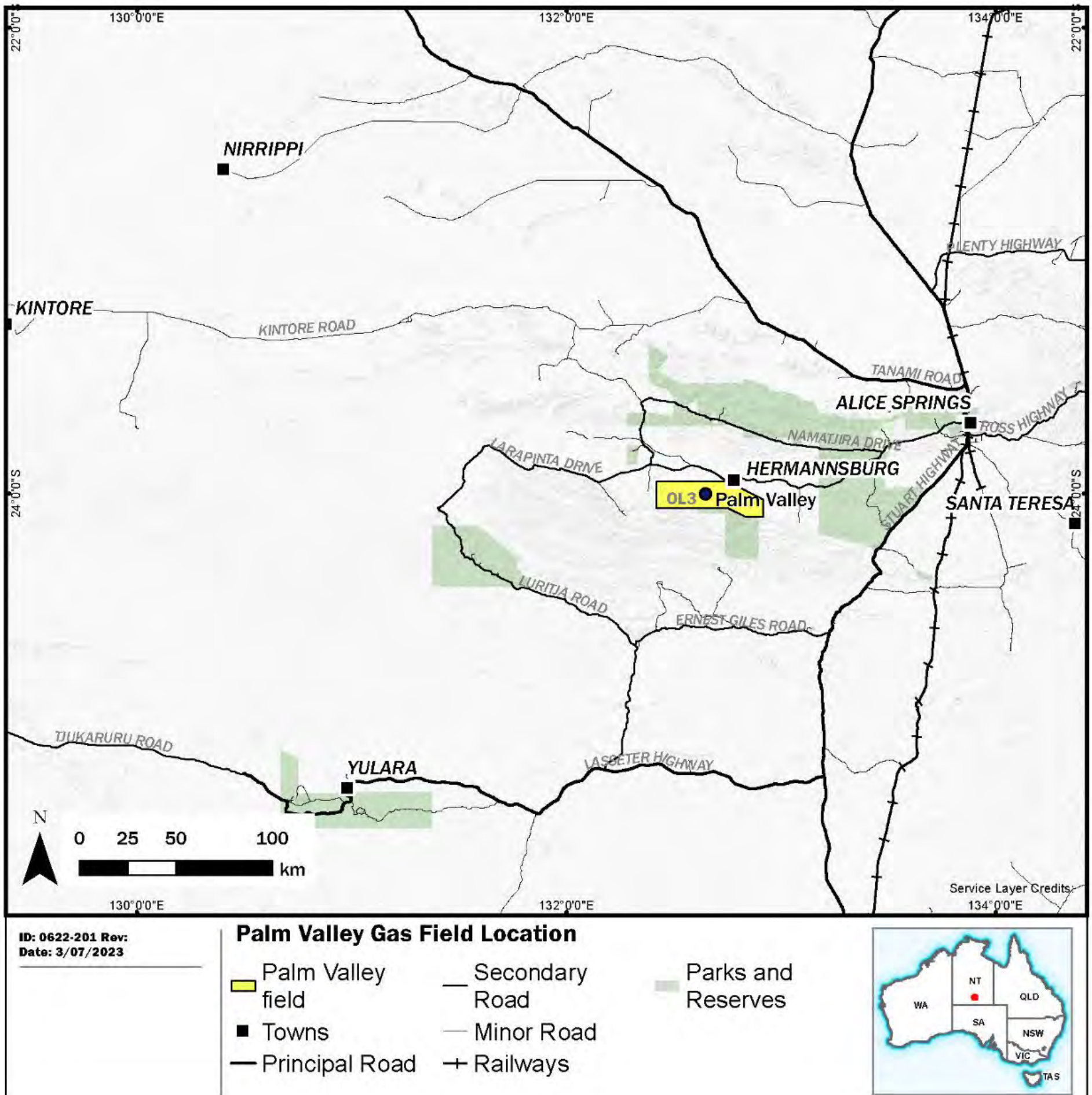


Figure 2: Location Map of the PVGF

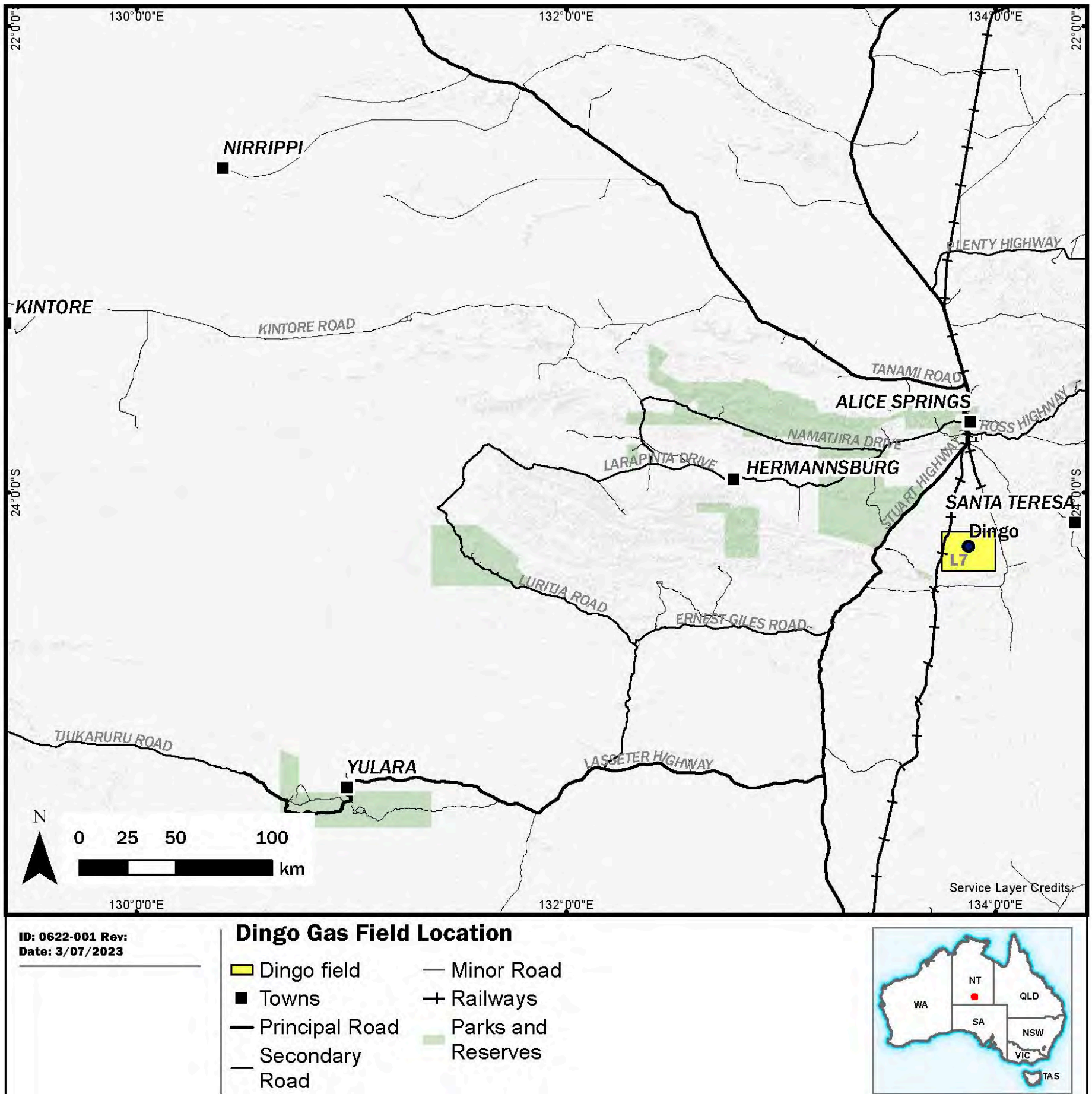


Figure 3: Location Map of the DGF

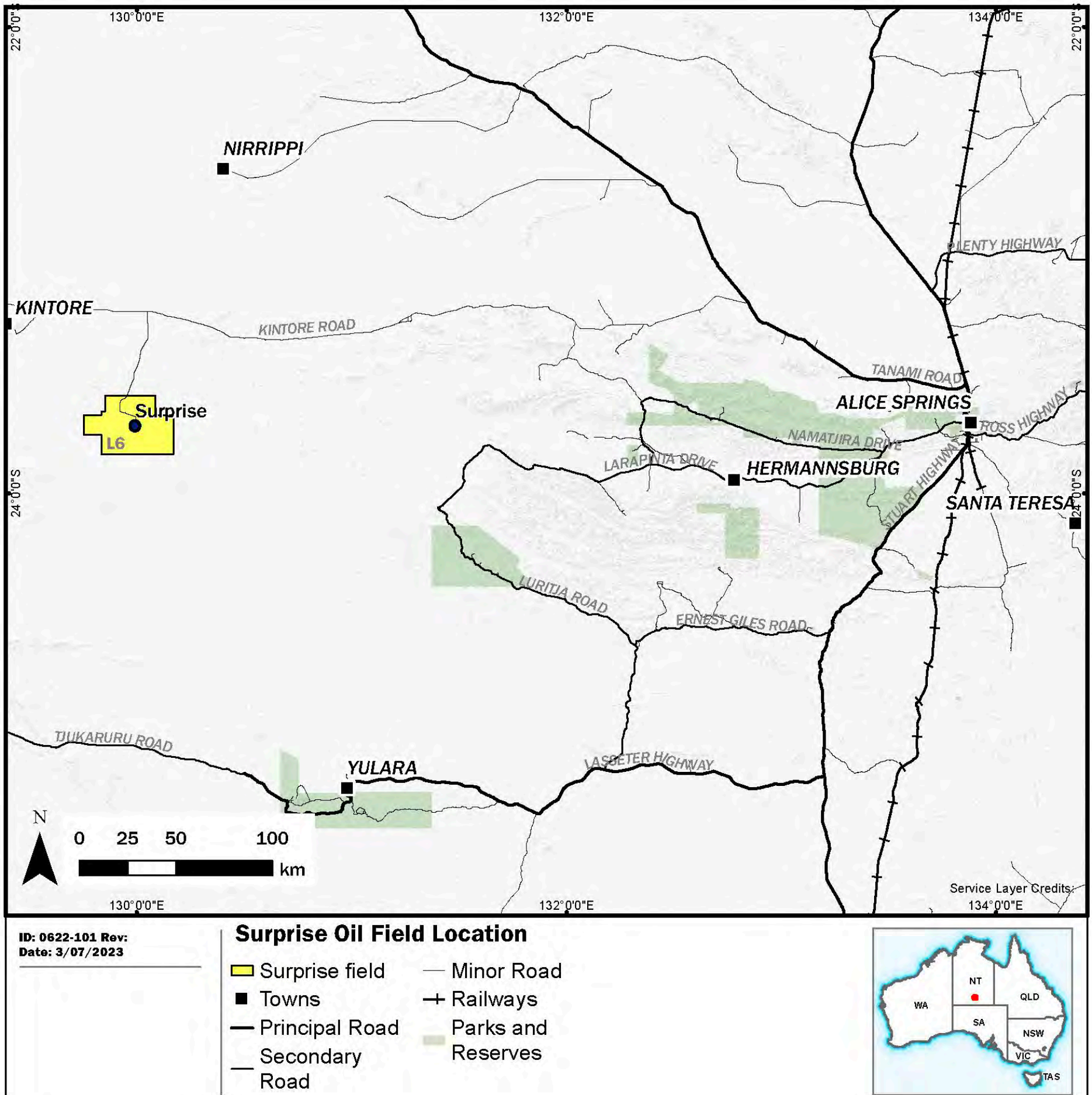


Figure 4: Location Map of the SOF

2 Environmental Legislation and Other Requirements

2.1 Key legislation

Applicable legislation for the operation, maintenance and well intervention activities at the PVGF, DGF and SOF is provided in Table 3.

2.2 Key Codes of Practice and Guidelines

In addition to legislative requirements, the Operator works to codes of practice, standards and guidelines in its production operations. These include, but are not limited to:

- Code of Practice: Onshore Petroleum Activities in the Northern Territory 2021
- Schedule of Onshore Petroleum Exploration and Production Requirements 2019
- Australian Pipeline Industry Association Code of Environmental Practice – Onshore Pipelines 2017
- APPEA Code of Environmental Practice 2008
- Best Practice Erosion and Sediment Control 2008
- DLPE Onshore Petroleum Guidelines (various)
- International Standards Organisation (ISO) 31000 Risk Management – Principles and guidelines
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000
- National Environment Protection (Assessment of Site Contamination) Measure, 1999
- Australian Standards
- Northern Territory Noise Management Framework Guidelines 2018
- Northern Territory Land Clearing Guidelines 2021

2.3 Ecologically Sustainable Development

Ecologically Sustainable Development (ESD) is a concept based on implementing practices and principles that meet the needs of ecological process and people today without impeding on future generations to meet theirs. There is no universally accepted definition of ESD however, the Commonwealth Government of Australia suggests 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 aim of ESD for the Operator is to utilise the natural environment to meet the current needs of the Operator is without jeopardising the environment for future operations or other land managers. All aspects of environmental impacts have been assessed with appropriate preventative and mitigation measures implemented to ensure that all aspects of the production lease areas are managed and developed in accordance with the ESD concepts and this EMP.

Forward planning and adaptation of ESD concepts from 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 PVGF, DGF and SOF and the potential impacts are presented in Section Environmental Impacts, Risks and Mitigation.

2.4 Central Land Council Agreement and Sacred Sites Certificates

2.4.1 PVGF

The Operator has an agreement with the Central Land Council (CLC) for use of OL3 land for petroleum activities. The CLC act as a representative of the Indigenous Traditional Owners. The agreement includes land access and other matters such as royalties, administration and Sacred Sites protection.

The Operator has obtained a Sacred Sites Clearance Certificate (SSCC) from the CLC (SSCC C2020-061 and SSCC-C2017-171). This certificate was issued following an assessment of the current and future activities to be conducted by the Operator at PVGF, a cultural heritage assessment and survey, and delineation of cultural heritage restricted work and exclusion zones.

2.4.2 DGF

The Operator has an agreement with the CLC for use of OL7 land for petroleum activities. The CLC act as a representative of the Indigenous Traditional Owners. The agreement includes land access and other matters such as royalties, administration and Sacred Sites protection.

The Operator has obtained a SSCC from the CLC (SSCC C2020-001). This certificate was issued following an assessment of the current and future activities to be conducted by the Operator at DGF, a cultural heritage assessment and survey, and delineation of cultural heritage restricted work and exclusion zones.

2.4.3 SOF

The Operator has an agreement with the CLC for use of OL6 land for petroleum activities. The CLC act as a representative of the Indigenous Traditional Owners. The agreement includes land access and other matters such as royalties, administration and Sacred Sites protection.

The Operator has obtained a SSCC from the CLC (SSCC C2014-029). This certificate was issued following an assessment of the current and future activities to be conducted by the Operator at SOF, a cultural heritage assessment and survey, and delineation of cultural heritage restricted work and exclusion zones.

Table 3: Key legislation

Legislation	Requirement	How Operator meets the requirement	Administered by
Commonwealth			
Environment Protection and Biodiversity Conservation Act 1999	The *EPBC Act* allows bilateral agreements between the Australian and Northern Territory (NT) governments. These agreements let the Commonwealth accredit NT environmental assessment and approval processes. Since 2013, the NT Environmental Protection Agency (EPA) can assess proposed actions on behalf of the Commonwealth. Refer to State Legislation *Environmental Protection Act 2019* and associated Environment Protection Regulations 2020 requirements below	A self-assessment of the activities to be undertaken within this EMP has been conducted and determined that significant impacts to MNES are not likely to occur and a referral is not required at this stage. A Protected Matters Search Tool (PMST) was conducted for PVGF, DGF and SOF on 5 December 2023. The comprehensive self-assessment indicated that the Operators' activities will not have a significant impact on MNES. The self-assessment report is attached in Appendix 4.	Department of Climate Change, Energy, Environment and Water (DCCEEW)
National Greenhouse and Energy Reporting Act 2007 (NGER Act)	Reporting under National Greenhouse and Energy Reporting Scheme where thresholds are exceeded	The PVGF and DGF facility energy consumption, production and greenhouse gas (GHG) emissions are reported as one of the facilities under the Operational Control of the Operator in accordance with the *NGER Act*.	Clean Energy Regulator
National Environment (National Pollution Inventory Protection) Measure 1998	Reporting under the National Pollution Inventory (NPI) where trigger thresholds are exceeded	The Operator's operational and workover 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 (CLC) regarding all activities undertaken on the Aboriginal Freehold Land.	Attorney General's Department
Northern Territory			
Bushfire 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 PVGF, DGF and SOF are 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 PVGF.	Department of Lands, Planning and Environment (DLPE)

Legislation	Requirement	How Operator meets the requirement	Administered by
Petroleum Act 1984	Petroleum titles	The Operator has obtained the necessary petroleum titles to undertake the activities listed in this EMP.	Department of Industry, Tourism and Trade (DITT)
	Land Access and Compensation Agreements	Land access agreements are in place with the Central Land Council for PVGF, DGF and SOF.	Central Land Council (CLC)
Petroleum (Environment) Regulations 2016 (PER)	Approved FEMP	This EMP provides a revision and renewal of the PVGF EMP (FEMP) previously approved in 2018. The previous PVGF FEMP was prepared prior to implementation of the Code in 2019. EMP activities seek to comply with requirements of the Code and Schedule 1 of the regulations. This EMP also incorporates DGF and SOF routine field activities and will replace the FEMP for DGF and SOF approved in 2020.	DLPE
Environmental Protection Act 2019 and associated Environment Protection Regulations 2020	If deemed to have a 'significant impact' to Matters of National Environmental Significance (MNES) referral of proposed action/ environmental approval is required.	The activities within the scope of this EMP do not include any material change of use or inclusion of additional activities/impacts. The EMP presented is a renewal of existing production operations and workover activities. No new development areas are proposed, and the Operator is of the view that the continued operations activities covered by this EMP do not have a significant impact on the environment and that an assessment under the NT bilateral agreement with the Commonwealth against the *Environment Protection Act 2019* is not required.	NT Environmental Protection Agency (EPA)
Northern Territory Aboriginal Sacred Sites Act 1989	Must not enter, damage or interfere with a Sacred Site (even if not registered)/Authority Certificate	The activities within the scope of the EMP do not constitute any material change of use or extension of already disturbed areas. The Operator is of the view that the activities covered by this EMP do not have a significant effect on the environment and that additional assessment under the Act is not required. Restricted work areas and no-go areas have been identified across the PVGF, DGF and SOF. All personnel and visitors are educated about these areas, and they are clearly delineated on maps and with signage. A new Aboriginal Areas Protection Authority (AAPA) Authority Certificate has been applied for, covering all the works described in this EMP. The Operator commits to complying with the requirement of the Authority once approved.	Aboriginal Areas Protection Authority (AAPA)/Central Land Council (CLC)
Heritage Act 2011	Work approval (for removal or damage of archaeological sites)	All activities outlined in this EMP will be conducted within the exiting operational footprint of PVGF, DGF and SOF and therefore the Operator does not anticipate an additional work approval will be required.	NT Heritage
Radiation Protection Act 2004	Disposal of radiation sources (Normally Radioactive Material, NORM)	The Operator to undertake NORM testing. If limits specified in the act are exceeded, disposal of the material to be in accordance with the Act.	NT Health

Legislation	Requirement	How Operator meets the requirement	Administered by
Territory Parks and Wildlife Conservation Act 1976	Protects wildlife and listed threatened species in the NT Feral animal management	EMP activities to be conducted within existing operational footprints and on existing disturbed areas so significant impacts to wildlife and listed threatened species are unlikely. The Operator responds to feral animal management as required for those species identified at PVGF.	DLPE
Public Health and Environmental Act 2011	Wastewater management	On-site systems meet requirements of Code of Practice for Onsite Wastewater Management.	NT Health
Water Act 1992	Groundwater extraction licence	Not applicable. Water is purchased and trucked to site if required at each field.	DLPE
Waste Management and Pollution Control Act 1998	General environmental duty	Where activities occur outside of lease areas (e.g. during transportation), the Operator and its interest holders must abide by the general environmental duty. An example of this would be following the NT Contaminated Land Guideline (2017) if a contamination event occurred.	NT EPA
	Licensed waste contractors	Any listed waste generated during operations or as part of workover and systems works is removed using a licensed waste transporter.	NT EPA
Weeds Management Act 2001	Weed declarations and statutory weed management plans	The Operator ensures that its activities are consistent with statutory weed management plans and undertakes weed management activities consistent with weed declaration classes.	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 dangerous goods transportation that occurs above the trigger levels are done so 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 of Practice (the Code) compliance and this EMP has been prepared to meet those requirements. In highlighting our commitment to complying with the Code, the majority of the PVGF, DGF and SOF were developed, infrastructure installed, and has been in operation prior to the introduction of the Code. As a result, there are instances where some equipment and processes in place do not achieve the minimum standards of the Code. There are also instances of the Code not being applicable, namely section D. The scope of Section D, as defined in D.2 is specific to “onshore shale gas fields”. The PVGF, DGF and SOF are conventional petroleum fields. Where infrastructure and or processes are not aligned with the Code, the Operator will ensure that any new facilities 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 is in alignment with the Act.	DITT

Legislation	Requirement	How Operator meets the requirement	Administered by
Work Health and Safety (National Uniform Legislation) Act 2011	Activities to be performed under an approved EMP are to be compliant	The Operator field operations described in this EMP are subject to the *Work Health and Safety (National Uniform Legislation) Act 2011* and Regulations	NT WorkSafe

3 Description of Activity

3.1 Activities and Indicative Timetable

The activities under this FEMP relate to all aspects directly associated with the day-to-day operations of the PVGF, DGF and SOF. An indicative timetable for these activities is outlined in Table 4 and detailed in the sections further below. Operations occur 24-hours a day, 365-days per year including the wetter months of the year (October to April). Weather conditions are monitored daily to allow reassessment of operational needs to be addressed.

Table 4: Indicative timetable

Activities	Indicative yearly timetable
Civil and project activities	Early and late dry season is preferred timing for civil related works under this EMP for maintenance and rehabilitation
Well operations	Monitoring and maintenance may occur year-round as scheduled in the approved well operations management plan (WOMP) and the Operator's Well Integrity Management System and on an as needs basis for producing wells
Production facilities	Monitoring and maintenance may occur year-round as scheduled in the Operator's pipeline and processing facility integrity maintenance systems and on an as needs basis for corrective active actions
Well workovers	Maintenance activity used to restore well bore integrity in compliance with the Code and/or increase production rates on an as needs basis and in accordance with the Operator's Well Integrity Management System annual scheduling and well decommissioning program schedule. While workovers are expected over the duration of this EMP, there are currently no workovers planned for any of the fields covered by this EMP however quarterly regulated activities reporting will include details once any workovers are committed to by the Operator.
Wellhead equipment	Wellhead equipment, safety systems and gathering lines work to allow tie in of new wells and replacement of equipment where required under the Operator's pipeline and processing facility integrity maintenance systems schedule
Progressive rehabilitation	Progressive rehabilitation and closure of areas in the field will be conducted in accordance with the progressive rehabilitation and closure plan (PRCP)/Rehabilitation Plan as outlined in Section 7.5 and Appendix 9
Supporting activities	Operational support activities occur year-round including workforce provision, power production, traffic and transport, product export, chemical storage and use, wastewater management, waste management and supporting field logistics
Environmental monitoring	Includes routine groundwater monitoring as per the Operator's current Groundwater Monitoring Program (Appendix 10), weed monitoring, incident investigations as specified in this EMP
Care and maintenance	SOF, firebreaks, erosion and sediment controls (ESC), fences and gates, wellheads

3.2 Civil and project activities

Examples of the scope of work for civil and project activities are provided in Table 5 below. The scope of work will vary based on the forward planning for the respective field, along with capital expenditure availability.

Table 5: Potential civil and project activities

Activities	Examples of scope of work
Road and access track maintenance	▪ Grading of access tracks and roads to maintain 24-hour/365-day access to all assets via light and heavy vehicles ▪ Installation of Erosion and Sediment Controls (ESC).

Activities	Examples of scope of work
Well pad and operational area maintenance/upgrade	▪ Re-instatement of hardstand ▪ Re-instatement of flare pits ▪ Installation of trenches and diversion drains to support rig infrastructure/layout. ▪ Installation and maintenance of containment, erosion and sediment controls
Land and vegetation management	▪ Maintenance of vegetation boundaries and fire breaks at least 4m. Firebreaks use previously disturbed areas, including former seismic lines and access tracks to provide a barrier around key infrastructure such as the PVGF–Central Treatment Plant (CTP) and camp facilities ▪ Erosion and sediment control works including repair of eroded areas, installation of diversion and dissipation devices, particularly after wet weather events ▪ Reinstatement of waterway crossings where erosion or sedimentation has occurred including from flooding or vehicle movements ▪ Vegetation clearing along existing gathering networks/pipelines to maintain flowline integrity ▪ Installation and maintenance of fencing/gates/grids to deter fauna interactions
Use of borrow pits	If gravel is required, then this is purchased off-site. Existing gravel pits at SOF are ear marked for rehabilitation. No further gravel pits are proposed.
Use of groundwater	If water is required, then this is purchased off-site
Projects	▪ Activities to facilitate asset/plant upgrades or replacement of existing or installation of new infrastructure within the current disturbance footprint ▪ Progressive rehabilitation and closure of redundant facilities/infrastructure ▪ Environmental monitoring including weeds, and groundwater monitoring ▪ Construction of new evaporation treatment pond at PV-12 ▪ Decommissioning of existing evaporation pond at PV-09 ▪ Rehabilitation and monitoring of PV-09 area to return it safely towards baseline arid vegetation conditions
Site mobilisation and demobilisation	▪ Movement of heavy machinery, equipment and facilities to and from wells, operational areas of laydown in-field ▪ Installation of temporary mobile support services such as camp, office and power generation

3.2.1 Well maintenance and integrity

Well integrity related maintenance and testing processes during the operational phase involves engaging specialist third party service providers to conduct servicing, maintenance, function testing, comprehensive bleed downs, top ups, pressure testing and data recording activities.

Well maintenance and integrity testing will be carried out in accordance with Department of Environment, Parks and Water Security (DEPWS) approved Well Operations Management Plan (WOMP) and the Operator's Well Integrity Management System which in turn is based on *ISO 16530-1:2017: Well Integrity Lifecycle Governance*. Well integrity management terminates downstream of the production wing valve (PWV) at PVGF and DGF.

Wellhead maintenance includes testing and servicing of surface components of the wellhead and production tree which are collectively referred to as wellhead components. This process does not extend past the PWV and covers both flow-wetted and non-flow wetted valves.

Subsurface integrity testing encompasses a combination of annuli and wellhead seal testing of barrier envelope integrity for both downhole and surface barrier components.

3.2.2 Well barriers and aquifer protection

Aquifer protection is a key objective of the Code and detailed well engineering requirements are laid out in respective WOMPs. An example of the typical well barriers that currently exist in the PVGF petroleum wells, relative to stratigraphy, is provided in Figure 5.

It shows two strings of cemented steel casing that meet the Code requirements for barrier testing, to permanently protect and isolate the regional Mereenie Sandstone aquifer in each petroleum well at each field. The Code also requires ongoing petroleum well integrity to ensure that all potable aquifers are isolated, and the wells are safe. Routine groundwater monitoring is undertaken bi-annually at monitoring bores specified in

the approved Groundwater monitoring plan at DGF and SOF. Groundwater at PVGF is too deep to access via water bores (refer to the groundwater monitoring program in Appendix 10)

The Mereenie Sandstone is the only major aquifer in the field areas as per the definition of aquifer under the Code related to water quality criteria for potability and/or suitability for agricultural use. The much deeper Pacoota Sandstone, which contains saline water and is the target formation for oil and gas, and the other formations penetrated by the well contain very limited groundwater resources and are not considered as aquifers, under the Code, in these regions. Please refer to the respective fields Section 4.1.4 for more information on groundwater and stratigraphy in the respective field area.

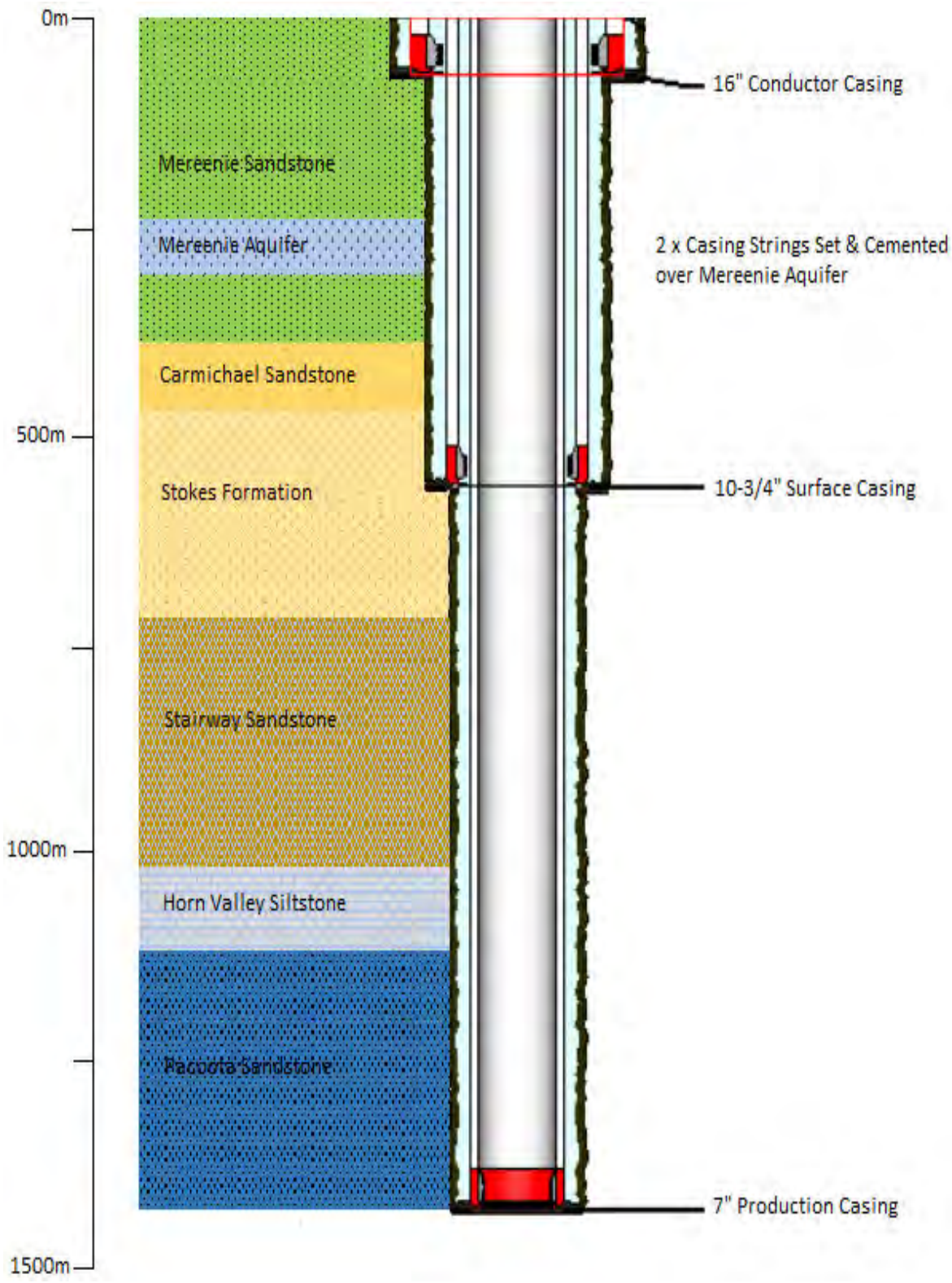


Figure 5: Petroleum well design and aquifer protection – generalised stratigraphy

3.3 Production facilities

3.3.1 Flowline integrity

The integrity of all gathering lines and flowlines within each field is managed in accordance with the Operator's Integrity Management System (IMS AS2885) and associated plans and procedures and to comply with the requirements of *AS2885: the Standard for High Pressure Pipeline Systems* (AS2885). Integrity of the flowlines

is via a program of monitoring, inspection and materials sampling of both internal and external components of the flowlines.

Plant integrity, containment, safety, and reliability is a major focus to all petroleum production related activities in the field. Pigging activities are conducted as part of maintenance of the flowlines. All material and debris from pigging is captured and directed to the evaporation ponds and via the processing facilities. Corrosion inhibitors, biocide treatment and cathodic protection are used to maintain the integrity of flowlines.

3.3.2 Venting and flaring

Routine flaring during normal operation / care and maintenance of the gas / oil fields are not undertaken at PVGF or SOF, respectively. Venting at PVGF may occur in the event of loss of asset integrity or an emergency shutdown situation. In circumstances where, for safety reasons, infrastructure, such as compressors, need to be purged of gas for maintenance and repair, gas may also be vented if it cannot be bled to the processing plant via the gathering network.

Any emergency venting will be in accordance with the requirements of the Code. IMS AS2885 records and investigates root cause and corrective action for loss of asset integrity incidents. The primary objective is to maintain the asset in a fit-for-service condition while extending its remaining life in the most reliable, safe, and cost-effective manner. Plant integrity, safety, and reliability are major focus to all petroleum production related activities in the field.

Limited amounts of flaring may occur during workovers at all fields. The Operator maintains records of all flaring and venting activities to support greenhouse gas reporting as part of the annual *National Greenhouse and Energy Reporting (NGER) Act* and as part of monthly reporting to DITT.

3.3.3 Plant and equipment maintenance and upgrade

All assets are recorded in the maintenance management system and programmed to have a planned maintenance frequency. Work orders are created from the system which enables the Operator's personnel to undertake maintenance inspections of assets in a systemic manner.

Where the work order requires a test or inspection to be performed on an asset it is recorded on a proforma/ checklist and retained in the Operator's document management system for future reference. Corrective actions and additional work orders, along with Management of Change procedures are implemented where required.

Where plant and equipment has reached the end of its design life, a program of replacement and upgrade is implemented. Equipment is replaced like for like, or with newer technologies.

3.3.4 Well workover

Workover is a maintenance activity used to restore well bore integrity and/or increase production rates, although the term workover is also used to describe re-completion activities when an existing production well is being completed in a new zone or work is being carried out on an existing zone. Workovers can cover several activities depending on the nature of the well and the issue being addressed. Workovers are usually conducted at the respective existing well site which was established prior to construction of the well.

Major workovers can include cleaning sand or other impurities such as wax or scale, fishing to recover original production equipment, installing equipment to prevent sand from entering the well, replacing liners, plugging the well, repairing casing, drilling or milling any obstructions in the well, stimulating intervals and re-perforating existing or new zones.

Upcoming workovers will be communicated to Department of Lands, Planning and Environment (DLPE) via the quarterly regulated activities report prior to the event.

Some wells have been subjected to varying degrees of minor integrity issues; therefore, workover activities have previously included casing inspection and repair activities.

Deterioration in wellbore condition is monitored through an established surveillance program that includes monitoring of annuli pressures and fluid contents; the results of which are critical for the performance of safety and environmental risk assessments that provide a basis for scheduling workover priorities.

For some workovers, limited equipment is required (for example, wireline equipment to lower tools into the hole to conduct operations), whilst others require rotation of the tubing or drill pipe, requiring a full workover

rig. Pumps and storage tanks may be required for associated activities that involve circulation of workover fluids.

3.3.5 Barrier protection

Workover activities are an important measure to ensure well integrity during the operation of the well. Workover activities will replace or repair casing strings and liners, and remedial cementing aims to maintain well barrier integrity at the aquifer (as defined by the Code) location and throughout the well.

The use and verification of well barriers that will be used and installed during workovers is prescribed by the Code. Given that final determination of wells undergoing workover has not been made for this EMP, the well barrier schematics are not yet developed, however the Operator will fully comply with section B.4.14 Workover and Intervention of the Code, which requires any workover or well modification to be designed to ensure the well is operated within the maximum expected pressures and load conditions until final decommissioning.

The Operator will ensure that well integrity is maintained, as set out in section B.4.1 of the Code.

3.3.6 Well suspension

Suspension activities are intended to be 'temporary', in that they are designed to secure conditions in a well so that any environmental or safety hazards are adequately controlled until the well undergoes either recompletion or final decommissioning. Suspension activities are closely dependent on the condition of the well and as a result vary in their complexity.

The primary considerations for suspension of a petroleum well are to ensure that:

- Well integrity is maintained at all times as set out in section B.4.1 of the Code
- Monitoring requirements can be met, and that production can readily be resumed
- All safety requirements are met.

3.3.7 Well decommissioning

Emergency decommissioning may be required in the event of unplanned circumstances (i.e. when safety tests/monitoring determine a well needs to be killed). All decommissioning activities will be conducted in accordance with the Code compliant and DITT approved WOMPs.

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. The two-stage decommissioning process as 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 two well barriers.

Complete and accurate records of the entire decommissioning procedure will be kept and submitted as part of the legislative reporting requirements for the decommissioning of petroleum wells.

The potential for accumulation of NORM in well equipment will be assessed and appropriate measures put in place to reduce risks to the health and safety of people and the environment.

3.3.8 Wellhead equipment, safety systems and gathering line replacement

Wellhead equipment, safety systems and gathering lines works allow the well to be connected to the existing gas gathering line for processing before transfer to market. Activities undertaken as part of the wellhead equipment, safety systems and gathering line replacement works include:

- Tie-in to the wellhead, installation of new well head equipment and safety systems such as metering instruments, control valves and/or shutdown skids within the existing well lease pad area.
- Installation of new pipelines to connect the wellhead equipment, safety systems and gathering lines and wellhead to existing pipelines. Pipelines will be above ground and installed within the existing disturbance footprint.
- Installation of pipework will be undertaken in accordance with Australian Standard 2885.0:2018 Pipelines – Gas and liquid petroleum – General requirements.

All wells have an existing wellhead located on a well lease which will be used as the work area during the installation. No ground disturbance will be required. No flaring or venting is required as the well is isolated, and

gas bled into the existing field gathering network. Pipes are then isolated at the gathering line and there may be a very small amount of gas trapped residual gas released when handling pipework.

Installed wellhead equipment, safety systems and gathering lines will undergo hydrostatic testing as required (using freshwater) for integrity and leak detection during commissioning.

Leak detection monitoring will occur as per the Methane Emissions Monitoring Plan and Code on recommissioning of the well. Removed pipework will be tested for NORMs and recycled at an approved facility provided no NORMs present.

3.3.9 Progressive rehabilitation and closure planning

Progressive rehabilitation and closure of areas will be conducted in accordance with the PRCP (PVL-630-PLN-0002) dated 30 June 2022 (Appendix 9) as summarised in Section A.8.5. The requirements of this plan have been absorbed by the Rehabilitation Management Plans for each field in this EMP.

3.4 Common support activities

3.4.1 Chemical storage and use

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 safety data sheet (SDS) for each chemical.

With regards to 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. These areas and specific worksites, such as the CTP, use a combination of permanent concrete bunds or temporary bunds where use is required at specific worksites/wells. Chemical spills accumulated within the secondary containment in the warehouse and production facilities is mopped up using spill kits and then disposed as solid waste in accordance with 3.4.3.1.

During workovers, chemical use and storage on existing well site (lease) areas will use the following and maintain secondary containment requirements as per A.3.8(g) of the Code depending on storage requirements:

- A compacted and impermeable high-density polyethylene (HDPE) lined hardstand bulk bag chemical storage area within the existing well site (lease), including bunding to contain 100% of the largest container stored plus 10%.
- A fully enclosed portable storage trailer 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 (lease).
- A fully enclosed portable workshop area that includes capacity to contain 100% of the volume of the largest container in the workshop plus 10%.
- Be compatible with the material or waste stored or used within the containment.
- Be resistant to physical, chemical and other failure during handling, installation and use.

At PVGF, secondary containment fluids are channelled to an oil/water separator. The coalesced oil is drummed and disposed of by a licensed waste contractor and the water is discharged to the evaporation ponds. At DGF, liquids collected within the secondary containment is drummed and disposed of at the BECGS facility. There are no tanks in use with secondary containment at SOF.

In terms of lifecycle chemical handling, given the remoteness of the location, chemicals are transported from off-site locations in the volumes required for safe operation plus contingency within our on-site storage capability to meet any operations requirements and road access limitations. The aim is to minimise the frequency of deliveries to reduce transportation risks while allowing the necessary quantities to be appropriately stored on-site for access as required. Table 6 shows the types of chemicals and quantities typically used or stored.

Table 6: Typical chemicals used during operations and workovers

Substance	Hazardous material	Dangerous good	Biodegradable	Typical quantity*
Anti-corrosives	Yes	Yes	N.A.	200L
Adhesives/glues	Yes	No	N.A.	500L
Acetone	Yes	Yes	Yes	100L
Thinners	Yes	Yes	Yes	200L
Acetylene	Yes	Yes	Yes	100L
Biocides	No	No	Yes	200L
Truck wash	Yes	No	Yes	100L
Priming fluids	Yes	Yes	Yes	200L
Diesel	Yes	Yes	Yes	25,000L
Pipe cement	Yes	Yes	Yes	100L
Degreaser	Yes	Yes	Yes	100L
Paint	Yes	Yes	Yes	100L
Soaps	No	No	Yes	50L
Sealant	No	No	Yes	200L
Herbicide	Yes	No	Yes	200L
Coolant	Yes	No	Yes	100L
Engine oil	No	No	Yes	20L–1,000L
Compressor oil	No	No	Yes	1,000L
Hydraulic oil	No	No	Yes	20L
Grease	No	No	Yes	100L
Nitrogen	Yes	Yes	N.A.	100kg
Oxygen	Yes	Yes	N.A.	100kg
Propane	Yes	Yes	N.A.	50kg
Methanol/ethylene glycol	Yes	Yes	Yes	6,000L
Helium	Yes	Yes	N.A.	100kg

** Quantities in stock will vary depending on the activities occurring at points in time.*

As part of maintenance planning activities for both the DGF and SOF, the storage of any chemicals, dangerous goods or hazardous materials and substances occurs at the BECGS. Minor quantities (i.e. generally less than 200L) of any chemicals, dangerous goods, hazardous materials or substances are transported by CP personnel in the vehicles to the DGF and SOF on an 'as needs' basis whilst maintenance activities are being performed. These vehicles are fitted with spill kits to address any spills or leaks which may occur.

3.4.2 Workover fluids

The proposed workover fluid is comprised predominately of water with the remaining made up of inert chloride salts and biodegradable, low toxicity fluid additives. Water for workover fluid will be stored at the well site in the engineered steel mud tank system. There may be two to three mud tanks on-site with a total volume of up to 80kL, but only approximately 60kL of workover fluid is required. The main chemicals added to the water to make up the workover fluid and the primary role of the additive is as follows:

- KCl (Potassium Chloride): an inert soluble salt that is an extremely efficient shale and clay stabiliser. If not used the clays swell with water and effectively block the reservoir and often permanently damage the well often severely impacting the well production ability. Inhibition is provided through ion exchange; the potassium ion enters between the individual clay platelets in the shale so that they are held together, thus

eliminating entry of water from the completion fluid. Typical concentrations of KCl may range between 10,000mg/L and 30,000mg/L KCl

- AMC Resi Drill: a biodegradable micronized cellulose polymer that is added to the workover fluid to act like a skin on the wellbore to help minimise the fluid invasion into the surrounding formations. It reduces dynamic filtration loss, stabilises wellbores and protects reservoirs from damage. The product is formulated to reduce fluid loss and stabilise shale by preventing filtrate invasion into permeable structures. Filter cake and differential sticking are therefore minimised, and weak formations are stabilised.
- AMC Biocide G: is a designed biodegradable, broad spectrum biocide designed to reduce and prevent bacterial and fungal activity in water-based fluids. This is added to ensure that any surface bacteria are not transferred to the reservoir.
- AMC Xan Bore: when water is not viscous enough to carry reservoir or other debris to surface, Xan bore is added to the water to increase viscosity. This product is specifically used as it passes the Standards Australia Test AS4351 for biodegradability.
- Caustic soda/acid: inert and used to alter the pH of the workover fluid.

The maximum concentration and degradation assessment of chemicals in the workover fluid is provided in Table 7. The workover fluid chemicals are stored in an enclosed purpose-built portable trailer, which keeps chemicals isolated, dry and safe. The portable trailer is located in a designated chemical storage area within the well lease which is bunded and can contain 100% of the largest container stored plus 10%.

Batch mixing of the fluid chemicals occur within steel mud tanks which will have temporary spill absorbent mats placed under them to capture any spills which may occur. Chemicals will be added to the workover fluid (water) using the mixing hopper and the ~100L batch of made-up workover fluid (water plus additives) returned to the mud tanks. Two options are proposed for secondary containment of mud tanks during workover activities.

Option 1 – A lined sump still exists on the well pad

In the event a lined sump exists on the work over well pad, mud tanks will be positioned adjacent, and a lined drain/pipe will be constructed to direct any spills to the sump at which point it will be collected via vacuum truck which will be on standby during all workover activities. The sump in use will include capacity to contain 100% of the volume plus 10% of largest the mud tank.

Option 2 – A sump no longer exists on the well pad

Where the sump has been filled in or rehabilitated on the work over well pad, a propriety temporary bund product (e.g. plastic liner with foam bund) or HDPE lined earthen bund will be installed to capture any unplanned spills from the mud tanks. Similarly, any secondary spill containment will be sized to contain 100% of the volume plus 10% of largest the mud tank.

In either scenario, additional controls will be implemented to control spill/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.

As discussed further in the Groundwater Sections for respective fields, the depth to groundwater at PVGF and DGF is significant, making any potential spill infiltration and environmental impact remote. In addition, the presence of the impervious Parke Siltstone above the Mereenie Sandstone at SOF, provides aquifer protection against contamination from any potential significant surface level spills. No persistent, bio-accumulative and toxic chemicals will be used in operations. In the event of spills occurring at a well site/workover area, the potential impact to 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 2013* contaminated soil guidelines. No workover fluid chemicals used in the workover process contain benzene, toluene, ethylbenzene and xylene (BTEX). All workover chemicals are biodegradable or inert.

Table 7: Potential workover fluid additives for each well

Product name	Concentration	Purpose	Readily Biodegrade	Dangerous/ Hazard
Potassium Chloride	30,000mg L^{-1}	Stabiliser	Inert but cumulative	No
AMC BIOCIDE G	1,500mg L^{-1}	Biocide	Yes	Yes
AMC RESI DRILL	5,000mg L^{-1}	Protect formation	Yes	No
AMC XAN BORE (Guar Gum)	3,000mg L^{-1}	Thickening agent	Yes	No
Caustic Soda	5,000mg L^{-1}	Buffer	Inert	Yes
HCl or Citric Acid	5,000mg L^{-1}	Buffer	Inert	Yes

Workover fluids are likely to be the only wastewater produced during workovers at existing well sites. DITT requires the Operator to ensure enough workover fluid and a weighting agent at the well site is available to "kill" the well in the event of an emergency/loss of containment during workovers.

The Operator will use water purchased from off-site providers for use in workover fluid, along with a small amount of biodegradable biocide and KCl. Workover fluid will not be mixed with any oil or BTEX based additives.

If the work over fluid is not required at a particular well site, the unused water will be used at another well site in the mud tank or disposed of in PVGF evaporation ponds. The anticipated total volume of workover fluid required is approximately 0.063ML per workover.

While undertaking routine[3] air/mist workovers at a well site, retrieved debris/fill/materials will be discharged into a flare tank (via the blooie line) at the well site. Limited flaring may be undertaken, as it commences any incidental small volumes of liquid within the flare pit is vaporised (not expecting water to be discharged as little water is present in gas cap at PVGF). Installed flare pits will remain at the well site as permanent infrastructure.

For larger workovers (i.e. flow rate > 5TJ/day anticipated) a flare pit will be utilised which will be lined with an impervious clay material and hydrotested prior to operation. Only once the flare pit has passed a hydrotest will workover activities be able to commence. Upon completion of the workover, discharged materials can be removed from the flare tank/pit and disposed or recycled at an approved facility. Metal waste generated will be tested for NORMs and recycled at an approved facility as scrap metal provided no NORMs present. In both cases, volume markers will be applied to the flare tank/pit to ensure visual inspections can accurately determine whether a leak has/is occurring. Visual inspections will be undertaken, at minimum, daily during workover.

The worst-case scenario for spill of workover fluid at a well site is taken to be 0.06ML. The constituents potentially present in the workover fluid are in Table 7. All constituents are either readily biodegradable or inert. Given that chloride is the dominant constituent that persists in the workover fluid, an assessment of this analyte is used in a hypothetical, maximum release scenario:

- Maximum potassium chloride (KCl) concentration = 30,000mg L–1 (calculated total dissolved solid (TDS)= 30,000mg L–1)
- Calculated electrical conductivity (EC) = 46.7dS/m
- Max volume workover fluid = 0.06ML being deposited within the well site bunded hardstand area (~<500m2) assuming 1-m infiltration at the well site

3.4.2.1 Spill scenario analysis

Chloride is the dominant anion in nearly all petroleum workover fluids, drilling fluids and formation water associated with conventional petroleum field operations. Chloride contamination is one of the primary historical environmental issues in US onshore oil and gas well sites (USGS, 2014).

[3] Routine workovers include all wells with a flow rate of less than or equal to 5TJ/day

The salts in brine can alter the chemical and physical properties of soils. High concentrations of water-soluble salt arising from a spill, such as sodium, potassium, chloride, and sulphate can lead to an increase in soil salinity. Spills at a well site may lead to excessive accumulation of the chloride in soils.

Although there is currently no appropriate screening criterion for chloride available from published guidelines. Salts from brine impair plants' ability to take up water and nutrients. High salt concentrations in the soil restrict the plants' ability to take up water despite adequate water being available in the soil. This causes the plant to exhibit symptoms of drought due to an osmotic effect, which causes water to move from areas of low salt concentrations to areas of high salt concentrations.

Due to the impacts of high salt concentrations on soil and vegetation, impacted sites suffer from a decline in plant growth. This is magnified by the inability of many seeds to germinate in highly saline soils. Under these conditions, seeds have difficulty taking up water, causing damage to the embryo or dormancy in response to water stress. In addition to the inability to take up water, nutrient uptake is also reduced.

Chloride negatively impacts most plants when it exceeds 350mg L^{-1} in water, 1% in plant tissue or 250mg L^{-1} in soil (Meehan et.al, 2023). Some grass species used for forage such as Puccinellia have been found to be tolerant of high EC concentrations of up to 10dS/m (DPI, 2016). Salt-tolerant plants are called halophytes.

In the US for on-well pad clean-ups, the chloride level in the soil material needs to be less than 1,000mg L^{-1} above baseline values, whereas for off-pad clean-ups, the chloride level is typically targeted to be less than 250mg L^{-1} above baseline but is subject to landowner approval (Green et al, 2020).

In the event of a spill, it is important to remove the excess chloride to prevent contamination of surface and groundwaters. Remediation can be in the form of excavating the impacted topsoil and replacing it with clean fill or through the application of calcium based chemical compounds such as gypsum.

3.4.3 Waste management

3.4.3.1 Solid waste

Typical wastes and the approach to their management are outlined in Table 8.

Table 8: Waste management approaches

Typical waste	Waste management approach
Comingled waste/general waste (including food, paper, plastics)	Dispose Skip bins contain comingled waste for disposal via licensed waste contractor to Alice Springs disposal facility.
Chemical storage containers	Dispose Dispose via licensed waste contractor to disposal facility. Containers will be returned to suppliers for re-use where suitable.
Contaminated soil	Dispose Dispose via licensed waste contractor to a registered off-site disposal facility
Drink containers (glass, aluminum, plastic)	Recycle/Donate Plastic drink containers are donated to social enterprises within the Alice Springs area under the Container Deposit Scheme.
Glass and cans	Recycle Store in recycling bins for transport to approved recycling facility.
Integrated Bulk Containers (IBC)	Reuse/Dispose Re-used/re-purposed where possible as storage containers for other waste materials Return to suppliers or disposed at approved facility.
Oily rags, oil contaminated material, filters, greases and any other hydrocarbon containing material	Recycle/Dispose Stored in a secure area for collection and transport to an approved recycling facility or disposal facility
Scrap metal	Recycle/Reuse

Typical waste	Waste management approach
	Stored in recycling bins or designated laydown areas for collection and transport to an approved recycling facility Transported off-site for re-use where vendors are identified Re-used/re-purposed within the field where possible
Sewage, grey water	Treat/Dispose Greywater and sewage are treated using an on-site wastewater system to secondary level prior to disposal of treated effluent to a small pond for evaporation/dust suppression Temporary facilities may be installed at well facilities Biosolids are removed by a licensed waste contractor and disposed of at an approved facility Any portable greywater and sewage treatment systems and disposal of treated effluent (via irrigation or evaporation) will be as per the Department of Health's Code of Practice for on-site wastewater management
Timber (including pallets)	Recycle/Dispose Stored in a secure area and either re-used on-site, returned to supplier where possible, or transported and disposed at an approved disposal facility
Used production tubing, well lines, pipes, wellhead equipment, safety systems	Dispose Storage (e.g. pipe racks) and containment (e.g. skip bins) facilities for replaced production tubing, well liners and other wastes from the activity
Used spill kit materials	Dispose Stored in a secure waste disposal area/container for collection and transport to an approved disposal facility
Workover fill/cuttings	Recycle/Treat/ Dispose Remaining fluids stored in lined sump/flare pit and evaporated. Solids disposed either off-site at an approved facility or via mix bury cover onsite.

3.4.3.2 Waste laydown area

A waste laydown area is located to the south of the PVGF CTP. This area is used for the storage of scrap metal, timber and redundant plant and infrastructure for re-use or until bulk removal can occur.

Operations at DGF and SOF, consists of short site visits and any rubbish is taken back to the PVGF base.

3.4.3.3 Sewage/grey water

Grey and black water from the PVGF camp is directed to an on-site wastewater system. Wastewater is treated to a secondary level. The existing septic system relies on anaerobic activity and is used to store and treat sewage at the camp site.

Liquid effluent from the septic tank flows through a rubble drain in a benign area. Temporary facilities may be established as required for workovers at well locations. Any portable greywater and sewage treatment systems installed at the workover well site office facilities will be operated as per the Department of Health's *Code of Practice for On-site Wastewater Management*.

There is no sewage or grey water generated from DGF.

At SOF, temporary facilities may be established as required for workovers at well locations. Any portable greywater and sewage treatment systems installed at the workover well site office facilities will be operated as per the Department of Health's *Code of Practice for On-site Wastewater Management*.

3.4.3.4 Waste tracking

Any listed wastes or by-products from on-site wastewater systems e.g. sewage sludge, that require disposal off-site, are transported and disposed of as solid waste in accordance with the requirements of the *Waste Management and Pollution Control Act 1998* and the *Radiation Protection Act 2004*.

3.4.3.5 Greenhouse gas emissions

Across all the Operator's NT operated fields, forecast GHG emissions through to FY 2027 inclusive, are estimated to total 334,815 tCO_2e. Emissions are based on calculated FY2022-23 NGERs (Table 9) data and assumes:

- Six successful workovers in FY23 at Mereenie
- Two successful development wells in FY24 at Mereenie
- Averaged production over the period of 35TJs (gas) and 0.022ML (oil) per annum
- SOF is shut-in, no GHG emissions.

The reported emissions are calculated using third party consultants who undertake a cumulative assessment of fugitive emissions across all sites and a tally of scope 1 and 2 greenhouse gas emissions associated with the daily operations of all operations.

Table 9: Reported emissions FY2022-23

No.	Field	Scope 1 Emissions (t CO2-e)	Scope 2 Emissions (t CO2-e)	Energy Consumed Total (GJ)	Energy Consumed Net (GJ)	Energy Produced (GJ)
1.	Mereenie	40,436	0	10,000,509	692,559	19,976,789
2.	PVGF	15,960	0	3,519,632	252,434	6,756,329
3.	DGF	5,368	37	1,409,611	77,373	2,741,531
4.	SOF	0	0	0	0	0

The forecast emissions from operations and workovers at PVGF over the next five years is <10,000 tCO_2e/annum. On average it was estimated that 4.67 tCO_2e/well was produced during workovers. All emissions are calculated using NGERs measurement determination requirements. At no time during the next five-year period does the Operator of the three fields breach the NT threshold as a large emitter. A summary of emissions for each field is presented below in Table 10, Table 11 and Table 12.

Table 10: PVGF forecasted emissions

PVGF emissions	Forecast volume t CO_2e						Methodology and assumptions
	FY24	FY25	FY26	FY27	FY28	FY29	
Fuel gas	8,500	8,000	7,500	7,000	6,000	5,000	Method 3
Diesel usage	2,000	2,000	1,500	1,000	750	500	Method 3
Development wells including associated activities		-	-	-	-	-	No new wells anticipated
Fugitive	1000	500	400	275	200	125	Method 3
Workovers		-	-	-	-	-	No workovers currently anticipated*
Wells	550	500	400	275	200	125	Method 3
Gathering	550	500	400	275	200	125	Method 3
Vented	550	500	300	175	150	125	Venting occurs only in emergency situations
Total	**13,150**	**12,000**	**10,500**	**9,000**	**7,500**	**6,000**	

**Indicative emissions per workover/well are ~4.67 t CO_2e (based on 2022/23 NGERs emissions data)*

Table 11: DGF forecasted emissions

DGF emissions	Forecast volume t CO_2e						Methodology and assumptions
	FY24	FY25	FY26	FY27	FY28	FY29	
Fuel gas	1,200	1,200	1,200	1,200	1,200	1,200	Method 3
Diesel usage	200	200	200	200	200	200	Method 3
Fugitive	-	-	-	-	-	-	Method 3
Workovers	-	-	-	-	-	-	No workovers currently anticipated*
Wells	-	-	-	-	-	-	Method 3
Gathering	50	50	50	50	50	50	Method 3
Flaring	3,550	3,550	3,550	3,550	3,550	3,550	Method 3
Total	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	**5,000**	

**Indicative emissions per workover/well are ~4.67 t CO_2e (based on 2022/23 NGERs emissions data)*

Table 12: SOF forecasted emissions

SOF emissions	Forecast volume t CO_2e						Methodology and assumptions
	FY24	FY25	FY26	FY27	FY28	FY29	
Fuel gas	-	-	-	-	-	-	Method 3
Diesel usage	-	-	-	-	-	-	Method 3
Fugitive	-	-	-	-	-	-	Method 3
Workovers	-	-	-	-	-	-	No workovers currently anticipated*
Wells	-	-	-	-	-	-	Method 3
Gathering	-	-	-	-	-	-	Method 3
Flared (Range)	500	500	-	-	-	-	Method 3
Total	**500**	**500**	-	-	-	-	

**Indicative emissions per workover/well are ~4.67 t CO_2e (based on 2022/23 NGERs emissions data)*

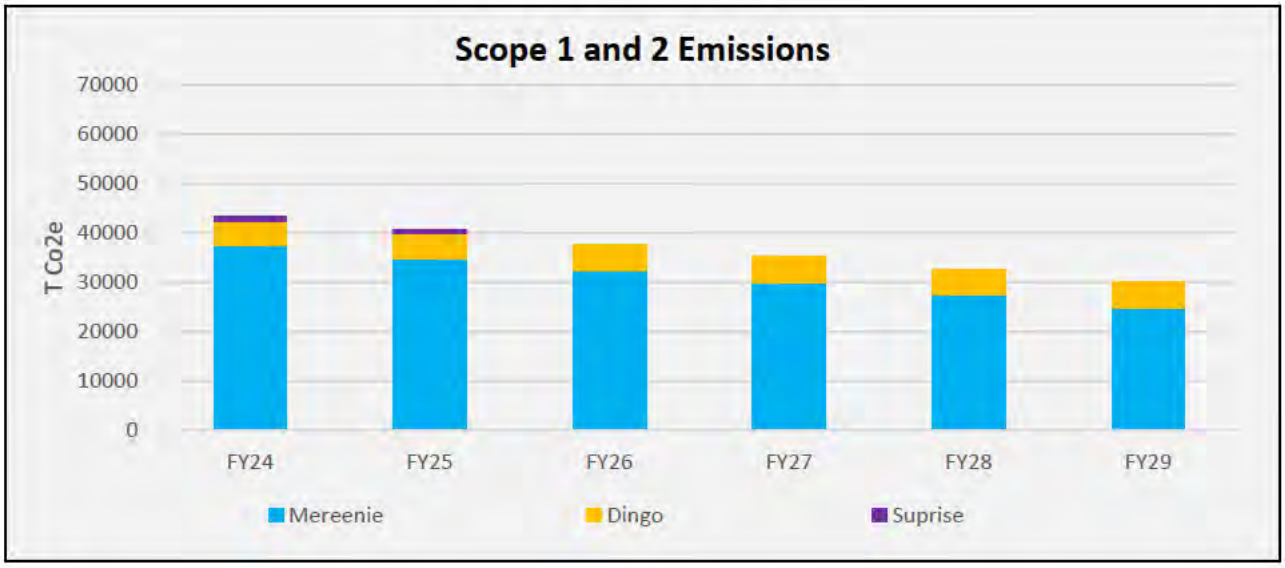


Figure 6: Forecast emissions aligned with NT Large Emitters Policy

3.4.3.5.1 GHG Mitigation controls

Greenhouse gas emissions generation will be mitigated through adoption of the Code requirements as required and implementation of a Methane Emission Management Plan (MEMP) (Section Methane Emissions Management Plan). The following GHG management control objectives and methods are specified in this EMP:

1. Develop petroleum production so that the optimum value of the resource is returned to the Territory, while applying the principles of ESD underpinning this EMP
2. Supply of low GHG emissions natural gas to the NT energy market
3. No unplanned flaring at any of the fields during routine operations
4. In-field solar evaporation for treatment of produced formation water brine at PVGF
5. Strict bushfire surveillance and management controls in OL3
6. PVGF has natural gas-powered electrical generation facility.
7. Containment integrity management controls for methane specified in this EMP.
8. Remote wellheads powered from 24V DC solar panels located adjacent to the wellhead controller with battery backup.
9. The Operator's travel approval process in place for managing all visitors and contractors
10. Planned logistics supply trips to/from Alice Springs to reduce transportation fuel consumption.
11. On-site accommodation for workers and service providers
12. Solid waste disposal service
13. No proposed clearing of vegetation
14. Active PRCP

Part A: PVGF

A.4 Production facilities

A.4.1 Introduction

A total of 13 petroleum wells have been drilled in PVGF. Petroleum wells may be active, shut-in, converted to re-injection wells, suspended, or decommissioned (Table 13).

Table 13: Overview of PVGF Wells

Well	Coordinates (GDA94)	Cleared Area (m^2)	Well Status	Additional Information
PV-01	-23° 59' 55.531" S 132° 46' 15.955" E	5,559	Currently shut-in (16/01/2012) due to low demand. Available for production.	
PV-02	-24° 0' 3.952" S 132° 39' 3.485" E	14,207	Shut-in	
PV-03	-24° 0' 19.388" S 132° 37' 5.351" E	6,987	Shut-in (1998) due to water loading	Well suspended – partially Restored
PV-04	-23° 59' 11.285" S 132° 39' 4.211" E	3,640	Cased and suspended as observation well – used as a re-injection well for formation water	Well reconfigured as a water re-injection well
PV-05	-23° 59' 11.285" S 132° 39' 4.211" E	10,650	Cased and suspended as observation well – located off the Palm Valley anticline	Well suspended – no Restoration
PV-06	-24° 0' 4.841" S 132° 42' 25.029" E	5,986	In production	In production
PV-07	-23° 59' 52.623" S 132° 43' 45.225" E	13,672	In production	In production
PV-08	-24° 0' 38.389" S 132° 47' 41.319" E	6,658	Plugged and abandoned (P&A)	Full rehabilitation including access road
PV-09	-24° 0' 6.103" S 132° 41' 4.517" E	1,794	Shut-in (03/2010) – Available for production	Well suspended – partially restored including unused evaporation pond
PV-10	-23° 59' 7.393" S 132° 43' 7.964" E	3,363	Cased and suspended as observation well	Well suspended – partially restored including unused evaporation pond
PV-11	-24° 1' 0.635" S 132° 37' 19.409" E	5,528	P&A	Partially restored land at request of Aboriginal Traditional Owners
PV-12	23° 59' 54.873" S 132° 44' 1.315" E	17,034	In production	In production
PV-13	-23° 59' 35.280" S 132° 43' 33.420" E	5,625	In production	In production

The production from the wells at PVGF consists of methane gas and small quantities of brine. The gas wells at these fields flow free to surface through natural reservoir drive mechanisms and are therefore considered "conventional" in terms of the *Petroleum (Environment) Regulations 2016*. The flow rate from wells is adjusted in line with production and sales market needs.

All the wells in the field are operated in accordance with DITT approved WOMPs for each well across the respective fields. The WOMPs detail all operational and intervention phases including well designs, subsurface information, construction, barriers in place, monitoring, maintenance, integrity and decommissioning.

All petroleum wells, regardless of status at each field, are included within this EMP.

Safe and reliable production of the hydrocarbon resources present is facilitated via the following infrastructure:

- Existing private access roads constructed and maintained by the Operator.
- Wells and gathering network.
- Permanent wellhead facilities for producing and suspending wells.
- At PVGF the following:
  - In-field gathering system (approx. 22.5km) generally adjacent to road network.
  - Central Compression Station (CCS): slug catcher, five reciprocating engine driven gas compressors totalling 3600 HP, parts shed, water reinjection skid and inlet and outlet separators
  - CTP for gas processing: separation, gas dehydration, compression, low temperature separation and liquid hydrocarbon stabilisation
  - Process water treatment and evaporation ponds at PV-09
  - Liquid hydrocarbon storage facilities at the CTP
  - CTP includes utilities systems and support infrastructure, including office, control room, maintenance workshop and accommodation-messing.
  - Approved reservoir reinjection facilities at PVGF
  - Roads, access track, water bores, camp, workshops, and access to an air strip at PVGF
- Export sales receiver to APA gas transmission pipeline at PVGF
- This FEMP does not pertain to maintenance and operational activities of the APA gas transmission pipeline.

A.4.2 Well operations

Petroleum well operations include the following activities:

- Ongoing production activities at PVGF
- Maintenance of surface well barriers
- Integrity testing of surface well barriers
- Integrity testing of subsurface well barriers
- Annular pressure monitoring
- Visual inspection and general well surveillance.

A.4.3 Gathering and boosting systems

Wellhead equipment, safety systems and gathering lines works allow the wells in the field to be connected to the existing in-field gathering line for processing before transfer to market (Figure 7).

A gathering network of approximately 22km of above ground flow lines is in place across PVGF. Each producing well is connected to the CCS by an in-field gathering system of pipelines as shown in Figure 8. The pipelines range in diameter from 75mm to 200mm and are all located above ground. Generally, the gathering system is adjacent to the road network.

The Alice Springs to Palm Valley Gas Pipeline, managed by a third party, connects PVGF to the 1,512km Amadeus Gas Pipeline (AGP) to Darwin. The custody transfer point from the Operator to the AGP is the pipe flange located immediately on the APA Group side of the APA Group compound at the CTP entrance gate.

Figure 7: PVGF Central processing facility

Figure 8: PVGF Gathering flowlines

A.4.4 Services

Table 14 outlines the services that support the conduct of all activities at PVGF.

Table 14: Services at PVGF

Activity	Description
Buildings: ▪ Administration ▪ Warehouse and Workshop	▪ At PVGF, CTP includes a main control room, meeting rooms, office and utilities, accommodation-messing ▪ Near CTP – accommodation, storage areas, warehouse, workshop, washdown bay, diesel refuelling bay, designated waste storage area, bunded chemical store
Workforce and facilities	▪ Permanent workforce at PVGF of up to 80 personnel, using local Alice Springs region-based employees and fly-in fly-out employees depending on required skills sets ▪ Workforce increases via contractor and visitors as required and approved via the Operator's internal approval processes to meet CLC permit requirements ▪ Permanent camp at PVGF ▪ Ten-person camp incorporating accommodation, kitchen and mess, recreation areas, communications systems and water and wastewater systems ▪ Temporary camps ▪ Temporary facilities may be brought to the field to accommodate additional personnel during key projects and workover activities at wells and laydown areas.
Laydown areas	Cleared areas, including former well pads, used to house materials, temporary camps or machinery
Power generation	▪ A combination of gas and diesel fuel generators located at PVGF to power production and accommodation facilities ▪ Small scale diesel fuel generator sets are used for remote operations in the Field when required, such as workover activities and groundwater bore pumps. In addition, telemetry systems for well infrastructure and flowlines are powered by individual solar systems with battery storage
Water supply	Water requirements at the field is purchased
Waste services	Waste services are provided by licensed waste transporters and disposers

Activity	Description
Wet weather operations	Operations occur 365-days per year including the wetter months of the year (October to April). Weather conditions are monitored daily to allow reassessment of operational needs to be addressed.
Naturally Occurring Radioactive Materials	▪ The Operator's radiation licence (permit number 1902650L) has been surrendered and a new licenced applied for. ▪ Very low-level radiation hazard associated with old liners and other well components that are potentially replaced during well workovers ▪ All works are conducted in accordance with the Operator's safe work standards including a NORMS (Radiation) Management Plan alongside a Job Hazard Analysis ▪ Materials with the potential for NORMS exposure from operational activities are tested by radiation meter, prior to storage or disposal via an appropriately licensed transporter ▪ Materials with elevated NORMs, which are very water soluble, are isolated and contained to prevent run-off prior to disposal

A.4.5 Wastewater management

The overarching Wastewater Management Plan for this EMP is contained Section 7.6 and the Spill Management Plan is contained in Section 7.7. The principles and methodology in these plans apply at all three fields, where relevant.

The volume of formation water produced may vary from well to well at PVGF and is separated from the gas stream at each well head and stored in a 20,000L HDPE tank farm at each well site. The tank farms are sized to provide suitable buffer storage of several weeks, at each well site, prior to transfer by on-site tanker truck on a regular, as needs basis, to the relevant wastewater management pathway shown in Figure 9.

The volume of formation water produced from the PVGF field varies around an average total mean of <3,000L day^{-1}. This production rate is variable depending on which wells are online, some wells produce more water than others. PVGF formation water storage tank levels are electronically monitored, and volumes and freeboard tracked in the PVGF Daily Production Report data base management system. The brine wastewater produced at PVGF has been effectively managed over the 30+ year life span of the operations without impact to the surrounding area.

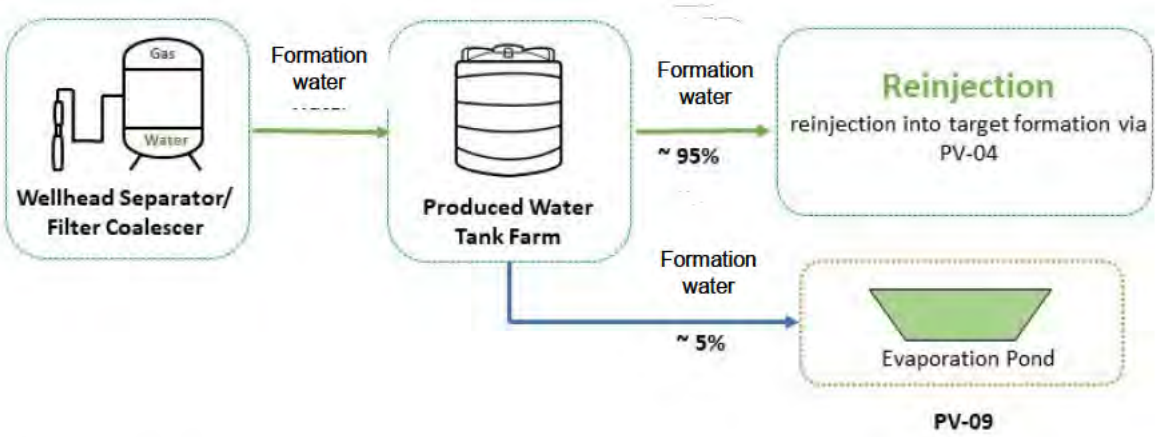


Figure 9: PVGF produced formation wastewater process

The water management at PVGF is hierarchal, operations proceed to manage formation water as follows:

1. Solar evaporation pond at PV-09 has historically, been the formation water management option but the facility is reaching end of life. It is proposed that PV-09 be decommissioned, and the site rehabilitated.

2. It is proposed in this EMP that a new solar evaporation pond is constructed at PV-12 out of the existing sump once it has been dried, had cuttings removed and has been relined in accordance with the Code. The new evaporation pond will act as an ongoing end-point treatment system during the life of the PVGF.

3. Formation water reinjection at PV-04, into the target reservoir; its main objective is to increase the pressure of the reservoir for production, but reinjection volumes are limited.

Workover fluids are likely to be the only wastewater produced during workovers at existing well sites. DITT requires the Operator to ensure enough workover fluid and a weighting agent at the well site is available to "kill" the well in the event of an emergency/loss of containment during workovers.

The Operator will use water purchased from off-site providers for use in workover fluid, along with a small amount of biodegradable biocide and potassium chloride (KCl). Workover fluid will not be mixed with any oil or BTEX based additives.

If the workover fluid is not required at a particular well site, the unused water will be used at another well site in the mud tank or disposed of as regulated waste. The anticipated total volume of workover fluid required is approximately 0.063ML per workover.

While undertaking air/mist workovers at a well site, retrieved debris/fill/materials will be discharged into the flare pit/tank (via the blooie line) at the well site. Once flaring commences any small volumes of liquid within the flare pit/tank is vaporised. Discharged materials can be removed and disposed or recycled at an approved facility.

No oil or condensate is produced at PVGF (see Table 12) however, the trace amounts of hydrocarbons that may be produced will be stored in above ground tanks with the formation water until it can be transferred to the evaporation pond.

A.4.5.1 PVGF Formation water

Water produced at PVGF is not defined as "produced water" for the purposes of the Regulation or the *Onshore Petroleum Code of Practice* as all the wells are conventionally developed and do not require hydraulic fracturing.

Formation water quality at PVGF is described in Table 15. Chloride is the dominant anion and sodium is the dominant cation in most formation water in petroleum fields and constitutes 70 to more than 90% of total cations (USGS, 2014).

The gas produced at PVGF is relatively "dry", so the "water-cut" is relatively low. The quantity of formation water at PVGF averaged <3,000L day^{-1} in June 2023 vs gas sales roughly 10TJ day^{-1}. The quality of formation water produced at PVGF is comprised predominantly of sodium chloride and calcium chloride. The measured levels of chloride are comparatively low concentration of 4,000–6,000mg/L (<1.2%). Using a hypothetical, maximum release scenario:

- Maximum chloride concentration = 6,000mg L^{-1}
- Calculated electrical conductivity (EC) = 9.4dS/m
- Max volume = 20,000L; equivalent to 1 x 20,000L HDPE storage tanks at a well site being deposited within the well site bunded hardstand area (~<500m^2) assuming 1-m infiltration at the well site
- In the event of a spill, it is important to remove the excess chloride to prevent contamination of surface and groundwaters. Potential chloride contamination and remediation is discussed in Section 3.4.2.2.

Table 15: PVGF Formation water quality

Water Analysis	Unit	PV-07	PV-02
pH		5.5	6.5
Electric Conductivity	µS/cm	18,000	12,000
Chloride	mg/L	6,300	4,400
Sodium	mg/L	2,700	1,800
Calcium	mg/L	650	530
Potassium	mg/L	110	61
Magnesium	mg/L	90	66
Nitrate	mg/L	<0.1	<0.1
Sulphate	mg/L	<0.1	6
Arsenic	mg/L	<0.105	<0.105
Cadmium	mg/L	<0.0105	<0.0105
Chromium	mg/L	<0.105	<0.105
Copper	mg/L	<0.105	<0.105
Lead	mg/L	<0.105	<0.105
Nickel	mg/L	<0.105	<0.105
Mercury	mg/L	<0.0001	<0.0001
Total PAH	µg/L	<2	<2
Total Recoverable Hydrocarbons	µg/L	<400	<400
Total BTEX	µg/L	<20	<20

Note: Samples are analysed by a 3rd party NATA accredited laboratory.

A.4.5.2 Formation water reinjection

Reinjection of formation water occurs via the former depleted production well PV-04 into the Pacoota 1 Formation approximately 2,500m below surface, and which is separated from any beneficial groundwater sources by the overlying low permeability Stokes Siltstone Formation. This represents a conventional petroleum formation water reservoir reinjection programme, of 'like-with-like', whereby the Pacoota Formation is the source of the produced water and the target reservoir for gas production. The reinjection of the formation water into PV-04 helps manage ongoing sustainability of PVGF by increasing production rates and prolonging the life of the field. It should be noted that reinjection has not taken place in recent years but may still be an option utilised by the Operator.

The reinjection system uses a wellhead injection pressure at maximum of 800psi.The system includes a tank farm at PV-02 with two HDPE tanks to store approximately 40kL of formation water. Biocide is dosed at a rate of 1,000mg L^{-1} and the scale control and oxygen scavenger are dosed at a rate of 60mgL^{-1}. Table 16 details the water treatment chemicals added prior to reinjection.

As per the diagram shown in Figure 9, when re-injection takes place, up to 95% of the ~3,000L (ie. 2,850L) of formation water may be re-injected into PV-04 daily.

Table 16: Water treatment chemicals for reinjection

Chemical Name	CAS-No.	Purpose	Readily Biodegradable	Toxicity
Ethylene Glycol	107-21-1	Scale control	Yes	Low
2-Mercaptoethanol	60-24-2	Oxygen scavenger	Yes	Low
Sodium Hydroxide	1310-73-2	Buffer	Yes	Low
Tetrakis (hydroxymethyl) phosphonium sulfate	55566-30-8	Biocide	Yes	High

A.4.5.3 Formation water management at PV-09

Isolation in the PV-09 evaporation pond is the primary management option for waste formation water at PVGF because the chloride levels are too high for potential beneficial reuse. Formation water is trucked by tanker to this in-field, end-point treatment system, using a HDPE lined solar evaporation pond which concentrates and precipitates chloride salts and trace levels of metals, similar to evaporated seawater, in the isolation pond (see Figure 10). This in-field treatment system for immobilisation and permanent isolation of solid waste salt, is characteristic of many onshore petroleum developments and has been the practice at PVGF since the petroleum field inception in the early 1980s.

The Operator has a comprehensive ongoing inspection program of the PV-09 wastewater treatment system including weekly inspection of liner integrity and the surrounding environment for evidence of leaks or seepage. The system is built as an engineered compacted earth (>30% clay) bunded pond system with two impermeable HDPE liners and situated above natural surrounding ground level, so any loss of containment/leaks beyond the two geo membranes would be visible as seepage at the foot of the bund.

The evaporation pond is double lined with a gravity-based leak detection and collection system. The design is such that any liquid that passes through the primary liner gets collected between the primary and secondary liners and gravity drains into a separate poly tank (spider tank) situated on the side of the pond below the water level. This tailwater liquid collected in the tank is returned into the pond via an automated pump activated by a float system.

The volume of liquid collected is monitored and used as an indicator of ongoing primary membrane integrity. The bunds are approximately 1.5m in height and are lined with impervious 1.2mm x 2 layers – welded HDPE geo-membrane.

PV-09 is not fenced however has gentle batters and fauna matting to allow fauna egress.

The evaporation pond at PV-09 pictured in Figure 11 has been in service since 2000. The built capacity of PV-09 evaporation pond is 5.8ML with 200mm freeboard selected using 24hr rainfall 1% AEP design curve. The evaporative capacity of PV-09 is ~160m^3 day^{-1} which is more than 50X the average daily produced volume of formation water at PVGF = ~3m^3 day^{-1}. PV-12 will have a smaller capacity but similar design layout to PV-09.

A.4.5.4 Formation water evaporation at PV-12

It is proposed that a new evaporation facility at PV-12 be constructed as detailed in Table 18. The well site was previously used for constructing the new petroleum well PV-12. PV-12 wastewater treatment system will be constructed in a similar manner to PV-09. PV-09 will commence decommissioning and site rehabilitation phase will follow.

A detailed study will be undertaken to manage the decommissioning and commissioning of PV-09 and PV-12 respectively. The study will assess the material in PV-09 and remaining material in the PV-12 sump to ensure it will be managed accordingly and any contaminants are collected and disposed of appropriately.

Tailwater from PV-09 will be re-directed to PV-12 until flow ceases. HDPE liners and other infrastructure at PV-09 will be removed to below ground level. A HDPE liner will be used to cap the remaining salt in PV-09 and then finally earthen fill and compaction will follow. The encapsulated pond then covered with >600mm of topsoil and active seed spreading and germination in the wet season will take place. Rehabilitation and monitoring of the PV-09 area will then be conducted to return it safely towards analogous arid vegetation conditions in accordance with PRCP. The proposed timeframe for PV-09 is detailed in the Table 17 below.

Table 17: Proposed timeframe for activities to decommission PV-09

Activity	Timeframe
1. Develop concept design	FY25
2. Conduct soil and groundwater contamination assessment	FY25
3. Complete detailed engineering	FY26
4. Obtain board financing and approvals	FY26
5. Select contractor	FY25
6. Cease flow of tailwater from PV-09	FY26
7. Commence earthworks	FY26
8. Rehabilitate and revegetate encapsulated pond and redundant infrastructure	FY27
9. Monitor and report	FY27 onwards

Table 18: Solar evaporation wastewater treatment system PV-09 and PV-12

Specification	PV-09	PV-12
Geo-membrane Liner Material	1x 1500µ HDPE, 1x 500µ LDPE	HDPE – 2x 1200µ
Liner coefficient of Permeability	< 10-9 m/s	< 10-9 m/s
Resistance to tearing	>0.5kN	>0.5kN
Static puncture	>0.5kN	>0.5kN
Leak detection and collection	Yes	Yes
Operating volume (m^3)	~3,000	~ 1,700
Area (m^2)	3,300	1,500
Built capacity (m^3) with freeboard	~5,800	~3,750
Annual Input (m^3)	<< 2,000	<< 2,000
Annual average evaporation capacity (m^3)	>5,000	>5,000
Daily average input (m^3)	3	3
Daily average evaporation capacity (m^3)	160	100
Minimum freeboard_90 day (cm)	20	50

Figure 10: View of PV-09

Figure 11: View of PV-12

A.4.5.5 Freeboard management

The Code specifies a minimum freeboard requirement for open wastewater tanks based on 0.1% Average Exceedance Probability (AEP) rainfall design. DLPE has requested that a 90-day cumulative rainfall period be used for the 0.1% AEP design freeboard calculations. Using Palm Valley BOM15633 daily rainfall and evaporation data from 1981 to the present, 0.1% AEP 90-day cumulative rainfall = 380mm as shown in Figure 12.

The equivalent highly conservative (P10%) evaporation estimate occurring over the same 90-day period is 340mm, resulting in a calculated net freeboard requirement (maximum 90-day potential cumulative net depth increase) = 60mm, should such an extreme rainfall event occur. This is not a suitable minimum freeboard when considering wind effects on open ponds.

The nominal minimum freeboard that the Operator has used in PV-09 is 200mm using a 24-hour storm event (1 in 100-year ARI). The new PV-12 evaporation treatment system will have a minimum design

freeboard of 500mm, consistent with all other open water storages in Central Petroleum fields, elsewhere in the Amadeus Basin.

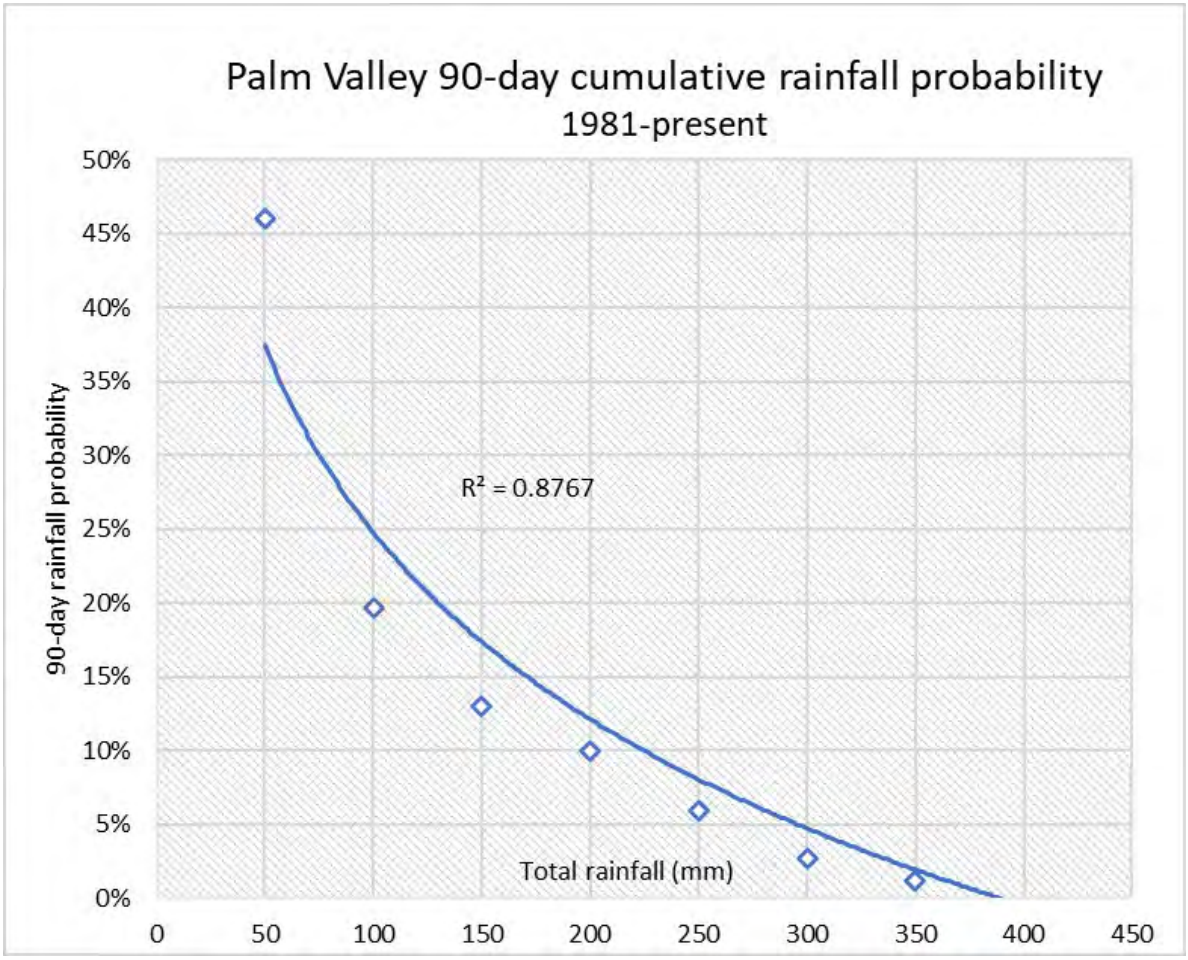


Figure 12: 90-day cumulative rainfall event probability PVGF (BOM 15633)

A.4.5.6 Monitoring of Formation Wastewater System at PVGF

As noted previously, the *Petroleum Environment Regulations* defines formation water to mean naturally occurring water that is extracted from the geological formation following hydraulic fracturing. Consequently, the formation water that is extracted from the reservoir together with petroleum at PVGF is not defined as "produced water" for the purposes of the Regulation or the *Onshore Petroleum Code of Practice*. The Code specifically 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 not relevant at PVGF where all the petroleum wells are conventionally developed and do not require hydraulic fracturing.

A chemical analysis of the brine in, in accordance with the analytes specified in the Code, from PV-09 pond and PV-09 tailwater collection system is provided in Table 19. As noted, it is a saturated chloride brine. There are no elevated metals or other contaminants of potential concern. Given that the endpoint in the PVGF process wastewater treatment systems is immobilisation and permanent isolation of in-situ precipitated salts, ongoing analysis of this wastewater will provide no new information. The quality of the salt is most unlikely to vary significantly.

The results of PV-09 formation water evaporite analysis is similar to that presented in the Mereenie Field EMP. Given that all these fields including Mereenie are located in the Amadeus Basin, it is most unlikely that formation water evaporite analysis at either of the respective fields (DGF or SOF) will vary

significantly from the findings in this analysis. As noted previously, daily inspections of system integrity, fauna interaction and freeboard levels are taken at each point in the wastewater treatment system. Anomalies are logged in the Operator's HSE system for corrective action as required.

Table 19: PV-09 Brine wastewater analysis

Analyte	Unit	PV-09 Pond	PV-09 Tank
pH Value	pH Unit	5.66	3.94
Electrical Conductivity @ 25°C	µS/cm	23,7000	22,5000
Total Dissolved Solids @180°C	mg/L	37,4000	39,1000
Chloride	mg/L	164,000	165,000
Bromide	mg/L	2,210	2,440
Calcium	mg/L	49,600	82,300
Magnesium	mg/L	4,940	7,900
Sodium	mg/L	93,100	63,800
Potassium	mg/L	5,100	8,630
Arsenic	mg/L	<0.105	<0.105
Cadmium	mg/L	<0.0105	<0.0105
Chromium	mg/L	<0.105	<0.105
Copper	mg/L	<0.105	<0.105
Lead	mg/L	<0.105	<0.105
Nickel	mg/L	<0.105	<0.105
Zinc	mg/L	1.24	2.75
Mercury	mg/L	<0.0001	<0.0001
Ammonia as N	mg/L	126	216
Total Nitrogen as N	mg/L	356	261
Total Phosphorus as P	mg/L	<5.00	<5.00
Total PAH	µg/L	<2	<2
Total Recoverable Hydrocarbons	µg/L	<400	<400
Total BTEX	µg/L	<20	<20

A summary of the bulk analysis of the evaporate at PV-09 evaporite is shown in Figure 13. Approximately 95% by weight, is made up of sodium chloride and calcium chloride salts. There are no elevated metals or other contaminants of potential concern present in the remaining crystallised evaporite.

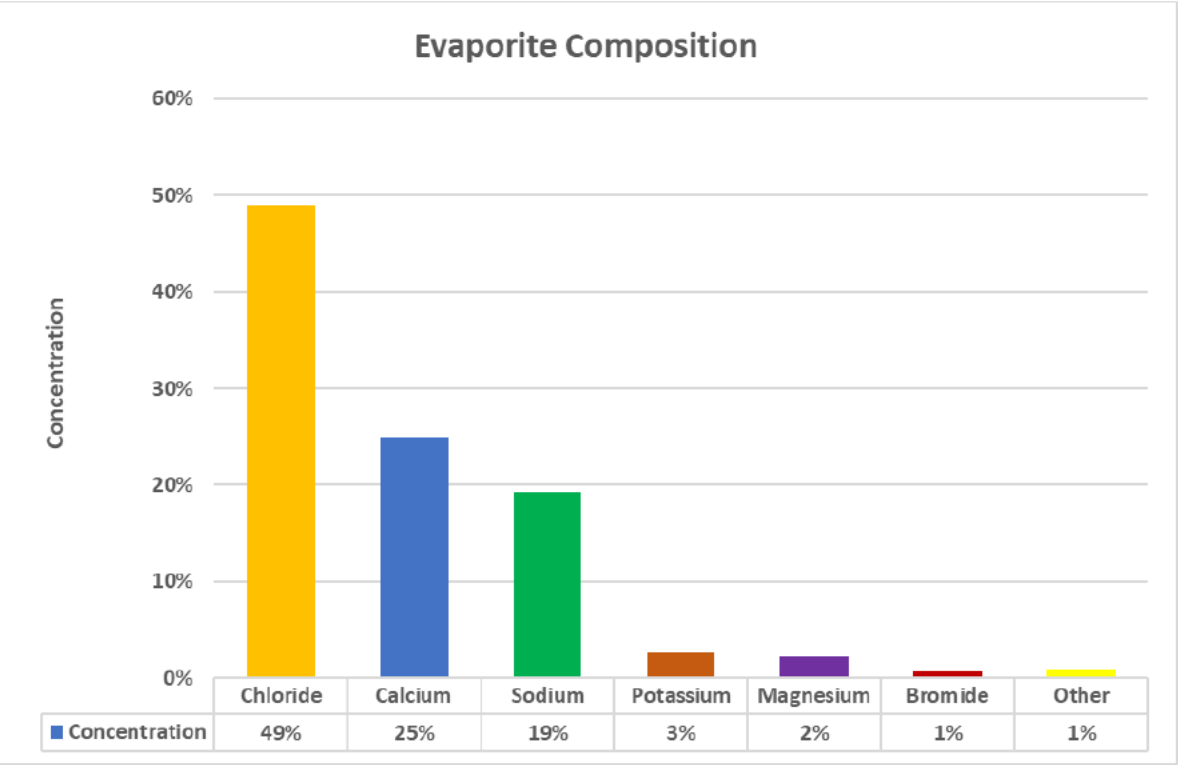


Figure 13: Evaporite composition – PV-09

A.5 Existing environment

A description of the physical, natural, and socio-economic environs of the respective fields is provided in the following sections. The Operator has used a combination of desktop and baseline results to develop a description of the current environment. If the Operator becomes aware of any additional information not contained in the EMP in relation to the existing environment that may influence the results of the risk assessment and mitigation measures outlined in this EMP, it will undertake a review of the EMP. It should be noted that there are no current future plans to impact reserved blocks within the PVGF.

A.5.1 Physical Environment

A.5.1.1 Climate

A summary of the climate statistics for PVGF is attached in Table 20.

Table 20: Climate statistics for PVGF

Climate Statistic	PVGF
Annual total average rainfall (P)	303 ± 201 mm
1 in 1000 (0.1%) year AEP_90-day cumulative rainfall	380mm
Annual total average evaporation (E)	2,900mm
Precipitation/Evaporation (P/E)	0.11
$10\%_{ile}$ evaporation_90 days	340mm
Average daily max temperature	$29.8^{O}C$
Number years daily observations	40 years

(Source: BOM, 2022)

A.5.1.2 Geology, Soils, and Land Systems

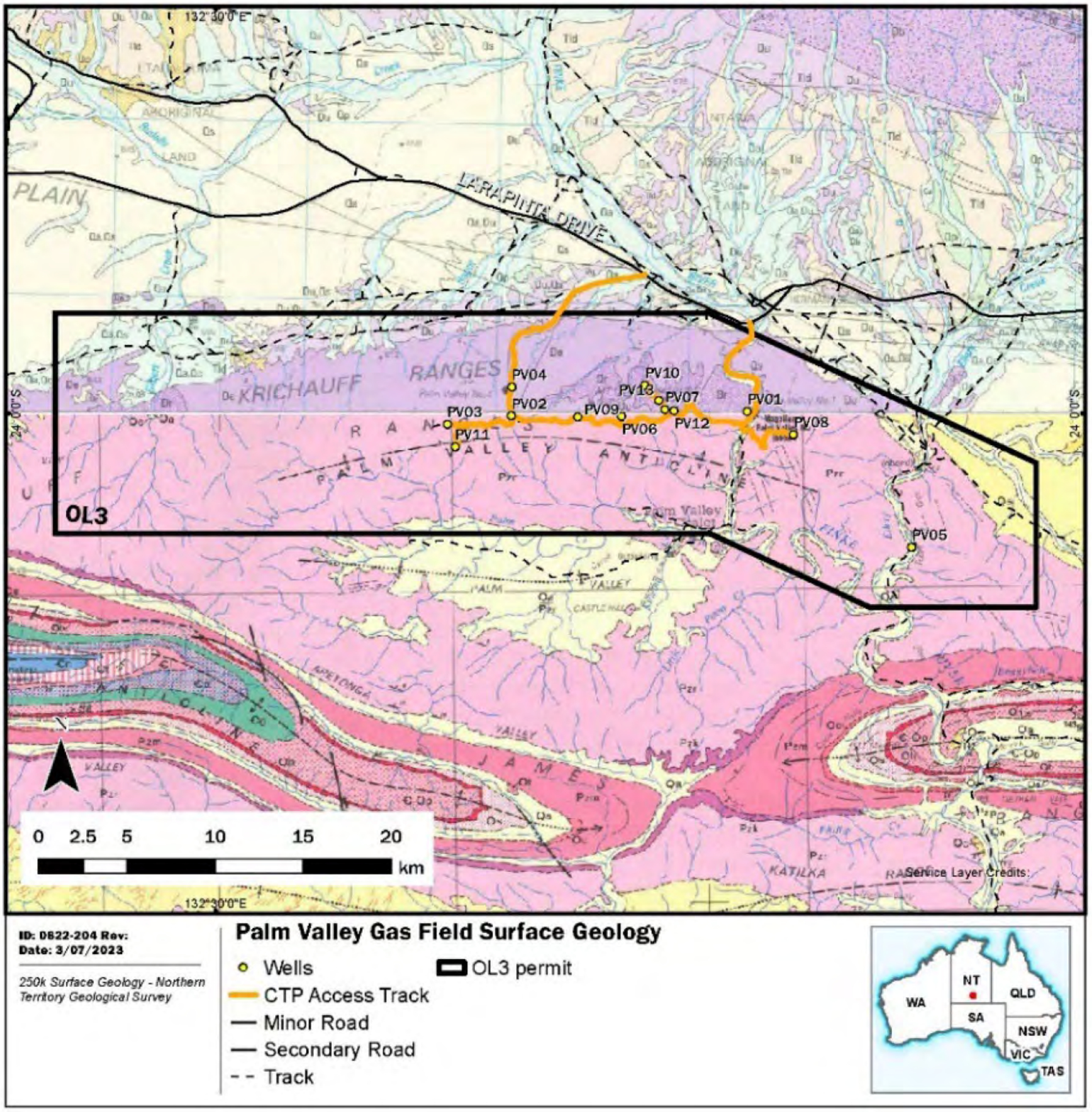
A.5.1.2.1 Geology

The PVGF (Table 21), located in the north central part of the Amadeus Basin is well expressed at the surface as an east-west arcuate anticline, convex to the north and about 45 kilometres long. Surface geomorphology at PVGF is constrained by the sandstone plateaux ranges, Hermannsburg Sandstone rocks of Devonian to Carboniferous age, of the Krichauff land system that define the McDonnell ranges.

Gas was discovered at the Palm Valley 1 well in 1965 in an extensive fracture system in the Lower Stairway Sandstone, Horn Valley Siltstone and Pacoota Sandstones at depths from 1,800m to 2,200m. The target zone of interest and predominantly dry gas reservoir at PVGF is in the Pacoota (P1 Sandstone) formation located approximately 2km below ground level.

Table 21: Geological units PVGF

Extent	Map Unit	Description of Lithology
100%	D	Outcropping of Hermannsburg Sandstone – summit montane plateaux



A.5.1.3 Regional Soils

Three soil types occur in the OL3. All developments at PVGF are in the montane area, located in soil type BA28 described in Table 22. This soil presents a low to moderate erosion risk as they are shallow stony sands and bare stone.

A.5.1.4 Land Systems

Four land systems occur in OL3 with all PVGF development occurring primarily in the Krichauff land system described in Table 23. The operational areas of the OL3 are all within “Sandstone Hills”. The Krichauff Range essentially consists of folded sedimentary rocks known as the Hermannsburg Sandstone, comprising red-brown sandstone, pebbly sandstone, and minor silty sandstone. While it is a region of varying relief, the ridges are characteristically 200–300m above the valley floors.

A.5.1.5 Surface Water

PVGF is situated within the Finke River Basin which is connected to the Lake Eyre Basin. There are several major ephemeral streams that join the Finke and Palm Creek from the OL3 area. Ellery Creek and the Finke River, both ephemeral with long lasting water holes, run through the eastern third of OL3; Ellery Creek joins up with the Finke River south of OL3. The Finke River runs out into Lake Eyre during extreme events. PVGF well pads and related infrastructure are located at the top of the Palm Valley Anticline, expressed as a ridge line in this uplift area as shown in the elevation mapping of PVGF shown below. Consequently, the risk of flooding to the PVGF field infrastructure is considered negligible as is evident in the topographical map (Figure 14).

A.5.1.6 Groundwater

There are no bores within PVGF, all water is trucked to site. Several water bores have been drilled in the region along the northern flank of the Krichauff Range and Kaporilya Springs was used for Hermannsburg water supply in 1935. DEPWS online water bore information shows wells along the north flank of the Krichauff Range are in Hermannsburg Sandstone aquifers where the sandstone is fractured or fissured, extensive and of low to moderate flow rate in wells.

Wells assessing regolith ground water in the Missionary Plain north of PVGF shows ground water is highly localised and invariably saline (R. Read, Pers Comm,). A belt of bores running along the James Ranges to the south, is in porous sandstone, extensive and highly productive aquifers. A detailed description of the hydrogeology of the area is provided by Wischusen et al (2002) in their hydrogeology study (Table 25), identifying potential sources of water in the Hermannsburg and Palm Valley area including bores and existing dams.

The Stokes siltstone and shale provide an impermeable layer between the freshwater sandstones in the Mereenie Sandstone formation from the underlying Stairway and Pacoota formations which contain the gas and brackish to saline formation water. The Stairway formation has low permeability of target gas, but the main reservoir at PVGF is in the Pacoota formation located approximately 2km below ground level. Results of bore sampling for water quality analysis in bores within the region at much lower ground levels than PVGF is provided in Table 24.

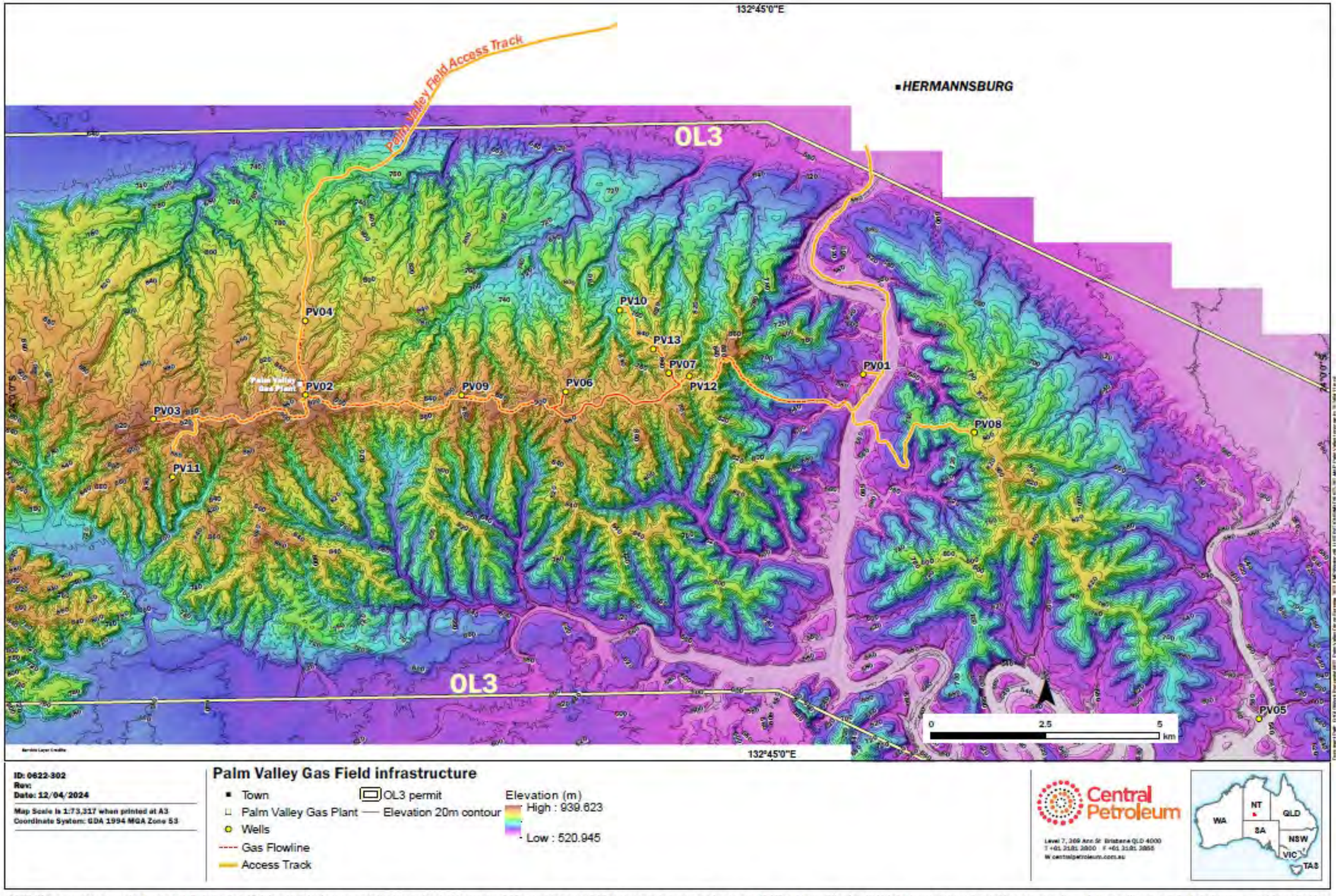


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Figure 14: Topographic map of PVGF well pads and infrastructure along the Palm Valley anticline

Table 22: Soil types PVGF

Extent	Soil Type	Landform	Soils
100%	BA28	Bold ranges with broad areas of sandstone plateaux; very extensive areas of bare rock.	Chief soils are shallow stony sands. Small areas of other soils are associated in areas of gentler relief

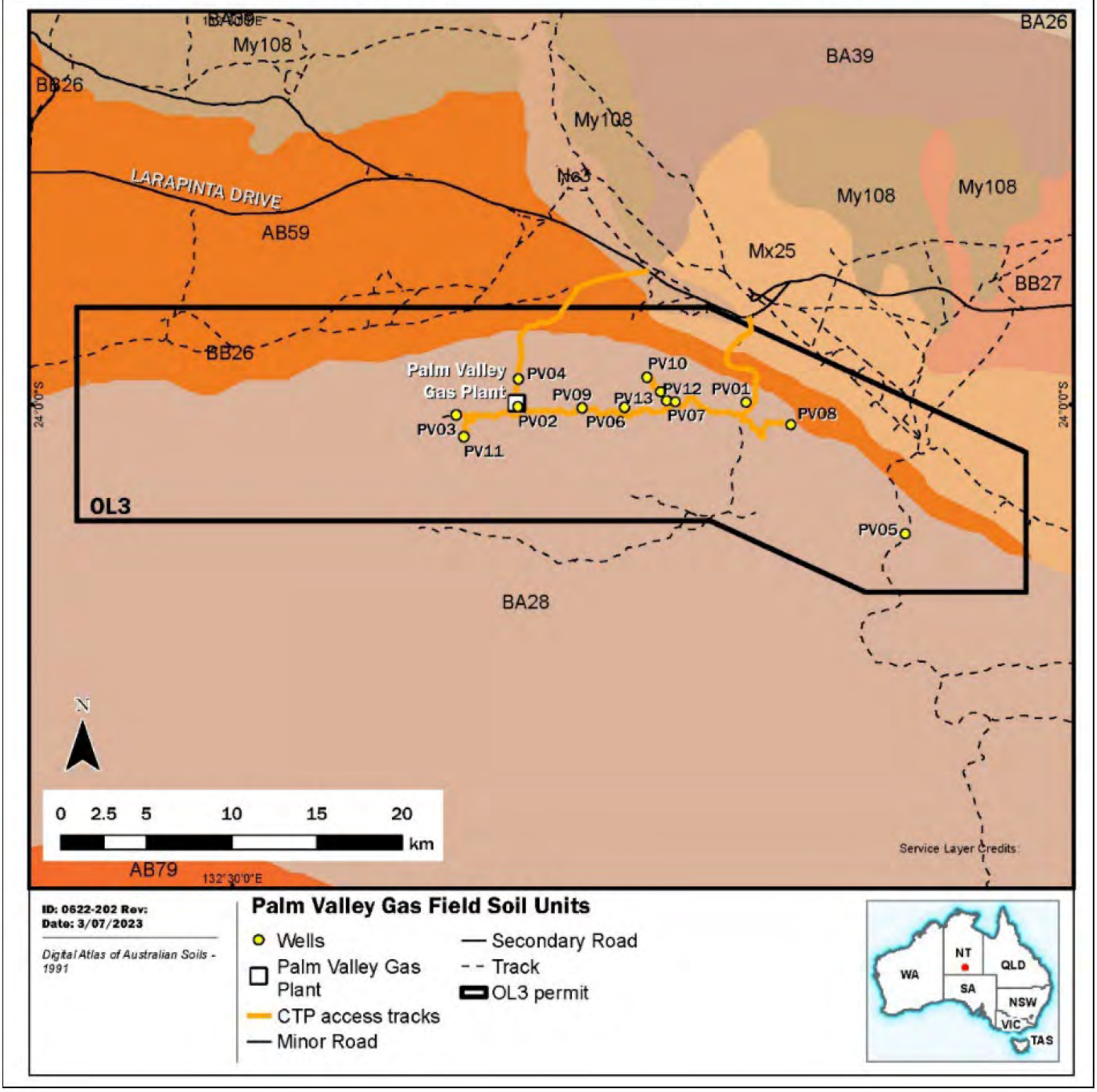


Table 23: Land systems PVGF

Extent	Land System	Description	Soils	Erosion Hazard
80%	Krichauff	Sandstone hills – Low hills, hill and stony plateaux on sandstone, siltstone, quartzite and conglomerate (deeply weathered in places); outcrop with shallow stony soils	Deep red sands and loamy limestone soils	Moderate
15%	Simpson	Desert Dune fields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes	Red dune sand	Low
3%	Amulda	Alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Quaternary alluvium.	Shallow, stony, undifferentiated soil	High
~1%	Muller	Limestone Plains, rises and plateaux on weathered and unweathered Cambrian limestone, dolomite, chalcedony, shale, sandstone and siltstone with associated sand sheets, sandy and earth soils	Sand sheets, sandy and earth soils	Moderate

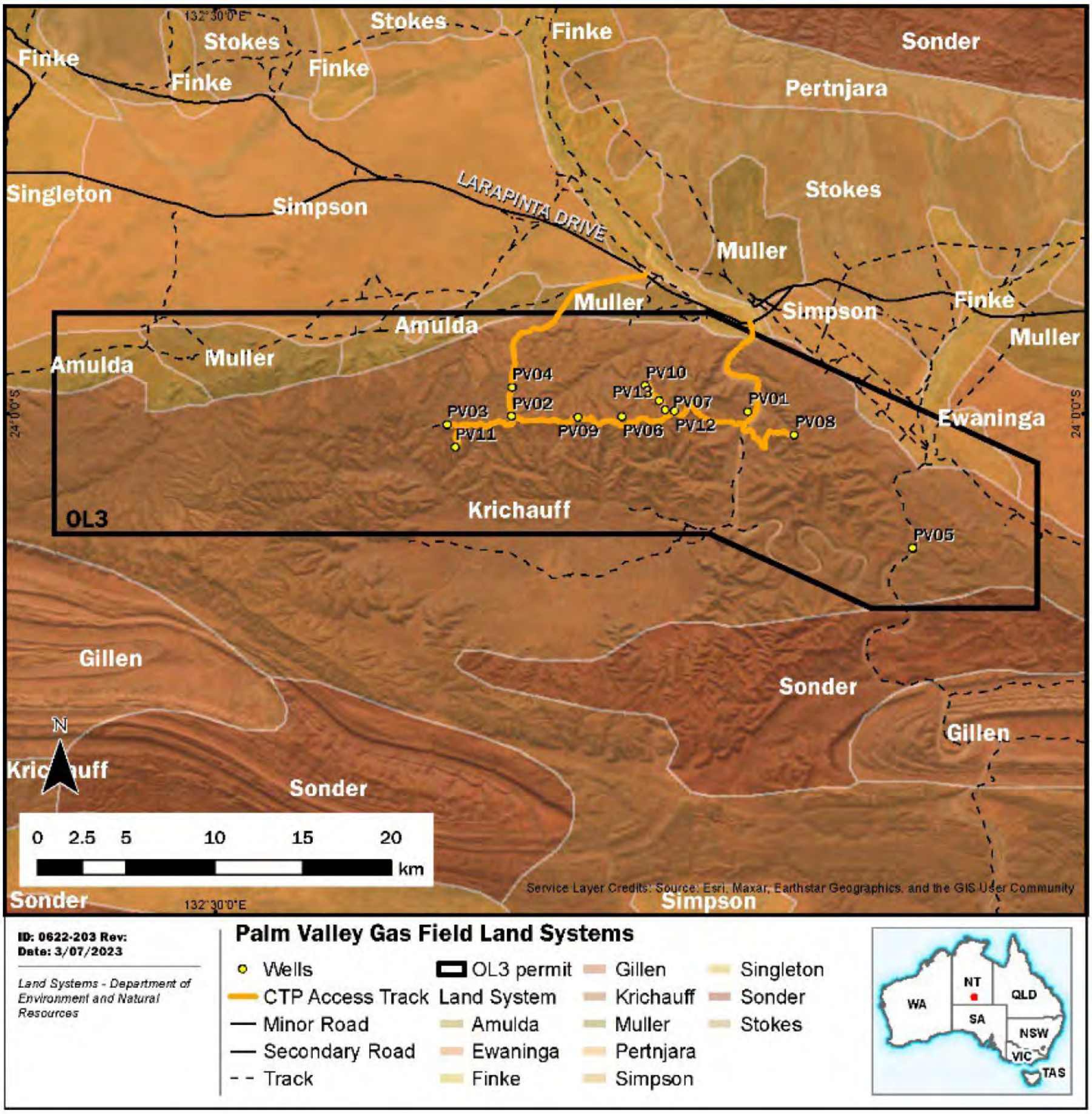


Table 24: Groundwater quality results PVGF Region

Analyte	Unit	PVGF Region	
		RN006503	RN012024
pH		8.0	8.0
E.C.	uS/cm	1400	1060
TDS	mg/L	910	689
Gross alpha	Bq/L	0.62	0.26
Gross beta	Bq/L	0.6	1.09
Bicarbonate	mg/L	233	310
Chloride	mg/L	198	137
Sulphate	mg/L	124	118
Fluoride	mg/L	<LOR	0.6
Sodium	mg/L	133	78
Potassium	mg/L	10	6
Calcium	mg/L	108	69
Magnesium	mg/L	46	50
Iron	mg/L	1.8	<LOR
Boron	mg/L	0.09	0.19
Selenium	mg/L	0.05	0.02
Silica	mg/L	20.3	29.6
Strontium	mg/L	0.91	0.33
Zinc	mg/L	0.01	<LOR
+ other Metals	mg/L	<LOR	<LOR
Hydrocarbons	ug/L	<LOR	<LOR
PAHs	ug/L	<LOR	<LOR
BTEX	ug/L	<LOR	<LOR

A.5.1.7 Wetlands, springs and aquatic inflow dependent ecosystems

The Finke River headwater gorge system is nationally recognised as a significant site, due to the abundance of conservation significant and endemic species. The rock holes and water springs at Palm Valley are within the protection of the Finke Gorge National Park and include the red cabbage palm (*Livistona mariae ssp. mariae*).

The red cabbage palm is located in Cycad Gorge on Palm Creek within Finke Gorge National Park and to the south of the park in a small semi-permanent water hole at Running Waters, both of these areas would be classed as Groundwater Dependent Ecosystems (GDE) with water supply draining through the Hermannsburg sandstone from the south flank of the Krichauff Range.

Both stands of red cabbage palms are outside the potential impact area in which the Gas Field operational area occurs, even though Cycad Gorge and Palm Creek are within OL3 lease area.

The surface water in Palm Valley is a combination of rainfall run-off and shallow groundwater recharge. The porous shallow Hermannsburg sandstone, near the surface, may behave as a double porosity aquifer (fracture and matrix permeability), due to the porous sandstone matrix and readily adsorbs flows

from percolating seepage, rivers and creeks (Wischusen 2005). In locations where this occurs, the roots of plants have access to a plentiful supply of water.

A.5.1.8 Surface water

PVGF is situated within the Finke River Basin which is connected to the Lake Eyre Basin. The Finke River runs out into Lake Eyre during extreme events. There are several major ephemeral streams that join the Finke and Palm Creek from the OL3 area. Ellery Creek and the Finke River, both ephemeral with long lasting water holes, run through the eastern third of OL3; Ellery Creek joins up with the Finke River south of OL3 (Figure 15). Smaller drainage lines are also present within the OL3 area. The surface water in Palm Valley is a combination of rainfall run-off and shallow groundwater recharge.

The Finke River headwater gorge system is nationally recognised as a significant site, due to the abundance of conservation significant and endemic species.

A.5.2 Natural Environment

A.5.2.1 Bioregions

Bioregions are defined through physical and environmental features, including watershed boundaries and soil and terrain characteristics. The latest version, IBRA7, classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information.

The OL3 area is in the MacDonnell Ranges Bioregion which covers 39,290km^2 of which 10-15% is protected within reserves. The bioregion (Table 26) contains the highest number of species listed with conservation status, nationally. It includes the small but nationally significant Finke River headwater gorge system (10ha); an important set of perennial waterholes in rugged ranges (Baker, et al., 2005).

This headwater gorge system lies outside and upstream of the PVGF area. The soils in this bioregion located at the PVGF, are dominated by shallow soils on rocky hills, having a low to moderate erosion potential. Mitigation measures described in this EMP detail the management of this erosion risk.

A.5.2.2 Sites of Conservation Significance

The OL3 area is located within the Greater MacDonnell Ranges recognised as an international Site of Conservation Significance (SoCS) and which covers an area of 31,326km^2 (Figure 16). It has high ecological value based on the number of threatened and endemic species, particularly short-range endemics and the permanent water sources which act as habitat refuges, floral diversity, geological formations and wetland values.

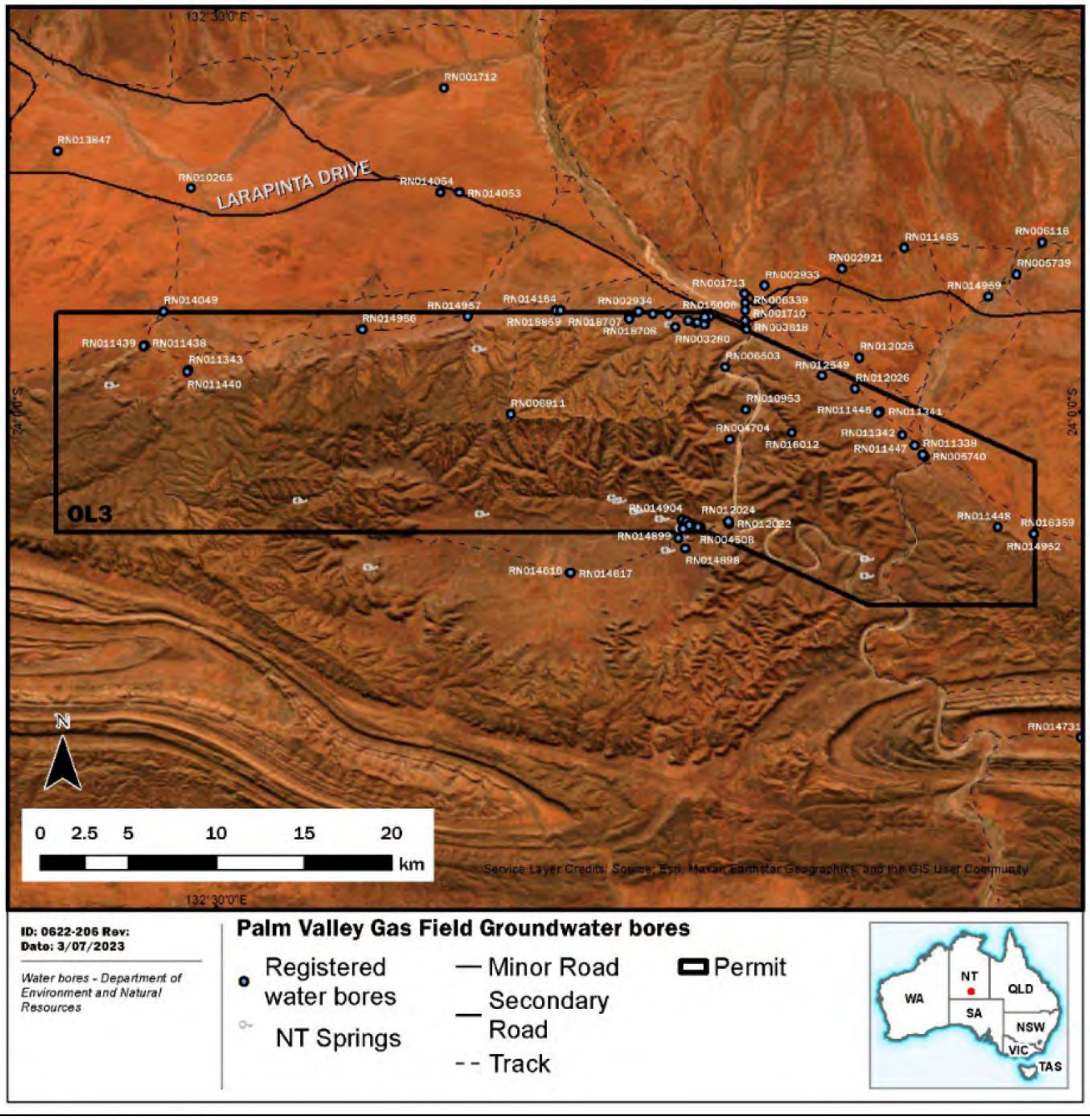
Finke Gorge National Park

On 7 June 2011, the land held under title Finke Gorge National Park was transferred to the Lhere Pirnte Aboriginal Land Trust to be held on trust for the Traditional Owners (TOs). The park was then leased back to the Northern Territory Government on a 99-year lease to be jointly managed as a national park. The three main values and conservation management objectives of the park are to:

- Conserve the Indigenous and non-Indigenous cultural and heritage values of the park; and to continue this living culture into the future.
- Conserve the unique flora, fauna and habitats of the area; and
- Allow access for four-wheel drive enthusiasts and tourism in such a way to protect people safety, maximise enjoyment, while preserving the integrity of the park for future generations.

Table 25: Stratigraphy and ground water OL3

Formation	Depth[1] (mBGL)	Thickness[2] (m)	Lithology	Groundwater Availability	Water Quality[3]
Hermannsburg Sandstone	6	398	Sandstone	Regional aquifer	Not known
Parkes Siltstone	389	34	Siltstone, minor claystone	Poor (Aquitard)[3]	Not known
Mereenie Sandstone	423	575	Porous quartz sandstone	Regional aquifer	Brackish
Carmichael Sandstone	998	84	Interbedded sandstone, siltstone and mudstone	Limited	Not known
Stokes Siltstone	1,082	330	Claystone, siltstone	Poor (Aquitard)[3]	Not known
Stairway Sandstone	1,407	349	Silty sandstone with interbedded siltstone	Oil reservoir	Not known
Horn Valley Siltstone	1,714	83	Shale, siltstone, dolomite	Poor	Not known
Pacoota P1 Sandstone	1,791	191	Sandstone with siltstone and shale	Regional aquifer	Not potable
TOTAL DEPTH	**1,988**				



[1] *Depths and thickness based on PV-12 well*
[3] *Designation of aquitard based on dominant lithology*
[3] *Water quality assessment based on formation water quality from Wischusen et al (2002)*

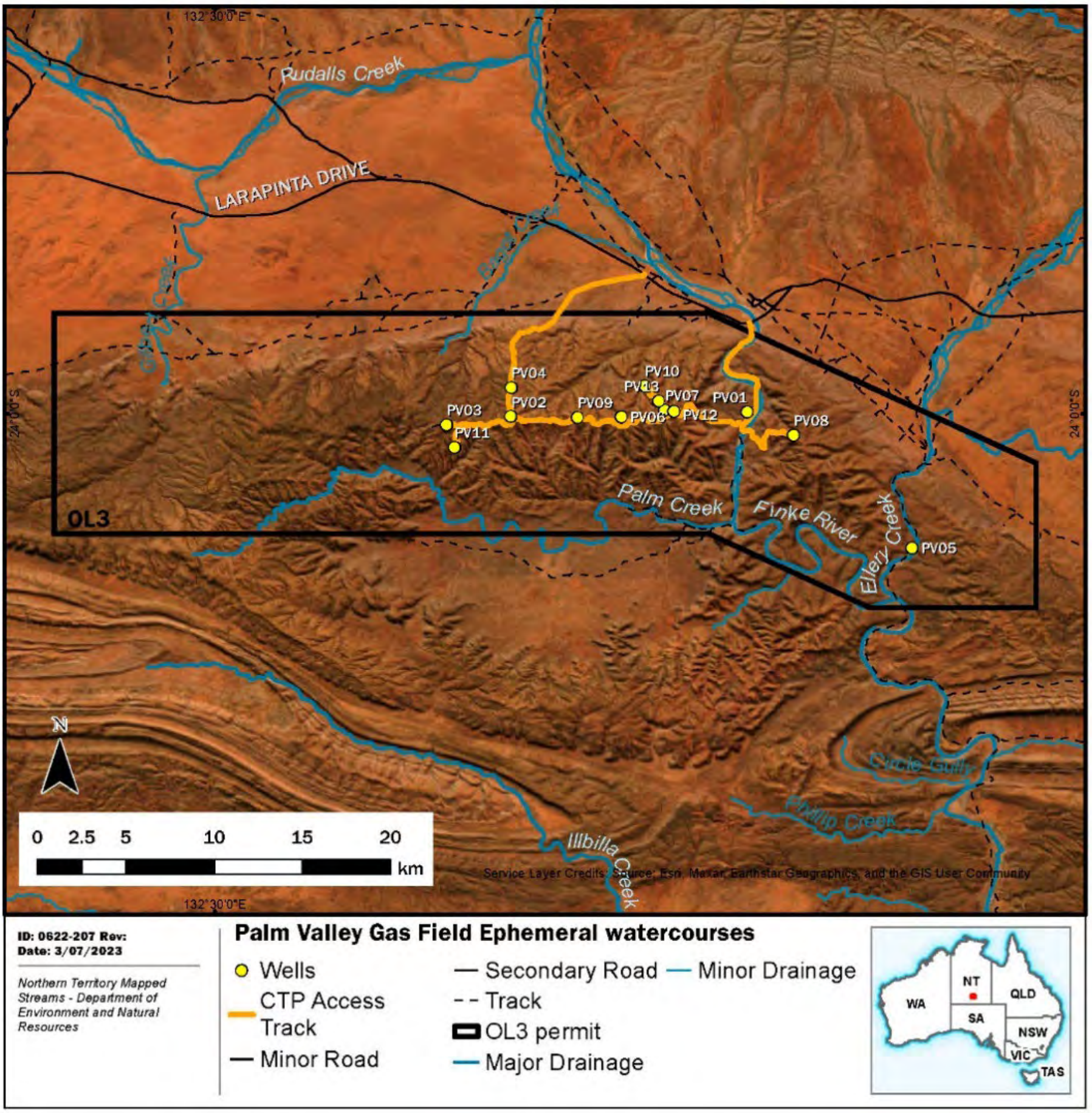
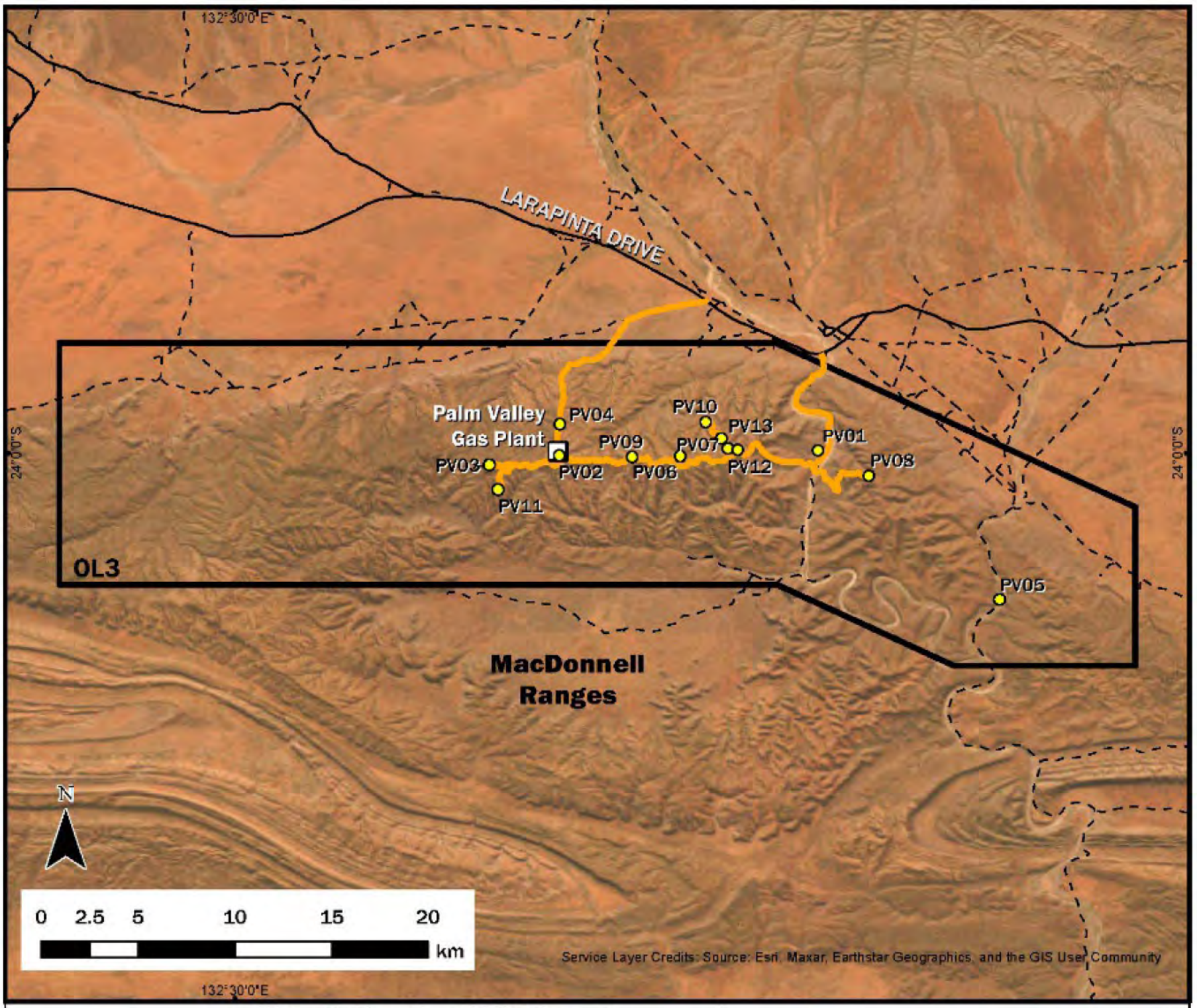


Figure 15: Natural Environment

Table 26: Bioregion OL3

Extent	Bio-region[4]	Topography	Geology	Soils	Vegetation
100%	MacDonnell Ranges	High relief ranges and foothills	Mostly sedimentary rocks in the Amadeus Basin	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



[4](Baker, et al., 2005)

A.5.2.3 Sites of Botanical Significance

The PVGF area is also within a Site of Botanical Significance (SoBS), Palm Valley. The Palm Valley SoBS (Figure 16) is regarded as nationally important due to the number of species of conservation significance and endemic species in the area.

Flora and fauna surveys in the OL3 area conducted by LES since it was operated by Magellan Petroleum Ltd; including approximately 16 years of quarterly environmental surveys, have not identified any species of conservation significance within impact distance from the PVGF.

A.5.2.4 Threatened Ecological Communities

A search across OL3 in the EPBC Protected Matters Search Tool confirmed there are no listed threatened ecological communities (TECs) within the PVGF operational areas. The closest TEC being Palm Valley within the Finke Gorge National Park which is outside any areas of direct impact.

A.5.2.5 Vegetation Communities

Vegetation mapping of OL3 shows the majority is within vegetation class 92. A small portion of vegetation class 87 is located in the west of the OL3 area outside PVGF activity areas (Table 27). The dominant vegetation is spinifex.

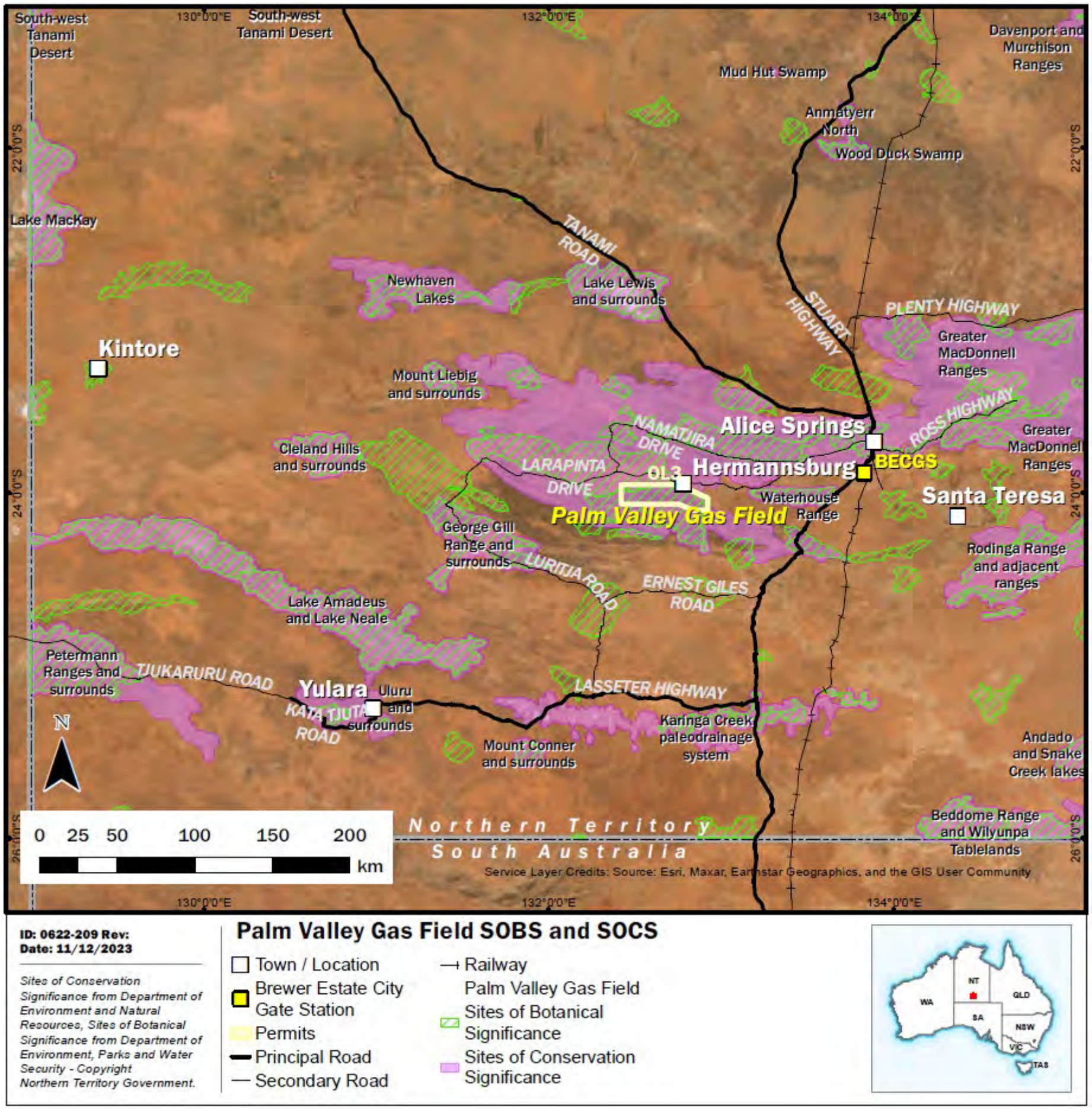
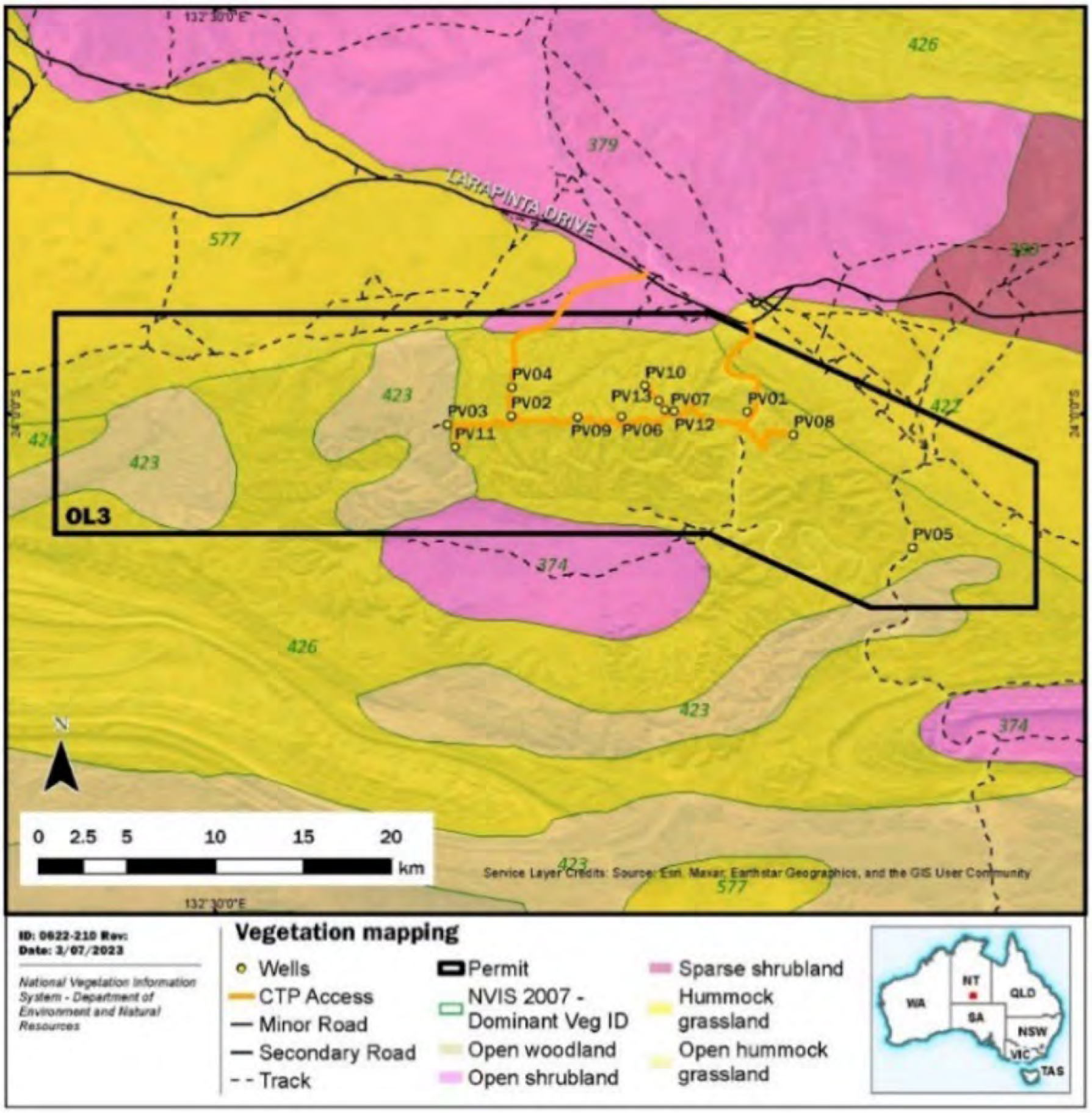


Figure 16: Sites of Botanical and Conservation Significance – PVGF

Table 27: Vegetation PVGF

Broad Vegetation Class	Fine Vegetation Class	Fine Vegetation Class Description	Secondary Community Descriptions	Structural Formation
Low open wood-lands	92	*Triodia brizoides (formerly clelandii)* (Weeping Spinifex) hummock grassland with mixed species low open-woodland over storey.	–	L1H3 Mixed species low open wood lands
Hummock grassland	87	*Triodia brizoides and basedowii* open-hummock grassland with *Acacia aneura* tall sparse-shrubland over storey	–	S1H2 Tall sparse shrubland, Open-hummock grassland



A.5.2.6 Conservation Significant Flora

A flora species is considered in this FEMP to be of conservation significance if it is:

- Listed as Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) under the *Territory Parks and Wildlife Conservation Act* (TWPC Act) and has been recorded in the NT Flora Atlas within a 25km buffer of the OL3 area or has been recorded on field surveys of the area; or
- Listed as CR, EN, VU or Conservation Dependent under the *EPBC* Act and is identified by a PMST (dated 5 December 2023) for the area or has been recorded in the NT Flora Atlas within a 25km buffer of the OL3 area or has been recorded on LES field surveys of the area.

There are no flora species of conservation significance matching these criteria within the OL3 area. Table 28 provides a list of all Near Threatened (NT) or Data Deficient (DD) species occurring or potentially occurring within the OL3 area.

These species do not require specific management plans; however, their presence will be recorded if identified. There are only two Territory Parks and Wildlife Conservation (TPWC) Act near threatened flora species identified in the area, *Eucalyptus lucens* and *Stenanthemum centrale.*

Table 28: Threatened flora OL3

Scientific name	Common name	NT Atlas[1]/ TPWC Status[2]	PMST[3] / EPBC Status[4]
Minuria tridens	Minnie Daisy	Y/VU	Y/VU
Bolboschoenus caldwellii	Bolboschoenus	Y/EN	-
Livistona mariae subsp. mariae	Red Cabbage Palm	Y/EN	Y/EN
Macrozamia macdonnellii	MacDonnell Ranges Cycad	Y/NT	Y/EN
Acacia sp. Krichauff Range (A.Soos 241)	Wispy Acacia	DD	-
Austrostipa aquarii		NT	-
Corynotheca licrota	Club-fruit Lily	NT	-
Eucalyptus lucens	Shiny-leaved Mallee	NT	-
Hakea grammatophylla	Mountain Hakea	NT	-
Lomandra patens	Iron Grass	NT	-
Monotaxis luteiflora		NT	-
Parietaria cardiostegia	Mallee Pellitory	NT	-
Phyllanthus lacunellus	Sandhill Spurge	DD	-
Pimelea interioris		NT	-
Swainsona colutoides	Bladder Swainsona	NT	-
Stenanthemum centrale	Stenanthemum	NT	-

[1] Recorded in the NT Flora Atlas within a 50km buffer of the OL3 area.

[2] TPWC Status: CR, Critical Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; DD, Data Deficient; NE, Not Evaluated; LC, Least Concern as listed under the Territory Parks and Wildlife Conservation Act (TPWC).

[3] Listed on the EPBC PMST retrieved for the area with a 25km buffer of the OL3 area (Appendix 3).

[4] EPBC Status: CR, Critical Endangered; EN, Endangered; VU, Vulnerable as listed under the Environmental Protection and Biodiversity Act (EPBC).

A.5.2.7 Conservation Significant Fauna

Field surveys have been undertaken of PVGF by Low Ecological Services Pty Ltd between 2007 and 2015 and a PMST (dated 5 December 2023).

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

- Listed as Extinct in Wild (EW), Critically Endangered (CE), Endangered (EN), Vulnerable (VU), Near threatened (NT) or Data Deficient (DD) under the TPWC Act and has been either:
    - Recorded in the NT Flora Atlas within a 10km buffer of the respective field; or
    - Recorded during ecological field surveys at respective fields.

The only current EPBC listed threatened fauna species recorded at the PVGF (Table 29) is the black-footed rock wallaby, *Petogale lateralis* (status vulnerable) and there was no evidence of the species around any of the project or operational areas. However, the presence of the isolated slater skink individuals immediately north of PV2 operational lay down area has resulted in site specific mitigation measures including sediment control banks and flagging of the site to be avoided to minimise risk to slater skinks within the lease area.

Table 29: Threatened fauna OL3

Type	Scientific Name	Common Name	NT Atlas Fauna Atlas[3]	PMST Report	Ecology Survey[5]	TPWC[1]	EPBC[2]	Habitat in PVGF	Likelihood of Occurrence[4]
Bird	*Aphelocephala leucopsis*	Southern Whiteface		X	Yes		VU	No suitable habitat in operational area	Low
Bird	*Calidris acuminate*	Sharp-tailed sandpiper		X	No		MIG, MAR	No suitable habitat in operational area	Low
Bird	*Calidris ferruginea*	Curlew sandpiper		X	No	VU	CR, MIG, MAR	No suitable habitat in project area	Low
Bird	*Erythrotriorchis radiatus*	Red goshawk	X	X	No	VU	VU	No suitable habitat in operational area	Low
Bird	*Falco hypoleucos*	Grey falcon	X	X	No	VU	VU	No suitable habitat in operational area	Low
Bird	*Leipoa ocellata*	Malleefowl	X		No	CR	VU	No suitable habitat in operational area	Low
Bird	*Pezoporus occidentalis*	Night parrot		X	No	CR	EN	No suitable habitat in operational area	Low
Bird	*Polytelis alexandrae*	Princess parrot	X	X	No	VU	VU	No suitable habitat	Low
Bird	*Rostratula australia - check record*	Australian painted snipe	X	X	No		EN	No suitable habitat	Low
Fish	*Chlamydogobius japalpa*	Finke desert goby	X		No	VU		Restricted to Finke River system and no suitable habitat in operational area. Will not be considered further.	Nil
Invertebrate	*Basedowena squamulosa*	Land snail	X		No	VU		Very small range and no suitable habitat	Low-Moderate
Invertebrate	*Bothriembryon spenceri*	Snail	X		No	VU		Very small range and no suitable habitat	Low-Moderate

Type	Scientific Name	Common Name	NT Atlas Fauna Atlas[3]	PMST Report	Ecology Survey[5]	TPWC[1]	EPBC[2]	Habitat in PVGF	Likelihood of Occurrence[4]
Invertebrate	*Divellomelon hillieri*	Snail	X		No	VU		Very small range and no suitable habitat	Low-Moderate
Invertebrate	*Granulomelon arcigerens*	Snail	X		No	VU		Very small range and no suitable habitat	Low
Invertebrate	*Semotrachia elleryi*	Snail	X		No	VU		Very small range and no suitable habitat	Low
Invertebrate	*Semotrachia esau*	Snail	X		No	VU		Very small range and no suitable habitat	Low-Moderate
Invertebrate	*Semotrachia euzyga*	Snail	X		No	EN		Very small range and no suitable habitat	Low
Mammal	*Dasycercys blythi*	Brush-tailed mulgara	X		No	VU	VU	No suitable habitat in operational area	Low
Mammal	*Dasyurus geoffroii*	Western Quoll	X		No	ER	VU		Regionally extinct
Mammal	*Macroderma gigas*	Ghost Bat	X		No	NT	VU	Records from pre-1970. Current range restricted to Northern Australia. Will not be considered further.	Nil
Mammal	*Macrotis lagotis*	Greater bilby	X	X	No	VU	VU	No suitable habitat within operational area.	Low
Mammal	*Notoryctes typhlops*	Southern Marsupial Mole	X		No	VU	EN	No suitable habitat in operational area	Low
Mammal	*Petrogale lateralis*	Black-footed rock wallaby	X	X	Yes	VU	VU	No sign present in isolated marginal habitat and project areas are not suitable habitat.	Moderate
Mammal	*Trichosurus vulpecula*	Common brushtail possum	X		No	EN	-	No suitable habitat in project areas but recent discovery west of gas field indicates remote possibility on lease.	Low

Type	Scientific Name	Common Name	NT Atlas Fauna Atlas[3]	PMST Report	Ecology Survey[5]	TPWC[1]	EPBC[2]	Habitat in PVGF	Likelihood of Occurrence[4]
Mammal	*Zyzomys pedunculatus*^	Central rock-rat		X	No	EN	EN	All recent records within West MacDonnell National Park	Low
Reptile	*Liopholis kintorei*	Great desert skink	X		No		VU	No suitable habitat in operational area	Low
Reptile	*Liopholis slateri slater*	Slater's skink	X	X	No	VU	EN	No suitable habitat but known individual in unlikely mountain habitat downslope from PVGF compressor site 13km south of known population on Finke River flood plain	High
Bird	*Acrocephalus australis*	Australian Reed Warbler	X		No	NT		No suitable habitat in operational areas	Low
Bird	*Actitis hypoleucos*	Common sandpiper		X	No		MIG, MAR	No suitable habitat in operational areas	Low
Bird	*Amytornis striatus*	Striated Grasswren	X		No	NT		No suitable habitat in operational area	Low
Bird	*Apus pacificus*	Fork-tailed swift		X	No		MIG, MAR	Aerial migrant	Moderate
Bird	*Ardea alba*	Great egret		X	No		MAR	No suitable habitat in operational areas	Low
Bird	*Ardea ibis*	Cattle egret		X	No		MAR	No suitable habitat in operational areas	Low
Bird	*Ardeotis australis*	Australian bustard	X		No	NT		No suitable habitat in operational area	Low
Bird	*Burhinus grallarius*	Bush-stone curlew	X		No	NT		Unsuitable habitat in operational areas	Low`
Bird	*Calidris acuminate*	Sharp-tailed sandpiper		X	No		MIG, MAR	No suitable habitat in operational areas	Low
Bird	*Calidris melanotos*	Pectoral Sandpiper		X	No		MIG, MAR	No suitable habitat in operational areas	Low

Type	Scientific Name	Common Name	NT Atlas Fauna Atlas[3]	PMST Report	Ecology Survey[5]	TPWC[1]	EPBC[2]	Habitat in PVGF	Likelihood of Occurrence[4]
Bird	*Calidris veredus*	Oriental Plover		X	No		MIG	No suitable habitat in operational areas	Low
Bird	*Calyptorynchus banksia samueli*	Red-tailed Black-cockatoo	X		No	NT		No suitable habitat in project areas	Moderate
Bird	*Charadrius veredus*	Oriental plover		X	No		MIG, MAR	No suitable habitat in operational areas	Low
Bird	*Chrysococcyx osculans*	Black-eared Cuckoo			No		MAR	Wide ranging vagrant and No suitable habitat in operational areas	
Bird	*Conopophila whitei*	grey honeyeater	X		No	DD		Irregular vagrant	Moderate
Bird	*Dromaius novaehollandiae*	emu	X		No	NT		No suitable habitat	Low
Bird	*Glareola maldivarum*	Oriental pratincole		X	No		MIG, MAR	Possible vagrant on cleared areas	Low
Bird	*Lophoictinia isura*	Square-tailed kite	X		No	NT		May pass overhead but no suitable habitat in operational areas	Low
Bird	*Merops ornatus*	Rainbow bee-eater		X	Yes		MAR	Wide ranging summer migrant	High
Bird	*Motacilla cinerea*	Grey wagtail		X	No		MIG, MAR	Rare migrant, habitat unsuitable in project areas	Low
Bird	*Motacilla flava*	Yellow wagtail		X	No		MIG, MAR	Rare migrant, habitat unsuitable in operational areas	Low
Bird	*Neophema splendida*	Scarlet-chested parrot	X		No	NT		No suitable habitat in operational areas	Moderate
Bird	*Pandion haliaetus*	Osprey		X	No		MI	No suitable habitat in operational areas	Low
Bird	*Porzana flumina*	Australian Spotted Crake	X		No	DD		No suitable habitat	Low

Type	Scientific Name	Common Name	NT Atlas Fauna Atlas[3]	PMST Report	Ecology Survey[5]	TPWC[1]	EPBC[2]	Habitat in PVGF	Likelihood of Occurrence[4]
Bird	*Porzana pusilla*	Baillon's Crake	X		No	DD		No suitable habitat	Low
Bird	*Pyrrholaemus brunneus*	Redthroat	X		No	NT		No suitable habitat in operational areas	Moderate
Bird	*Rostratula benghalensis*	Painted Snipe		X	No		MAR	No suitable habitat in operational areas	Low
Bird	*Stictonetta naevosa*	Freckled Duck	X		No	NT		No suitable habitat	Low
Fish	*Craterocephalis centralis*	Finke Hardyhead	X		No	NT		No suitable habitat in operational areas	Nil
Fish	*Mogurnda larapintae*	Desert Mogurnda	X		No	NT		No suitable habitat in operational areas	Nil
Invertebrate	*Sinumelon bednalli*	Bednall's Land Snail	X		No	NT		Very small range and no suitable habitat	Low
Mammal	*Antechinomys laniger*	Kultarr	X		No	NT		Habitat unsuitable	Nil
Reptile	*Anilios centralis*	Centralian blind snake	X		No	DD	-	Habitat unsuitable	Low
Reptile	*Pseudechis australis*	king brown snake	X		No	NT		Wide ranging	Moderate

[1] TPWC Status: ER, Regionally Extinct, CR, Critical Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; DD, Data Deficient; NE, Not Evaluated; LC, Least Concern as listed under the Territory Parks and Wildlife Conservation Act (TPWC).

[2] EPBC Status: EX, Extinct, CR, Critical Endangered; EN, Endangered; VU, Vulnerable; MIG, Migratory; MAR, Marine; WET, Wetland; TER, Terrestrial; (L) MAR, Listed Marine Species as listed under the Environmental Protection and Biodiversity Act (EPBC) using 25km buffer.

[3] Recorded in the NT Fauna Atlas within a 25km buffer of the OL3 area.

[4] Likelihood of occurrence within OL3 determined through consideration of available habitat and existing records within 25km of lease area.

[5]Low Ecological Services PVGF 2007 Fauna Survey results

A.5.2.8 Introduced flora (weeds)

Previous weed surveys conducted in PVGF identified weeds listed in Table 30.

Table 30: Weeds in the environs of PVGF

Scientific Name	Common Name	Priority/ Alert	NT Atlas/ Declared Weed Class	Invasive/ WoNS	Survey[1]
Cenchrus ciliaris	Buffel Grass	No	No/ -	Yes/No	Yes
Solanum lycopersicum	Tomato	No	No	No	Yes
Solanum nigrum	Nightshade	No	No	No	Yes
Sonchus oleraceus	Sowthistle	No	No	No	Yes
Tribulus terrestris	Caltrop	No	Yes/B	Yes/No	Yes

[1] *Detected during annual weed survey*

A.5.2.9 Introduced fauna (pests)

An introduced fauna species is considered in this FEMP to be of management concern if it is:

- Listed in the NT Fauna Atlas as "Introduced" or "declared" and has been recorded within a 10 km buffer PVDF or has been recorded on field surveys of the area; or
- Identified as an invasive species by an EPBC Protected Matters Search Tool report within a 10 km buffer of PVDF or has been recorded on field surveys of the area.

Table 31 lists the introduced fauna species to be of management concern for this FEMP.

Table 31: Introduced fauna (pests)

Scientific name	Common name	NT Atlas	PMST	Survey[1]
Columbia livia	Domestic Pigeon	Yes	Yes	No
Passer domesticus	House Sparrow	No	Yes	no
Bos Taurus	Domestic Cattle	Yes	Yes	Yes
Camelus dromedarius	Camel	Yes	Yes	No/Yes
Equus caballus	Horse	Yes	Yes	Possible
Felis catus	Domestic Cat	Yes	Yes	High
Mus musculus	House Mouse	Yes	Yes	Yes/No
Oryctolagus cuniculus	European Rabbit	Yes	Yes	Yes/No

[1] *NT Fauna Atlas & EPBC PMST,2022*

A.5.2.10 Fire history

Fire is universal in the Australian deserts, an evolutionary concoction created from sporadic heavy rainfall and infertile soils (Morton, 2022). The dominant vegetation community across the arid Amadeus basin is Spinifex (*Triodia spp.*) grassland.

Open spinifex hummock grassland is Australia's unique desert landscape, this type of grassland being found nowhere else in the world. The spiky hummocks of spinifex grow over 2 million square kilometres of sandplains and dune fields; spinifex grows also on the hard ground of mountain ranges and rocky outcrops like PVGF. Spinifex grassland contain numerous shrubs of acacias, eremophilas, desert oaks eucalypts and grevilleas.

Fire is an elemental part of the spinifex deserts (Morton, 2022). Spinifex grasslands all lie somewhere in a succession from burnt through regenerating to mature, in a cyclical process that is as inevitable as it is longstanding. In an evolutionary sense, spinifex needs to burn. Fire clears its home ground of competing shrubs, simultaneously reducing persistent litter to ash, and mineralising its scarce and valuable nutrients.

Spinifex continues growing through small and big rains alike, at a pace governed by aggregated rainfall. Eventually, the biomass accumulates into fuel sufficiently dense to carry a fire, which is especially likely after a year of heavy rainfall. Spinifex responds to high rainfall by producing bumper crops, a mechanism to swamp seed eaters so that they cannot remove more than a tiny proportion of the seeds.

Seedlings that establish in burnt country also have the advantage of growing under conditions of reduced competition and increased soil nutrients. Not all spinifex species recruit purely from seeds. Soft spinifex frequently is not killed by burning, because it is able to regrow from buds that survive in the stems just below ground level.

The next rainfall stimulates regeneration of these buds, while also providing opportunity for establishment of fresh seedlings. Feathertop spinifex is like soft spinifex in sometimes regenerating from buds, but hard spinifex is usually killed by fire (Morton, 2022).

Regional fire history and fire scar mapping was obtained through the Northern Australia and Rangelands Fire Information website and a general review of Landsat Imagery (using Google Timelapse and VegMachine). Table 33 details the recent fire history map for PVGF.

A.5.3 Socio-Economic Environment

A.5.3.1 Surrounding Land Tenure

The Amadeus basin is a sparsely populated area with Alice Springs being the major centre for the region. PVGF is located in remote and isolated locations many kilometres from the nearest neighbours, per Table 32.

Table 32: Surrounding Land Tenure

Field	Property Name	Survey Plan Number	Land Tenure	Operation Footprint
PVGF	[redacted]		Land Trust	All

A.5.3.2 Surrounding Populated Places

All fields are in remote locations, far distant from the nearest populated places as shown in the tables below, though there are several small Aboriginal communities within proximity, or that have strong traditional ties with the surrounding land, including: Hermannsburg, Kulpidjara, Areyonga, Underana, Undandita, Haasts Bluff, Papunya, and Ipolera (Table 34).

As part of stakeholder consultation and requirements under the PVGF Agreement and Central Land Council (CLC) SSCC, the Operator has, and will continue to engage with surrounding stakeholders regarding the workover and wellhead equipment, safety systems and gathering line works.

The PVGF has a positive impact on the social and economic values of these communities through increased workforce participation opportunities.

Table 33: Fire history PVGF

Fire History Map
The most recent bushfire came in close to PV-05 well in 2021 (NAFI, 2023) and a small area southwest of PV-08 in 2015. Fire breaks were established by Tjuwampa Rangers under training by BFC south of the main east west access road southwest of the Gas Plant to Palm Paddock in Finke Gorge National Park in 2007/08 and by NT Parks and Wildlife Rangers in 2018. The majority of the OL3 area has a low bushfire risk due to scattered shrub vegetation, rocky surface and low ground cover. Both bushfires in the area were following years of above average rainfall, which resulted in high vegetation growth. Bushfire potential is higher following favourable vegetation growing conditions.

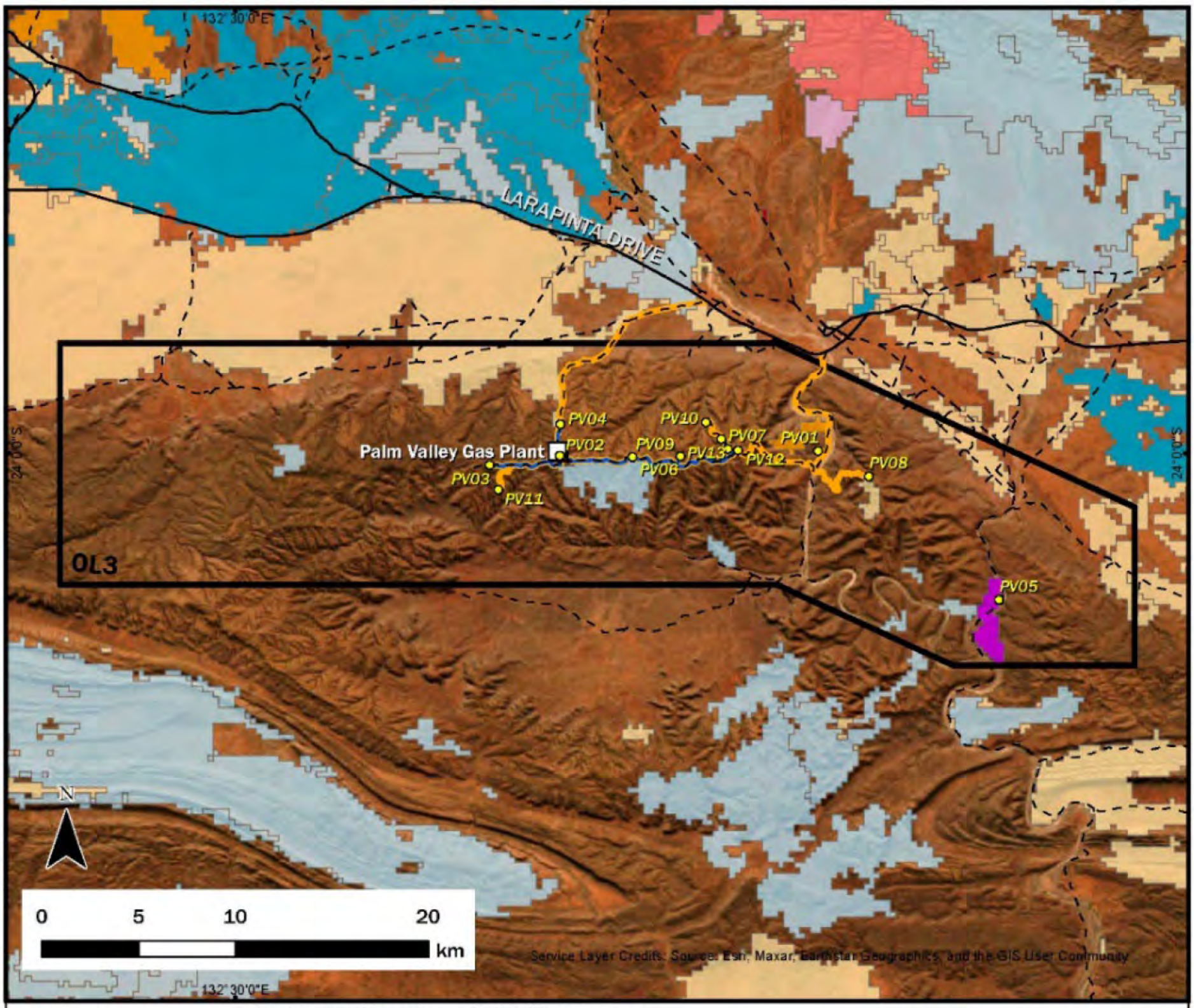
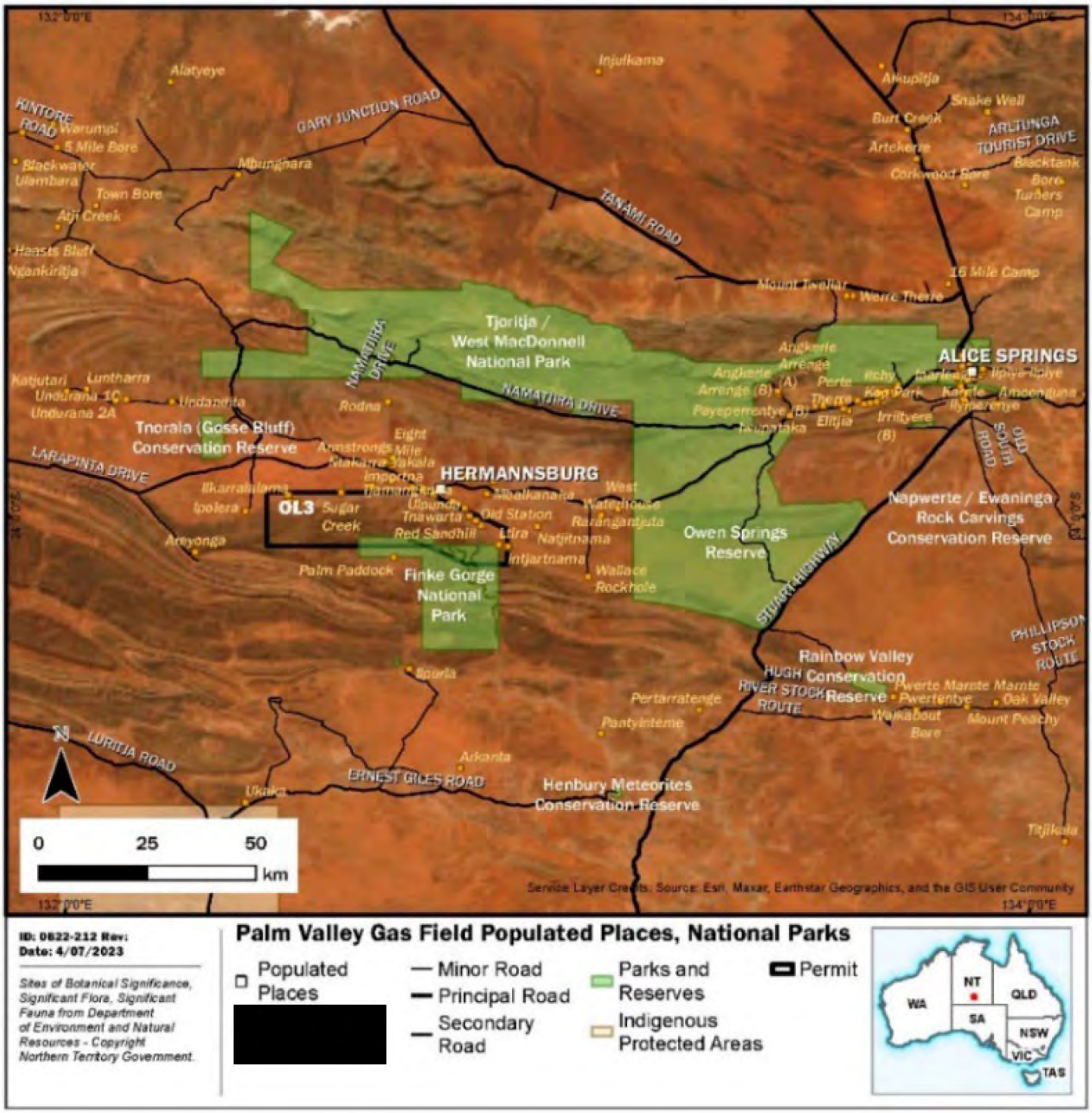


Table 34: Populated places PVGF

Surrounding populated places
▪ Ntaria (Hermannsburg), approximately 14km to the northeast ▪ Glen Helen Resort, approximately 35km to the north ▪ Aeryonga community, 40km west of the gas plant ▪ Alice Springs, approximately 130km to the east



A.5.3.3 Noise

As noted in Section A.5.3.2 above, all fields are located within a sparsely populated region. There are no communities within the area bounded by respective tenements and the nearest sensitive receptor are more than 25km from the noise sources located across the field.

Northern Territory Noise Management Framework Guideline 2018 refers to offensive noise that may cause an environmental nuisance. Noise sources at the PVGF are centred on the CTP processing facilities.

The operation of compressors and power generation units at these industrial facilities occurs 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 Northern Territory *Work Health and Safety Regulation 2011* which provide 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 that potential noise generated within each of the fields 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.

A.5.3.4 Cultural heritage

A.5.3.4.1 Historic and natural heritage

PVGF 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 of which are within nor adjacent to fields. No non-public sites were found by the online search.

An EPBC Protected Matter Search Tool (PMST) retrieved for the OL3 area and 10km buffer identifies one National Heritage Place, The Hermannsburg Historic Precinct which is located within 25km of OL3. No operations at the PVGF will impact on this place as it is outside of all operational areas and not located on any access track or road associated with PVGF operations.

A heritage and archaeological survey at PV-12 in 2014 (Everick Heritage Consultants Pty Ltd) carried out an assessment of archaeological sites and heritage sites as per the NT Heritage Act and found a low scatter of stone chippings deemed to be not significant. The OL3 area is on Aboriginal Land Trust, and as such a CLC clearance is required before any new works are commenced.

A.5.3.4.2 Aboriginal archaeological assessment

No new areas of disturbance are proposed for consideration within this EMP as no new archaeological assessment has been conducted.

The PVGF operates under AAPA Authority Certificate 202408607 (C2025/036).

A.5.3.4.3 Sacred Sites

The PVGF is operated under and in compliance with SSCC C2020-061 and SSCC-C2017-171 (PV-12).

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A.6 Engagement and Consultation

A.6.1 Stakeholder engagement

The Operator is 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 of 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 per CLC guidance.

No consultation with the Commonwealth Government was required as it has been determined through an EPBC self-assessment (Appendix 4) that the works are unlikely to cause a significant impact on MNES (PMST dated 5 December 2023). Therefore, the *EPBC Act* will not be triggered.

A record of all engagements undertaken with stakeholders is captured in a stakeholder engagement register

A.6.2 Traditional Owner(s) engagement

The Operator undertakes regular consultation with Traditional Owners primarily through annual community liaison meetings. At these meetings the Operator provides an overview of its ongoing production operations, anticipated field workover programs and other development activities. 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.

A.6.3 Assessment of merit of stakeholder objection or claim

The process that the Operator will undertake in assessing any stakeholder objection/claim that it receives 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 the Operator and that no additional action is required; or
  - If the results confirm that the objection/claim is related to the 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 outcomes of the investigation including any actions that the Operator has/will undertake to address the objection/claim – if required. Following the discussion, a written response will be provided.

A.6.4 Details of changes due to engagement

Any proposed changes in operations, policy or procedures because of stakeholder consultation or other engagement will be considered by the Operator's Management Team. If any changes for merit are deemed necessary, these changes will follow the approved the Operator's management of change process and captured in a register.

A.7 Environmental Impacts, Risks and Mitigation

A.7.1 Approach

A.7.1.1 Risk assessment methodology

The Operator's 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 35)
- Recorded in a risk register
- 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 the Operator's Risk Matrix (Section Risk Matrix) 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 determination can then be made about whether the risk is ALARP and acceptable or whether further mitigation is required.

Table 35: 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.

A.7.1.2 ALARP and acceptability

As part of the Operator's risk assessment process, each risk is mitigated to ALARP. The Operator considers risks having been reduced to ALARP 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, time and resources involved to mitigate it.

To determine whether potential environmental risks and inputs are 'acceptable' is a matter of judgement that depends on issues such as the nature and scale of impacts and the social or economic benefits. The Operator's risk tolerance/acceptance process (Table 36) is utilised to determine whether to accept the assessed residual risk or implement improvement actions.

Table 36: 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 risk 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 being demonstrated through:
    - Alignment with legislative requirements, regulator guidance, stakeholder expectations
    - Adoption of regional strategies and plans
    - Not compromising ESD Principles, and
    - Limiting the nature and scale of the effect on the environment.

A.7.1.3 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 a management control. Additional baseline studies or other safeguards may be required to increase the accuracy of an assessment to determine the acceptability of a risk.

Scientific uncertainty is qualitatively assessed using a generic means of ranking the data available in accordance with the criteria assigned in Table 37. Considerations of scientific uncertainty have been included in the risk assessment.

Table 37: 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 as 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. The precautionary approach to management of the risk is required.

A.7.1.4 Risk assessment summary

The outcomes of the environmental risk assessment are presented in Appendix 1. A summary of the residual risks for PVGF activities under the EMP is shown in Table 38. All risks are considered by the Operator to be as low as reasonably practicable and are accepted.

Table 38: Risk assessment summary

	Low	Medium	High	Very High
Count	6	6	0	0

The 'Medium' residual risks for activities under this environment management plan 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 release of hydrocarbons and formation water, including wastewater to ground
- Loss of places or items of cultural significance from fire as a result of activities under this EMP
- Subsurface loss of contaminants during workovers contaminating surface water and/or groundwater and reducing groundwater pressure

A.7.1.5 Environmental management strategy

Based on the results of the risk assessments conducted and the identification of critical controls as detailed in Appendix 1. 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 Biodiversity to Cumulative impacts.

A.7.1.6 Risk Matrix

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

A.7.2 Biodiversity

<table>
<tr><th colspan="6">Environmental performance measures: Biodiversity</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management
▪ Well operations – surface infrastructure
▪ Production facilities – gathering and boosting, oil and gas processing,
▪ Well workover – fluid systems
▪ Rehabilitation
▪ Support activities – chemical storage, workover fluids, waste and wastewater management</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="3">Consequences</td><td colspan="2">Critical controls</td></tr>
<tr><td colspan="3">▪ Loss of vegetation/fauna habitat values from:
- Loss of containment, including spills and leaks, of hydrocarbons, chemicals, workover fluids, 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 or trenches or similar</td><td colspan="2">▪ Weed Management Plan
▪ Rehabilitation Management Plan
▪ Fire Management Plan
▪ Spill Management Plan
▪ Erosion and Sediment Control Plan
▪ Wastewater Management Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The residual risk remains medium based on moderate impacts of loss of conservation significant fauna. The Operator considers that the risk has been reduced to ALARP and acceptable based on the following:
▪ Vehicle movements are a necessary part of operations controls are aligned with industry practice and consistent with ESD principles to co-exist without any long-term impacts to the local environment.
▪ No Weeds of National Significance (WoNS) or declared weeds in respective fields so risk of weed spread between well sites is minimised. Best practice weed management practice areas in place and the Operator seeks to achieve the requirements of key legislation and strategies as outlined in Section 2.
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
</table>

Environmental performance measures: Biodiversity			
Environmental outcome	**Environmental performance standard**	**Measurement criteria**	**Records**
No significant impact[5] to threatened fauna, their habitat and sites of conservation significance	No unauthorised clearing of vegetation or loss of fauna habitat	▪ Areas of known threatened fauna habitat will be sign posted to avoid impacts to 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	▪ Permit to work records ▪ Incident records ▪ Environmental sensitivity maps
	No introduction of new or spread of existing Weeds of National Significance, weed listed under NT legislation or locally significant weed species	▪ Complete annual weed survey ▪ No new WONS, NT listed weed species or locally significant weed species identified ▪ Weed certifications from vehicles, equipment and machinery entering from known weed infestation areas are obtained ▪ Weed hygiene training has been 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 protection of fauna, flora, their habitat and reporting fauna interactions ▪ No incidents recorded in incident management system of driving off designated roads, access tracks and well pads ▪ No incidents within incident management system involving vehicle related fauna strikes with speeds above 70km/hr within the field.	▪ Incident records ▪ Induction and register of participants
	No uncontrolled fires from the Operator's activities	▪ The incident management system shows no recorded incidents of uncontrolled fires starting because of the operator's activities	▪ Incident records
	The Operator's activities will not encourage pest species	▪ The incident management system shows no records of pest species interactions with waste or inappropriate waste storage and handling that encourages vermin access.	▪ Incident records ▪ Inspection records
Environmental monitoring and reporting		See Table 110 for details	
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	

▪ [5] Refer to glossary for measurable definition of significant impact

A.7.3 Land

<table>
<tr><th colspan="6">Environmental management strategy: Land</th></tr>
<tr><td>Activities</td><td colspan="3">▪ Civil and project activities – earthworks, land and vegetation management
▪ Well operations –surface infrastructure
▪ Production facilities – gathering and boosting, gas processing,</td><td colspan="2">▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities – services, chemical storage, workover fluids, waste and wastewater management
▪ Export sales receiver to APA gas transmission pipeline</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 rowspan="2">Risk</td><td colspan="3">Consequences</td><td colspan="2">Critical controls</td></tr>
<tr><td colspan="3">▪ Soil/land contamination from:
- Loss of containment, including spills and leaks, of hydrocarbons, chemicals, workover fluids, wastewater, including during wet weather
- Storage, handling, use of fuels, oils and chemicals
- Wastewater 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="2">▪ Spill Management Plan
▪ Wastewater Management Plan
▪ Wet Season Management Plan
▪ Erosion and Sediment Control Plan
▪ Rehabilitation Management Plan
▪ Waste segregation and implementation of waste management hierarchy
▪ Job Hazard Analysis/ Permit to work systems</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that the risks have been reduced to ALARP and no further risk reduction is warranted as:
▪ A strong historical knowledge of the field and the environmental response to land disturbance, erosion and contamination events presents a low level of uncertainty.
▪ Operation of flowlines in accordance with legislative and best practice guides/codes.
▪ Operation of wastewater storage and disposal as per the Code. The ponds were developed prior to the implementation of the Code, no leak detection is in place but a program of regular inspections as part of the Asset Management System has been successfully implemented.
▪ Operation and maintenance of the gathering network in accordance legislative and with best practice industry standards (refer Section 2).
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
</table>

Environmental management strategy: Land			
Environmental outcome	**Environmental performance standards**	**Measurement criteria**	**Records**
No significant long-term impacts on soil stability, soil quality and land formations from the Operator's activities	Erosion and sediment controls in place, including wet weather response.	▪ Records show the erosion and sediment control measures are being implemented ▪ Records show inspections of erosion and sedimentation issues after significant rainfall events ▪ Records show all active work sites inspected for evidence of erosion and sedimentation, including after significant rain events, 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) ▪ Records show restricted use of roads and tracks to operational safety activities across the field after significant rainfall event (>10mm in 24 hours)	▪ Inspection records ▪ Incident records ▪ Weather records
	Disturbance of land remains within existing cleared and operational areas.	▪ 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	▪ Incident records ▪ Induction records ▪ Permit to work records
	No releases of contaminants (including wastes, wastewater, chemicals, hydrocarbons or workover fluids) resulting in long-term contamination of the soil	▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken ▪ The incident management system indicates no releases of contaminants incidents related to wet weather operations ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling, 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 spills resulting in significant, long term impacts on soils and land formations ▪ Records show 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 the operator's activities ▪ Records show progressive rehabilitation has been initiated to reinstate/reduce areas no longer required	▪ Rehabilitation success monitoring ▪ Incident records

Environmental management strategy: Land	
Environmental monitoring and reporting	See Table 110 for details
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

[1] International Association of Oil & Gas Producers, Process safety – Recommended practice on Key Performance Indicators (report 456), May 2023. Tier 1 threshold for loss of primary containment event impacting the community is defined as officially declared community evacuation or community shelter-in-place including precautionary community evacuation or community shelter-in-place. In the event of a fire or explosion the Tier 1 threshold is damage resulting in greater than or equal to $100,000 of direct cost to the Company.

A.7.4 Surface water

<table>
<tr><th colspan="6">Environmental performance measures: Surface water</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, project, borrow pits, mobilisation/demobilisation
▪ Well operations – surface infrastructure, well maintenance and integrity
▪ Production facilities – gathering and boosting, gas processing, condensate and oil storage and loadout
▪ Well workover – fluid systems
▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities – chemical storage, workover fluids, waste and wastewater management</td></tr>
<tr><td>Residual risk</td><td>Medium</td><td>Code of Practice</td><td>A.3.4, A.3.8, C.3, C.4.1, C.4.2, C.5, C.7.1, C.7.2</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">▪ Surface water contamination from:
- Loss of containment, including spills and leaks, of hydrocarbons, workover fluids, 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</td><td colspan="2">▪ Asset Management System
▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Wet Season Management Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that the risks have been reduced to ALARP and no further risk reduction is warranted as:
▪ Operation of flowlines in accordance with legislative and best practice guides/codes (refer Section 2)
▪ Operation of wastewater storage and disposal as per the Code. The ponds were developed prior to the implementation of the Code, no leak detection is in place but a program of regular inspections as part of the Asset Management System has been successfully implemented.
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standards</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>No significant impact[6] on surface water quality</td><td>No release of contaminants resulting in long term</td><td colspan="2">▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken</td><td colspan="2">▪ Inspection records
▪ Incident records
▪ Chemical register</td></tr>
</table>

▪ [6] Refer to Glossary for measurable definition of significant impact

Environmental performance measures: Surface water			
from the Operator's activities	contamination of surface waters, including during wet weather operations	▪ The incident management system indicates no release of contaminant incidents related to storage, handling, use or disposal of chemicals, fuels, 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, 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 spills resulting in significant, long-term contamination of surface waters ▪ Records show emergency response plan implemented in the event of a reportable spill or leak	
	Erosion and sediment controls in place	▪ Records show the erosion and sediment control plan is implemented ▪ Records show all active work site inspected for evidence of erosion and sedimentation, including after significant rain events, 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 ▪ Job hazard analysis
	No long-term impacts on surface water from operation of evaporation ponds	▪ Records show freeboard is maintained ▪ No incidents of overtopping from evaporation ponds recorded within the incident management system ▪ Records show inspections of containment integrity are maintained ▪ Records show production needs consider available holding capacity within evaporation ponds, particularly during wet weather	▪ Inspection records ▪ Daily production reports ▪ Incident records
Environmental monitoring	See Table 110 for details		
Corrective actions	▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily. ▪ Soil remediation where spills occur to reduce impact to nearby surface water ▪ Review of wet weather procedures and response ▪ Review of storage and handling practices of contaminants ▪ Increased awareness and training		

A.7.5 Groundwater

<table>
<tr><th colspan="6">Environmental performance measures: Groundwater</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Well operations – well barriers, maintenance and integrity
▪ Production facilities – gathering and boosting, gas processing
▪ Well workover – barrier protection, fluid systems, suspension, decommissioning
▪ Support activities – services, chemical storage, workover fluids, waste and wastewater management</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 workovers
- Groundwater inflow from workover activities
- Well integrity
- Spill or leak from the use, transportation, treatment, handling and storage of, workover fluids, wastewater, and diesel, fuel, oils and chemicals, including during wet season
- Loss of containment from wastewater ponds
▪ Reduced groundwater availability for wider community from use of groundwater resources to support the Operator's activities</td><td colspan="2">▪ Asset Management System
▪ Wells managed in accordance with DITT approved WOMPs
▪ Implement Emergency Response Plan
▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Groundwater Management Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that this risk has been reduced to ALARP and no further risk reduction is warranted based on:
▪ Well operations and workovers will be conducted using extensive best practice controls as outlined in the DITT approved WOMPs for each well. The subsurface loss of containment risks of operations and workovers are generally lower than drilling a new well because cement casing is already in place and there are no open zones, which provides some protection against hydrocarbon migration. Multiple well barriers are used across aquifers to minimise interaction.
▪ 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.
▪ We also note that part of the rationale for conducting the workover activities is to improve well integrity in an aging field. Workovers will ensure well barriers are in-tact so that subsurface loss of containment risks are reduced during the operation of the well
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
</table>

Environmental performance measures: Groundwater			
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 workover fluids) resulting in long-term contamination of groundwater resources	▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken ▪ The incident management system indicates no releases of contaminants incidents related to wet weather operations ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling, 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 spills resulting in significant, long-term contamination of ground waters ▪ Records show Emergency Response Plan implemented in the event of a reportable spill or leak ▪ The field Groundwater Management Plan (GWMP) has been implemented*	▪ Inspection records ▪ Groundwater monitoring results ▪ Incident records
	Wells are managed under a Well Operations Management Plan to monitor integrity and potential for impact on groundwater	▪ Records show that a DITT approved WOMP is implemented for each well ▪ Records indicate that BOPs and well control equipment is installed, maintained and routinely tested on workover rigs ▪ Records show ongoing maintenance, monitoring and testing processes as specified in WOMPs	▪ Well Barrier Integrity Verification reports ▪ Inspection records ▪ Incident records
Environmental monitoring and reporting	See Table 110 for details		
Corrective actions	▪ Remediate spills and leaks where possible to reduce groundwater impact ▪ Conduct workover to improve integrity of wells, thereby reducing potential for groundwater interaction ▪ Review opportunities for water reduction across field operations and subsequent groundwater extraction reduction.		

** Monitoring undertaken every six months as per the existing field GWMP until the new Groundwater Monitoring Guidelines are released. Thereafter, the monitoring frequency will be reviewed with reference to those included in the Groundwater Sampling and Analysis – Field Guide by Geoscience Australia, Sundaram et al.*

A.7.6 Air and noise

<table>
<tr><th colspan="6">Environmental performance measures: Air and noise</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, borrow pits, wastewater evaporation systems
▪ Well operations – operations, maintenance and integrity
▪ Workovers – well interaction, suspension, decommissioning
▪ Wellhead equipment, safety systems and gathering network replacement
▪ Production facilities –, gathering and boosting, gas processing, venting, maintenance
▪ Support activities – waste, chemical storage, greenhouse gas emissions</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 combustion of fuel/gas
- Flaring and venting of gas and processing by-products
- Emission from release of chemicals, hazardous substances to atmosphere
- Vehicle and heavy machinery movements
- Explosion or fire from the Operator's activities</td><td colspan="2">▪ Asset integrity and maintenance systems
▪ Emergency Response Plan
▪ Methane Emissions Plan/leak detection program
▪ Well Operation Management Plan
▪ Job Hazard Analysis and Permit to Work systems
▪ Flaring (during workovers) is within designated and restricted areas</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Code dictates methane emissions for onshore shale gas fields (Clause D.2). PVGF 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>
<tr><td>Environmental outcome</td><td colspan="2">Environmental performance standards</td><td colspan="2">Measurement criteria</td><td>Records</td></tr>
<tr><td>The Operator's activities do not create a measurable decrease in air quality at sensitive receptors</td><td colspan="2">No release of air contaminants resulting in long term impact to sensitive receptors</td><td colspan="2">▪ Records indicate regular inspections are conducted in line with Well Operations Management Plan and asset maintenance systems
▪ Records of inspection identify asset integrity system and processes are being implemented
▪ Records show that safety critical processes and procedures are in place</td><td>▪ Inspection records
▪ Process/metering records
▪ Incident records
▪ Calibration records</td></tr>
</table>

Environmental performance measures: Air and noise			
	No uncontrolled fire or explosion from the Operator's activities	▪ Records show that safety critical processes and procedures are in place as per Integrity Management System ▪ Incident management system shows that 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 is metered and recorded ▪ Calculation of greenhouse gas emissions in accordance with the NGER Measurement Determination	▪ Incident records ▪ NGER Report ▪ Venting records ▪ Flaring records (during workovers)
	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	See Table 110 for details		
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, the Operator is working to meet the requirements of Section D of the Code where relevant to our operations*

A.7.7 Hazards

<table>
<tr><th colspan="6">Environmental performance measures: Hazards</th></tr>
<tr><td>Activities</td><td colspan="3">▪ Civil and project activities – earthworks, land and vegetation management, site mobilisation/demobilisation
▪ Well operations -surface infrastructure
▪ Production facilities – gathering and boosting, gas processing, venting, oil loadout
▪ Well workover – fluid systems</td><td colspan="2">▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities –chemical storage, workover fluids, waste and wastewater management
▪ Export sales receiver to APA gas transmission pipeline</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 rowspan="2">Risk</td><td colspan="2">Consequences</td><td colspan="3">Critical controls</td></tr>
<tr><td colspan="2">▪ Ignition sources present from the Operator's 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">▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Erosion and Sediment Control Plan
▪ Bushfire Management Plan
▪ Methane Emissions Management Plan
▪ Wet Season Management Plan
▪ Asset Management System
▪ Waste management hierarchy implementation</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">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 and the Operator is experienced with operating in the climatic and environmental conditions. Systems and controls are in place to effectively manage operations in the event of natural hazards such as bushfire, wet weather and the occurrence of NORMS.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standard</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>Bushfires are not started from conduct of the regulated activity and infrastructure is protected from fires started outside of the OL areas</td><td>No uncontrolled bushfires caused by the Operator's activities</td><td colspan="2">▪ The Incident Management System shows no fires resulting from the operator's activities
▪ Records show annual fire scar mapping, annual fire load estimates and maintenance of firebreaks are undertaken
▪ Records show emergency response plan implemented in the event of a fire
▪ Records show weather conditions, including current fire danger are reviewed as part of pre-start/toolbox/Job Hazard Analysis/Permit to Work processes</td><td colspan="2">▪ Incident records
▪ JHA records
▪ Daily reports</td></tr>
</table>

Environmental performance measures: Hazards			
		▪ Records show NAFI fire tracking maps are reviewed daily as part of operations where a high fire danger is present ▪ Records show emergency response drills are conducted	
No significant impact[7] on the natural environment from the Operator's 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 in place where required and working as designed	▪ Records show Erosion and Sediment Control Plan 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
The extraction of subsurface equipment, hydrocarbons and water does not result in human health impacts	No impacts from presence of NORMs on environment or human health	▪ Records indicate that NORMS levels are within acceptable limits prior to handling and disposal ▪ Records show licenced waste contractors are used for movement of waste materials.	▪ NORMS testing records ▪ Incident records ▪ Waste tracking records
Environmental monitoring and reporting		See Table 110 for details	
Corrective actions		▪ Maintain capacity in bunds/secondary containment devices ▪ Manage freeboard within wastewater storage ▪ Replace defective fire equipment ▪ Reinstate fire breaks ▪ Reinstate/repair erosion and sediment control devices	

▪ [7] Refer to Glossary for measurable definition of significant impact

A.7.8 Heritage

<table>
<tr><th colspan="6">Environmental performance measures: Heritage</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, site mobilisation/demobilisation, borrow pits
▪ Rehabilitation</td></tr>
<tr><td>Residual risk</td><td>Medium</td><td>Code of Practice</td><td>A.3.1, A.3.5, A.3.7, A.3.8</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">▪ Loss of heritage values or items of significance from:
- Disturbance/exposure of heritage sites/artefacts of cultural significance
- Ignition sources present from the Operator's 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</td><td colspan="2">▪ 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 Bushfire Management Plan
▪ Implement Emergency Response Plan/actions</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">▪ Activities are not being conducted in the cultural heritage 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 low risk. Works are remaining within previously disturbed areas and under permits from CLC (SSCC C2020-061) and AAPA (updated application in process).
▪ Fire could spread to culturally significant areas if started by the Operator's 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 the Operator considers that this risk has been reduced to lowest possible and is ALARP and acceptable.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standard</td><td colspan="3">Measurement criteria/monitoring</td><td>Records</td></tr>
<tr><td>No significant impact[8] to indigenous and non-indigenous artefacts, Aboriginal Sacred Sites, and</td><td>No non-compliance with AAPA Sacred Site Certificates or CLC permits</td><td colspan="3">▪ 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.</td><td>▪ Incident records
▪ Induction (Heritage and Cultural Awareness)</td></tr>
</table>

▪ [8] Refer to Glossary for measurable definition of significant impact

Environmental performance measures: Heritage			
non-indigenous heritage sites	No unauthorised disturbance of Aboriginal archaeological places/objects and/or Aboriginal Sacred Sites	▪ Incident Management System show no recorded incidents involving damage to Aboriginal archaeological places/objects and/or Aboriginal Sacred Sites ▪ No removal of artefacts in situ without prior approval from Heritage Branch NT	▪ Incident records ▪ Communication minutes with CLC
Bushfires are not started from conduct of the regulated activity and infrastructure is protected from fires started outside of the OL areas	No uncontrolled bushfires caused by the Operator's activities	▪ The Incident Management System shows no fires resulting from the operator's activities ▪ Records show annual fire scar mapping, annual fire load estimates and maintenance of firebreaks are undertaken ▪ Records show emergency response plan implemented in the event of a fire ▪ 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 NAFI fire tracking maps are reviewed daily as part of operations where a high fire danger is present ▪ Records show emergency response drills are conducted	▪ Incident records ▪ JHA records ▪ Daily reports
Environmental monitoring and reporting		See Table 110 for details	
Corrective actions		▪ Consult with Traditional Owners/CLC ▪ Investigate incidents and review and revise procedures	

A.7.9 Community

<table>
<tr><th colspan="6">Environmental performance measures: Community</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – site mobilisation/demobilisation
▪ Well operations -surface infrastructure
▪ Production facilities – gathering and boosting, gas processing,
▪ Well workover – fluid systems</td></tr>
<tr><td>Residual risk</td><td>Low</td><td>Code of Practice</td><td>A.3.1, A.3.7</td><td>Uncertainty</td><td>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">▪ Ignition sources present from the Operator's 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</td><td colspan="3">▪ 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</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">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 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.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standard</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>The Operator's activities minimise the following:
▪ Reduction in capacity of road infrastructure
▪ Maintain and enhance</td><td>No complaints from stakeholders</td><td colspan="2">▪ Records of the operator's approved journey management plans
▪ Records show Traditional Owners able to access field in liaison with Production Supervisor/Person in Charge
▪ Contact information provided to local communities and stakeholder to facilitate communication
▪ No recorded incidents of work being conducted beyond approved operational areas</td><td colspan="2">▪ Records of the operator's approved journey management plans
▪ Records show Traditional Owners able to access field in liaison with Production Supervisor/Person in Charge
▪ Contact information provided to local communities and stakeholder to facilitate communication
▪ No recorded incidents of work being conducted beyond approved operational areas</td></tr>
</table>

Environmental performance measures: Community			
community relationships ▪ Safety risks to the community	No disturbance to surrounding land uses/access from the Interest Holder's 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 the operator's activities ▪ Records of journey management system implementation	▪ 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 the operator's activities ▪ Records of journey management system implementation
	No impact on regional waste resources and services	▪ Records show only licensed waste contractors are used for waste handling, treatment and/or disposal	▪ Records show only licensed waste contractors are used for waste handling, treatment and/or disposal
	Visitors and contractors are aware of environmental requirements	▪ All visitors and contractors are approved for access and inducted according to their visit requirements.	▪ All visitors and contractors are approved for access and inducted according to their visit requirements.
	No significant impacts[9] to the wider community from the operation of the field	▪ Records indicate that the Pipeline Management Plan is implemented for the field ▪ Incident management system does not indicate repeated complaints from the community over the same issue.	▪ Records indicate that the Pipeline Management Plan is implemented for the field ▪ Incident management system does not indicate repeated complaints from the community over the same issue.
Environmental monitoring and reporting		See Table 110 for details	
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 ▪ Re-instate areas disturbed beyond approved boundaries	

▪ [9] Refer to Glossary for measurable definition of significant impact.

A.7.10 Cumulative impacts

The cumulative impacts (Table 39) associated with the ongoing operation and well integrity and intervention campaigns have been assessed as low. The PVGF has been part of the local community since the mid-1980s, with a permanent workforce stationed at site. PVGF activity has supported the local Traditional Owners via a wide range of mechanisms under the agreement.

Table 39: Cumulative impacts for PVGF

Aspect	Risk rating	Summary
Biodiversity	Medium	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) will be inspected weekly, unless 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. ▪ Operation of assets in accordance with legislative and best practice guides/codes
Surface water	Medium	▪ No surface water will be taken, and no surface water extraction licences exist for the area. ▪ No release to surface water proposed ▪ Produced formation water evaporated or reinjected to formation.
Groundwater	Medium	Groundwater purchased off-site. No impacts identified on surrounding users.
Air and noise	Medium	PVGF 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.
Hazards	Low	The activities under this EMP have been occurring for over 40 years and the Interest Holder is experienced with operating in the climatic and environmental conditions. Systems and controls are in place to effectively manage operations in the event of natural hazards such as bushfire, wet weather and the occurrence of NORMS.
Heritage	Medium	▪ Activities are not being conducted in the cultural heritage 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 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, but through the implementation of control measures outlined within the Bushfire Management Plan the Operator considers that this risk has been reduced to lowest possible and is ALARP and acceptable.
Greenhouse Gas Emissions	Low	▪ No emissions from land clearing activities. Solar evaporation is an effective and most efficient means of treating wastewater produced from the target formation ▪ For the 2022 NGER reporting period, total greenhouse gas emissions from PVGF were 15,960 tCO2e. This included a two well drilling program that occurred under the NT Drilling Program EMP (EMP CTP3-4). ▪ Production and metering improvements in addition to leak detection and repair programs are showing an improvement in emissions. Current emissions levels do not trigger the Northern Territory Governments Large Emitters Policy 2021.

Aspect	Risk rating	Summary
Community – traffic	Low	▪ An additional 10 vehicles per day accessing the respective fields are anticipated during specific work programs such as the well integrity and intervention programs. ▪ Journey Management Planning and personnel awareness through daily pre-start meetings of increased traffic during peak tourist periods and maintaining safety for the Operator crews and tourists alike is a priority for the Operator.
Community – tourism	Low	▪ Tourism activities have worked nearby to PVGF and other fields 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 Operator considers the impacts of ongoing activities to be low.
Community – amenity/visual impact	Low	The majority of infrastructure at each field is not visible or accessible.
Rehabilitation – final land use	Low	Successful rehabilitation is dependent on the vegetation type, soil type and moisture content in the soil which, in turn, is dependent on the timing and amount of rainfall in the region after earth work restoration commences.

A.8 Management Plans

A.8.1 Wet Season Management Plan

A Wet Season Management Plan has been developed and presented below Table 40 to address the risks and management measures put in place to ensure operations can continue with little impact on gas production or impact on the environment.

A.8.2 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. Table 41 presents the ESCP.

A.8.3 Weed Management Plan

The Code requires a Weed Management Plan (WMP) that is developed in accordance with the requirements of the *NT Weed Management Planning Guide: Onshore Petroleum Projects.* The Weed Management Plan is provided below in Table 42.

A.8.4 Bushfire Management Plan

The Bushfire Management Plan for the PVGF is provided in Table 43 and has been based on the *Bushfire Management Planning Guide: Onshore Petroleum Projects (*DENR, 2020) and the Code.

A.8.5 Rehabilitation Management Plan

The Rehabilitation Management Plan in Table 44 addresses both rehabilitation of decommissioned areas/wells and also the progressive rehabilitation of areas where the disturbance footprint can be reduced without impacting the daily operations of the area.

A.8.6 Wastewater Management Plan

The Wastewater Management Plan (WWMP) is provided in Table 45. 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.

A.8.7 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 46.

A.8.8 Methane Emissions Management Plan

The Methane Emissions Management Plan (MEMP) aims to reduce emissions via emissions detection and management in the gas field. Monitoring and measurement is undertaken to quantify and reduce fugitive methane emissions from the activities. The Plan is presented in Table 47.

Table 40: Wet Season Management Plan

Amadeus EMP – Palm Valley Gas Field
Wet Season Management Plan 2024

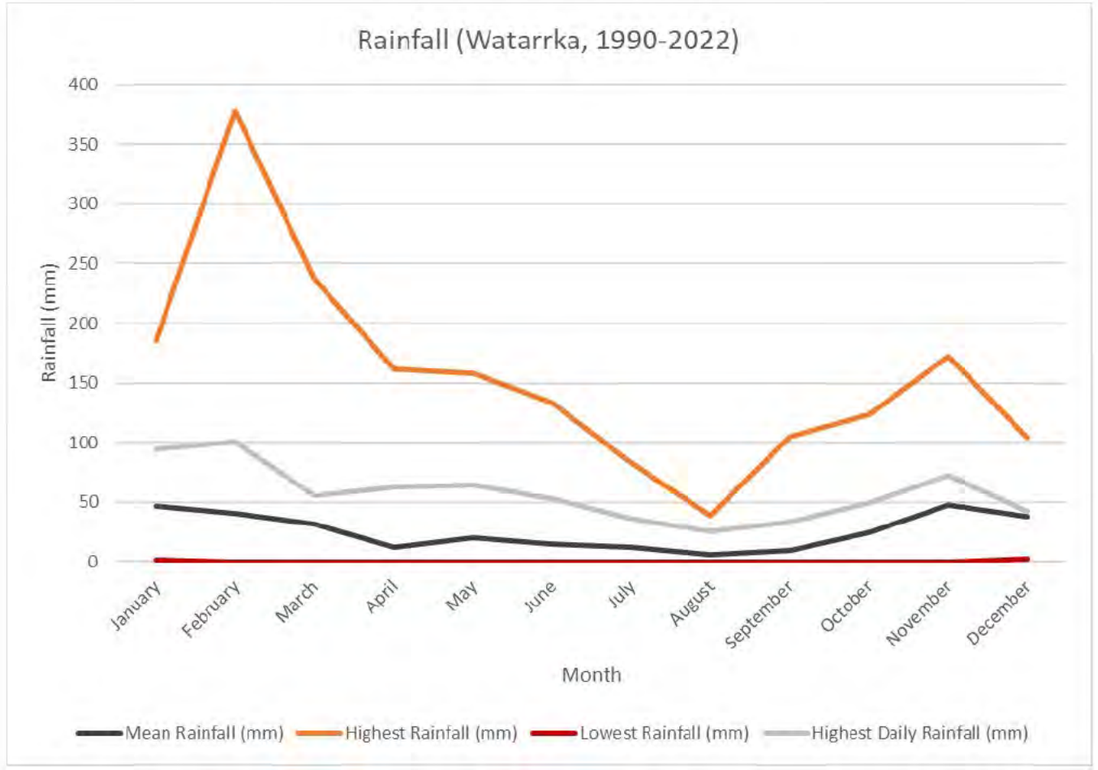
Position	Owner	Implementation
	Risk and HSE Manager	Production Supervisor Ned Garland / Brett Manual

Location of Field	
Property Land Users	PGVF operates the field under OL3 production license
Site Description	The PVGF started production in 1983. Four out of the 13 wells drilled are currently in production.

Wet Management Plan	
Purpose	To respond to the risks associated with wet weather on daily operations.
Objectives	Ensure that all 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	• 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.

Wet Season Monitoring			
Monitoring	Information Location/Action	Frequency	Record
Weather forecast	http://www.bom.gov.au/nt/	Daily	Daily Production Report
Road conditions	https://roadreport.nt.gov.au/home	After significant rainfall event	Daily Production Report
Internal roads and access tracks	Visual monitoring for erosion	After significant rainfall event	Daily Production Report



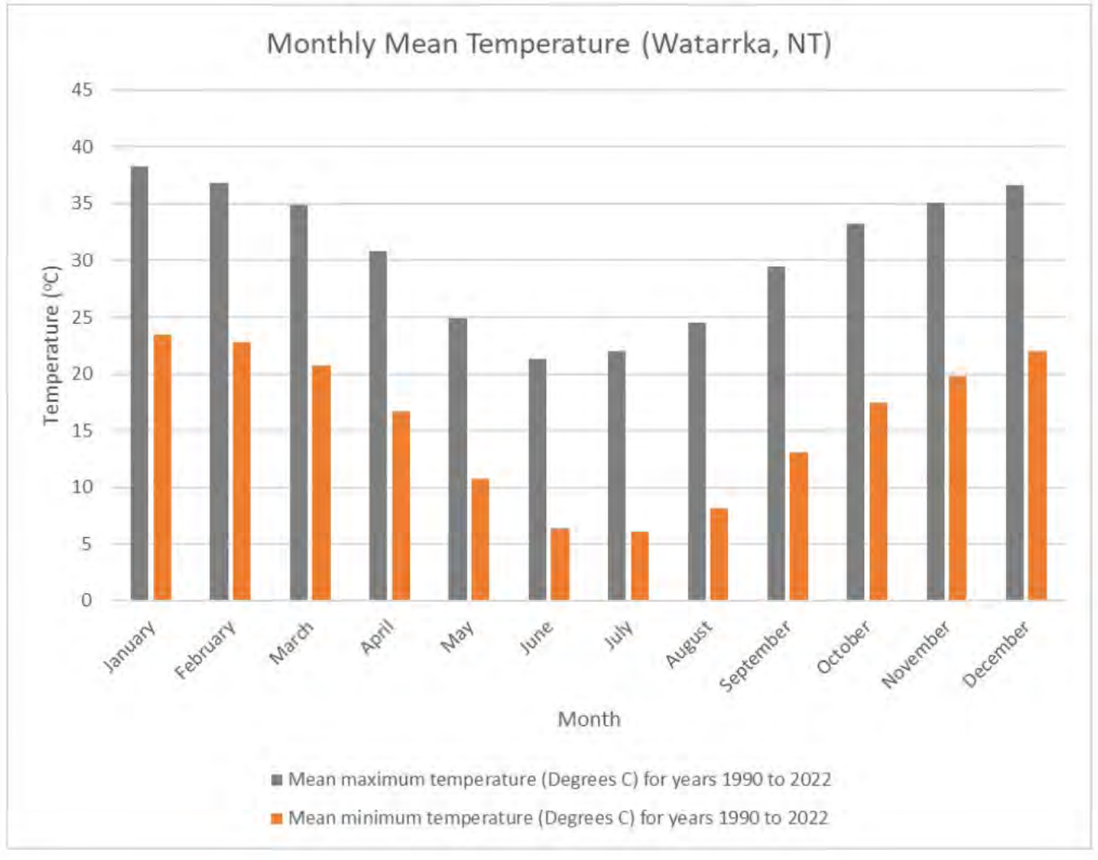


Table 41: Erosion and Sediment Control Plan

Amadeus EMP – Palm Valley Gas Field
Erosion and Sedimentation Control Plan 2024

	Position	Field Implementation
ESCP	Risk and HSE Manager	Production Supervisor
Developed by	Low Ecological Services, on behalf of CP	Bill Low – SQP based on 44 years' experience assessing NT ecology and landforms and development of numerous ESC Plans

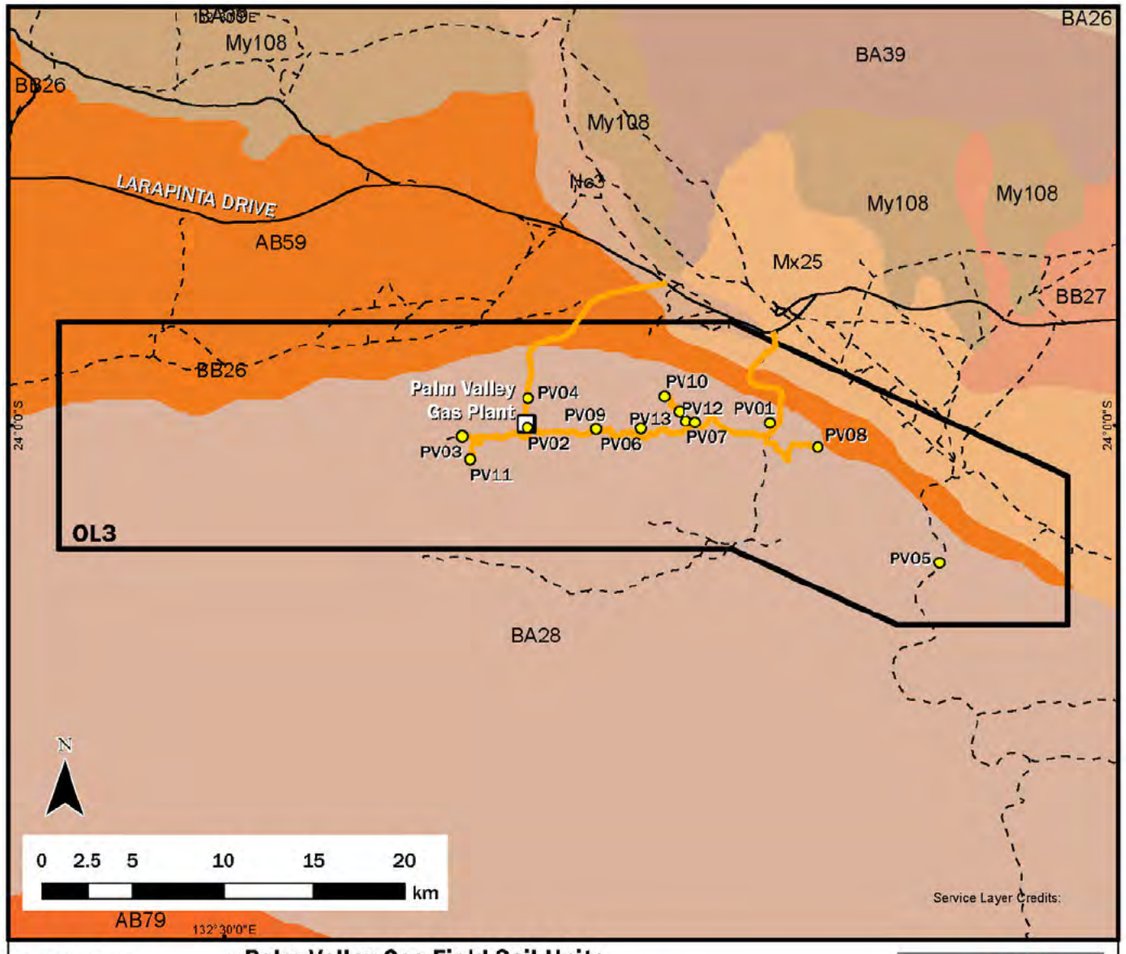
Location of Field	
Property land uses	CP operates the following field: • Palm Valley Gas Field (OL3)
Objectives	To minimise land and water impacts in relation to well activities by preventing erosion and controlling sediment discharge.

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.	
Well pad and operational area maintenance/ upgrade	• 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
Land and vegetation management	• 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.

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)	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		

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* *Developed by: Bill Low – SQP based on 44 years' experience assessing NT ecology and landforms and development of numerous ESC Plans*		

Land Systems					
Land System	Description	Geology	Topography	Soils	Erosion Hazard
Krichauff	Sandstone hills - Low hills, hill and stony plateaux on sandstone, siltstone, quartzite and conglomerate (deeply weathered in places); outcrop with shallow stony soils.	• High relief ranges and foothills	• Mostly sedimentary rocks in the Amadeus Basin	Deep red sands & loamy limestone soils	Moderate
Simpson	Desert Dunefields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes.			Red dune sand	Low
Amulda	Alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Quaternary alluvium.			Shallow, stony, undifferentiated soil	High
Muller	Limestone Plains, rises and plateaux on weathered and unweathered Cambrian limestone, dolomite, chalcedony, shale, sandstone and siltstone with associated sand sheets, sandy and earth soils			Sand sheets, sandy and earth soils	Moderate

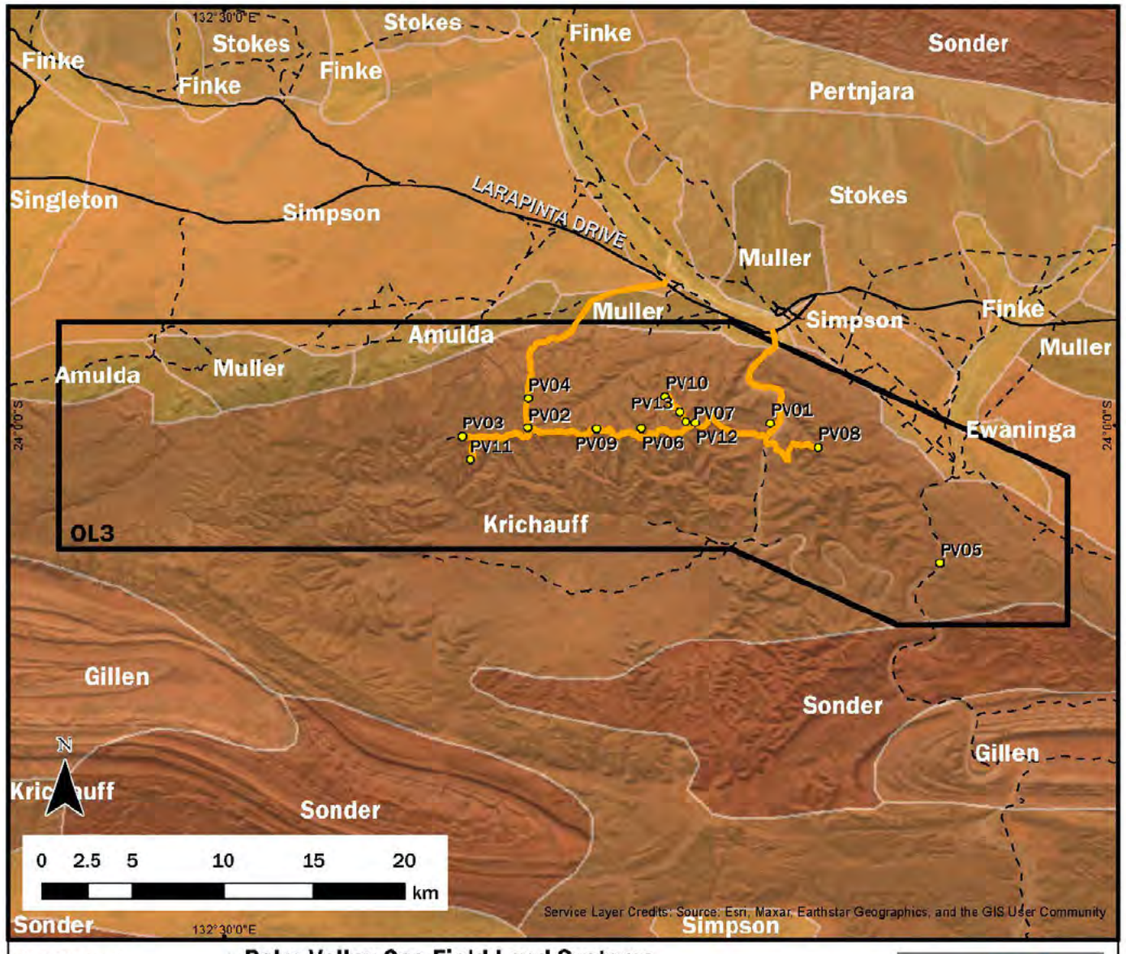


ID: 0622-202 Rev:
Date: 3/07/2023

Digital Atlas of Australian Soils - 1991

Palm Valley Gas Field Soil Units

- Wells
- Palm Valley Gas Plant
- CTP access tracks
- Minor Road
- Secondary Road
- Track
- OL3 permit



ID: 0622-203 Rev:
Date: 3/07/2023

Land Systems - Department of Environment and Natural Resources

Palm Valley Gas Field Land Systems

- Wells
- CTP Access Track
- Minor Road
- Secondary Road
- Track
- OL3 permit

Land System
- Amulda
- Ewaninga
- Finke
- Gillen
- Krichauff
- Muller
- Pertnjara
- Simpson
- Singleton
- Sonder
- Stokes

Table 42: Weed Management Plan

Amadeus EMP – Palm Valley Gas Field
Weed Management Plan 2024

	Contact Details	Name
Weeds Officer	EcOz Environmental Consultants on behalf of CP	Tom Reilly

Central Petroleum PVGF	
Property land uses	PGVF operates the field under OL3 production license.
Site Description	The PVGF started production in 1983. Seven out of the 12 wells drilled produce commercial sales gas.

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 seismic survey 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 Declared Weeds 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	• Use 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 weeds 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 Weeds 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 Weeds Officer	Ongoing as part of activities
Weed Control	Existing weeds are controlled using effective methods Reduce the density and distribution of weeds on site Chemical control of weeds when plants are actively growing 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 Weeds Officer to be more aware of the spread or containment of existing weeds and the effectiveness of weed control • Ensure target weeds growing seasons are noted and chemical treatment is undertaken when most effective. • Recording of weed control events and information	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 burnt in a burn pit or removed from site (e.g. via waste bins) • It is illegal to transport declared weeds. If declared weeds enter the site, these should be burnt and then buried on site at a depth sufficient to prevent emergence of seeds or seedlings • Chemical containers disposed of correctly	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 Weed Species			
Common Name	Scientific Name	Image	Treatment timing / Description / Control
Buffel grass	*Cenchrus ciliaris*		• November—December • 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. • Apply the principals of the Commonwealth (EPBC Act) buffel grass abatement plan (refer to guiding principles within the plan in Appendix 7). • Foliar spray with Glyphosate (360g/L) Roundup Bioactive® or other aquatic-sensitive Glyphosate product. At least two treatments within a growing season • Residual herbicide: Foliar spraying with Flupropanate at an application rate of 1000L/ha or 1L/10m².
Kapok bush	*Aerva javanica*		• December - May • Bushy, perennial plant to 1.5 m. • Greyish appearance due to covering of short white hairs. Fluffy flowers form at the end of stems in up-right pikes. • Kapok will flower throughout most of the year. Hand removal can be difficult due to a long tap root. • MSF600 - 5g per 10L of water and add 10ml Spraywetter per 10L. MSF600 is low cost but is not grass friendly and has a slow kill time. • GrassMate – 30ml/10L water plus 10ml Spraywetter per 10L • A mix of 33ml Rainbow & Brown 2,4-D 720 Amine and 25ml Dicamba 500 SL per 10L of water plus 10ml Spraywetter per 10L • Glyphosate 540 - 133ml/10L + MSF600 1.5G/10L plus 10ml Spraywetter.
Paddy Melon	*Cucumis myriocarpus*		• September - November • Common and relatively widespread in Australia • Mainly a weed of disturbed sites, roadsides and agricultural areas (i.e. pastures and crops), but is also widespread in rangelands and natural communities (e.g. grasslands and open woodlands). • Physical/manual control • Foliar spray : Garlon + An□evap spray adjuvant 1% or mixture of triclopyr, 2,4-D and metsulfuron • Paddy melons have hairy and waxy leaf surfaces that are hard to wet and penetrate when applying herbicide
Pitted Love Grass	*Eragrostis barrelieri*		• May - November • Flat bright green leaves to 30 cm x 4 mm, spreading to erect. Sheaths bearded. • Grows in moist areas beside watercourses and in gullies. Full sun, semi shade. • Foliar spray Glyphosate (360 g/L) 100mL/10L water Spot spray only Apply to actively growing plants
Caltrop	*Tribulus terrestris*		• May - November • Caltrop is a prostrate annual herb with stems spreading out for up to 2 metres from a woody taproot. • Leaves consist of 4 to 8 pairs of opposite oblong leaflets. The upper surface is dark green, while the lower surface is covered with hairs, • Flowers are small, 8–15mm in diameter and bright yellow with 5 petals, usually lasting only one day. • Hand-pulling Caltrop is effective if the infested area is not too large. • Foliar spray Glyphosate (360 g/L) 100mL/10L water Spot spray only Apply to actively growing plants • The timing of spray applications is critical to ensure that the majority of the weeds have been sprayed before seed set occurs.

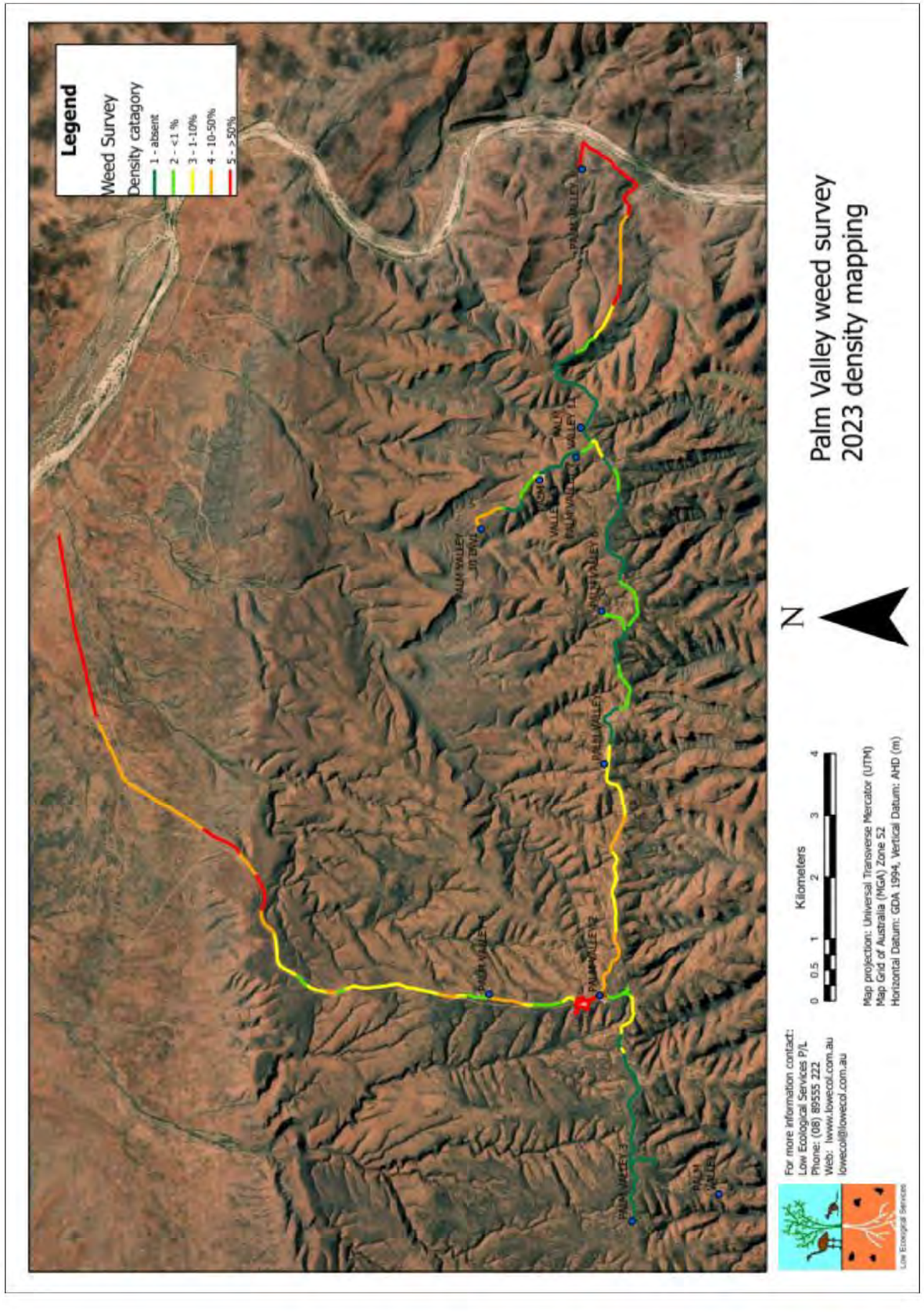


Table 43: Bushfire Management Plan

Amadeus EMP – Palm Valley Gas Field
Bushfire Management Plan 2024

Location of Field	
Property land uses	PGVF operates the field under OL3 production license
NT Fire Management Zone	Alice Springs
NT Fire Protection Zone	OL3 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

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 • The control of a bushfire rests with the Rural Fire Brigade until the fire reaches 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 • If requested, CP will assist nearby communities in installing firebreaks annually, as an alternative to contributing to firefighting capacity regionally
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

	Position	Name
Bushfire Officer	Production Supervisor	Ned Garland / Brett Manual

Stakeholders	Contact Details
Emergency	000 or 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

Fire Management Zones	Actions
Low Fuel Zone (10m)	• Remove fire fuel load if bushfire risk is high • Use manual/mechanical removal, burns are not the preferred option
Fire Break Zone (4m)	• Only diesel vehicles to be used • Store chemicals in designated areas • Sufficient fire fighting water is available during projects activities • No open flames or fires outside of designated areas (inclusive of flare pits) • Remove vegetation from bare earth fire break area • Use manual/mechanical removal, burns are not the preferred option
Cleared Access Track	• · Remove vegetation from bare earth tracks • · Maintain 4m exclusion zone

Bushfire Management	
Plan	
Map Critical Functions	• Review emergency management structure • Contact and collaborate with neighbours
Identify Threats	• Identify local site conditions and fuel loads • Identify bushfire threats to operations and assets
Assess Risk	• Conduct annual fire mapping • Develop fire fuel load reduction program • Proper storage of flammable chemicals • Vegetation stockpiles are placed at safe distances from potential ignition sources • Update risk assessment
Update Plans	• Update Bushfire Management Plan and Emergency Response Plan
Prepare	
Check Fire Fighting Capability	• Inspect and test critical equipment • Identify staging areas for emergency equipment • Fire fighting equipment located in every vehicle. • Train staff
Reduce Hazard	• Fire fuel load reduction manual/mechanical removal • Controlled burns is not the preferred option • Maintenance of fire breaks and fire access tracks
Test Emergency Plans	• Conduct fire drills • Conduct incident and emergency training with partners
Respond	
Monitor Conditions	• Check NAFI daily
Fire Danger Period	• Permit to burn (including for open flares) required • Check fire danger status daily
Fire Ban Day	• No burns or flaring
Recovery	
Repair and Replace Assets	• Repair and replace damaged assets
Improve Resilience	• Review and improve asset standards for buildings and infrastructure

Seasonal Bushfire Calendar					
Month	Bushfire Risk	**Activities**	Month	Bushfire Risk	**Activities**
Jan	Low	• Map critical functions • Identify threats • Assess risks	Jul	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Feb	Low	• Update plans • Check fire fighting capabilities	Aug	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Mar	Low	• Reduce hazard—start	Sep	Medium	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Apr	Medium	• Reduce hazard—end • Test emergency plans	Oct	Low	• Repair and replace assests
May	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions	Nov	Low	• Repair and replace assests
Jun	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions	Dec	Low	• Improve resilience

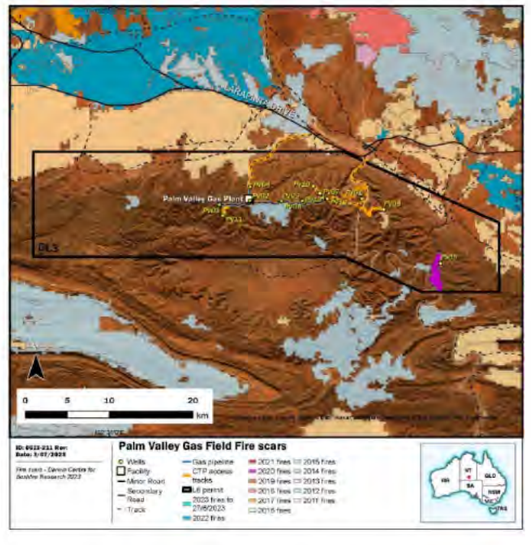


Table 44: Rehabilitation Management Plan

Amadeus EMP – Palm Valley Gas Field
Rehabilitation Management Plan 2024

	Position	Name
CP Rehabilitation Officer	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)
Developed By	EcOz	Tom Reilly

Location of the Field	
Property land uses	Gas production and compression
Climate	In general, OL3 experience a semi-arid climate, with 70% of precipitation occurring between October and March, influenced mainly by monsoonal depression systems in northern Australia
Site Description (pre-disturbance)	The OL3 area is predominantly located in the Krichauff land system and all of the operational areas are in this land system, with small portions of Amulda, Muller and Simpson land systems in the north eastern and north western corners of the lease.

Rehabilitation Objectives	Actions for Successful Rehabilitation
The objectives of this rehabilitation management plan are to: • Progressively rehabilitate significantly disturbed land which is not required for ongoing activities • Return 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 vegetation condition and land use • Provide an area free of residual contamination • Ensure 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
Climate extremes - 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
Pest animals and lack of existing vegetation - 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
Fire, changed landform, weeds and erosion- 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
Contaminated soil	• Remove, remediate and rehabilitate contaminated areas • Re-spread topsoil evenly across rehabilitated areas

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

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 towards 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 • No declared weed species 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 scarring, 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 • Check for soil inversion issues and map areas of concern • Weed survey	• 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.	• 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

Decommissioning and Rehabilitation Process		
Asset	Specific activities to the asset	General activities across all assts
Well – Sub surface	• Decommissioned in accordance with the principals of the CoP (NTG, 2019) section • B.4.15.1 and specifically the mandatory sections B.4.15.2 and B.4.15.3. • Decommissioning of a well is a regulated activity and this activity will be inan approved Well Operations Management Plan that will be approved by DITT.	• 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.
Well pad, flare pits	• Backfill pits, and water storage, including removal and disposal ofliner materials • Contouring of capping to encourage surface runoff and minimise water pooling • Where incompatible with on-site mix bury cover, implement wastemanagement process for off-site disposal	
Well lease area, including surface infrastructure (wellhead, separator)	• Full decommissioning and rehabilitation: • Wellhead removed and casing cut per the CoP: Surface cement plug detailed in B.4.15.3: Cement plug requirements and validation methods. • A steel marker plate as per the CoP • Filling of cellar • Removal of hardstand materials for use across field or stockpile for future useacross field • Assessment of NORMs of down well and surface equipment • Progressive decommissioning and rehabilitation • Reduction in well lease area size to a sizing approximately 75m x 75m orequivalent to accommodate future well development activities.	
Flowlines (surface and sub-surface)	• Purge of flowline contents. Method depends on material held in flowline (e.g. nitrogen, biocide charged water) • Removal of surface infrastructure (e.g. pipe and struts) • Scraping, grading/re-contour to local landscape and deep ripping toencourage natural regeneration	
Formation Water Tanks	• Disconnection from water gathering network • Transfer water for disposal/evaporation	
Access Roads and Tracks	• Grading and recontouring in line with adjoining environment where landform permits • Where landform involves extensive cut and fill of rock recontouring will be limited to minimise further erosion or landslip potential • Where landform involves sand dunes, removal of hardstand across dune and re- contouring to blend with existing dune and surrounding landform • Construction of erosion controls • Ripping of compacted soils • Natural regeneration	
Evaporation Ponds	• Removal of remaining water either via evaporation or vacuum truck disposal to licenced facility • Where off-site disposal proposed: • Removal of salts and residual solids, reviewing opportunities for beneficial re-use • Removal of liner and leak detection • Assess for land contamination and remediate where necessary • Removal of geomembrane • Remove clay base layer for capping/re-use • Deep ripping of base of pond and mixing with clean soil materials • Backfill pond and re-contour in line with surrounding environment, including capping to divert surface water pooling • Note: the methodology for decommissioning of PV09 is dependent on the outcomes of the Closure Options Assessment and Feasibility Study and is subject to change.	
Gas processing facilities	• Decommissioning would be covered under a separate Decommissioning Plan at the end of life of the production facility	
Administration and Accommodation Facilities	• The following would be considered: • Removal of buildings and foundations • Removal of water and wastewater infrastructure, including pipework and tanks • Removal of concrete surfaces • Removal of communications facilities • Preliminary investigation of site contamination where required	
Water and wastewater infrastructure including bores and dams/ponds (excluding evaporation ponds)	• Water bores will be retained, and licencing transferred to Traditional Owners or returned to Water Resources: • Dewatering of ponds and dams via evaporation or surface irrigation • Push in banks of dams/ponds • Fill void to surface level • Removal of pipelines (above and below surface) • Removal of wastewater treatment tanks	

Activity	Proposed rehabilitation approach	Timing
Analogue sites1	• Identify appropriate analogue sites for each of the disturbance areas prior to decommissioning and rehabilitation for monitoring and measurement of rehabilitation success	• Determined as part of PRCP development • Review at first monitoring event and/or first wet season monitoring
Post decommissioning	• Remove above ground infrastructure • Remove waste materials • Treat weeds prior to soil disturbance • Allow fluids to evaporate from sumps, pits, and water storage • Backfill and close sumps and pits • Remove temporary fencing	• Commence within 12 months of well decommissioning and prior to significant soil disturbance
Landform reinstatement	• Reduction in well lease area size to a sizing approximately: - 75m x 75m or equivalent to accommodate future well development activities; or - 2mx2m to accommodate decommissioned well plate. • Any imported gravel material is removed and returned to the source quarry or utilised elsewhere on CP operational sites • Hardstand is deep ripped to relieve compaction, encourage infiltration, and water retention • The site is re-contoured as close as possible to the pre- existing natural landscape • Topsoil is respread evenly over the lease area and lightly scarified to encourage moisture retention and seed capture • Revegetation, refer below • Review weed status and treat as required, refer below	• Commence within 12 months of well decommissioning2
Land use	Final land use options will be developed in consultation with the landowners and other relevant stakeholders. These may include: • Pre-disturbance land use • Tourism related activities • Conservation (reserve or park) • Grazing or horticultural activities	• Commence within 12 months of well decommissioning
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 • Deep ripping and contouring of access roads and well leases to as close to natural landform as possible • Ensure all cleared areas have a rough surface to aid in water, seed, and litter catchment • Erosion and sedimentation devices installed and • maintained in accordance with site specific ESC Plan, including temporary and permanent measures	• Commence within 12 months of well decommissioning
Contaminated soil (including drilling fluid sumps)	• Site Contamination - Preliminary site investigation - Undertake remediation of contaminated soil to ensure rehabilitated area is non-polluting and in accordance with the CP Emergency Response Plan • Drilling Sump - Testing of material as per CoP	• Remediation of contamination to be undertaken prior to decommissioning.
Revegetation / Natural regeneration	• Revegetation of decommissioned wells to a 2m x 2m lease size • Revegetation of existing active well leases to a maximum of 75m x 75m • Revegetation of closed lease area access tracks, where suitable • Spread of stockpiled vegetation across reinstated areas to promote natural regeneration, act as erosion control and provide habitat • Reliance on natural regeneration from surrounding environment seedbank • Direct broadscale re-seeding, using local seed collection, where natural regeneration success is low	• Lease - commence within 12 months of decommissioning • All other areas – at completion of infrastructure / area decommissioning
Maintenance	• Weed management via chemical and physical treatment, based on field specific Weed Management Plan prior to rehabilitation activities commencing • Follow-up assessment of weeds via regular surveys and treatment as needed	• As required following monitoring and inspection program

Table 45: Wastewater Management Plan

Amadeus EMP – Palm Valley Gas Field
Wastewater Management Plan 2024

	Position	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

Location of Field	
Property land uses	PGVF operates the field under OL3 production license
Site Description	The PVGF started production in 1983. Four out of the 13 wells drilled are currently in production.

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

To manage the wastewater to minimise environmental risks and impacts		
Location	0.1% AEP Rainfall	Rainfall (mm)
PVGF	90 day	380
The new PV-12 pond will be designed with a minimum design freeboard of 500mm		

Wastewater Sources				
Activity	Type	Quantity	Target Quality	Management Method
Workover fluid (Groundwater mixed with KCl and biocide)	Workover Fluid	0.063 ML/yr	• pH: 6-10.5 • KCl: 2-5% • Biocide: 0.02% • Conductivity: 8-30 mS/cm	During workover program: • Store onsite in tanks • Re-use After workover program: • Dispose in evaporation pond or offsite facility
Production	Formation water	<3,000 L/d	Refer to Table 15 and Table 16 in the EMP	• Up to 95% reinjection into PV-04 • 5% into evaporation pond (PV-09)

Wastewater Risks	
Key Risks	Controls
Spill or leak from the use, transportation, treatment, handling and storage of formation water, fluids and wastewater	• Store liquid wastes in a secured container within a bunded area • 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

Wastewater Monitoring Program and Records				
Type	Requirements	Frequency	Parameters	Records
Workover formation water	• Measure quantity (estimate based on actual workover data) • Measure quality	• Every time wastewater is treated and used • Prior to disposal	• Volume	• Wastewater volumes for re-injection • Wastewater volumes generated during workovers If wastewater to be transported and disposed of offsite • Wastewater volume spilled

Wastewater Monitoring Program and Records				
Type	Requirements	Frequency	Parameters	Records
Workover formation water	• Measure quantity (estimate based on actual workover data) • Measure quality	• Every time wastewater is treated and used • Prior to disposal	• Volume	• Wastewater volumes for re-injection • Wastewater volumes generated during workovers If wastewater to be transported and disposed of offsite • Wastewater volume spilled
Production evaporation ponds	• Analysis of available freeboard • Integrity inspections • Volume of formation water entering ponds	• Freeboard of production pond inspected daily • Pond integrity monthly • Daily for volume	• Volume • Potential leakage	• Formation water volume entering the evaporations ponds • Wastewater volume spilled
Wildlife / stock / human interactions	• Inspect control measures at pond	• Daily	• Pond has fauna egress escapes	• Number of wildlife/stock interactions

PV-09 evaporation pond

New evaporation PV-12 pond to

Table 46: Spill Management Plan

Amadeus EMP – Palm Valley Gas Field
Spill Management Plan 2024

	Position	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

Spill Risks	
Key Risks	**Controls**
Contamination of groundwater	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface and infiltrate to the ground, migrating to shallow, perched aquifers, springs or waterholes. This may affect groundwater quality
Contamination of surface waters	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface and migrate to surface waters and affect surface water quality and ecological values of the habitat
Contamination of soil	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface. Smaller spills and leaks are likely to be retained in the soil and not migrate to groundwater or surface waters.

Chemicals Storage and Used

Product Name	Hazardous Material	Dangerous Good	Typical Quantity	Container Size / Type	Storage Location
Anti-corrosives	Yes	Yes	200L	5 – 20 L / Package	Warehouse/ production facility. If for workovers, then on well lease.
Adhesives/glues	Yes	No	500L	5 – 20 L / Package	
Acetone	Yes	Yes	100L	5 – 20 L / Package	
Thinners	Yes	Yes	200L	5 – 20 L / Package	
Acetylene	Yes	Yes	100L	5 – 20 L / Package	
Bestolife 2000	Yes	Yes	100L	5 – 20 L / Package	
Truck wash	Yes	Yes	100L	5 – 20 L / Package	
Priming fluids	Yes	Yes	200L	5 – 20 L / Package	
Diesel	Yes	Yes	500L	200L / drum	
Pipe cement	Yes	Yes	100L	5 – 20 L / Package	
Coregas	Yes	Yes	100kg	25 kg / Tank	
Degreaser	Yes	Yes	100L	5 – 20 L / Package	
Paint	Yes	Yes	100L	5 – 20 L / Package	
Soaps	No	No	50L	5 – 20 L / Package	
Sealant	No	No	200L	5 – 20 L / Package	
Herbicide	Yes	No	200L	5 – 20 L / Package	
Coolant	Yes	No	100L	5 – 20 L / Package	
Engine oil	No	No	20L–1,000L	5 – 20 L / Package	
Compressor oil	No	No	100L	5 – 20 L / Package	
Hydraulic oil	No	No	100L	5 – 20 L / Package	
Grease	No	No	100L	5 – 20 L / Package	
Nitrogen	Yes	Yes	100kg	25 kg / Tank	
Oxygen	Yes	Yes	100kg	25 kg / Tank	
Propane	Yes	Yes	50kg	25 kg / Tank	
Methanol/ethylene glycol	Yes	Yes	6,000L	5 – 20 L / Package	
Helium	Yes	Yes	100kg	25 kg / Tank	

Location of Field	
Property land uses	CP operates the PVGF under OL3
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

Spill Scenarios and Management

Activity	Activity Duration	Mechanism	Location	Type	Key Management Control
Chemical storage	Operations/ Workover	• 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 • Workover chemicals • Workover fluids	• Daily visual checks of the chemical storage area • Secondary containment / bunding • Spill kits available • Minimise quantity of chemicals at well site
Handling / mixing of chemicals	Workover	• 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 • Workover chemicals • Workover fluids	• 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 absorbent mats used • Spill kits available
Truck and / or rig refuelling	Workover	• Incorrect refuelling set-up • Poor refuelling practices	• Rig fuel tanks	• General use chemicals (e.g. oil, diesel, hydraulic oils degreasers, pesticides) as per SDS • Workover chemicals	• 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 absorbent mats used • Spill kits available
Chemical transportation to / from location outside of OL3	Workover	• Coupling, hosing and pipe failures	• Chemical loading area • Pipework	• General use chemicals (e.g. oil, diesel, hydraulic oils degreasers) as per SDS • Workover chemicals • Workover fluids	• Transport hazardous material within the NT by a licensed NT EPA contractor • Well lease compacted • Spill kits available
Storage of workover fluid in tanks on the well lease	Workover	• Container rupture • Lids / taps not fitted correctly	• Workover fluid tanks	• Workover fluids	• Daily visual checks during activities • Spill kits available • Compacted well lease
Transfer of produced formation water from the wellhead to evaporation ponds by truck	Workover	• Coupling, hosing and pipe failures	• Truck	• Produced formation water	• Operator monitor transfer from tank to truck • Spill kits available • Compacted well lease

Definition of Environmental Harm under the NT *Petroleum Act 1984*

Increasing Severity of Impact

Environmental Harm	• Means: (a)Any harm to or adverse effect on the environment, or (b) 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: (a) 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 (a) that is not trivial or negligible in nature; (b) consists of an environmental nuisance of a high impact or on a wide scale; (c) 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 (d) 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: (a) is irreversible or otherwise of a high impact or on a wide scale; (b) 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; (c) 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 (d) results in actual or potential loss or damage to the value of more than $50 000.

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

Types of Incidents	
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

Definition 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 47: Methane Emissions Management Plan

Amadeus EMP – Palm Valley Gas Field

Methane Emissions Management Plan 2024

	Position	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

Location of Field	
Property land uses	PGVF operates the field under OL3 production license
Site Description	The PVGF started production in 1983. Four out of the 13 wells drilled are currently in production.

Methane Management Plan	
Purpose	To monitor and reduce fugitive methane emissions from operational activities.
Objectives	To reduce fugitive methane emissions through effective detection and management practices across operations activities.

Leak Monitoring

Inspection Frequency	Leak Detection Instruments

• 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 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: annually
  ◦ Low pressure pipelines and fittings: annually
  ◦ Plant including compressors: annually
• 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
	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:

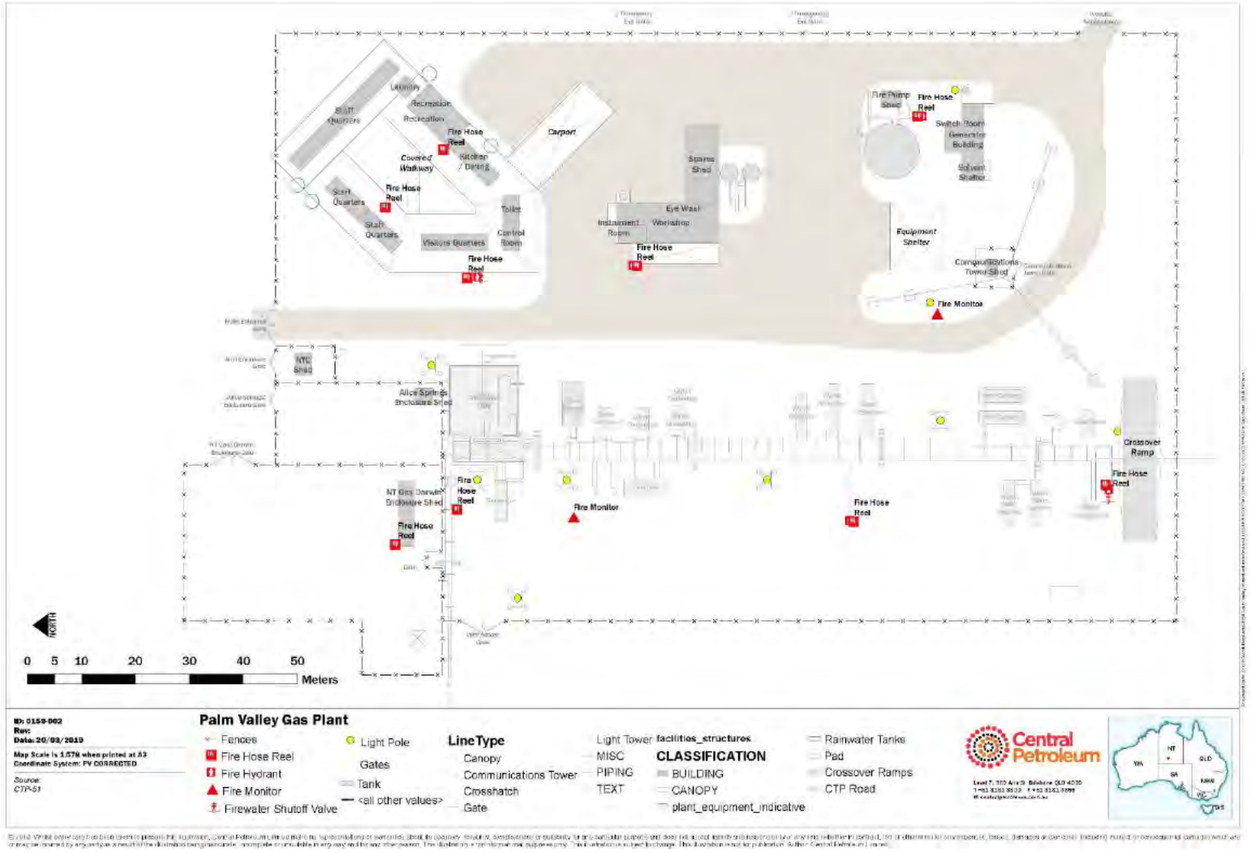
- Prior to commencing monitoring, calibrate and bump test the gas detector according to manufacturer's
- recommendation
- Monitoring is carried out at each well site, along the gathering system (vents, drains, metering instruments, manifolds) and within DGF:
  - Place the probe at the surface of the 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 operation 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 well operations
	  ◦ Leak detection implemented consistent with the Code of Practice.
	  ◦ Ongoing well maintenance as per the Well Operations Management Plan.
		• During workovers, 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 workovers. 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

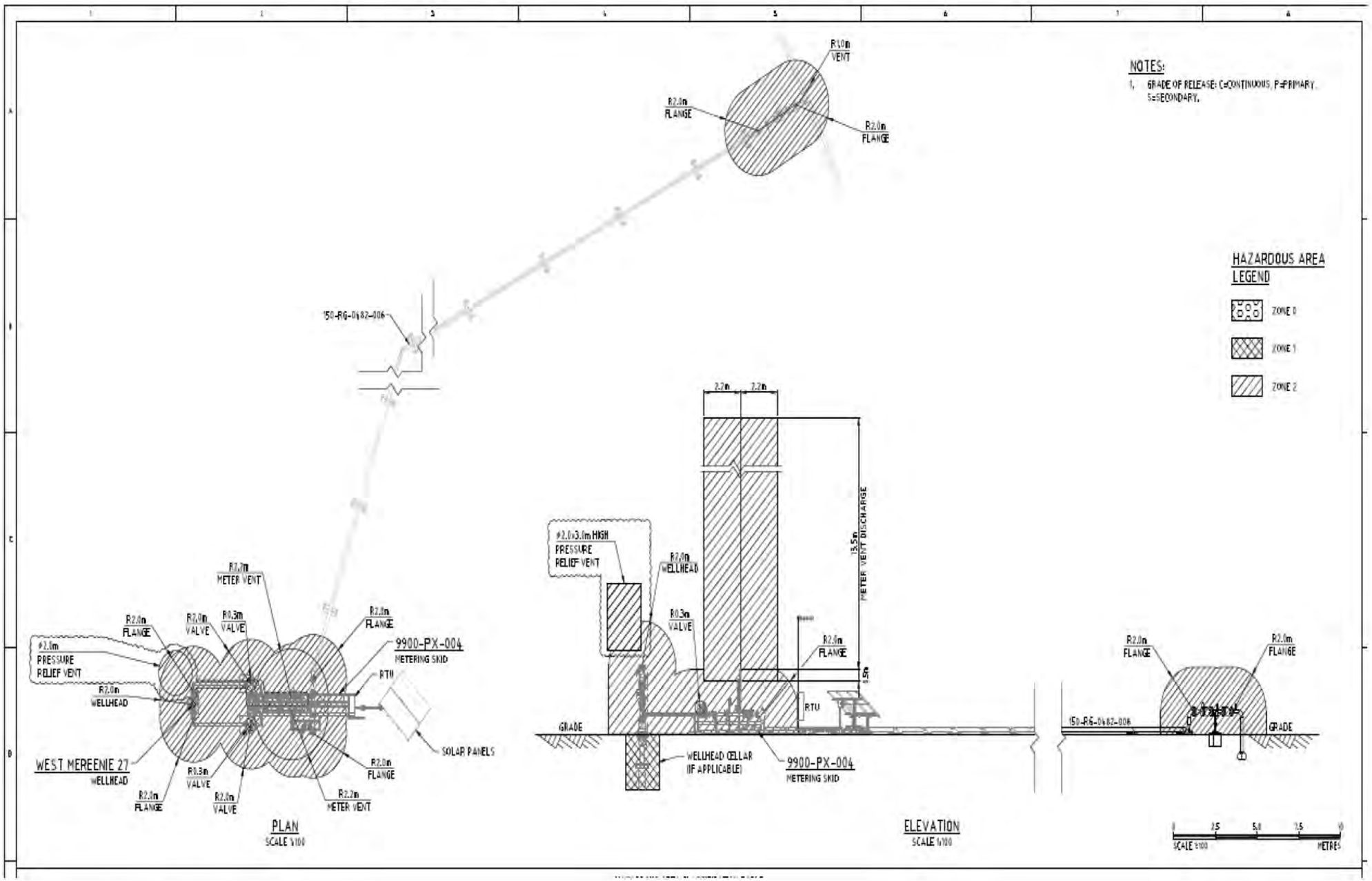


This.Plan.operates.in.conjunction.with.the.PVGF.Emergency.Response.Plan

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)

Examples of hazardous areas for operator leak detection

Well



Part B. DGF

B.4 Description of Activity

B.4.1 Introduction

DGF is located in the eastern section of the basin on Orange Creek Station, a large (232,100ha) pastoral station ~60km southeast of Alice Springs. A total of four petroleum wells have been drilled at DGF. DGF has been supplying gas since 2015 via the 50km Dingo pipeline (Pipeline Licence 30) via the Brewer Estate City Gate Station (BECGS) facility to the Owen Springs Power Station. The power station supplies electricity to Alice Springs and the wider region.

The production from the wells at DGF consists of methane gas and small quantities of brine. The gas wells at these fields flow free to surface through natural reservoir drive mechanisms and are therefore considered "conventional" in terms of the *Petroleum (Environment) Regulations 2016*. The flow rate from wells is adjusted in line with production and sales market needs.

All of the wells in the field are operated in accordance with DITT approved WOMPs for each well across the respective fields. The WOMPs detail all operational and intervention phases including well designs, subsurface information, construction, barriers in place, monitoring, maintenance, integrity, decommissioning, etc.

Petroleum wells at DGF may be active, shut-in, converted to re-injection wells, suspended, or decommissioned. All petroleum wells, regardless of status at each field, are included within this EMP. An overview of the wells is provided in Table 48. Safe and reliable production of the hydrocarbon resources present is facilitated via the following infrastructure:

- Existing private access roads constructed and maintained by the Operator.
- Wells and gathering network at each field.
- Permanent wellhead facilities for producing and suspending wells.
- Export sales receiver to APA gas transmission pipeline at Dingo Gas Pipeline (PL 30) which is located within the DGF.
- This EMP does not pertain to maintenance and operational activities of the APA gas transmission pipeline or the Dingo Gas Pipeline.

Table 48: Overview of Dingo Wells

Well	Coordinates (GDA94)	Cleared Area (m^2)	Well Status	Additional Information
Dingo 1	24° 13' 29.750" S 133° 53' 51.568" E	900	Suspended	
Dingo 2	24° 13' 48.576" S 133° 52' 30.931" E	3,229	In production	
Dingo 3	24° 12' 56.483" S 133° 51' 47.705" E	6,147	In production	
Dingo 4	24 14' 26.873" S 133 55' 22.570" E	0	P&A	Rehabilitated

B.4.2 Well operations

Petroleum well operations include the following activities:

- Ongoing production activities at DGF
- Maintenance of surface well barriers
- Integrity testing of surface well barriers
- Integrity testing of subsurface well barriers
- Annular pressure monitoring
- Visual inspection and general well surveillance

B.4.3 Support activities

B.4.3.1 Services

Table 49 outlines the services that support the conduct of all activities at DGF.

Table 49: Services at DGF

Activity	Description
Workforce and facilities	There is no permanent workforce at DGF. Operations personnel based in PVGF visit to monitor gas field integrity
Laydown areas	Cleared areas, including former well pads, used to house materials, temporary camps or machinery
Power generation	There are no power generators on-site
Water supply	Water requirements at the field is purchased
Waste services	Waste services are provided by licensed waste transporters and disposers
Wet weather operations	Operations occur 365-days per year including the wetter months of the year (October to April). Weather conditions are monitored daily to allow reassessment of operational needs to be addressed.
Naturally Occurring Radioactive Materials	▪ The Operator's radiation licence (permit number 1902650L) has been surrendered and a new licenced applied for. ▪ Previous surveys have indicated that site emits a very, very low-level radiation hazard ▪ All works are conducted in accordance with the Operator safe work standards including a NORMS (Radiation) Management Plan alongside a Job Hazard Analysis ▪ Materials with the potential for NORMS exposure from operational activities are tested prior to storage or disposal via an appropriately licensed transporter

B.4.3.2 Wastewater management

Formation water produced from the DGF is managed at the BECGS facility, not included in the scope of this EMP, and which is located 20km south of Alice Springs in the Brewer Industrial Estate. The lined evaporation treatment system at BECGS has a minimum design freeboard of 500mm, consistent with all other open water storages in the Operator's fields, elsewhere in the Amadeus Basin. The results of PVGF formation water evaporite analysis (see Figure 13) is similar to that presented in the Mereenie Field EMP. Given that DGF is also located in the Amadeus Basin, it is most unlikely that formation water evaporite analysis will vary significantly from the findings in this analysis.

Workover fluids are likely to be the only wastewater produced during workovers at existing well sites. DITT requires the Operator to ensure enough workover fluid and a weighting agent at the well site is available to "kill" the well in the event of an emergency/loss of containment during workovers.

The Operator will use water purchased from off-site providers for use in workover fluid, along with a small amount of biodegradable biocide and potassium chloride (KCl). Workover fluid will not be mixed with any oil or BTEX based additives.

If the work over fluid is not required at a particular well site, the unused water will be used at another well site in the mud tank or disposed of in the BECGS facility. The anticipated total volume of workover fluid required is approximately 0.063ML per workover.

While undertaking air/mist workovers at a well site, retrieved debris/fill/materials will be discharged into the flare pit/tank (via the blooie line) at the well site. Once flaring commences any small volumes of liquid within the flare pit/tank is vaporised. Discharged materials can be removed and disposed or recycled at an approved facility.

B.4.3.2.1 DGF Formation water

DGF commenced in 2015 and currently supplies gas to the Owen Springs Power Station via the BECGS facility and Dingo pipeline (managed under Pipeline Licence 30). Formation water produced from the

DGF is managed at the BECGS facility, not included in the scope of this EMP, and is located 20km south of Alice Springs in the Brewer Industrial Estate.

The gas produced at DGF is relatively “dry”, so the “water-cut” is relatively low. High pressure gas is transported via pipeline to the Dingo processing facility at Brewer Estate near Alice Springs. From there, water and condensates are removed, and the pressure is reduced. The containment facilities for the DGF formation water at the BECGS are “over-designed” to ensure evaporation of the low volume of wastewater separated in the facility.

B.5 Existing Environment

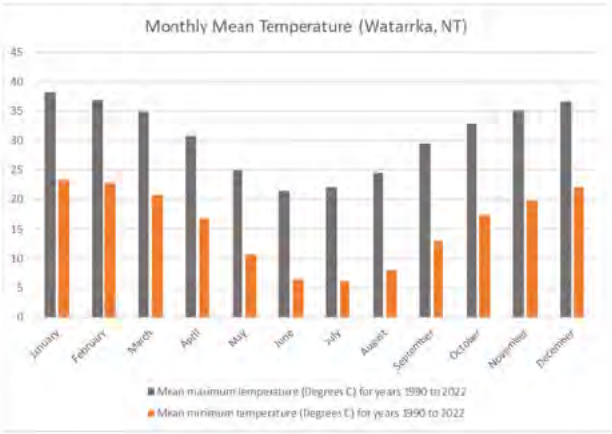
B.5.1 Physical Environment

B.5.1.1 Climate

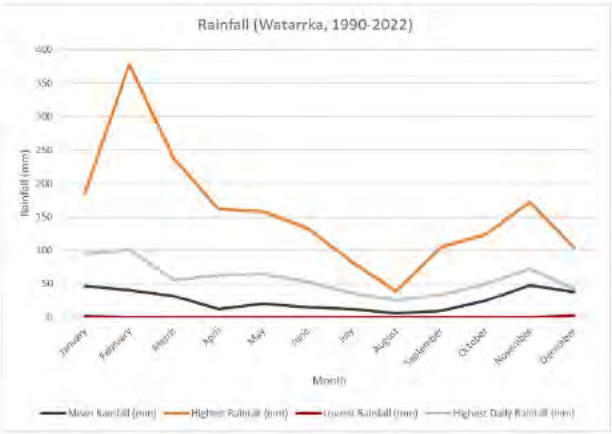
A summary of the climate statistics for DGF is attached in Table 50.

Table 50: Climate statistics for DGF

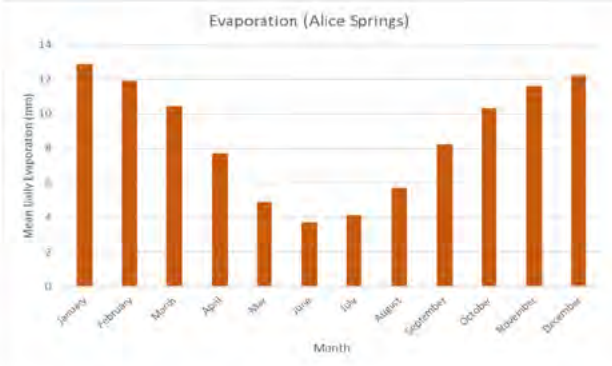
Climate Statistic	DGF
Annual total average rainfall (P)	280 ± 150mm
1 in 1000 (0.1%) year AEP_90-day cumulative rainfall	320mm
Annual total average evaporation €	2,970mm
Precipitation/Evaporation (P/E)	0.09
10%$_{ile}$ evaporation_90 days	325mm
Average daily max temperature	28.8^{O}C
Number years daily observations	140 years



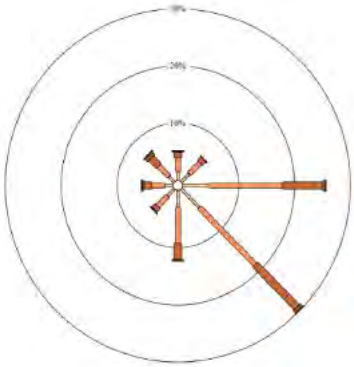
Average temperatures



Average rainfall



Average evaporation rates



Prevailing wind conditions

(Source: BOM, 2022)

B.5.1.2 Geology, Soils, and Land Systems

B.5.1.2.1 Geology

The DGF (Table 51) is a simple unfaulted domal anticline in the north central part of the basin. The surface geology over the DGF comprises Quaternary and Tertiary aged sands, clay and limestone. The target zone of interest and dry gas reservoir at DGF is in 4-m thick beds of porous sandstone at the base of the Arumbera sandstone formation at depth >2,800m BGL.

B.5.1.2.2 Regional Soils

Three soil types occur in the L7. All developments at DGF are in the Mx25 soil type described in Table 52. This soil presents a low to moderate erosion risk given the topology of the area.

B.5.1.2.3 Land Systems

Three land systems occur within L7 with all development occurring primarily in the Simpson land system described in Table 53.

The Simpson is characterised by long parallel sand dunes that run orthogonal to prevailing winds from the southeast; fringing dune fields; extensive sandplains; dry watercourses and saltpans.

The arid dune fields and sandplains support sparse shrubland and spinifex hummock grassland, with cane grass (*Zygochloa paradoxa*) on deep sands along dune crests. The swales of claypans and stony plains support a sparse shrubland of acacias, and coolabah woodlands fringe the creeks and flood outs.

B.5.1.2.4 Surface Water

The DGF area is situated within both the Finke River and Todd River Basins, both of which are within the Lake Eyre catchment. The only major watercourse in DGF area is an unnamed ephemeral tributary of the Hugh River. The Hugh River merges with the Finke River further downstream. As noted, the DGF is situated on a domal anticline; in sandy plains with low sandy rises and scattered dunes. Topographic mapping in the area reflects this topology and indicates that DGF is located across the highest elevations on the domal anticline in this region. The topographic mapping is validated by the measured elevations, relative to AHD, for each of the DGF well pads as shown in the topographic map below (Figure 17). Consequently, the risk of flooding at DGF is considered remote.

B.5.1.3 Groundwater

The DGF is located in the north-central area of the Amadeus Basin and overlies a series of regional scale productive aquifers. The DGF is located within the Alice Springs Water Control District and is centred over the Orange Creek Syncline.

Local aquifers in L7 environs are typically discontinuous. Several current bores within 10km of the southern edge of the DGF provide water for stock watering on Orange Creek and Deep Well stations. The regional Mereenie Sandstone aquifer is at depths in excess of 600m BGL in this area.

However, these aquifers are typically discontinuous and rare with water bore records suggesting that attempts to target the shallow aquifer has resulted in over 20 unsuccessful bores across the Orange Creek plains. Results of RN011831 bore sampling for water quality analysis is provided in Table 54. The associated Bore Statement shows the standing water level is approximately 84m BGL and 3.8 L/s bore supply.

The Mereenie Sandstone underlies the Pertnjara Formations at depths more than 600m BGL and flow direction is from the north and west toward the east. A groundwater divide is mapped to the north of the DGF which separates the DGF from the Roe Creek bore field which supplies Alice Springs.

The Pacoota Sandstone underlies the Mereenie Sandstone and forms a regional aquifer extending from the northern margin of the basin near Alice Springs to the High River south of L7. No bores are constructed in the Pacoota Sandstone in the immediate vicinity of L7, however, a formation water sample with a TDS of 500mg/L collected during the drilling of Dingo No. 4 suggests the groundwater quality is potable beneath the lease. The groundwater flow direction in the Pacoota Sandstone across L7 is from the north-west to the south-east/east (Lau and Jacobson, 1991).

The DGF sources gas from a reservoir within the Arumbera Sandstone >2,700m BGL. Productive aquifers overlie the Arumbera Sandstone typically occurring at significant depth (> 500 m) beneath the DGF but become shallower to the south where they outcrop along the James Range.

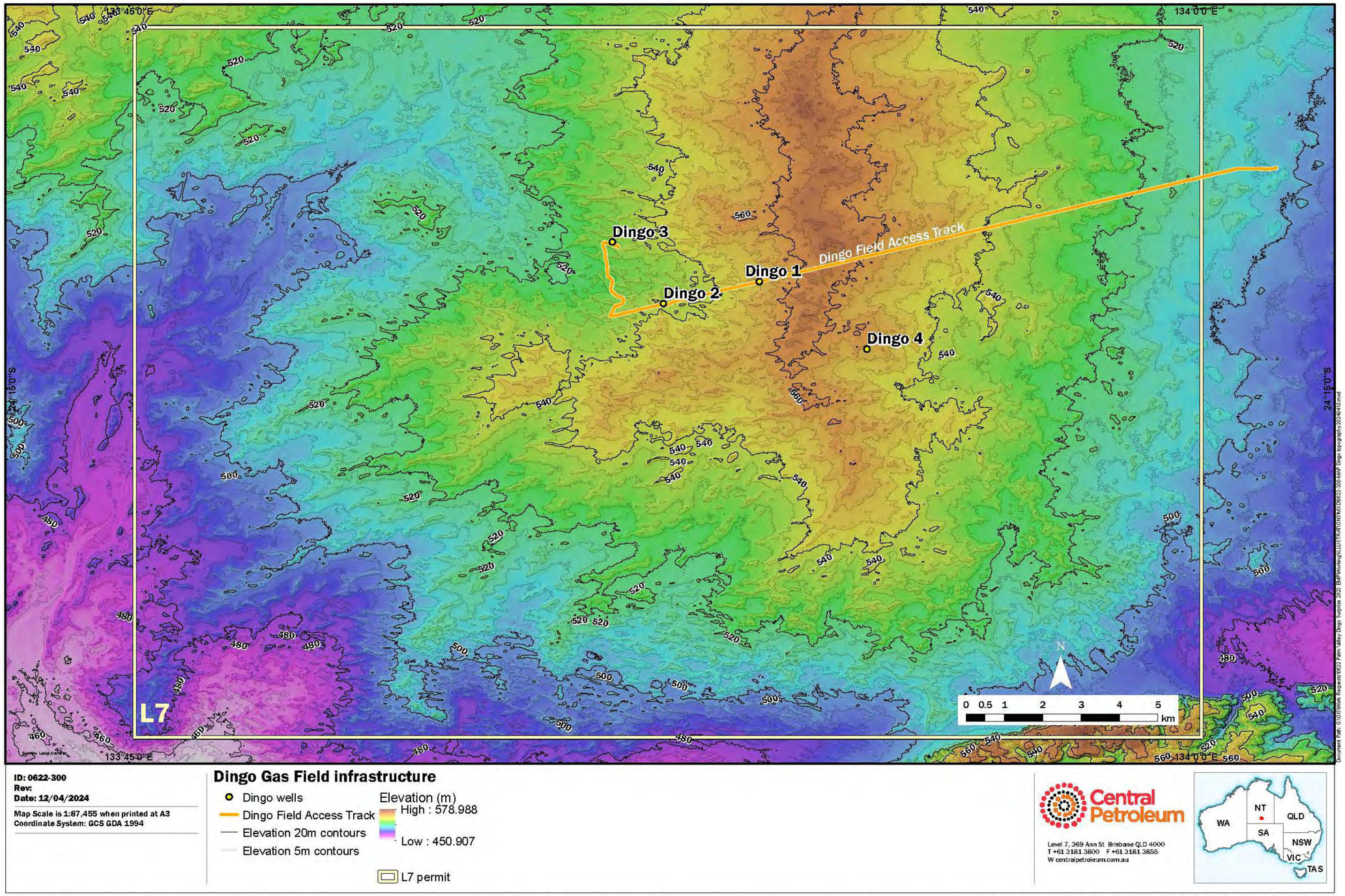


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Figure 17: Topographic map of DGF well pads and infrastructure

Table 51: Geological units DGF

Extent	Map Unit	Description of Lithology
2%	Pzr	Red-brown sandstone, pebbly sandstone
89%	Qs	Aeolian Sand
<1%	Tl	Chalcedonic limestone, siltstone and calcareous sandstone
8%	Ql	Calcrete

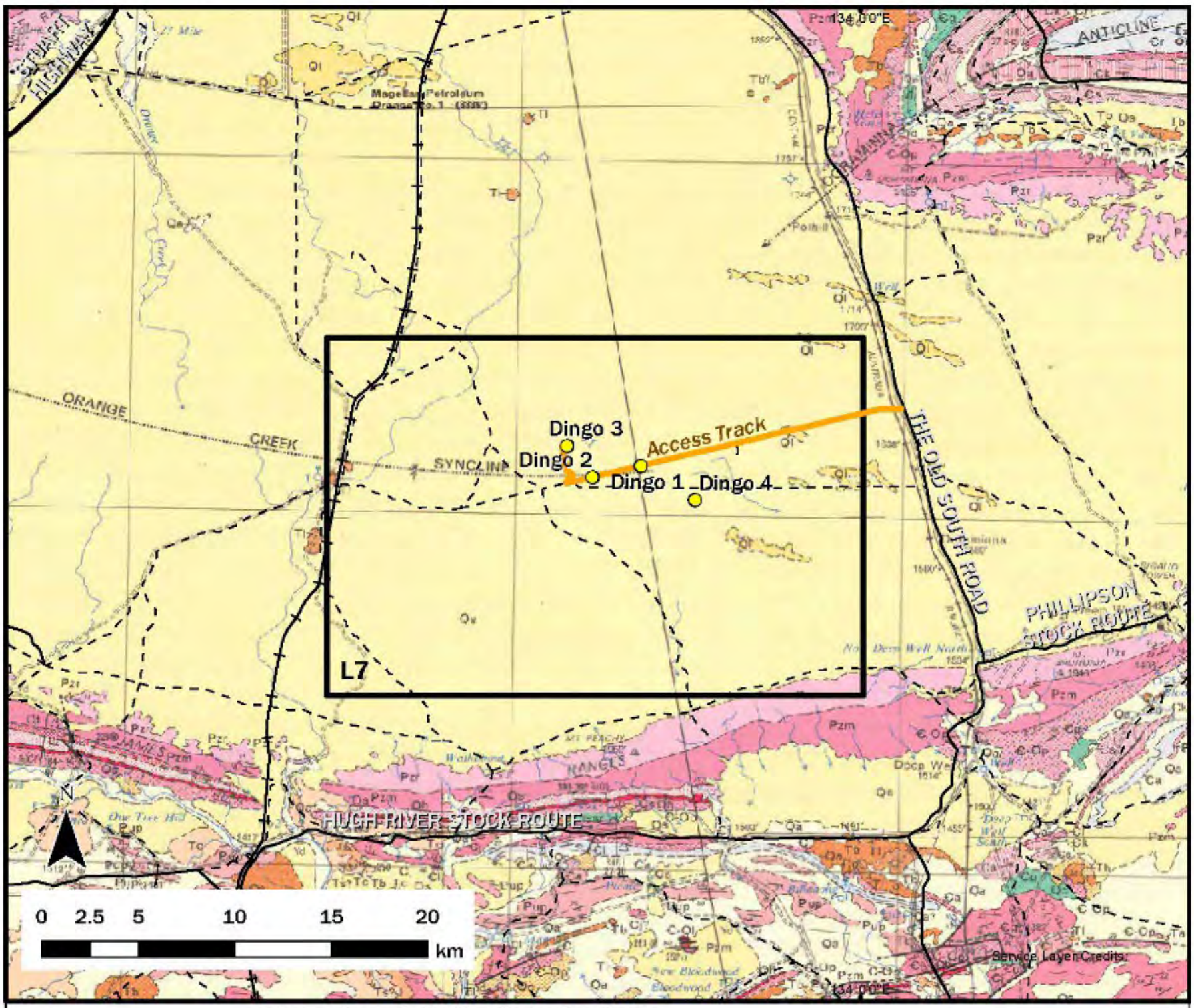


Table 52: Soil types DGF

Extent	Soil Type	Landform	Soils
76%	Mx25	Sandy plains with low sandy rises and scattered dunes. Small areas of rugged rocky hills are included locally	Alkaline and neutral red earths, with lesser areas of deep sands
20%	AB59	Sandy plains with some dunes	Chief soils are red earthy sands and red siliceous sands on the plains
4%	BA27	Bold ranges, ridges, cuestas, and hills on sandstones and quartzites. Extensive areas of bare rock	Chief soils are shallow stony sands

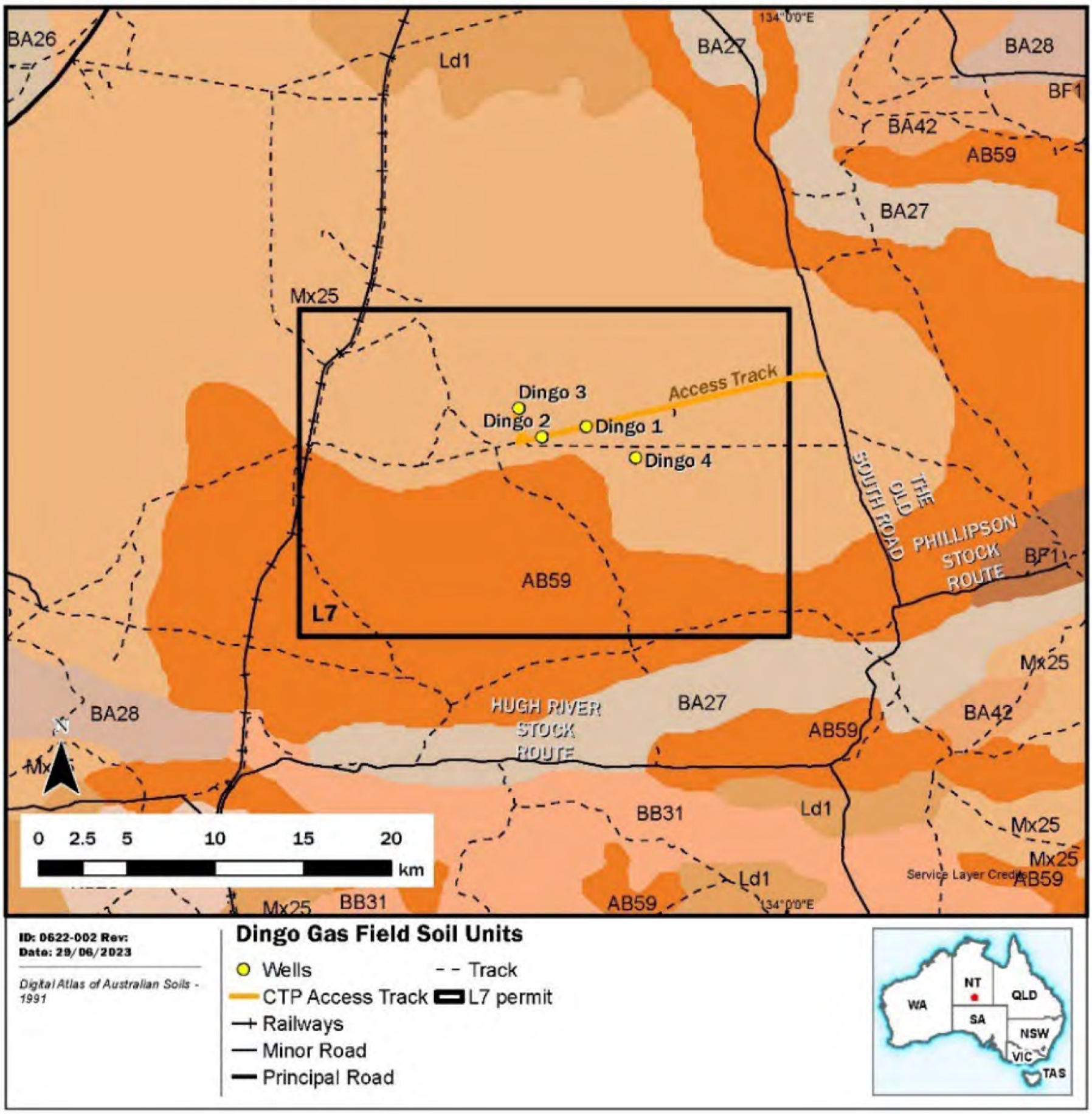


Table 53: Land systems DGF

Extent	Land System	Description	Soils	Erosion Hazard
24%	Ewaninga	Level to undulating sandplains with red sands	Deep red sands and loamy limestone soils	Moderate
75%	Simpson	Dune fields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes	Red dune sand	Moderate
<1%	Sonder	Rugged ranges on quartz, sandstone and conglomerate	Shallow, stony, undifferentiated soil	Moderate

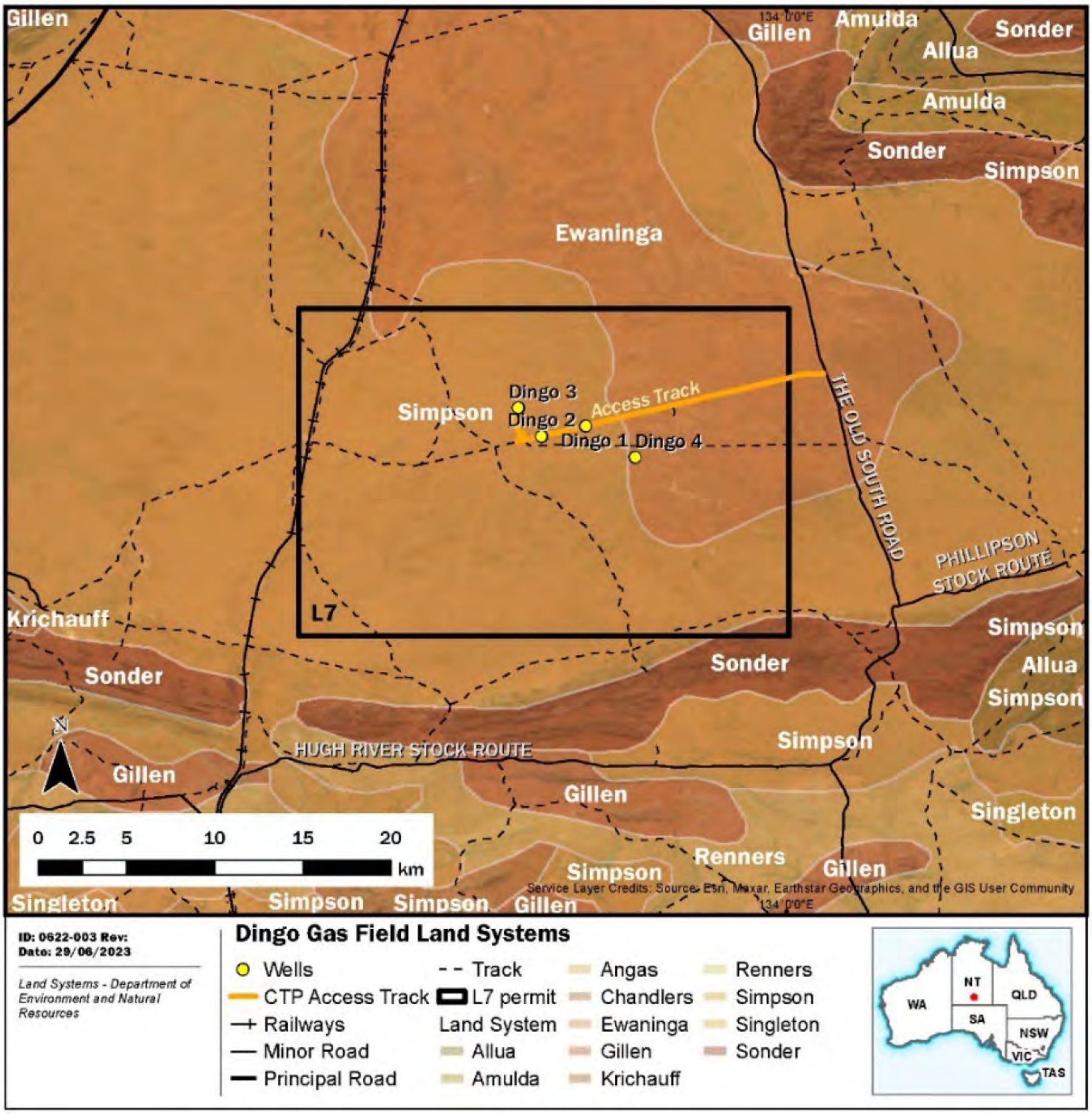


Table 54: Groundwater quality results RN011831

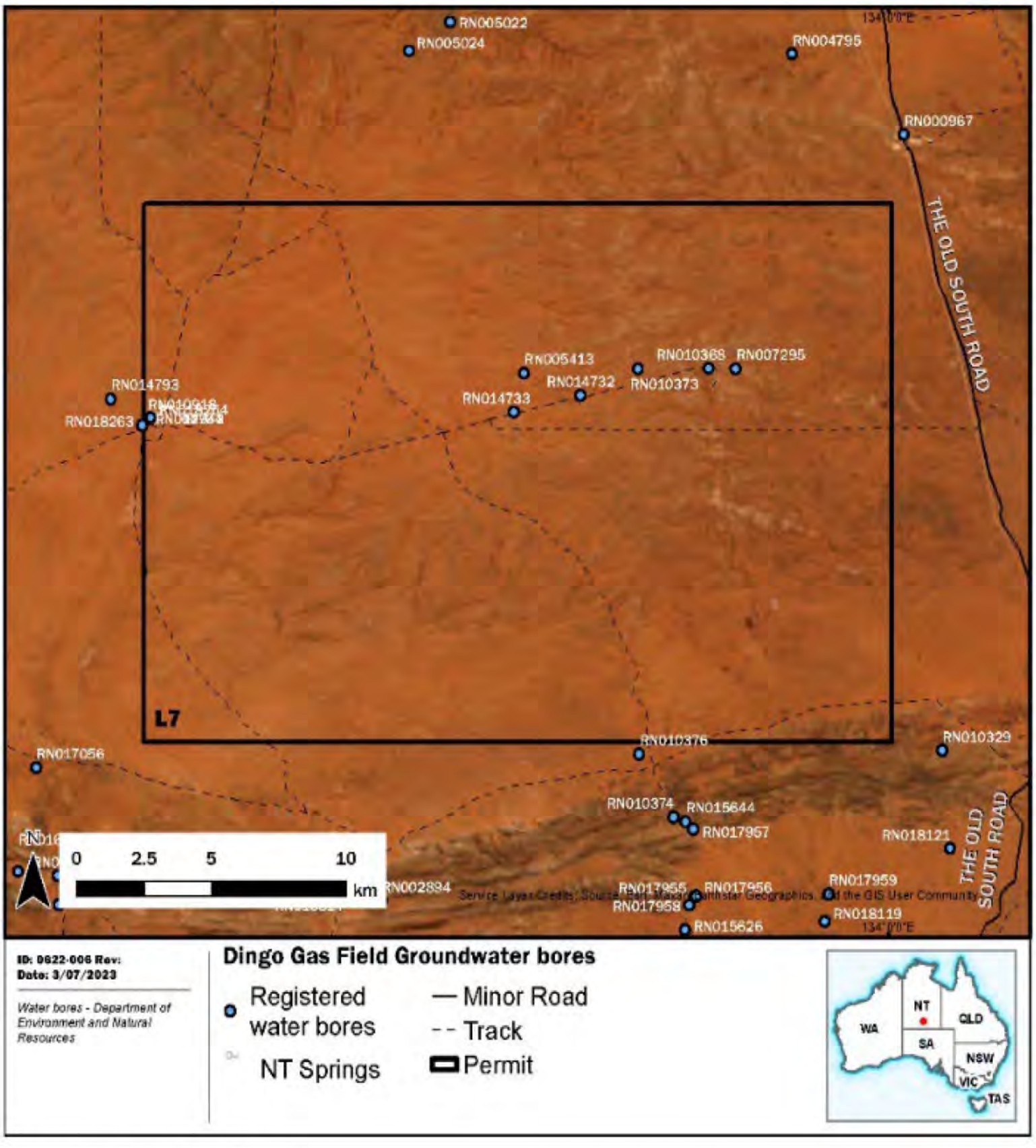
Analyte	Unit	DGF
		RN011831
pH		8.0
E.C.	uS/cm	1390
TDS	mg/L	964
Gross alpha	Bq/L	0.78
Gross beta	Bq/L	1.49
Bicarbonate	mg/L	274
Chloride	mg/L	243
Sulphate	mg/L	124
Fluoride	mg/L	1.1
Sodium	mg/L	130
Potassium	mg/L	15
Calcium	mg/L	73
Magnesium	mg/L	53
Iron	mg/L	<LOR
Boron	mg/L	0.26
Selenium	mg/L	0.01
Silica	mg/L	16.8
Strontium	mg/L	0.74
Zinc	mg/L	0.01
+ other Metals	mg/L	<LOR
Hydrocarbons	ug/L	<LOR
PAHs	ug/L	<LOR
BTEX	ug/L	<LOR

The surface geology over the DGF comprises Quaternary and Tertiary aged sands, clay and limestone. In areas where valleys or depressions have been incised into the underlying Pertnjara Formation the Quaternary/Tertiary deposits have sufficient saturated thickness to form a local aquifer (e.g. RN002943 on the western margin of the DGF).

Table 55 provides a summary of the stratigraphy and recorded groundwater occurrence from the surface down to the Arumbera Sandstone beneath the DGF.

Table 55: Stratigraphy and ground water DGF

Formation	Depth[1] (mBGL)	Thickness[2] (m)	Lithology	Groundwater Availability	Water Quality[3]
Quaternary/Tertiary aged sediments	Surficial	< 70	Quartz sand, clay/ limestone, calcareous siltstone	Limited – Forms local aquifer where sufficient saturated thickness exists.	Fresh to brackish
Pertnjara Formation	Surface to 70	670	Sandstone, minor shale and siltstone	Poor	Brackish
Mereenie Sandstone	650	350	Quartz sandstone	Regional aquifer	Fresh
Stairway Sandstone	1,000	20	Silty sandstone with interbedded siltstone	Local aquifer (permeability from joints and fractures)	Not known
Horn Valley Siltstone	1,030	30	Shale, siltstone, dolomite	Poor	Not known
Pacoota Sandstone	1,060	360	Sandstone with siltstone and shale	Regional aquifer	Fresh
Goyder Formation	1,420	110	Shale, siltstone and dolomite	Regional aquifer	Fresh
Shannon Formation	1,530	390	Dolomite, shale	Regional aquifer (Cambrian Carbonate Aquifer, after Short, 2018)	Brackish
Hugh River Shale	1,920	240	Siltstone, shale, limestone, dolomite		Brackish
Giles Creek Dolomite	2,160	300	Dolomite, siltstone, shale		Not known
Chandler Formation	2,460	240	Silty halite, minor limestone, mudstone	Poor. Presence of evaporates suggests poor water quality	Saline
Todd River Equivalent	2,700	20	Mudstone	Poor (based on thickness and lithology)	Not known
Arumbera Sandstone	2,720	310	Interbedded sandstone, siltstone, shale	Gas reservoir	Not known
TOTAL DEPTH	**3,045**				



[1] Depths and thickness based on Dingo 3 gas well
[3] Designation of aquitard based on dominant litholo
[3] Water quality assessment is made for aquifers based on bore data or formation water quality from Dingo well completion reports with the exception of the Chandler Formation

B.5.1.4 Wetlands, springs and aquatic inflow dependent ecosystems

Duguid (2013) undertook a comprehensive review of wetlands within the Alice Springs Water Control District, which includes DGF, and found that the majority of wetlands in the district are intermittent and only hold water after rainfall events. The report did not identify any groundwater fed wetlands or springs in the vicinity of the DGF.

B.5.1.5 Surface water

DGF is situated within both the Finke River and Todd River Basins, both of which are within the Lake Eyre catchment. The only major watercourse in the area is an unnamed ephemeral tributary of the Hugh River. The Hugh River merges with the Finke River further downstream. Smaller drainage lines are also present within the DGF area (Figure 18).

B.5.2 Natural Environment

B.5.2.1 Bioregions

Bioregions are defined through physical and environmental features, including watershed boundaries and soil and terrain characteristics. The latest version, IBRA7, classifies Australia's landscapes into 89 large geographically distinct bioregions based on common climate, geology, landform, native vegetation and species information.

The DGF is located within the Finke Bioregion which covers an area of 72,700km^2 and described in Table 56. The main land types of the Finke bioregion are arid sandplains with dissected uplands and valleys, including three major rivers: Finke, Hugh and Palmer rivers.

B.5.2.2 Sites of Conservation Significance

The DGF is not located within an identified SOCS (Figure 19).

B.5.2.3 Sites of Botanical Significance

There are no sites of botanical significance within the DGF (Figure 19).

B.5.2.4 Threatened Ecological Communities

Recent EPBC Protected Matter Search Tool results confirmed there are no listed threatened ecological communities within the DGF.

B.5.2.5 Vegetation Communities

Vegetation mapping of the L6 (Table 57) shows the majority is within vegetation class 85 with a small area of vegetation class 87 located on the eastern boundary of the lease. All DGF activities have been conducted within vegetation class 83. Dominated by perennial hummock-forming grasses, typically covering about one-third of the ground surface. All hummock grasses have characteristically spikey leaves and exhibit low (<1m) domed, annular or mat-like growth forms. They are among the most fire-prone desert ecosystems in the world.

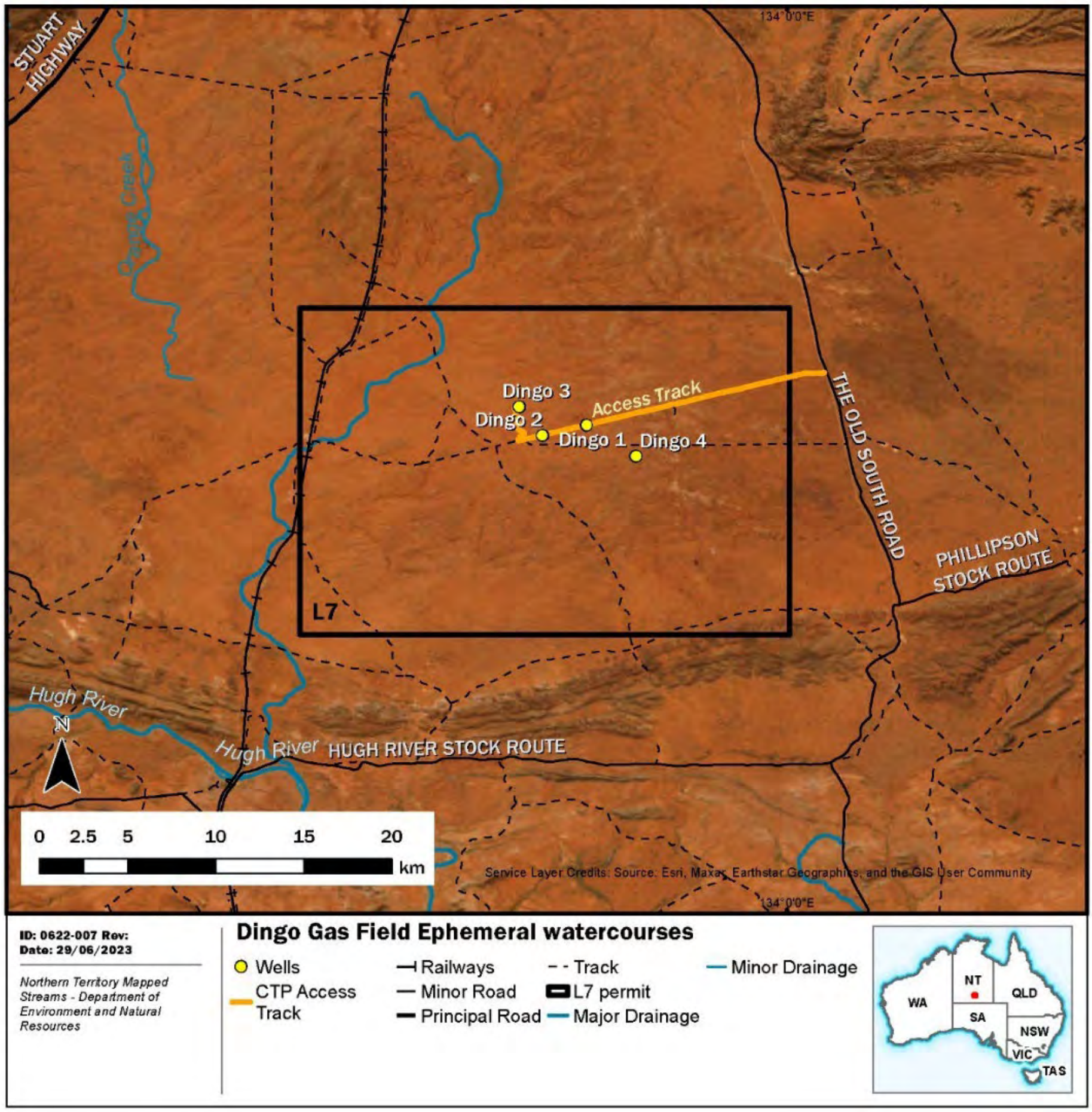


Figure 18: Ephemeral water courses DGF

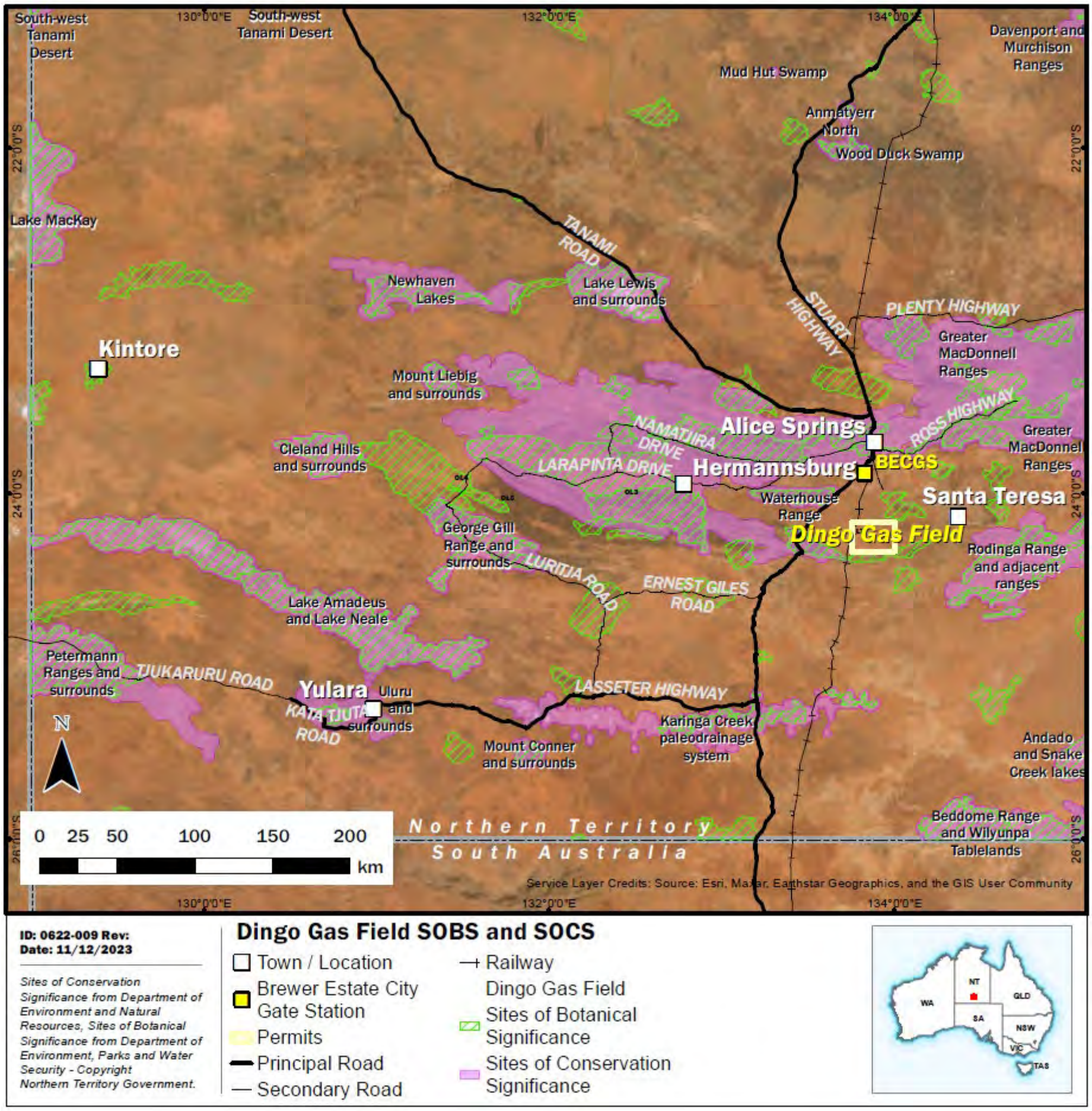
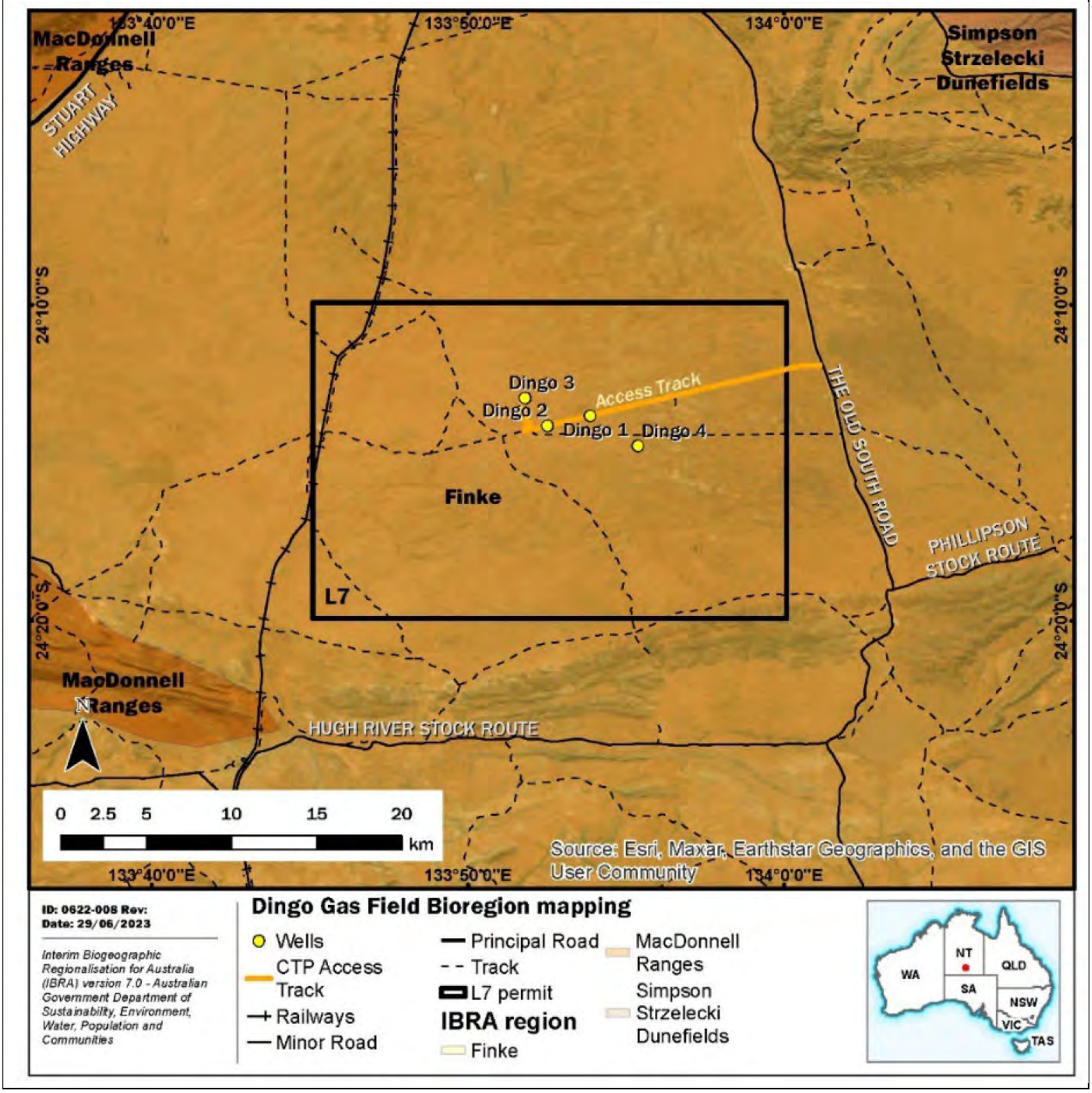


Figure 19: Sites of Botanical and Conservation Significance – DGF

Table 56: Bioregion DGF

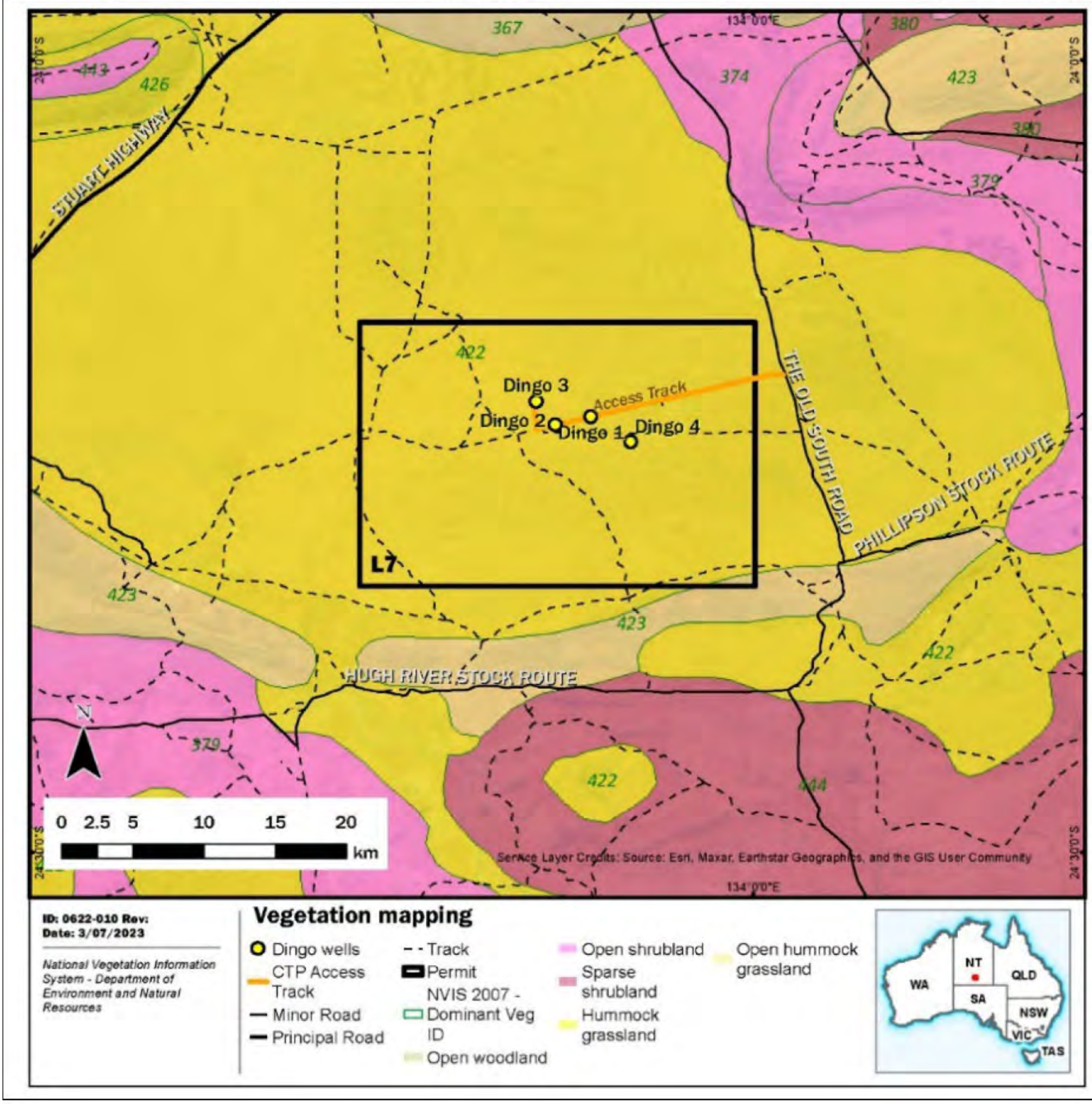
Extent	Bio-region[10]	Topography	Geology	Soils	Vegetation
100%	Finke	Geomorphologically variable complex of low sandstone ranges, weathered tablelands and rounded metamorphic hills, giving rise to undulating plains and low hills with extensive sand plains and sand dunes and flood outs	Lies over the Amadeus Basin and small parts of the Pedirka and Eromanga Basins. Contains sedimentary rocks of Devonian and Cambrian age	Soils are a mix of shallow and deep sands, massive earths, and red duplex saline affected soils.	Dominant vegetation includes hummock grasslands, *Acacia* shrublands and Saltbush/ Bluebush open shrublands



[10](Baker, et al., 2005)

Table 57: Vegetation DGF

Extent	Broad Vegetation Class3F[11]	Fine Vegetation Class	Fine Vegetation Class Description	Secondary Community Descriptions	Structural Formation
95%	Hummock grasslands	85	*Triodia basedowii* hummock grassland with *Acacia* tall sparse shrubland overstorey between dunes and *Zygochloa paradoxa* open-hummock grassland on dune crests	**85a:** *Triodia basedowii* hummock grassland with *Acacia* tall sparse shrubland overstorey between dunes	S1H3 Tall sparse shrubland, Hummock grassland
				85b: *Zygochloa paradoxa* open-hummock grassland on dune crests	S1H2 Tall sparse shrubland, Open-hummock grassland
5%	Hummock grassland	87	*Triodia* open-hummock grassland with *Acacia aneura* tall sparse-shrubland overstorey	–	S1H2 Tall sparse shrubland, Open-hummock grassland



[11](Wilson, Brocklehurst, Clark, & Dickinson, 1991)

B.5.2.6 Conservation Significant Flora

A flora species is considered in this report to be of conservation significance if it is:

- Listed as Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) under the *Territory Parks and Wildlife Conservation Act* (TWPC Act) and has been recorded in the NT Flora Atlas within a 25km buffer of the OL3 area or has been recorded on field surveys of the area; or
- Listed as CR, EN, VU or Conservation Dependent under the *EPBC* Act and is identified by a PMST (dated 5 December 2023) for the area or has been recorded in the NT Flora Atlas within a 25km buffer of the OL3 area or has been recorded on LES field surveys of the area.

Field surveys have been undertaken at the DGF by Low Ecological Services Pty Ltd between 2009 and 2013. Based on the results of desktop searches, previous field surveys and the Protected Matters Search Tool Report for the DGF.

Table 58 provides a summary of flora species of conservation significance which may be present within the DGF and identifies the likelihood of each species occurring within the DGF.

Table 58: Threatened flora DGF

Scientific name	Common name	TPWC Act Status	EPBC Act Status	Survey[1]	Habitat in DGF	Likelihood of occurrence in the DGF
Acacia undoolyana	Undoolya Wattle	VU	VU	No	No	Unlikely
Eleocharis papilosa	Dwarf Desert Spike-rush	VU	VU	No	No	Unlikely
Eremophila prostrata	Rainbow Valley Fuchsia Bush	VU	VU	No	Yes	Potential but unlikely
Minuria tridens	Minnie Daisy	VU	VU	No	Yes	Unlikely
Ricinocarpos gloria-medii	Glory of the Centre	VU	VU	No	No	Unlikely
Macrozamia macdonnelli	MacDonnell Ranges Cycad	NT	VU	No	No	Unlikely

B.5.2.7 Conservation Significant Fauna

Field surveys have been undertaken at DGF by Low Ecological Services Pty Ltd between 2007 and 2015 and a PMST (dated 5 December 2023). A fauna species is considered in this FEMP to be of conservation significance if it is:

- Listed as Extinct in Wild (EW), Critically Endangered (CE), Endangered (EN), Vulnerable (VU), Near threatened (NT) or Data Deficient (DD) under the TPWC Act and has been either:
    - Recorded in the NT Flora Atlas within a 10km buffer of the respective field; or
    - Recorded during ecological field surveys at respective fields.

Based on the results of desktop searches, ecological field surveys and the PMST report for the DGF, Table 59 provides a summary of fauna species of conservation significance which may be present in the DGF and identifies the likelihood of each species occurring within the DGF.

Table 59: Threatened fauna DGF

Type	Scientific name	Common name	Flora Atlas Record[3]	PMST Report	Ecology Survey[5]	TPWC Status[1]	EPBC Status[2]	Habitat in DGF	Likelihood of occurrence in DGF[4]
Bird	*Aphelocephala leucopsis*	Southern Whiteface	No	Yes	No		VU	No	Unlikely
Bird	*Amytornis modestus*	Thick-billed Grasswren	No	Yes	No	CR	VU	No	Unlikely
Bird	*Calidris ferruginea*	Curlew Sandpiper	Yes	Yes	No	VU	CE, MIG, MAR	No	Unlikely
Bird	*Erythrotriorchis radiatus*	Red Goshawk	No	Yes	No	VU	VU	No	Unlikely
Bird	*Pezoporus occidentalis*	Night Parrot	Yes	Yes	No	CE	EN	No	Unlikely
Bird	*Polytelis alexandrae*	Princess Parrot	Yes	Yes	No	VU	VU	Yes	Potential
Bird	*Rostratula australis*	Australian Painted Snipe	Yes	Yes	No	VU	EN	No	Unlikely
Bird	*Apus pacificus*	Fork-tailed Swift	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Motacilla cinerea*	Grey Wagtail	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Motacilla flava*	Yellow Wagtail	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Actitis hypoleucos*	Common Sandpiper	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Calidris acuminata*	Sharp-tailed Sandpiper	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Calidris melanotos*	Pectoral Sandpiper	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Charadrius veredus*	Oriental Plover, Oriental Dotterel	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Glareola maldivarum*	Oriental Pratincole	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Ardea alba*	Great Egret, White Egret	No	Yes	No	-	MAR	No	Unlikely
Bird	*Ardea ibis*	Cattle Egret	No	Yes	No	-	MAR	No	Unlikely
Bird	*Chrysococcyx osculans*	Black-eared Cuckoo	No	Yes	No		MAR	No	Unlikely
Bird	*Merops ornatus*	Rainbow Bee-eater	No	Yes	No	-	MAR	Yes	Potential

Type	Scientific name	Common name	Flora Atlas Record[3]	PMST Report	Ecology Survey[5]	TPWC Status[1]	EPBC Status[2]	Habitat in DGF	Likelihood of occurrence in DGF[4]
Bird	*Rostratula benghalensis (sensu lato)*	Painted Snipe	No	Yes	No	-	MAR	Yes	Potential
Bird	*Calidris canutus*	Red Knot	Yes	No	No	VU	-	No	Unlikely
Bird	*Calidris tenuirostris*	Great Knot	Yes	No	No	VU	-	No	Unlikely
Bird	*Charadrius leschenaultii*	Greater Sand Plover	Yes	No	No	VU	-	No	Unlikely
Bird	*Charadrius mongolus*	Lesser Sand Plover	Yes	No	No	VU	-	No	Unlikely
Bird	*Falco hypoleucos*	Grey Falcon	Yes	No	No	VU	-	Yes	Potential
Bird	*Limosa lapponica*	Bar-tailed Godwit	Yes	No	No	VU	-	No	Unlikely
Bird	*Macrotis lagotis*	Greater Bilby	Yes	No	No	VU	VU	Yes	Potential
Bird	*Rattus tunneyi*	Pale Field-rat	Yes	No	No	VU	-	No	Unlikely
Bird	*Notocytes typhlops*	Southern Marsupial Mole	Yes	No	No	VU	-	Yes	Potential
Mammal	*Petrogale lateralis MacDonnell Ranges Race*	Black-footed Rock-wallaby	Yes	Yes	No	NT	VU	No	Unlikely
Mammal	*Zyzomys pedunculatus*	Central Rock Rat	Yes	Yes	No	EN	EN	No	Unlikely
Mammal	*Macroderma gigas*	Ghost Bat	Yes	Yes	No	NT	VU	Nil	Records from pre-1970. Current range restricted to Northern Australia. Will not be considered further.
Reptile	*Liopholis slateri*	Slater's Skink	Yes	Yes	No	VU	EN	Yes	Potential

[1] TPWC Status: ER, Regionally Extinct, CR, Critical Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; DD, Data Deficient; NE, Not Evaluated; LC, Least Concern as listed under the Territory Parks and Wildlife Conservation Act (TPWC).

[2] EPBC Status: EX, Extinct, CR, Critical Endangered; EN, Endangered; VU, Vulnerable; MIG, Migratory; MAR, Marine; WET, Wetland; TER, Terrestrial; (L) MAR, Listed Marine Species as listed under the Environmental Protection and Biodiversity Act (EPBC) using 25km buffe

[3] Recorded in the NT Fauna Atlas within a 25km buffer of the L7 are

[4] Likelihood of occurrence within L7 determined through consideration of available habitat and existing records within 25km of lease area.

[5]Low Ecological Services DGF 2013 Fauna Survey.

B.5.2.8 Introduced flora (weeds)

A weed survey was conducted at Dingo Gas Pipeline and Brewer Estate City Gate Station by Low Ecological Services in February 2023. A class B weed, Caltrop (*Tribulis terrestris*) was identified during the survey. Other non-listed weeds identified during the survey included Paddy Melon (*Cucumis myriocarpus*), Feathertop Rhodes Grass (*Chloris virgata*), Stinky Love Grass (*Eragrostis barrelieri*) and Buffel Grass (*Cenchrus ciliaris*). The survey found the main introduced plant present was the invasive Buffel Grass, which is a fire risk species due to its fuel load and resin content. Previous weed surveys conducted identified the following weeds listed in Table 60.

Table 60: Weeds in the environs of respective fields

Scientific Name	Common Name	Priority/ Alert	NT Atlas/ Declared Weed Class	Invasive/ WoNS	Survey[1]
Acacia nilotica	Prickly Acacia	Alert	No/A	No/Yes	No
Andropogon gayanus	Gamba Grass	No	Yes/A/B	Yes/Yes	No
Argemone ochroleuca	Mexican Poppy	No	Yes/B	No/No	No
Calotropis procera	Rubber Bush	Priority	Yes/B	No/No	No
Carthamus lanatus	Saffron Thistle	No	Yes/B	No/No	No
Cenchrus ciliaris	Buffel Grass	No	No/ -	Yes/No	Yes
Cenchrus echinatus	Mossman River Grass	No	Yes/B	No/No	No
Cenchrus setaceus	Fountain Grass	Alert	Yes/B	No/No	No
Chloris virgata	Rhodes Grass	No	No	No	Yes
Cucumis myriocarpus	Paddy Melon	No	No	No	Yes
Cylindropuntia spp.	Prickly Pears	Priority	Yes/A	Yes/Yes	Yes
Eragrostis barrelieri	Stinky Love Grass	No	No	No	Yes
Eragrostis cillianensis	African Lovegrass	No	No	No	Yes
Opuntia stricta	Prickly Pear	Priority	Yes/A	Yes/Yes	No
Parkinsonia aculeata	Parkinsonia	Priority	Yes/B	Yes/Yes	No
Prosopis velutina	Mesquite	Alert	Yes/A	Yes/Yes	No
Tamarix aphylla	Athel Pine	Alert	Yes/B	Yes/Yes	No
Tribulus terrestris	Caltrop	No	Yes/B	Yes/No	Yes
Xanthium spinosum	Bathurst Burr	No	Yes/B	No/No	No

[1] *Detected during annual weed survey*

B.5.2.9 Introduced fauna (pests)

An introduced fauna species is considered in this FEMP to be of management concern if it is:

- Listed in the NT Fauna Atlas as “Introduced” and has been recorded within a 10km buffer of the DGF or has been recorded on field surveys of the area; or
- Identified as an invasive species by an EPBC Protected Matters Search Tool report within a 10km buffer of the DGF or has been recorded on field surveys of the area.

Table 61 lists the introduced fauna species to be of management concern for this FEMP.

Table 61: Introduced fauna (pests)

Scientific Name	Common Name	NT Atlas	PMST	Survey[1]
Columbia livia	Domestic Pigeon	Yes	Yes	No
Streptopelia chinenis	Spotted Turtle Dove	Yes	Yes	No
Sturnus vulgaris	Common Starling	Yes	Yes	No
Streptopelia roseogrisea	Barbay Dove	Yes	No	No
Bos Taurus	Domestic Cattle	Yes	Yes	Yes
Camelus dromedarius	Camel	Yes	Yes	No/Yes
Canis lupus familiaris	Domestic Dog	No	Yes	Yes
Equus caballus	Horse	Yes	Yes	Possible
Felis catus	Domestic Cat	Yes	Yes	High
Mus musculus	House Mouse	Yes	Yes	Yes/No
Oryctolagus cuniculus	European Rabbit	Yes	Yes	Yes/No
Rattus norvegicus	Brown Rat	Yes	Yes	No
Rattus	Black Rat	No	Yes	No
Vulpes	Red Fox	Yes	Yes	Yes/No
Sus scrofa	Pig	Yes	Yes	No
Equus asinus	Donkey	Yes	Yes	Moderate
Ramphotyphops braminus	Flower-pot Blind Snake	Yes	No	No

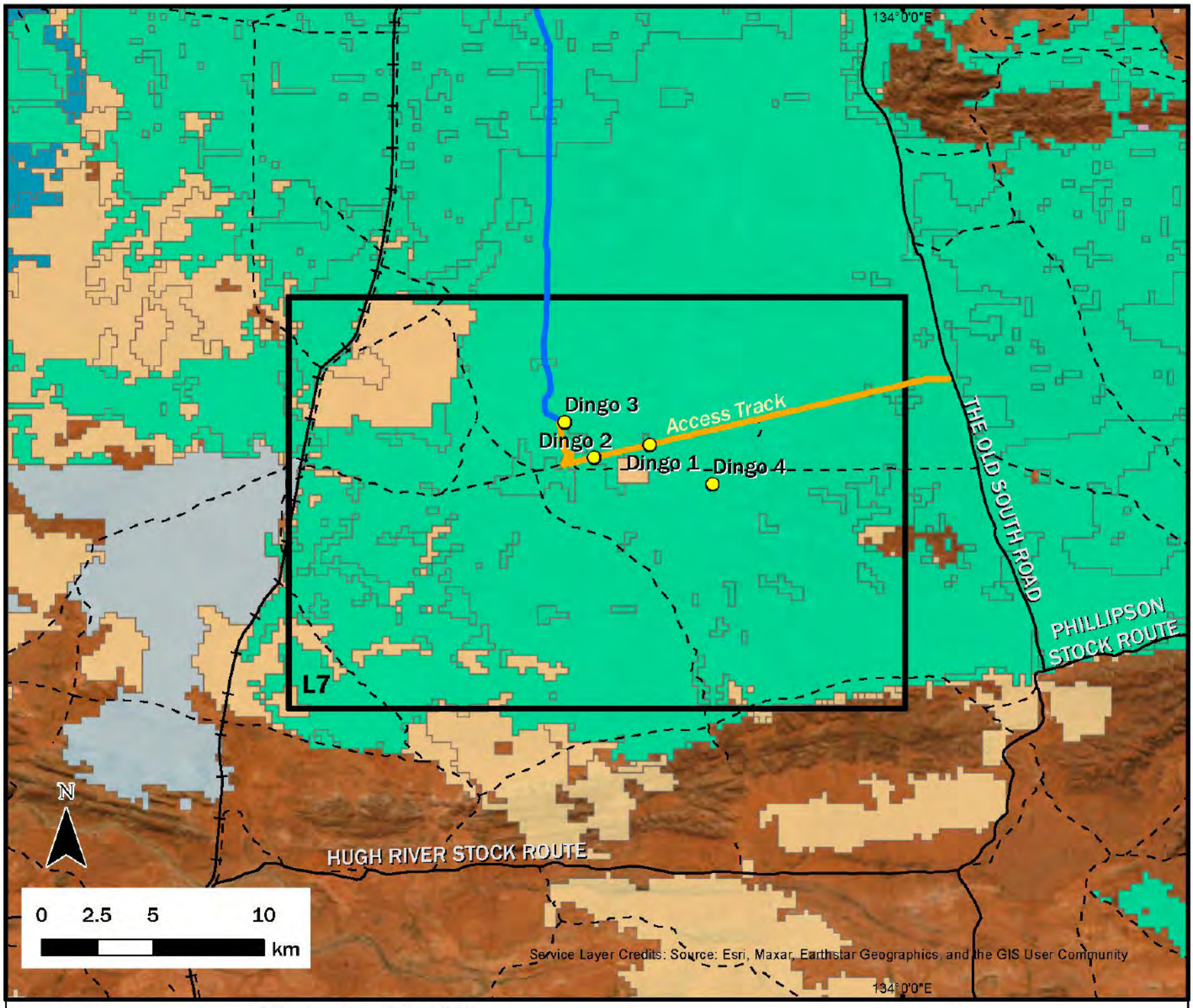
[1] *NT Fauna Atlas & EPBC PMST,2022*

B.5.2.10 Fire history

Regional fire history and fire scar mapping was obtained through the Northern Australia and Rangelands Fire Information website and a general review of Landsat Imagery (using Google Timelapse and VegMachine). Table 62 details the recent fire history map of DGF.

Table 62: Fire history DGF

Fire History Map
Fire frequency in the DGF area is low with the last fire year in 2011 occurring in the late dry season



ID: 0622-011 Rev:
Date: 12/04/2024

Fire scars - Darwin Centre for Bushfire Research 2024

Dingo Gas Field Fire scars

- Wells
- CTP Access Track
- Railways
- Minor Road
- Track
- Dingo pipeline
- L7 permit
- 2024 fires to 12/4/2024
- 2023 fires
- 2022 fires
- 2021 fires
- 2020 fires
- 2019 fires
- 2018 fires
- 2017 fires
- 2016 fires
- 2015 fires
- 2014 fires
- 2013 fires
- 2012 fires
- 2011 fires

B.5.3 Socio-Economic Environment

B.5.3.1 Surrounding Land Tenure

The Amadeus Basin is a sparsely populated region with Alice Springs being the major centre for the region. DGF is located in remote and isolated locations many kilometres from the nearest neighbours. Table 63 details the surrounding land tenures.

Table 63: Surrounding Land Tenure

Property Name	Survey Plan Number	Land Tenure	Operation Footprint
Deep Well Station	S 88/194	Pastoral Lease	Nil
Orange Creek Station	CP5213	Pastoral Lease	All

B.5.3.2 Surrounding Populated Places

All fields are in remote locations, far distant from the nearest populated places as shown in the tables below, 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, and Ipolera (Table 64).

DGF is located in the eastern section of the basin on Orange Creek Station, a large (232,100ha) pastoral station southeast of Alice Springs.

B.5.3.3 Noise

As noted in Table 64 below, all fields are located within a sparsely populated region. There are no communities within the area bounded by respective tenements and the nearest sensitive receptor are more than 25km from the noise sources located across the field.

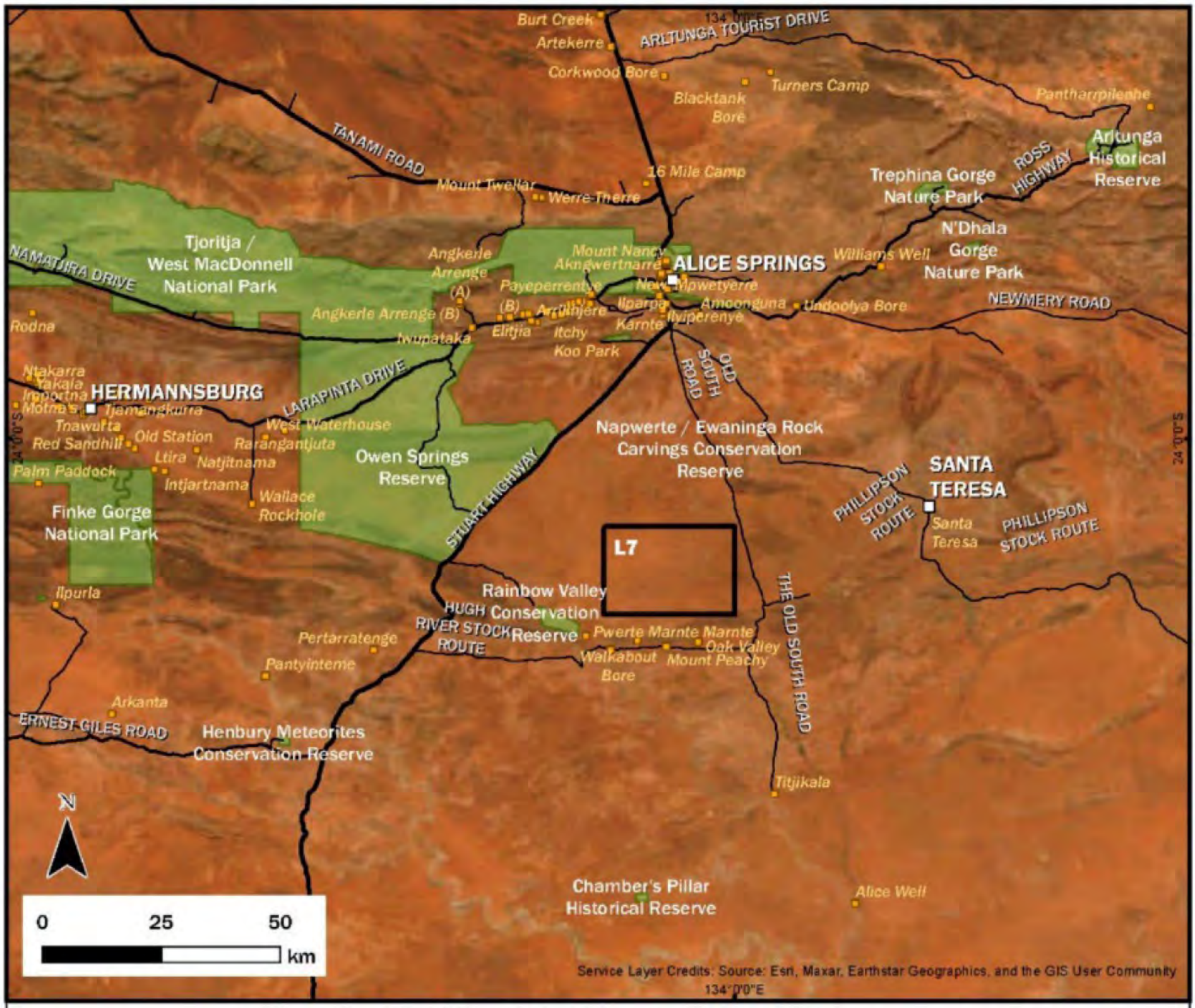
Northern Territory Noise Management Framework Guideline 2018 refers to offensive noise that may cause an environmental nuisance. There are no operation of compressors and power generation units at DGF.

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 provide 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 that potential noise generated within each of the fields 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.

Table 64: Populated places DGF

DGF – Surrounding populated places
▪ Alice Springs, approximately 40km to the north ▪ Santa Teresa, approximately 40km to the east ▪ Titjikala (Maryvale), approximately 40km to the south ▪ Nataria (Hermannsburg), approximately 100km to the west



B.5.3.4 Cultural heritage

B.5.3.4.1 Historic and natural heritage

The DGF 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 of which are within nor adjacent to fields. No non-public sites were found by the online search.

EPBC PMST for the DGF did not identify any World Heritage Properties, National Heritage Places, Commonwealth Heritage Places or Places on the Register of National Estate within or within a 10km buffer of either field. A Heritage/Archaeological Survey of the Dingo Pipeline Project was undertaken by Tim Hill in December 2013 (Hill, 2013). No archaeological sites were located during the survey.

B.5.3.4.2 Aboriginal archaeological assessment

No additional surveys are required as all activities are within existing, surveyed disturbance areas. There is no work in mapped cultural heritage exclusion or restricted work zones.

Known Aboriginal areas of value are protected under provisions contained in approved sacred sites certificates and the *Heritage Act 2011*.

B.5.3.4.3 Sacred Sites

The Dingo Field is operated under and in compliance with SSCC C2020-001.

B.6 Engagement and Consultation

B.6.1 Stakeholder engagement

The Operator is 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 of 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 per CLC guidance. [redacted] is the landowner on which the DGF assets are located on.

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 (PMST dated 5 December 2023). Therefore, the *EPBC Act* will not be triggered.

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

B.6.2 Traditional Owner(s) engagement

The Operator undertakes regular consultation with Traditional Owners primarily through annual community liaison meetings. At these meetings the Operator provides an overview of its ongoing production operations, anticipated field workover programs and other development activities. 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.

B.6.3 Assessment of merit of stakeholder objection or claim

The process that the Operator will undertake in assessing any stakeholder objection/claim that it receives 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 the Operator and that no additional action is required; or
  - If the results confirm that the objection/claim is related to the 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 outcomes of the investigation including any actions that the Operator has/will undertake to address the objection/claim – if required. Following the discussion, a written response will be provided.

B.6.4 Details of changes due to engagement

Any proposed changes in operations, policy or procedures because of stakeholder consultation or other engagement will be considered by the Operator's Management Team. If any changes for merit are deemed necessary, these changes will follow the Operator's approved management of change process (MOC) and captured in a register.

B.7 Environmental Impacts, Risks and Mitigation

B.7.1 Approach

B.7.1.1 Risk assessment methodology

The Operator's 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 65)
- Recorded in a risk register
- 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 the Operator's Risk Matrix (Section Risk Matrix) 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 determination can then be made about whether the risk is ALARP and acceptable or whether further mitigation is required.

Table 65: 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.

B.7.1.2 ALARP and acceptability

As part of the Operator's risk assessment process, each risk is mitigated to ALARP. The Operator considerers risks having been reduced to ALARP 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, time and resources involved to mitigate it.

To determine whether potential environmental risks and inputs are 'acceptable' is a matter of judgement that depends on issues such as the nature and scale of impacts and the social or economic benefits. The Operator's risk tolerance/acceptance process (Table 66) is utilised to determine whether to accept the assessed residual risk or implement improvement actions.

Table 66: 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 risk 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 being demonstrated through:
- Alignment with legislative requirements, regulator guidance, stakeholder expectations
- Adoption of regional strategies and plans
- Not compromising ESD Principles, and
- Limiting the nature and scale of the effect on the environment.

B.7.1.3 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 a management control. Additional baseline studies or other safeguards may be required to increase the accuracy of an assessment to determine the acceptability of a risk.

Scientific uncertainty is qualitatively assessed using a generic means of ranking the data available in accordance with the criteria assigned in Table 67. Considerations of scientific uncertainty have been included in the risk assessment.

Table 67: 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 as 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. The precautionary approach to management of the risk is required.

B.7.1.4 Risk assessment summary

The outcomes of the environmental risk assessment are presented in Appendix 1. A summary of the residual risks for DGF activities under the EMP is shown in Table 68. All risks are considered by the Operator to be as low as reasonably practicable and are accepted.

Table 68: Risk assessment summary

	Low	Medium	High	Very High
Count	8	4	0	0

The 'Medium' residual risks for activities under this environment management plan 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 release of hydrocarbons and formation water, including wastewater to ground
- Loss of places or items of cultural significance from fire as a result of activities under this EMP
- Subsurface loss of contaminants during workovers contaminating surface water and/or groundwater and reducing groundwater pressure

B.7.1.5 Environmental management strategy

Based on the results of the risk assessments conducted and the identification of critical controls as detailed in Appendix 1. 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 7.2 to 7.10.

B.7.1.6 Risk Matrix

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

B.7.2 Biodiversity

<table>
<tr><th colspan="6">Environmental performance measures: Biodiversity</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management
▪ Well operations – surface infrastructure
▪ Production facilities – gathering and boosting
▪ Well workover – fluid systems
▪ Rehabilitation
▪ Support activities – chemical storage, workover fluids, waste and wastewater management</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="3">Consequences</td><td colspan="2">Critical controls</td></tr>
<tr><td colspan="3">▪ Loss of vegetation/fauna habitat values from:
- Loss of containment, including spills and leaks, of hydrocarbons, chemicals, workover fluids, 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 or trenches or similar</td><td colspan="2">▪ Weed Management Plan
▪ Rehabilitation Management Plan
▪ Fire Management Plan
▪ Spill Management Plan
▪ Erosion and Sediment Control Plan
▪ Wastewater Management Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The residual risk remains medium based on moderate impacts of loss of conservation significant fauna. The Operator considers that the risk has been reduced to APLARP and acceptable based on the following:
▪ Vehicle movements are a necessary part of operations controls are aligned with industry practice and consistent with ESD principles to co-exist without any long-term impacts to the local environment.
▪ No WoNS or declared weeds in respective fields so risk of weed spread between well sites minimised. Best practice weed management practice areas in place and the Operator seeks to achieve the requirements of key legislation and strategies as outlined in Section 2.
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
</table>

Environmental performance measures: Biodiversity			
Environmental outcome	**Environmental performance standard**	**Measurement criteria**	**Records**
No significant impact to threatened fauna, their habitat and sites of conservation significance	No unauthorised clearing of vegetation or loss of fauna habitat	▪ Areas of known threatened fauna habitat will be sign posted to avoid impacts to 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	▪ Permit to work records ▪ Incident records ▪ Environmental sensitivity maps
	No introduction of new or spread of existing Weeds of National Significance, weed listed under NT legislation or locally significant weed species	▪ Complete annual weed survey ▪ No new WONS, NT listed weed species or locally significant weed species identified ▪ Weed certifications from vehicles, equipment and machinery entering from known weed infestation areas are obtained ▪ Weed hygiene training has been 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 protection of fauna, flora, their habitat and reporting fauna interactions ▪ No incidents recorded in incident management system of driving off designated roads, access tracks and well pads ▪ No incidents within incident management system involving vehicle related fauna strikes with speeds above 70km/hr within the field.	▪ Incident records ▪ Induction and register of participants
	No uncontrolled fires from the Operator's activities	▪ The incident management system shows no recorded incidents of uncontrolled fires starting because of the operator's activities	▪ Incident records
	The Operator's activities will not encourage pest species	▪ The incident management system shows no records of pest species interactions with waste or inappropriate waste storage and handling that encourages vermin access.	▪ Incident records ▪ Inspection records
Environmental monitoring and reporting		See Table 110 for details	
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	

B.7.3 Land

<table>
<tr><th colspan="6">Environmental management strategy: Land</th></tr>
<tr><td>Activities</td><td colspan="3">▪ Civil and project activities – earthworks, land and vegetation management
▪ Well operations –surface infrastructure
▪ Well workover – fluid systems
▪ Production facilities – gathering and boosting</td><td colspan="2">▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities – chemical storage, workover fluids, waste and wastewater management</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 rowspan="2">Risk</td><td colspan="3">Consequences</td><td colspan="2">Critical controls</td></tr>
<tr><td colspan="3">▪ Soil/land contamination from:
- Loss of containment, including spills and leaks, of hydrocarbons, chemicals, workover fluids, wastewater, including during wet weather
- Storage, handling, use of fuels, oils and chemicals
- Wastewater 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="2">▪ Spill Management Plan
▪ Wastewater Management Plan
▪ Wet Season Management Plan
▪ Erosion and Sediment Control Plan
▪ Rehabilitation Management Plan
▪ Waste segregation and implementation of waste management hierarchy
▪ Job Hazard Analysis/ Permit to work systems</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that the risks have been reduced to ALARP and no further risk reduction is warranted as:
▪ A strong historical knowledge of the field and the environmental response to land disturbance, erosion and contamination events presents a low level of uncertainty.
▪ Operation of flowlines in accordance with legislative and best practice guides/codes.
▪ Operation of wastewater storage and disposal as per the Code. The ponds were developed prior to the implementation of the Code, no leak detection is in place but a program of regular inspections as part of the Asset Management System has been successfully implemented.
▪ Operation and maintenance of the gathering network in accordance legislative and with best practice industry standards (refer Section 2).
▪ Secondary containment (when in use) will be inspected when personnel attends site, unless being operated through the wet season during which period it will be monitored when personnel attends site.</td></tr>
</table>

Environmental management strategy: Land			
Environmental outcome	**Environmental performance standards**	**Measurement criteria**	**Records**
No significant long-term impacts on soil stability, soil quality and land formations from the Operator's activities	Erosion and sediment controls in place, including wet weather response.	▪ Records show the erosion and sediment control measures are being implemented ▪ Records show inspections of erosion and sedimentation issues after significant rainfall events ▪ Records show all active work sites inspected for evidence of erosion and sedimentation, including after significant rain events, 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) ▪ Records show restricted use of roads and tracks to operational safety activities across the field after significant rainfall event (>10mm in 24 hours)	▪ Inspection records ▪ Incident records ▪ Weather records
	Disturbance of land remains within existing cleared and operational areas.	▪ 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	▪ Incident records ▪ Induction records ▪ Permit to work records
	No releases of contaminants (including wastes, wastewater, chemicals, hydrocarbons or workover fluids) resulting in long-term contamination of the soil	▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken ▪ The incident management system indicates no releases of contaminants incidents related to wet weather operations ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling, 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 spills resulting in significant, long term impacts on soils and land formations ▪ Records show 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 the operator's activities ▪ Records show progressive rehabilitation has been initiated to reinstate/reduce areas no longer required	▪ Rehabilitation success monitoring ▪ Incident records

Environmental management strategy: Land	
Environmental monitoring and reporting	See Table 110 for details
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

B.7.4 Surface water

<table>
<tr><th colspan="6">Environmental performance measures: Surface water</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, project, borrow pits, mobilisation/demobilisation
▪ Well operations – surface infrastructure, well maintenance and integrity
▪ Production facilities – gathering and boosting
▪ Well workover – fluid systems
▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities – chemical storage, workover fluids, waste and wastewater management</td></tr>
<tr><td>Residual risk</td><td>Low</td><td>Code of Practice</td><td>A.3.4, A.3.8, C.3, C.4.1, C.4.2, C.5, C.7.1, C.7.2</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">▪ Surface water contamination from:
- Loss of containment, including spills and leaks, of hydrocarbons, workover fluids, 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</td><td colspan="2">▪ Asset Management System
▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Wet Season Management Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that the risks have been reduced to ALARP and no further risk reduction is warranted as:
▪ Operation of flowlines in accordance with legislative and best practice guides/codes (refer Section 2)
▪ Operation of wastewater storage and disposal as per the Code. The ponds were developed prior to the implementation of the Code, no leak detection is in place but a program of regular inspections as part of the Asset Management System has been successfully implemented.
Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standards</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>No significant impact on surface water quality from the Operator's activities</td><td>No release of contaminants resulting in long term contamination of surface waters,</td><td colspan="2">▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken
▪ The incident management system indicates no release of contaminant incidents related to storage, handling, use or disposal of chemicals, fuels, wastes</td><td colspan="2">▪ Inspection records
▪ Incident records
▪ Chemical Register</td></tr>
</table>

Environmental performance measures: Surface water			
	including during wet weather operations	▪ 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, 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 spills resulting in significant, long-term contamination of surface waters ▪ Records show emergency response plan implemented in the event of a reportable spill or leak	
	Erosion and sediment controls in place	▪ Records show the erosion and sediment control plan is implemented ▪ Records show all active work site inspected for evidence of erosion and sedimentation, including after significant rain events, 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 ▪ Job hazard analysis
	No long-term impacts on surface water from operation of evaporation ponds	▪ Records show freeboard is maintained ▪ No incidents of overtopping from evaporation ponds recorded within the incident management system ▪ Records show inspections of containment integrity are maintained ▪ Records show production needs consider available holding capacity within evaporation ponds, particularly during wet weather	▪ Inspection records ▪ Daily production reports ▪ Incident records
Environmental monitoring	See Table 110 for details		
Corrective actions	▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily ▪ Soil remediation where spills occur to reduce impact to nearby surface water ▪ Review of wet weather procedures and response ▪ Review of storage and handling practices of contaminants ▪ Increased awareness and training		

B.7.5 Groundwater

<table>
<tr><th colspan="6">Environmental performance measures: Groundwater</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Well operations – well barriers, maintenance and integrity
▪ Production facilities – gathering and boosting
▪ Well workover – barrier protection, fluid systems, suspension, decommissioning
▪ Support activities –chemical storage, workover fluids, waste and wastewater management</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 workovers
- Groundwater inflow from workover activities
- Well integrity
- Spill or leak from the use, transportation, treatment, handling and storage of, workover fluids, wastewater, and diesel, fuel, oils and chemicals, including during wet season
- Loss of containment from wastewater ponds
▪ Reduced groundwater availability for wider community from use of groundwater resources to support the Operator's activities</td><td colspan="2">▪ Asset Management System
▪ Wells managed in accordance with DITT approved WOMPs
▪ Implement Emergency Response Plan
▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Groundwater Management Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that this risk has been reduced to ALARP and no further risk reduction is warranted based on:
▪ Well operations and workovers will be conducted using extensive best practice controls as outlined in the DITT approved WOMPs for each well. The subsurface loss of containment risks of operations and workovers are generally lower than drilling a new well because cement casing is already in place and there are no open zones, which provides some protection against hydrocarbon migration. Multiple well barriers are used across aquifers to minimise interaction.
▪ 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.
▪ We also note that part of the rationale for conducting the workover activities is to improve well integrity in an aging field. Workovers will ensure well barriers are in-tact so that subsurface loss of containment risks are reduced during the operation of the well.
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
</table>

Environmental performance measures: Groundwater			
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 workover fluids) resulting in long-term contamination of groundwater resources	▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken ▪ The incident management system indicates no releases of contaminants incidents related to wet weather operations ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling, 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 spills resulting in significant, long-term contamination of ground waters ▪ Records show Emergency Response Plan implemented in the event of a reportable spill or leak ▪ The field Groundwater Management Plan (GWMP) has been implemented*	▪ Inspection records ▪ Groundwater monitoring results ▪ Incident records
	Wells are managed under a Well Operations Management Plan to monitor integrity and potential for impact on groundwater	▪ Records show that a DITT approved WOMP is implemented for each well ▪ Records indicate that BOPs and well control equipment is installed, maintained and routinely tested on workover rigs ▪ Records show ongoing maintenance, monitoring and testing processes as specified in WOMPs	▪ Well Barrier Integrity Verification reports ▪ Inspection records ▪ Incident records
Environmental monitoring and reporting	See Table 110 for details		
Corrective actions	▪ Remediate spills and leaks where possible to reduce groundwater impact ▪ Conduct workover to improve integrity of wells, thereby reducing potential for groundwater interaction ▪ Review opportunities for water reduction across field operations and subsequent groundwater extraction reduction.		

** Monitoring undertaken every six months as per the existing field GWMP until the new Groundwater Monitoring Guidelines are released. Thereafter, the monitoring frequency will be reviewed with reference to those included in the Groundwater Sampling and Analysis – Field Guide by Geoscience Australia, Sundaram et al.*

B.7.6 Air and noise

<table>
<tr><th colspan="6">Environmental performance measures: Air and noise</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, borrow pits, wastewater evaporation systems
▪ Well operations – operations, maintenance and integrity
▪ Production facilities – gathering and boosting, venting
▪ Workovers – well interaction, suspension, decommissioning
▪ Wellhead equipment, safety systems and gathering network replacement
▪ Support activities – waste, chemical storage, greenhouse gas emissions</td></tr>
<tr><td>Residual risk</td><td>Low</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="2">Consequences</td><td colspan="3">Critical controls</td></tr>
<tr><td colspan="2">▪ Release of contaminants to air environment through:
- Loss of containment (gas)
- Fugitive emissions/leaks from wells, flowlines and processing equipment
- Air emissions from combustion of fuel/gas
- Venting of gas and processing by-products
- Emission from release of chemicals, hazardous substances to atmosphere
- Vehicle and heavy machinery movements
- Explosion or fire from the Operator's activities</td><td colspan="3">▪ Asset integrity and maintenance systems
▪ Emergency Response Plan
▪ Methane Emissions Plan/leak detection program
▪ Well Operation Management Plan
▪ Job Hazard Analysis and Permit to Work systems
▪ Flaring (during workovers) is within designated and restricted areas</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Code dictates methane emissions for onshore shale gas fields (Clause D.2). DGF 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>
<tr><td>Environmental outcome</td><td colspan="2">Environmental performance standards</td><td colspan="2">Measurement criteria</td><td>Records</td></tr>
<tr><td>The Operator's activities do not create a measurable decrease in air quality at sensitive receptors</td><td colspan="2">No release of air contaminants resulting in long term impact to sensitive receptors</td><td colspan="2">▪ Records indicate regular inspections are conducted in line with Well Operations Management Plan and asset maintenance systems
▪ Records of inspection identify asset integrity system and processes are being implemented
▪ Records show that safety critical processes and procedures are in place</td><td>▪ Inspection records
▪ Process/metering records
▪ Incident records
▪ Calibration records</td></tr>
</table>

Environmental performance measures: Air and noise			
	No uncontrolled fire or explosion from the Operator's activities	▪ Records show that safety critical processes and procedures are in place as per Integrity Management System ▪ Incident management system shows that 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 is metered and recorded ▪ Calculation of greenhouse gas emissions in accordance with the NGER Measurement Determination	▪ Incident records ▪ NGER Report ▪ Venting records ▪ 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	See Table 110 for details		
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, the Operator is working to meet the requirements of Section D of the Code where relevant to our operations*

B.7.7 Hazards

<table>
<tr><th colspan="6">Environmental performance measures: Hazards</th></tr>
<tr><td>Activities</td><td colspan="3">▪ Civil and project activities – earthworks, land and vegetation management, site mobilisation/demobilisation
▪ Well operations -surface infrastructure
▪ Production facilities – gathering and boosting, venting
▪ Well workover – fluid systems</td><td colspan="2">▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities –chemical storage, workover fluids, waste and wastewater management</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 rowspan="2">Risk</td><td colspan="2">Consequences</td><td colspan="3">Critical controls</td></tr>
<tr><td colspan="2">▪ Ignition sources present from the Operator's 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">▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Erosion and Sediment Control Plan
▪ Bushfire Management Plan
▪ Methane Emissions Management Plan
▪ Wet Season Management Plan
▪ Asset Management System
▪ Waste management hierarchy implementation</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">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 and the Operator is experienced with operating in the climatic and environmental conditions. Systems and controls are in place to effectively manage operations in the event of natural hazards such as bushfire, wet weather and the occurrence of NORMS.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standard</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>Bushfires are not started from conduct of the regulated activity and infrastructure is protected from fires started outside of the OL areas</td><td>No uncontrolled bushfires caused by the Operator's activities</td><td colspan="2">▪ The Incident Management System shows no fires resulting from the operator's activities
▪ Records show annual fire scar mapping, annual fire load estimates and maintenance of firebreaks are undertaken
▪ Records show emergency response plan implemented in the event of a fire
▪ 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 NAFI fire tracking maps are reviewed daily as part of operations where a high fire danger is present</td><td colspan="2">▪ Incident records
▪ JHA records
▪ Daily reports</td></tr>
</table>

Environmental performance measures: Hazards			
		▪ Records show emergency response drills are conducted	
No significant impact on the natural environment from the Operator's 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 in place where required and working as designed	▪ Records show Erosion and Sediment Control Plan 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
The extraction of subsurface equipment, hydrocarbons and water does not result in human health impacts	No impacts from presence of NORMs on environment or human health	▪ Records indicate that NORMS levels are within acceptable limits prior to handling and disposal ▪ Records show licenced waste contractors are used for movement of waste materials.	▪ NORMS testing records ▪ Incident records ▪ Waste tracking records
Environmental monitoring and reporting		See Table 110 for details	
Corrective actions		▪ Maintain capacity in bunds/secondary containment devices ▪ Manage freeboard within wastewater storage ▪ Replace defective fire equipment ▪ Reinstate fire breaks ▪ Reinstate/repair erosion and sediment control devices	

B.7.8 Heritage

<table>
<tr><th colspan="6">Environmental performance measures: Heritage</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, site mobilisation/demobilisation, borrow pits
▪ Rehabilitation</td></tr>
<tr><td>Residual risk</td><td>Medium</td><td>Code of Practice</td><td>A.3.1, A.3.7, A.3.5, A.3.8</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 heritage values or items of significance from:
- Disturbance/exposure of heritage sites/artefacts of cultural significance
- Ignition sources present from the Operator's 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</td><td colspan="3">▪ 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 Bushfire Management Plan
▪ Implement Emergency Response Plan/actions</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">▪ Activities are not being conducted in the cultural heritage 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 low risk. Works are remaining within previously disturbed areas and under permits from CLC (SSCC C2020-001) and AAPA (certificate number Dingo 1-4: 202002682 and Proposed Dingo 5: 202000442).
▪ Fire could spread to culturally significant areas if started by the Operator's 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 the Operator considers that this risk has been reduced to lowest possible and is ALARP and acceptable.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standard</td><td colspan="2">Measurement criteria/monitoring</td><td colspan="2">Records</td></tr>
<tr><td rowspan="2">No significant impact to indigenous and non-indigenous artefacts, Aboriginal Sacred Sites, and non-indigenous heritage sites</td><td>No non-compliance with AAPA Sacred Site Certificates or CLC permits</td><td colspan="2">▪ 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.</td><td colspan="2">▪ Incident records
▪ Induction (Heritage and Cultural Awareness)</td></tr>
<tr><td>No unauthorised disturbance of Aboriginal archaeological places/objects and/or Aboriginal Sacred Sites</td><td colspan="2">▪ Incident Management System show no recorded incidents involving damage to Aboriginal archaeological places/objects and/or Aboriginal Sacred Sites
▪ No removal of artefacts in situ without prior approval from Heritage Branch NT</td><td colspan="2">▪ Incident records
▪ Communication minutes with CLC</td></tr>
</table>

Environmental performance measures: Heritage			
Bushfires are not started from conduct of the regulated activity and infrastructure is protected from fires started outside of the OL areas	No uncontrolled bushfires caused by the Operator's activities	▪ The Incident Management System shows no fires resulting from the operator's activities ▪ Records show annual fire scar mapping, annual fire load estimates and maintenance of firebreaks are undertaken ▪ Records show emergency response plan implemented in the event of a fire ▪ 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 NAFI fire tracking maps are reviewed daily as part of operations where a high fire danger is present ▪ Records show emergency response drills are conducted	▪ Incident records ▪ JHA records ▪ Daily reports
Environmental monitoring and reporting		See Table 110 for details	
Corrective actions		▪ Consult with Traditional Owners/CLC ▪ Investigate incidents and review and revise procedures	

B.7.9 Community

Environmental performance measures: Community					
Activities	▪ Civil and project activities – site mobilisation/demobilisation ▪ Well operations -surface infrastructure ▪ Production facilities – gathering and boosting ▪ Well workover – fluid systems				
Residual risk	Low	**Code of Practice**	A.3.1, A.3.7	**Uncertainty**	Low
Risk	**Consequences**		**Critical controls**		
	▪ Ignition sources present from the Operator's 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		▪ 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	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 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 outcome	**Environmental performance standard**	**Measurement criteria**		**Records**	
The Operator's activities minimise the following: ▪ Reduction in capacity of road infrastructure ▪ Maintain and enhance	No complaints from stakeholders	▪ Records of the operator's approved journey management plans ▪ Records show Traditional Owners able to access field in liaison with Production Supervisor/Person in Charge ▪ Contact information provided to local communities and stakeholder to facilitate communication ▪ No recorded incidents of work being conducted beyond approved operational areas		▪ Records of the operator's approved journey management plans ▪ Records show Traditional Owners able to access field in liaison with Production Supervisor/Person in Charge ▪ Contact information provided to local communities and stakeholder to facilitate communication ▪ No recorded incidents of work being conducted beyond approved operational areas	

Environmental performance measures: Community			
community relationships ▪ Safety risks to the community	No disturbance to surrounding land uses/access from the Operator's 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 the operator's activities ▪ Records of journey management system implementation	▪ 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 the operator's activities ▪ Records of journey management system implementation
	No impact on regional waste resources and services	▪ Records show only licensed waste contractors are used for waste handling, treatment and/or disposal	▪ Records show only licensed waste contractors are used for waste handling, treatment and/or disposal
	Visitors and contractors are aware of environmental requirements	▪ All visitors and contractors are approved for access and inducted according to their visit requirements.	▪ All visitors and contractors are approved for access and inducted according to their visit requirements.
	No significant impacts to the wider community from the operation of the field	▪ Records indicate that the Pipeline Management Plan is implemented for the field ▪ Incident management system does not indicate repeated complaints from the community over the same issue.	▪ Records indicate that the Pipeline Management Plan is implemented for the field ▪ Incident management system does not indicate repeated complaints from the community over the same issue.
Environmental monitoring and reporting		See Table 110 for details	
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 ▪ Re-instate areas disturbed beyond approved boundaries	

B.7.10 Cumulative impacts

The cumulative impacts (Table 69) associated with the ongoing operation and well integrity and intervention campaigns have been assessed as low. The DGF development is in highly remote locations with no permanent workforce at site. The DGF Field has been part of the local community since 2014 and has supported the local community through the supply of gas to the regional power station.

Table 69: Cumulative impacts for DGF

Aspect	Risk rating	Summary
Biodiversity	Medium	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) will be inspected weekly, unless 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. ▪ Operation of assets 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 proposed ▪ Formation water evaporated or reinjected to formation.
Groundwater	Medium	No bores are constructed in the Pacoota Sandstone in the immediate vicinity of L7. Groundwater is not extracted at L7. However, formation water sample collected during the drilling of Dingo No. 4 suggests the groundwater quality is potable beneath the lease. To minimise the risk: ▪ Well operations and workovers will be conducted using extensive best practice controls as outlined in the DITT approved WOMPs for each well.
Air and noise	Low	DGF is a conventional gas operation but adheres to the requirements as far as practical 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.
Greenhouse Gas Emissions	Low	▪ No emissions from land clearing activities. ▪ For the 2022 NGER reporting period, total greenhouse gas emissions from DGF were 5,405 tCO2e. Production and metering improvements in addition to leak detection and repair programs are showing an improvement in emissions. Current emissions levels do not trigger the Northern Territory Governments Large Emitters Policy 2021.
Hazards	Low	▪ The activities under this EMP have been occurring for over 40 years and the Operator is experienced with operating in the climatic and environmental conditions. ▪ Systems and controls are in place to effectively manage operations in the event of natural hazards such as bushfire, wet weather and the occurrence of NORMS.
Heritage	Medium	▪ Activities are not being conducted in the cultural heritage sensitive areas (exclusion zones). ▪ Fire risk is mitigated through the implementation of the Bushfire Management Plan.
Community – traffic	Low	▪ An additional 10 vehicles per day accessing the respective fields are anticipated during specific work programs such as the well integrity and intervention programs.

Aspect	Risk rating	Summary
		▪ Journey Management Planning and personnel awareness through daily pre-start meetings of increased traffic during peak tourist periods and maintaining safety for the Operator crews and tourists alike is a priority for the Operator.
Community – tourism	Low	With the isolated location of the wells and supporting infrastructure and no other resource or industrial projects in the area the Operator considers the impacts of ongoing activities to be low.
Community – amenity/visual impact	Low	The majority of infrastructure at each field is not visible or accessible.
Rehabilitation – final land use	Low	Successful rehabilitation is dependent on the vegetation type, soil type and moisture content in the soil which, in turn, is dependent on the timing and amount of rainfall in the region after earth work restoration commences.

B.8 Management Plans

B.8.1 Wet Season Management Plan

A Wet Season Management Plan has been developed and presented below in Table 70 to address the risks and management measures put in place to ensure operations can continue with little impact on gas production or impact on the environment.

B.8.2 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. Table 71 presents the ESCP for DGF.

B.8.3 Weed Management Plan

The Code requires a Weed Management Plan (WMP) that is developed in accordance with the requirements of the *NT Weed Management Planning Guide: Onshore Petroleum Projects.* The Weed Management Plan is provided below in Table 72.

B.8.4 Bushfire Management Plan

The Bushfire Management Plan for the DGF is provided in Table 73 and has been based on the *Bushfire Management Planning Guide: Onshore Petroleum Projects (*DENR, 2020) and the Code.

B.8.5 Rehabilitation Management Plan

The Rehabilitation Management Plan, Table 74 addresses both rehabilitation of decommissioned areas/wells and also the progressive rehabilitation of areas where the disturbance footprint can be reduced without impacting the daily operations of the area.

B.8.6 Wastewater Management Plan

The Wastewater Management Plan (WWMP) is provided in Table 75. 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.

B.8.7 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 76.

B.8.8 Methane Emissions Management Plan

The Methane Emissions Management Plan (MEMP) aims to reduce emissions via emissions detection and management in the gas field. Monitoring and measurement is undertaken to quantify and reduce fugitive methane emissions from the activities. The Plan is presented in Table 77.

Table 70: Wet Season Management Plan

Amadeus EMP – Dingo Gas Field
Wet Season Management Plan 2024

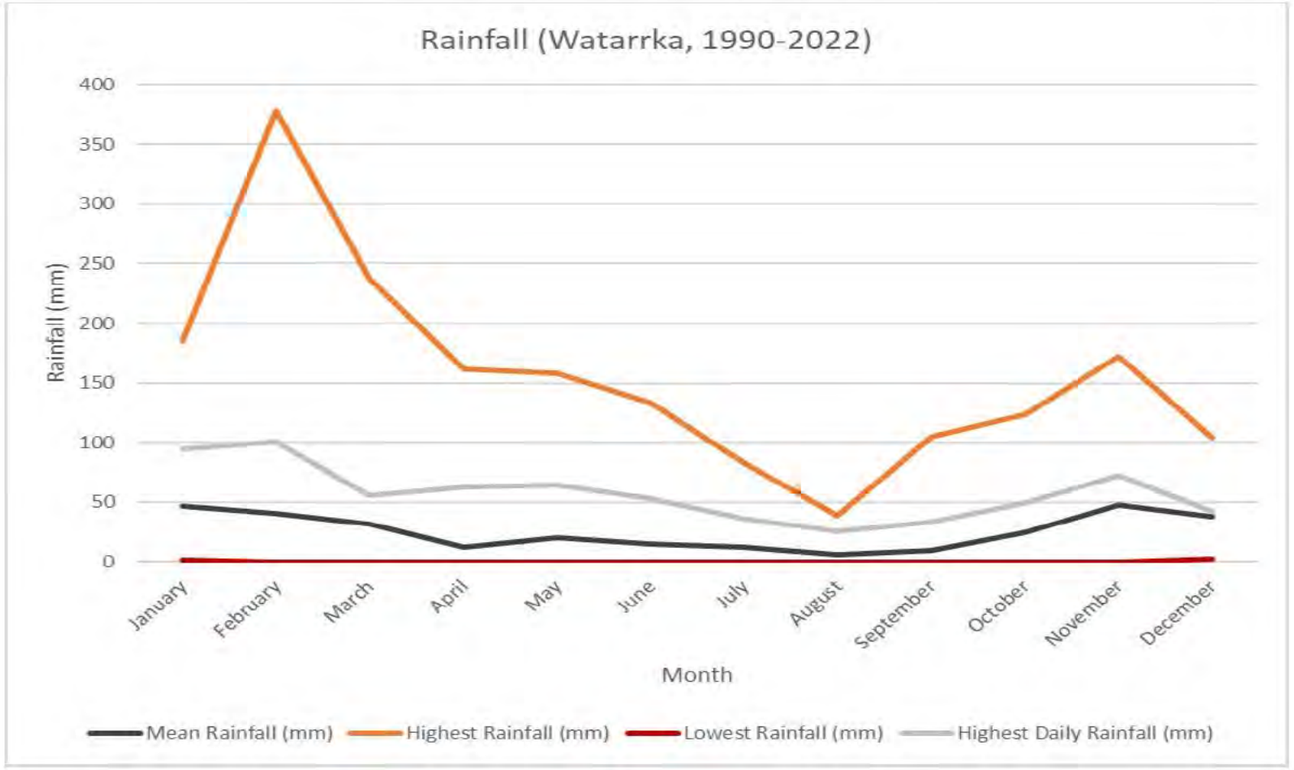
	Owner	Implementation
Position	Risk and HSE Manager	Production Supervisor Ned Garland / Brett Manual

Location of Field	
Property Land Users	DVF operates the field under L7 production license.
Site Description	The DGF was developed in 2014 to supply gas to the Power and Water Corporation of the Northern Territory (NT) via the Dingo Gas Pipeline (PL30). Two out of the four wells drilled are currently operational.

Wet Management Plan	
Purpose	To respond to the risks associated with wet weather on daily operations.
Objectives	Ensure that all 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	• 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.

Wet Season Monitoring			
Monitoring	Information Location/Action	Frequency	Record(s)
Weather forecast	http://www.bom.gov.au/nt/	Daily	Daily production report
Road conditions	https://roadreport.nt.gov.au/home	After significant rainfall event	Daily production report
Internal roads and access tracks	Visual monitoring for erosion	After significant rainfall event	Daily production report



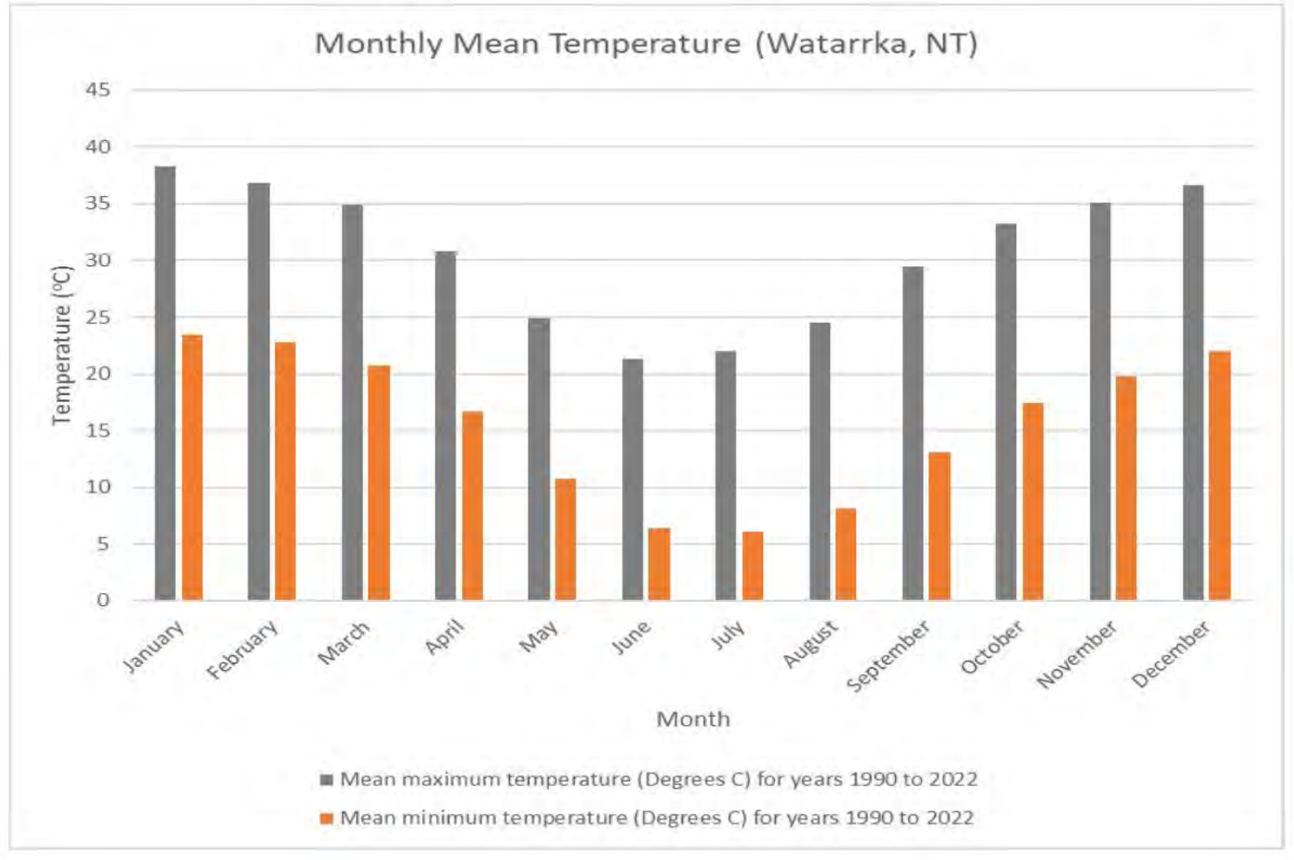


Table 71: Erosion and Sediment Control Plan

Amadeus EMP – Dingo Gas Field
Erosion and Sedimentation Control Plan 2024

	Owner	Field Implementation
ESCP	Risk and HSE Manager	Production Supervisor Ned Garland / Brett Manual
Developed by	Low Ecological Services, on behalf of CP	Bill Low – SQP based on 44 years' experience assessing NT ecology and landforms and development of numerous ESC Plans

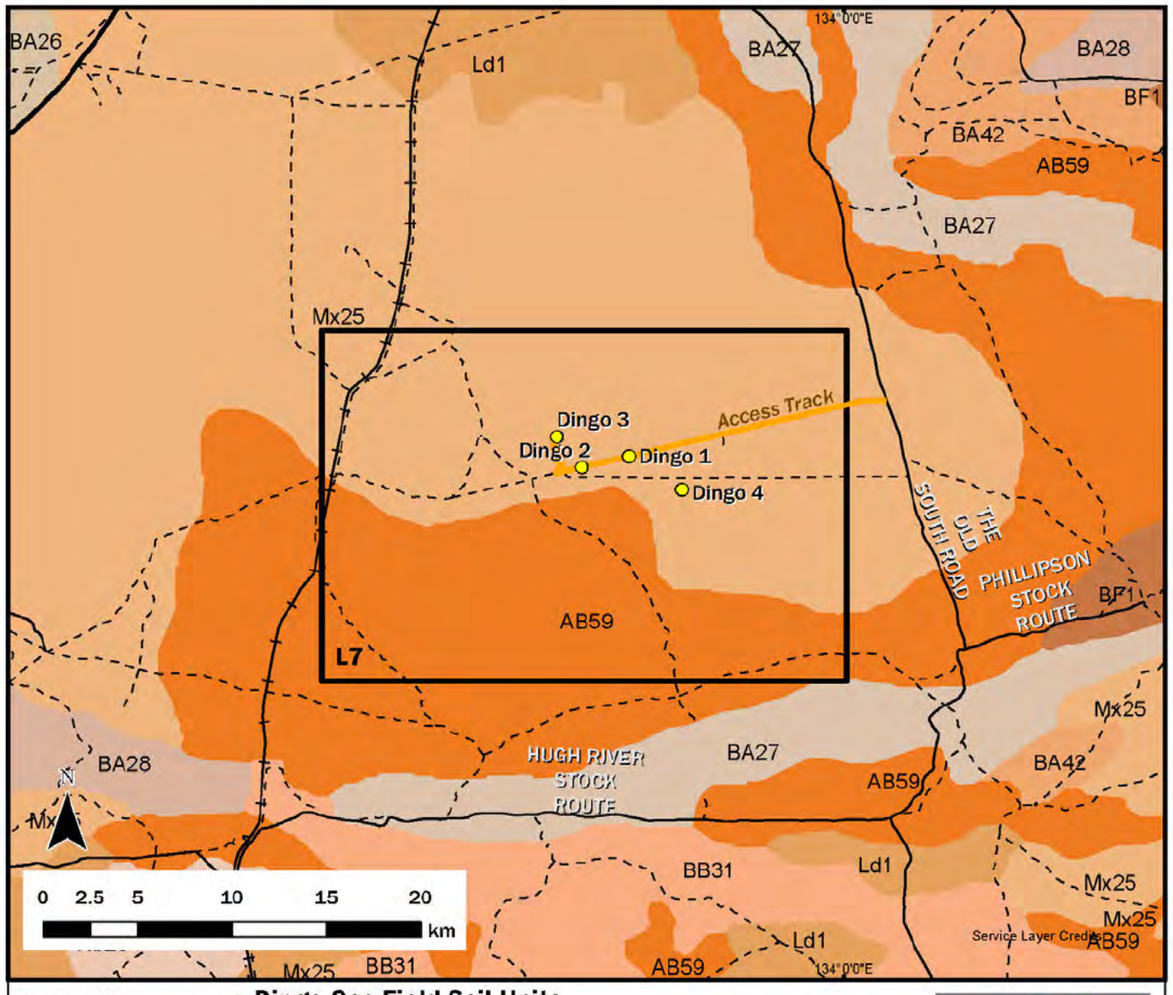
Location of Field	
Property land uses	CP operates the following field: • Dingo Gas Field (L7)
Objectives	To minimise land and water impacts in relation to well activities by preventing erosion and controlling sediment discharge.

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.	
Well pad and operational area maintenance/ upgrade	• 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
Land and vegetation management	• 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.

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 event	• 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)	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		

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* *Developed by: Bill Low – SQP based on 44 years' experience assessing NT ecology and landforms and development of numerous ESC Plans*		

Land Systems					
Land System	Description	Geology	Topography	Soils	Erosion Hazard
Ewaninga	Level to undulating sandplains with red sands	Geomorphologically variable complex of : • Low sandstone ranges • Weathered tablelands • Rounded metamorphic hills, giving rise to undulating plains and low hills with extensive sand plains and sand dunes and flood outs	• Lies over the Amadeus Basin and small parts of the Pedirka and Eromanga Basins. • Contains sedimentary rocks of Devonian and Cambrian age	Deep red sands & loamy limestone soils	Moderate
Simpson	Desert Dunefields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes			Red dune sand	Moderate
Sonder	Rugged ranges on quartzile, sandstone and conglomerate			Shallow, stony, undifferentiated soil	Moderate

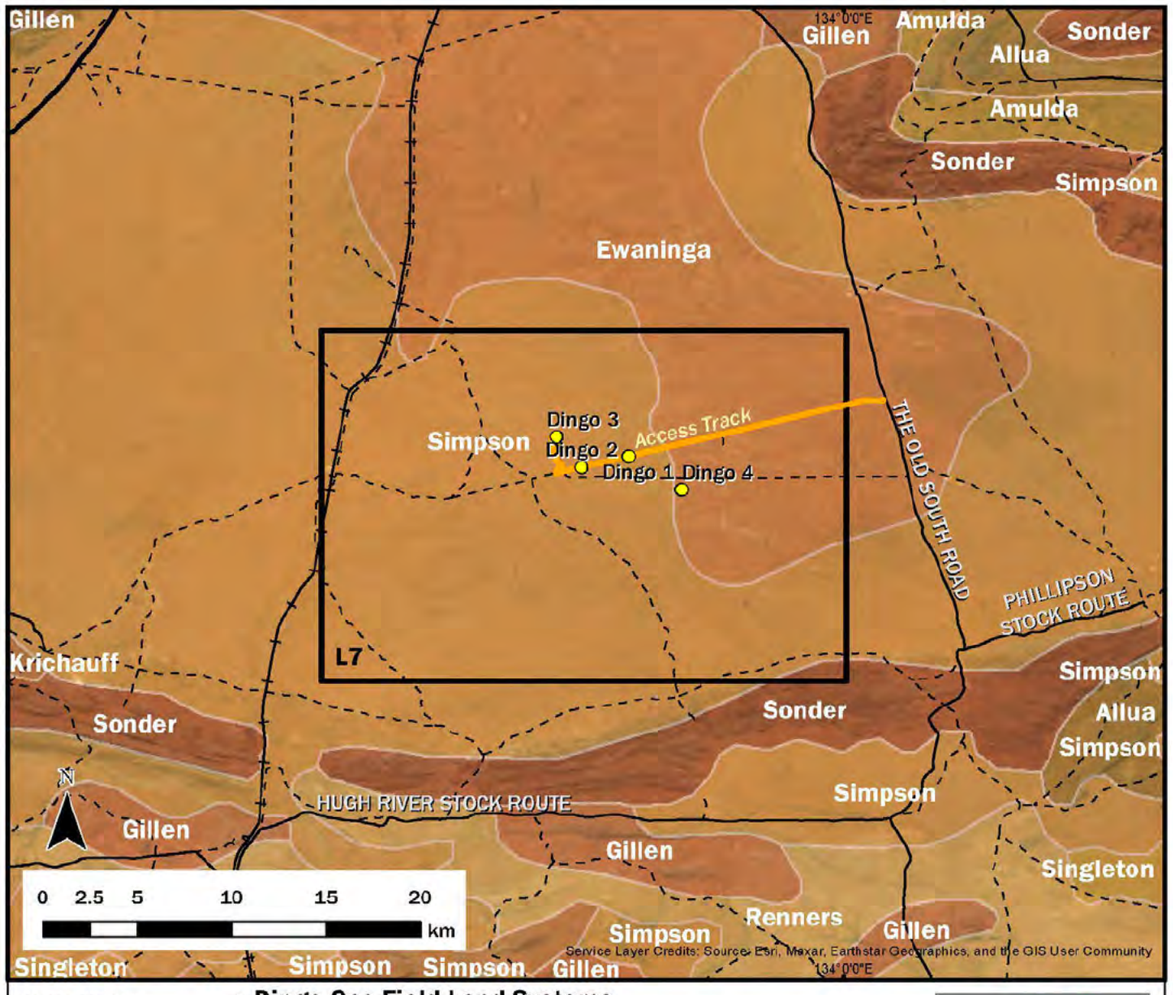


ID: 0622-002 Rev:
Date: 29/06/2023

Digital Atlas of Australian Soils - 1991

Dingo Gas Field Soil Units

- Wells
- Track
- CTP Access Track
- L7 permit
- Railways
- Minor Road
- Principal Road



ID: 0622-003 Rev:
Date: 29/06/2023

Land Systems - Department of Environment and Natural Resources

Dingo Gas Field Land Systems

- Wells
- Track
- CTP Access Track
- L7 permit
- Railways
- Minor Road
- Principal Road

Land System
- Allua
- Amulda
- Angas
- Chandlers
- Ewaninga
- Gillen
- Krichauff
- Renners
- Simpson
- Singleton
- Sonder

Table 72: Weed Management Plan

Amadeus EMP – Dingo Gas Field
Weed Management Plan 2024

	Contact Details	Name
Weeds Officer	EcOz Environmental Consultants on behalf of CP	Tom Reilly

Location of the Field	
Property land uses	DGF operates under L7 production license.
Site Description (pre-disturbance)	The DGF was developed in 2014 to supply gas to the Power and Water Corporation of the Northern Territory (NT) via the Dingo Gas Pipeline (PL30). Two out of the four wells drilled are currently operational.

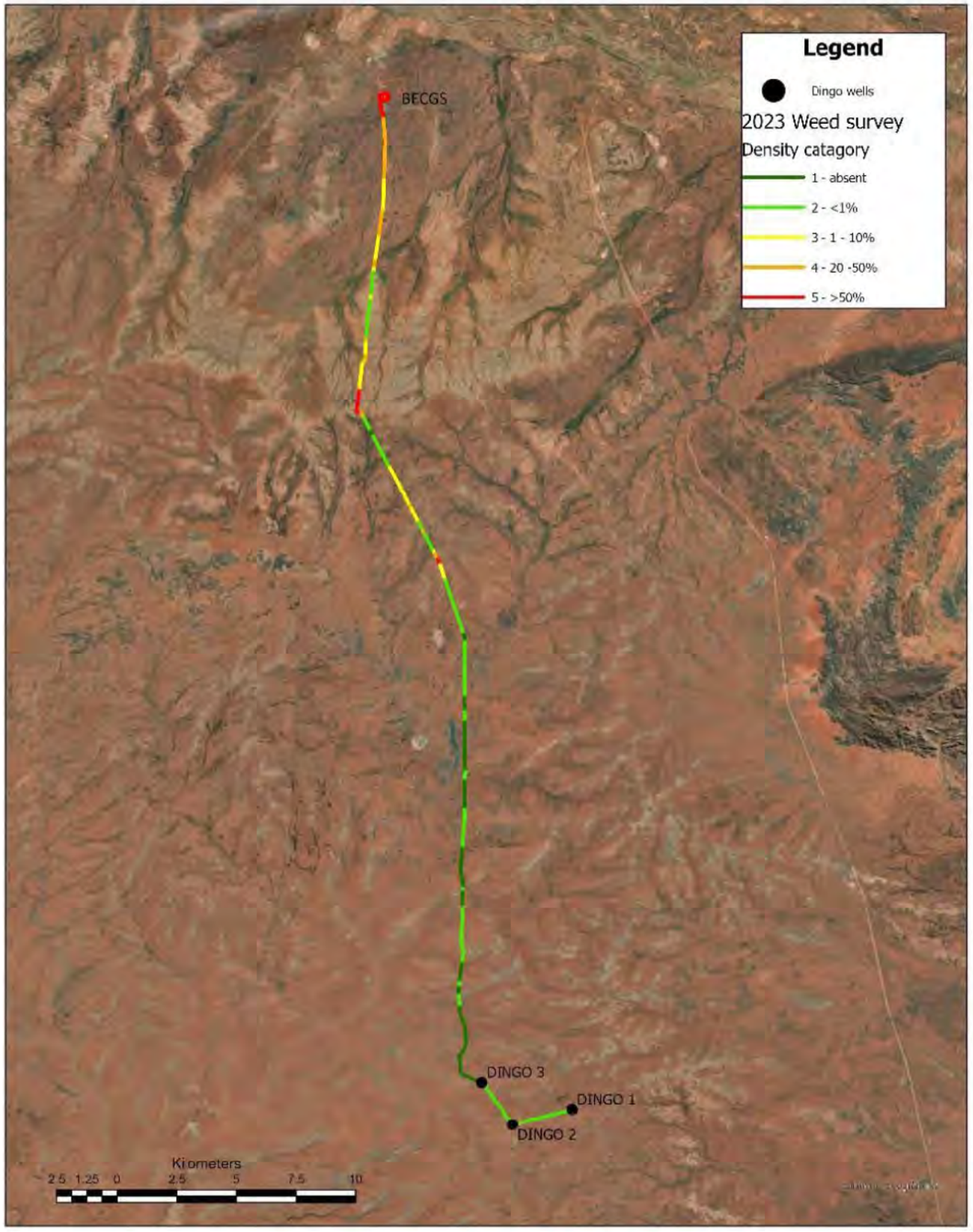
Weeds Management Plan	
Purpose	To prevent and control new and existing weed species within the operating licence areas.
Objectives	To prevent weeds through the following process steps: 1. Identification 2. Prevention 3. Control 4. Disposal
Frequency	Annual

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 seismic survey 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 are 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 Declared Weeds 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	• Use 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.

Notification, Recording and Reporting			
Process Step	Objective	Actions	Frequency
Weed Identification	Weed species and area of infestation is identified and monitored	• Weed surveys undertaken annually by dedicated weeds 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 Weeds 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 Weeds Officer	Ongoing as part of activities
Weed Control	Existing weeds are controlled using effective methods Reduce the density and distribution of weeds on site Chemical control of weeds when plants are actively growing 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 Weeds Officer to be more aware of the spread or containment of existing weeds and the effectiveness of weed control • Ensure target weeds growing seasons are noted and chemical treatment is undertaken when most effective. • Recording of weed control events and information	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 burnt in a burn pit or removed from site (e.g. via waste bins) • It is illegal to transport declared weeds. If declared weeds enter the site, these should be burnt and then buried on site at a depth sufficient to prevent emergence of seeds or seedlings • Chemical containers disposed of correctly	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 Weed Species			
Common Name	Scientific Name	Image	Treatment timing / Description / Control
Buffel grass	*Cenchrus ciliaris*		• November—December • 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. • Apply the principals of the Commonwealth (EPBC Act) buffel grass abatement plan (refer to guiding principles within the plan in Appendix 7). • Foliar spray with Glyphosate (360g/L) Roundup Bioactive® or other aquatic-sensitive Glyphosate product. At least two treatments within a growing season • Residual herbicide: Foliar spraying with Flupropanate at an application rate of 1000L/ha or 1L/10m².
Kapok bush	*Aerva javanica*		• December - May • Bushy, perennial plant to 1.5 m. • Greyish appearance due to covering of short white hairs. Fluffy flowers form at the end of stems in up-right pikes. • Kapok will flower throughout most of the year. Hand removal can be difficult due to a long tap root. • MSF600 - 5g per 10L of water and add 10ml Spraywetter per 10L. MSF600 is low cost but is not grass friendly and has a slow kill time. • GrassMate – 30ml/10L water plus 10ml Spraywetter per 10L • A mix of 33ml Rainbow & Brown 2,4-D 720 Amine and 25ml Dicamba 500 SL per 10L of water plus 10ml Spraywetter per 10L • Glyphosate 540 - 133ml/10L + MSF600 1.5G/10L plus 10ml Spraywetter.
Paddy Melon	*Cucumis myriocarpus*		• September - November • Common and relatively widespread in Australia • Mainly a weed of disturbed sites, roadsides and agricultural areas (i.e. pastures and crops), but is also widespread in rangelands and natural communities (e.g. grasslands and open woodlands). • Physical/manual control • Foliar spray : Garlon + An□evap spray adjuvant 1% or mixture of triclopyr, 2,4-D and metsulfuron • Paddy melons have hairy and waxy leaf surfaces that are hard to wet and penetrate when applying herbicide
Pitted Love Grass	*Eragrostis barrelieri*		• May - November • Flat bright green leaves to 30 cm x 4 mm, spreading to erect. Sheaths bearded. • Grows in moist areas beside watercourses and in gullies. Full sun, semi shade. • Foliar spray Glyphosate (360 g/L) 100mL/10L water Spot spray only Apply to actively growing plants
Caltrop	*Tribulus terrestris*		• May - November • Caltrop is a prostrate annual herb with stems spreading out for up to 2 metres from a woody taproot. • Leaves consist of 4 to 8 pairs of opposite oblong leaflets. The upper surface is dark green, while the lower surface is covered with hairs, • Flowers are small, 8–15mm in diameter and bright yellow with 5 petals, usually lasting only one day. • Hand-pulling Caltrop is effective if the infested area is not too large. • Foliar spray Glyphosate (360 g/L) 100mL/10L water Spot spray only Apply to actively growing plants • The timing of spray applications is critical to ensure that the majority of the weeds have been sprayed before seed set occurs.



Low Ecological Services

For more information contact:
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Phone: (08) 89555 222
Web: lwww.lowecol.com.au
lowecol@lowecol.com.au

Map projection: Universal Transverse Mercator (UTM)
Map Grid of Australia (MGA) Zone 52
Horizontal Datum: GDA 1994, Vertical Datum: AHD (m)

N

CTP Dingo
Weed Survey
2023

Table 73: Bushfire Management Plan

Amadeus EMP –Dingo Gas Field
Bushfire Management Plan 2024

Location of Field	
Property land uses	DVF operates the field under L7 production license
NT Fire Management Zone	Alice Springs
NT Fire Protection Zone	L7 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

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 • The control of a bushfire rests with the Rural Fire Brigade until the fire reaches 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 • If requested, CP will assist nearby communities in installing firebreaks annually, as an alternative to contributing to firefighting capacity regionally
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

	Position	Name
Bushfire Officer	Production Supervisor	Ned Garland / Brett Manual

Stakeholders	Contact Details
Emergency	000 or 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

Fire Management Zones	Actions
Low Fuel Zone (10m)	• Remove fire fuel load if bushfire risk is high • Use manual/mechanical removal, burns are not the preferred option
Fire Break Zone (4m)	• Only diesel vehicles to be used • Store chemicals in designated areas • Sufficient fire fighting water is available during projects activities • No open flames or fires outside of designated areas (inclusive of flare pits) • Remove vegetation from bare earth fire break area • Use manual/mechanical removal, burns are not the preferred option
Cleared Access Track	• · Remove vegetation from bare earth tracks • · Maintain 4m exclusion zone

Bushfire Management	
Plan	
Map Critical Functions	• Review emergency management structure • Contact and collaborate with neighbours
Identify Threats	• Identify local site conditions and fuel loads • Identify bushfire threats to operations and assets
Assess Risk	• Conduct annual fire mapping • Develop fire fuel load reduction program • Proper storage of flammable chemicals • Vegetation stockpiles are placed at safe distances from potential ignition sources • Update risk assessment
Update Plans	• Update Bushfire Management Plan and Emergency Response Plan
Prepare	
Check Fire Fighting Capability	• Inspect and test critical equipment • Identify staging areas for emergency equipment • Fire fighting equipment located in every vehicle. • Train staff
Reduce Hazard	• Fire fuel load reduction manual/mechanical removal • Controlled burns is not the preferred option • Maintenance of fire breaks and fire access tracks
Test Emergency Plans	• Conduct fire drills • Conduct incident and emergency training with partners
Respond	
Monitor Conditions	• Check NAFI daily
Fire Danger Period	• Permit to burn (including for open flares) required • Check fire danger status daily
Fire Ban Day	• No burns or flaring
Recovery	
Repair and Replace Assets	• Repair and replace damaged assets
Improve Resilience	• Review and improve asset standards for buildings and infrastructure

Seasonal Bushfire Calendar					
Month	Bushfire Risk	**Activities**	Month	Bushfire Risk	**Activities**
Jan	Low	• Map critical functions • Identify threats • Assess risks	Jul	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Feb	Low	• Update plans • Check fire fighting capabilities	Aug	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Mar	Low	• Reduce hazard—start	Sep	Medium	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Apr	Medium	• Reduce hazard—end • Test emergency plans	Oct	Low	• Repair and replace assets
May	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions	Nov	Low	• Repair and replace assets
Jun	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions	Dec	Low	• Improve resilience

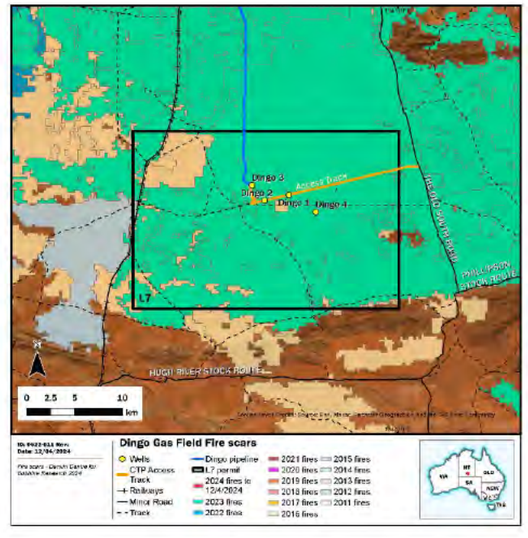


Table 74: Rehabilitation Management Plan

Amadeus EMP – Dingo Gas Field
Rehabilitation Management Plan 2024

CP Rehabilitation Officer	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)
Developed by	EcOz	Tom Reilly

Location of the Field	
Property land uses	Gas production and compression
Climate	In general, L7 experience a semi-arid climate, with 70% of precipitation occurring between October and March, influenced mainly by monsoonal depression systems in northern Australia
Site Description (pre-disturbance)	The L7 area is predominantly located in the three land systems, Ewaninga, Simpson and Sonder. DGF is predominately within the Simpson land system while Dingo 4 and approximately 12 km of access tracks is constructed in the Ewaninga land system.

Rehabilitation Objectives	Actions for Successful Rehabilitation
The objectives of this rehabilitation management plan are to: • Progressively rehabilitate significantly disturbed land which is not required for ongoing activities • Return 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 vegetation condition and land use • Provide an area free of residual contamination • Ensure 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
Climate extremes - 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
Pest animals and lack of existing vegetation - 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
Fire, changed landform, weeds and erosion- 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
Contaminated soil	• Remove, remediate and rehabilitate contaminated areas • Re-spread topsoil evenly across rehabilitated areas

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

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 towards 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 • No declared weed species 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 scarring, 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. • Year 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 • Check for soil inversion issues and map areas of concern • Weed survey	• 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.	• 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

Decommissioning and Rehabilitation Process		
Asset	Specific activities to the asset	General activities across all assts
Well – Sub surface	• Decommissioned in accordance with the principals of the CoP (NTG, 2019) section • B.4.15.1 and specifically the mandatory sections B.4.15.2 and B.4.15.3. • Decommissioning of a well is a regulated activity and this activity will be inan approved Well Operations Management Plan that will be approved by DITT.	• 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.
Well pad, flare pits	• Mixing and aeration of sump materials with clean soil material at a ratio of 1:3 • Backfill pits including removal and disposal ofliner materials • Contouring of capping to encourage surface runoff and minimise water pooling • Where incompatible with on-site mix bury cover, implement wastemanagement process for off-site disposal	
Well lease area, including surface infrastructure (wellhead, separator)	• Full decommissioning and rehabilitation: • Wellhead removed and casing cut per the CoP: Surface cement plug detailed in B.4.15.3: Cement plug requirements and validation methods. • A steel marker plate as per the CoP • Filling of cellar • Removal of hardstand materials for use across field or stockpile for future useacross field • Assessment of NORMs of down well and surface equipment • Progressive decommissioning and rehabilitation • Reduction in well lease area size to a sizing approximately 75m x 75m orequivalent to accommodate future well development activities.	
Flowlines (surface and sub-surface)	• Purge of flowline contents. Method depends on material held in flowline (e.g. nitrogen, biocide charged water) • Removal of surface infrastructure (e.g. pipe and struts) • Scraping, grading/re-contour to local landscape and deep ripping toencourage natural regeneration	
Access Roads and Tracks	• Grading and recontouring in line with adjoining environment where landform permits • Where landform involves extensive cut and fill of rock recontouring will be limited to minimise further erosion or landslip potential • Where landform involves sand dunes, removal of hardstand across dune and re- contouring to blend with existing dune and surrounding landform • Construction of erosion controls • Ripping of compacted soils • Natural regeneration	
Gas processing facilities	• Decommissioning would be covered under a separate Decommissioning Plan at the end of life of the production facility	

Activity	Proposed rehabilitation approach	Timing
Analogue sites1	• Identify appropriate analogue sites for each ofthe disturbance areas prior to decommissioning and rehabilitation for monitoring and measurement of rehabilitation success	• Determined as part of PRCP development • Review at first monitoring event and/or first wet season monitoring
Post decommissioning	• Remove above ground infrastructure • Remove waste materials • Treat weeds prior to soil disturbance • Allow fluids to evaporate from sumps, pits, andwater storage • Backfill and close sumps and pits • Remove temporary fencing	• Commence within 12 months of well decommissioning and prior to significant soil disturbance
Landform reinstatement	• Reduction in well lease area size to a sizing approximately: - 75m x 75m or equivalent to accommodate futurewell development activities; or - 2mx2m to accommodate decommissioned well plate. • Any imported gravel material is removed and returned to the source quarry or utilised elsewhere on CP operational sites • Hardstand is deep ripped to relievecompaction, encourage infiltration, and water retention • The site is re-contoured as close as possible to the pre- existing natural landscape • Topsoil is respread evenly over the lease area and lightly scarified to encourage moisture retentionand seed capture • Revegetation, refer below • Review weed status and treat as required, refer below	• Commence within 12 months of well decommissioning2
Land use	Final land use options will be developed in consultation with the landowners and other relevant stakeholders. These may include: • Pre-disturbance land use • Tourism related activities • Conservation (reserve or park) • Grazing or horticultural activities	• Commence within 12 months of well decommissioning
Soil Stability	• Remove any flow concentration points that mayblock 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 finallayer where possible • Deep ripping and contouring of access roads andwell leases to as close to natural landform as possible • Ensure all cleared areas have a rough surface to aidin water, seed, and litter catchment • Erosion and sedimentation devices installed and • maintained in accordance with site specific ESC Plan, including temporary and permanent measures	• Commence within 12 months of well decommissioning
Contaminated soil	• Site Contamination - Preliminary site investigation - Undertake remediation of contaminated soil to ensure rehabilitated area is non-polluting and in accordance with the CP Emergency Response Plan	• Remediation of contamination to be undertaken prior to decommissioning.
Revegetation / Natural regeneration	• Revegetation of decommissioned wells to a 2m x 2m lease size • Revegetation of existing active well leases to a maximum of 75m x 75m • Revegetation of closed lease area access tracks, where suitable • Spread of stockpiled vegetation across reinstatedareas to promote natural regeneration, act as erosion control and provide habitat • Reliance on natural regeneration fromsurrounding environment seedbank • Direct broadscale re-seeding, using local seed collection, where natural regeneration success islow	• Lease - commence within 12 months of decommissioning • All other areas – at completion of infrastructure / area decommissioning
Maintenance	• Weed management via chemical and physical treatment, based on field specific Weed Management Plan prior to rehabilitation activities commencing • Follow-up assessment of weeds via regular surveys and treatment as needed	• As required following monitoring and inspection program

Table 75: Wastewater Management Plan

Amadeus EMP – Dingo Gas Field
Wastewater Management Plan 2024

	Contact Details	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

Location of Field	
Property land uses	DGF operates the field under L7 production license
Site Description	The DGF was developed in 2014 to supply gas to the Power and Water Corporation of the Northern Territory (NT) via the Dingo Gas Pipeline (PL30). Two out of the four wells drilled are currently operational.

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. Recycle – recover resources from a waste 4. Treat: bring wastewater back into use through treatment to improve water quality or to make quality suitable for disposal 5. Dispose

Wastewater Sources				
Activity	Type	Quantity	Target Quality	Management Method
Workover fluid (Groundwater mixed with KCl and biocide)	Workover Fluid	0.063 ML/yr	• pH: 6-10.5 • KCl: 2-5% • Biocide: 0.02% • Conductivity: 8-30 mS/cm	During workover program: • Store onsite in tanks • Re-use After workover program: • Dispose in offsite facility
Production	Formation water	NA	NA	Transferred to BECGS facility for treatment.

Wastewater Risks	
Key Risks	Controls
Spill or leak from the use, transportation, treatment, handling and storage of formation water, fluids and wastewater	• Store liquid wastes in a secured container within a bunded area • 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	• 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

Wastewater Monitoring Program and Records				
Type	Requirements	Frequency	Parameters	Records
Workover formation water	• Measure quantity (estimate based on actual workover data) • Measure quality	• Every time wastewater is treated and used • Prior to disposal	• Volume	• Wastewater volumes for re-injection • Wastewater volumes generated during workovers If wastewater to be transported and disposed of offsite • Wastewater volume spilled

Table 76: Spill Management Plan

Amadeus EMP – Dingo Gas Field
Spill Management Plan 2024

	Position	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

ill Risks	
Key Risks	Controls
Contamination of groundwater	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface and infiltrate to the ground, migrating to shallow, perched aquifers, springs or waterholes. This may affect groundwater quality
Contamination of surface waters	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface and migrate to surface waters and affect surface water quality and ecological values of the habitat
Contamination of soil	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface. Smaller spills and leaks are likely to be retained in the soil and not migrate to groundwater or surface waters.

Chemicals Storage and Used

Product Name	Hazardous Material	Dangerous Good	Typical Quantity	Container Size / Type	Storage Location
Anti-corrosives	Yes	Yes	200L	5 – 20 L / Package	BECGS
Adhesives/glues	Yes	No	500L	5 – 20 L / Package	
Acetone	Yes	Yes	100L	5 – 20 L / Package	
Thinners	Yes	Yes	200L	5 – 20 L / Package	
Acetylene	Yes	Yes	100L	5 – 20 L / Package	
Bestolife 2000	Yes	Yes	100L	5 – 20 L / Package	
Truck wash	Yes	Yes	100L	5 – 20 L / Package	
Priming fluids	Yes	Yes	200L	5 – 20 L / Package	
Diesel	Yes	Yes	500L	200L / drum	
Pipe cement	Yes	Yes	100L	5 – 20 L / Package	
Coregas	Yes	Yes	100kg	25 kg / Tank	
Degreaser	Yes	Yes	100L	5 – 20 L / Package	
Paint	Yes	Yes	100L	5 – 20 L / Package	
Soaps	No	No	50L	5 – 20 L / Package	
Sealant	No	No	200L	5 – 20 L / Package	
Herbicide	Yes	No	200L	5 – 20 L / Package	
Coolant	Yes	No	100L	5 – 20 L / Package	
Engine oil	No	No	20L–1,000L	5 – 20 L / Package	
Compressor oil	No	No	100L	5 – 20 L / Package	
Hydraulic oil	No	No	100L	5 – 20 L / Package	
Grease	No	No	100L	5 – 20 L / Package	
Nitrogen	Yes	Yes	100kg	25 kg / Tank	
Oxygen	Yes	Yes	100kg	25 kg / Tank	
Propane	Yes	Yes	50kg	25 kg / Tank	
Methanol/ethylene glycol	Yes	Yes	6,000L	5 – 20 L / Package	
Helium	Yes	Yes	100kg	25 kg / Tank	

Location of Field	
Property land uses	CP operates the DGF under L7
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

Spill Scenarios and Management

Activity	Activity Duration	Mechanism	Location	Type	Key Management Control
Chemical storage	Operations/ Workover	• 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 • Workover chemicals • Workover fluids	• Daily visual checks of the chemical storage area • Secondary containment / bunding • Spill kits available • Minimise quantity of chemicals at well site
Handling / mixing of chemicals	Workover	• 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 • Workover chemicals • Workover fluids	• 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 absorbent mats used • Spill kits available
Truck and / or rig refuelling	Workover	• Incorrect refuelling set-up • Poor refuelling practices	• Rig fuel tanks	• General use chemicals (e.g. oil, diesel, hydraulic oils degreasers, pesticides) as per SDS • Workover chemicals	• 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 absorbent mats used • Spill kits available
Chemical transportation to / from location outside of L7	Workover	• Coupling, hosing and pipe failures	• Chemical loading area • Pipework	• General use chemicals (e.g. oil, diesel, hydraulic oils degreasers) as per SDS • Workover chemicals • Workover fluids	• Transport hazardous material within the NT by a licensed NT EPA contractor • Well lease compacted • Spill kits available
Storage of workover fluid in tanks on the well lease	Workover	• Container rupture • Lids / taps not fitted correctly	• Workover fluid tanks	• Workover fluids	• Daily visual checks during activities • Spill kits available • Compacted well lease
Transfer of produced formation water from the wellhead to evaporation ponds by truck	Workover	• Coupling, hosing and pipe failures	• Truck	• Produced formation water	• Operator monitor transfer from tank to truck • Spill kits available • Compacted well lease

Definition of Environmental Harm under the NT *Petroleum Act 1984*

Increasing Severity of Impact

Environmental Harm	• Means: (a)Any harm to or adverse effect on the environment, or (b) 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: (a) 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 (a) that is not trivial or negligible in nature; (b) consists of an environmental nuisance of a high impact or on a wide scale; (c) 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 (d) 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: (a) is irreversible or otherwise of a high impact or on a wide scale; (b) 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; (c) 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 (d) results in actual or potential loss or damage to the value of more than $50 000.

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

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

Types of Incidents	

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

Definition 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 77: Methane Emissions Management Plan

Amadeus EMP – Dingo Gas Field
Methane Emissions Management Plan 2024

	Position	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

Location of Field	
Property land uses	DGF operates the field under L7 production license.
Site Description	The DGF was developed in 2014 to supply gas to the Power and Water Corporation of the Northern Territory (NT) via the Dingo Gas Pipeline (PL30). Two out of the four wells drilled are currently operational.

Methane Management Plan	
Purpose	To monitor and reduce fugitive methane emissions from operational activities.
Objectives	To reduce fugitive methane emissions through effective detection and management practices across operations activities.

Leak Monitoring	
Inspection Frequency	Leak Detection Instruments

• 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 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: annually
  ◦ Low pressure pipelines and fittings: annually
  ◦ Plant including compressors: annually
• 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
	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

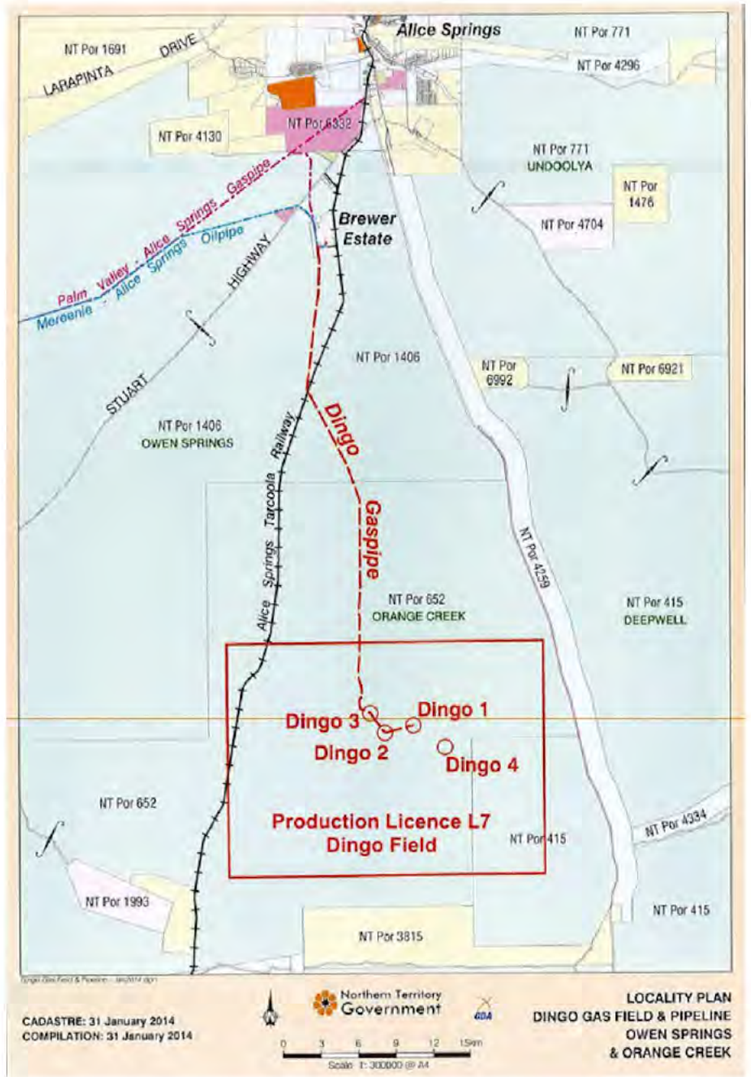
Leak detection is undertaken in accordance with the USEPA Method 21. The procedure is as follows:

- 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 DGF:
  - 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 operations 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 during workovers and well operations
	  ◦ Leak detection implemented consistent with the Code of Practice.
	  ◦ Ongoing well maintenance as per the Well Operations Management Plan.
		• During workovers, 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 operations. 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.

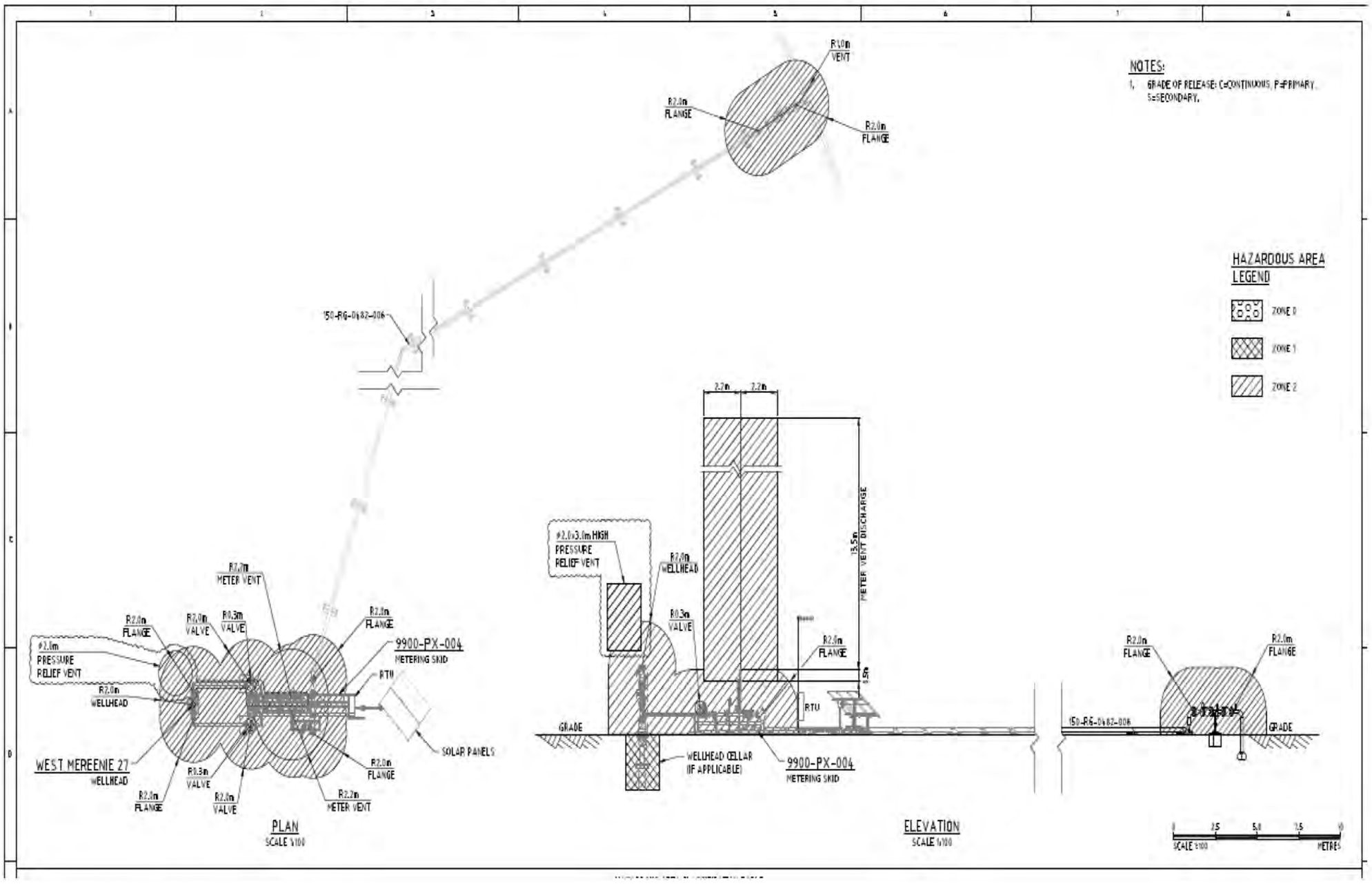
Fugitive methane emissions during operations leading to health and safety hazard including adverse environmental impacts	• All assets to be managed in accordance with the following to mitigate and response to fugitive emissions and leaks:
	  ◦ Permit to work procedure
	  ◦ Asset maintenance system
	  ◦ 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)

Examples of hazardous areas for operator leak detection

Well



Part C. SOF

C.4 Description of Activity

C.4.1 Introduction

SOF is located near the Western Australian boarder approximately 80km south east of the remote [redacted]. At the 2016 census, [redacted] had a population of 410. A total of two petroleum wells have been drilled at SOF. Both the Surprise 1 (S-1) re-entry H ST1 and Johnstone West-1 (JW-1) wells are shut-in but only S-1 was producing oil, into a small tank farm located on the site.

Additionally, an exploration well Mamlambo-1 (M-1) has been planned. All petroleum wells, regardless of status at the field, are included within this EMP (Table 78).

The SOF is in care and maintenance mode. Safe and ongoing maintenance of facilities and suspension of the petroleum wells at SOF is facilitated via the following infrastructure:

- Existing private access road constructed and maintained by the Operator
- Permanent wellhead facilities for producing and suspending wells

Table 78: Overview of Surprise Wells

Well	Coordinates (GDA94)	Cleared Area (m^2)	Well Status	Additional Information
S-1	23° 42' 50.758" S 129° 59' 36.091" E	55,716	Shut-in	Producing well. Total area inside fence, includes camp etc
JW-1	23° 39' 21.861" S 129° 56' 39.124" E	5,625	Shut-in	Non-producing well

C.4.2 Well operations

Petroleum well operations at each field include the following activities:

- Maintenance of surface well barriers
- Integrity testing of surface well barriers
- Integrity testing of subsurface well barriers
- Annular pressure monitoring
- Visual inspection and general well surveillance

C.4.3 Gathering and boosting systems

Wellhead equipment, safety systems and gathering lines works allow the well to be connected to the existing in-field gathering line for processing before transfer to market.

At SOF, a small tank farm is located within the lease pad. The production process involved pumping fluid to surface where it was separated into its oil, water and gas components before storage and trucking of the oil.

C.4.4 Support activities

C.4.4.1 Services

Table 79 outlines the services that support the conduct of all activities at SOF.

Table 79: Services at SOF

Activity	Description
Workforce and facilities	There is no permanent workforce at SOF. Operations personnel based in PVGF visit to monitor oil field integrity.
Laydown areas	Cleared areas, including former well pads, used to house materials, temporary camps or machinery
Power generation	There is a power generator on-site which is operated only when staff are at site
Water supply	Water is supplied by bore at SOF

Activity	Description
Waste services	SOF is in care and maintenance mode. Any solid waste generated during short site visits is taken back to the PVGF base.
Wet weather operations	SOF is in care and maintenance mode
Naturally Occurring Radioactive Materials	▪ The Operator's radiation licence (permit number 1902650L) has been surrendered and a new licenced applied for. ▪ Previous surveys have indicated that site emits an extremely low level radiation hazard ▪ All works are conducted in accordance with the Operator's safe work standards including a NORMS (Radiation) Management Plan alongside a Job Hazard Analysis ▪ Materials with the potential for NORMS exposure from operational activities are tested prior to storage or disposal via an appropriately licensed transporter

C.4.4.2 SOF Formation water

SOF commenced production in March 2014 and produced approximately 87,000 barrels of oil to 30 June 2015. Low oil prices and the remoteness of the field led to the decision to shut-in oil production from August 2015.

Formation water produced during the limited period of petroleum production was evaporated in a lined evaporation pond like the historical design of formation water evaporation ponds used in the other regional CP fields. The SOF has been in a care and maintenance regime since the SOF oil well was “shut-in” (suspended) in August 2015.

C.4.4.3 Wastewater management

The SOF has been in a care and maintenance regime since the SOF oil well was “shut-in” (suspended) in August 2015. No wastewater is presently produced at SOF. However, any wastewater open tank/evaporation treatment system that may be operated at SOF facility will have a minimum design freeboard of 500mm, consistent with all other open water storages in the Operator’s fields, elsewhere in the Amadeus Basin.

Workovers are not currently anticipated at SOF however, may be undertaken in future. In this event, workover fluids are likely to be the only wastewater produced during workovers at existing well sites. DITT requires the Operator to ensure enough workover fluid and a weighting agent at the well site is available to “kill” the well in the event of an emergency/loss of containment during workovers.

The Operator will use water purchased from off-site providers for use in workover fluid, along with a small amount of biodegradable biocide and potassium chloride (KCl). Workover fluid will not be mixed with any oil or BTEX based additives.

If the workover fluid is not required at a particular well site, the unused water will be used at another well site in the mud tank or disposed of as regulated waste. The anticipated total volume of workover fluid required is approximately 0.063ML per workover.

While undertaking air/mist workovers at a well site, retrieved debris/fill/materials will be discharged into the flare pit/tank (via the blooie line) at the well site. Once flaring commences any small volumes of liquid within the flare pit/tank is vaporised. Discharged materials can be removed and disposed or recycled at an approved facility.

The results of PVGF formation water evaporite analysis (see Figure 13) is similar to that presented in the Mereenie Field EMP. Given that SOF is also located in the Amadeus Basin, it is most unlikely that formation water evaporite analysis will vary significantly from the findings in this analysis.

C.5 Existing environment

A description of the physical, natural, and socio-economic environs of the respective fields is provided in the following sections. The Operator has used a combination of desktop and baseline results to develop a description of the current environment. If the Operator becomes aware of any additional information not contained in the EMP in relation to the existing environment that may influence the results of the risk assessment and mitigation measures outlined in this EMP, it will undertake a review of the EMP.

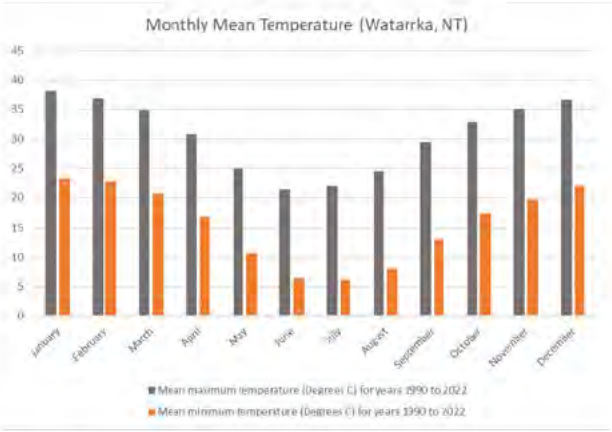
C.5.1 Physical Environment

C.5.1.1 Climate

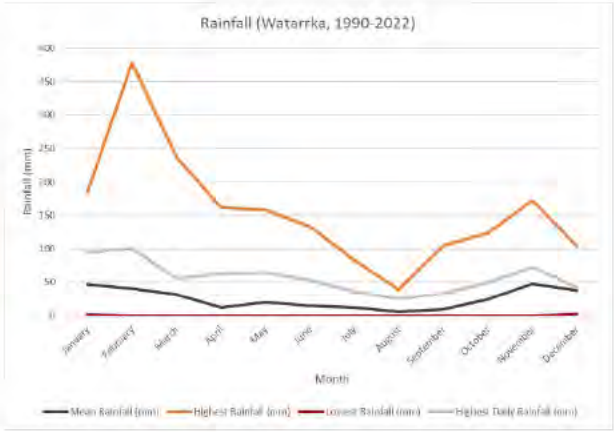
A summary of the climate statistics for SOF is attached in Table 80

Table 80: Climate statistics for SOF

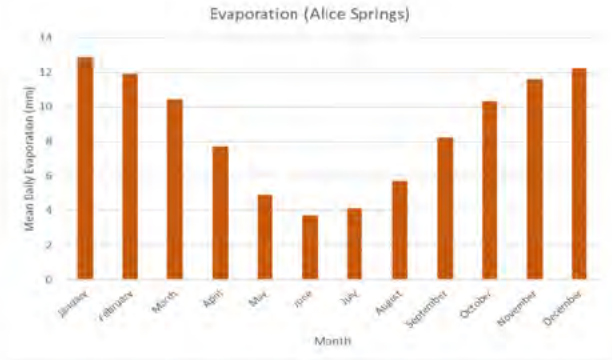
Climate Statistic	SOF
Annual total average rainfall (P)	268 ± 145 mm
1 in 1000 (0.1%) year AEP_90-day cumulative rainfall	600mm
Annual total average evaporation (E)	2960mm
Precipitation/Evaporation (P/E)	0.10
$10\%_{ile}$ evaporation_90 days	340mm
Average daily max temperature	32.8^{O}C
Number years daily observations	20 years



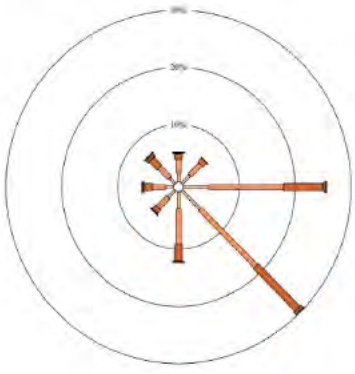
Average temperatures



Average rainfall



Average evaporation rates



Prevailing wind conditions

(Source: BOM, 2022)

C.5.1.2 Geology, Soils, and Land Systems

C.5.1.2.1 Geology

The SOF (Table 81) is located in the north-west of the Amadeus Basin. The lease area straddles the northern edge of the basin over a north-south anticlinal feature. The surface geomorphology at SOF is defined by the sand dune system of the Great Sandy Desert. The surface geology is characterised by Quaternary dune sands, clay pans, gypsum and calcrete which form local scale aquifers. Combined, they reached a thickness of 70m when drilling the Surprise 1 well. Beds of sandstone at the lower Stairway Sandstone, at a depth of approximately 2,500m BGL form the zone of interest and the oil reservoir of the SOF. The unit is comprised of 100% sandstone which is fine grained with good porosity.

C.5.1.3 Regional Soils

Three soil types occur in L6. All developments at SOF are in the AB56 soil type described in Table 82. This soil presents a low to moderate erosion risk given the topology of the area.

C.5.1.4 Land Systems

Three land systems occur within L6 with all development occurring primarily in the Simpson land system described in Table 83. The Simpson land system is characterised by long parallel sand dunes that run orthogonal to prevailing winds from the south-east; fringing dune fields; extensive sandplains; dry watercourses; and saltpans. The arid dune fields and sandplains support sparse shrubland and spinifex hummock grassland *(Triodia basedowii)*, with cane grass (*Zygochloa paradoxa*) on deep sands along dune crests. The swales of claypans and stony plains support a sparse shrubland of acacias, and desert oak woodlands fringe the creeks and flood outs.

C.5.1.5 Surface Water

There are limited mapped steams either within or adjacent to the SOF. None of the SOF infrastructure is located within 5km of a mapped stream. As noted, the SOF is situated on a north-south anticline; characterised by dunal system of the Simpson Desert. Topographic mapping in the area reflects this topology and indicates that SOF, including the Johnstone West airstrip, is located across the highest elevations of the dune system in this region. The topographic mapping is validated by the measured elevations, relative to AHD, for each of the SOF well pads as shown in the topographic map below (Figure 20). Consequently, the risk of flooding at SOF is considered remote.

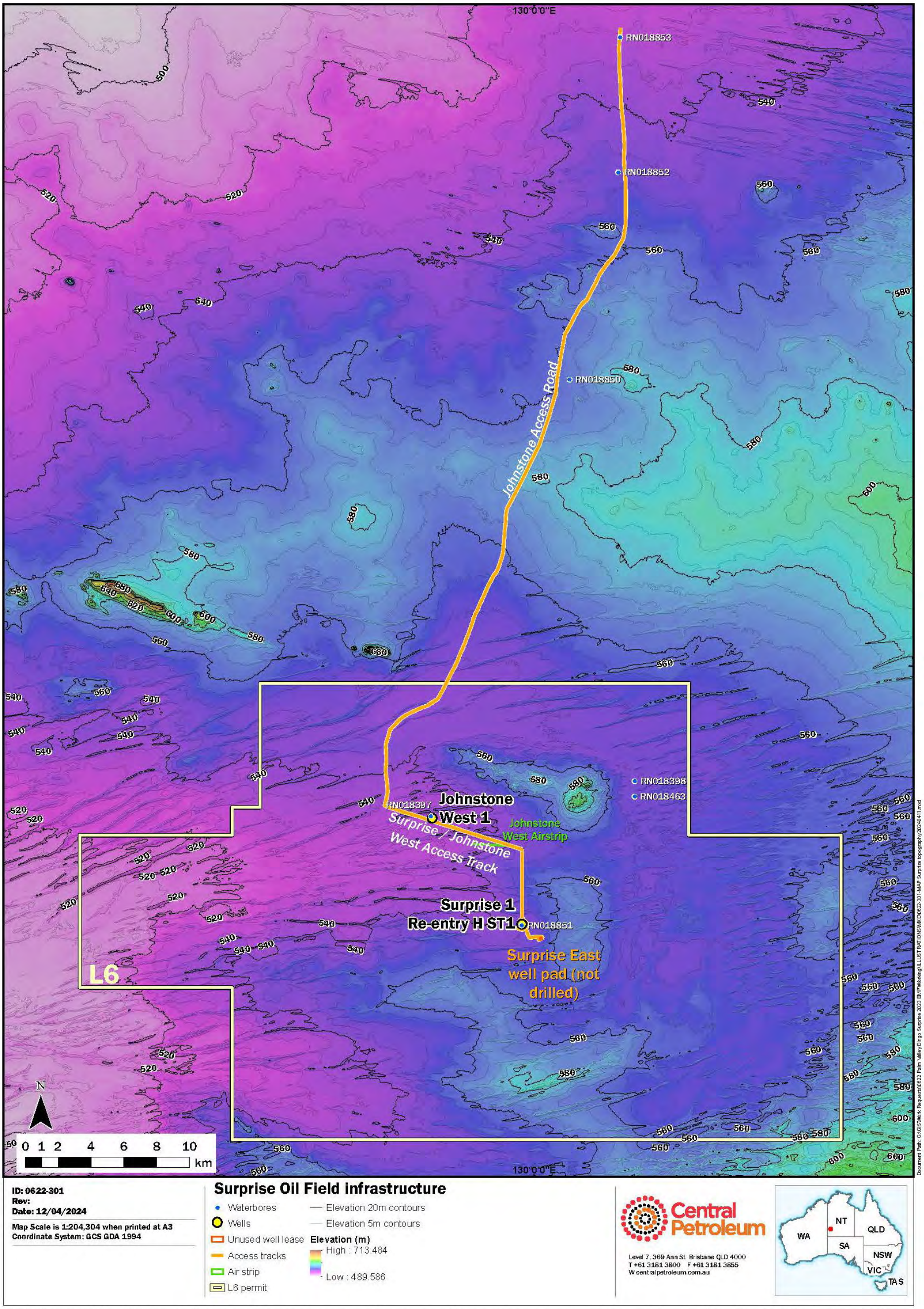


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Figure 20: Topographic map of well pads and infrastructure on the SOF domal anticline

Table 81: Geological units SOF

Extent	Map Unit	Description of Lithology	Extent in SOF	Map Unit	Description of Lithology
4%	Qa	Alluvial flats and scree slopes	<1%	Cop	Sandstone
3%	Qc	Calcrete, minor silcrete	4%	Czf	Talus, pebble, cobble and boulder deposits, locally lithified, often dissected
<1%	Qr	Colluvium and sheet wash plains	3%	Du	Calcareous siltstone, siltstone, sandstone
84%	Qs	Sand sheets and dune fields	<1%	Pzm	White sandstone, large scale cross bedding
<1%	Cpi	Breccia, sandstone, conglomerate, conglomeratic sandstone	<1%	Pbi	Crystalline dolostone, dolomilic limestone, limestone, siltstone, evaporates, stromatolites
<1%	Ccl	Sandstone, pebbly sandstone			

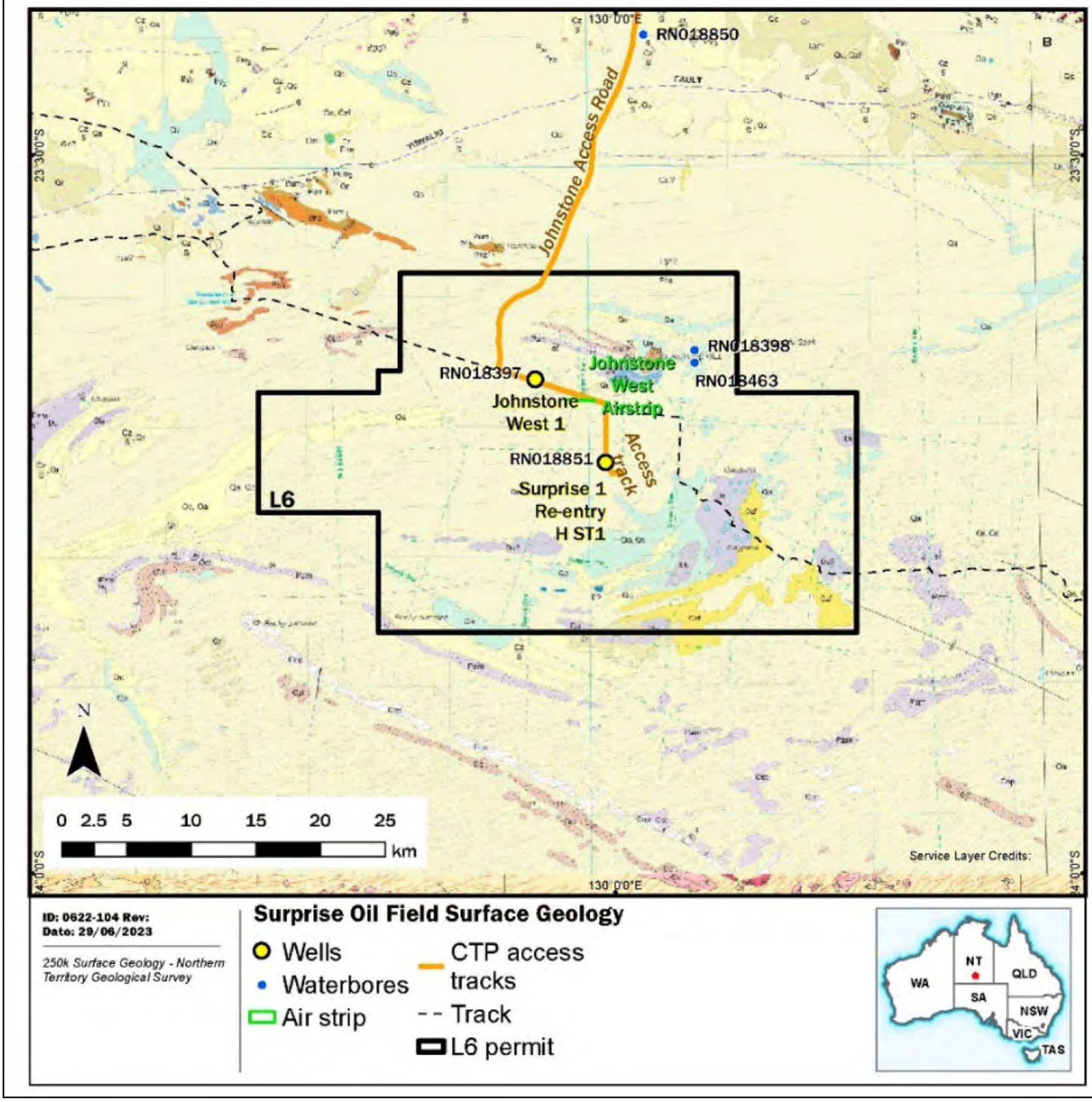


Table 82: Soil types SOF

Extent	Soil Type	Landform	Soils
98%	AB56	Plains covered with longitudinal dunes, some hilly residuals with rock outcrops	Chief soils are red earthy sands on interdune plains and red siliceous sands on dunes
2%	BA27	Bold ranges, ridges, cuestas, and hills on sandstones and quartzites. Extensive areas of bare rock	Chief soils are shallow stony sands
<1%	AB57	Plains with scattered dunes	Chief soils are red earthy sands

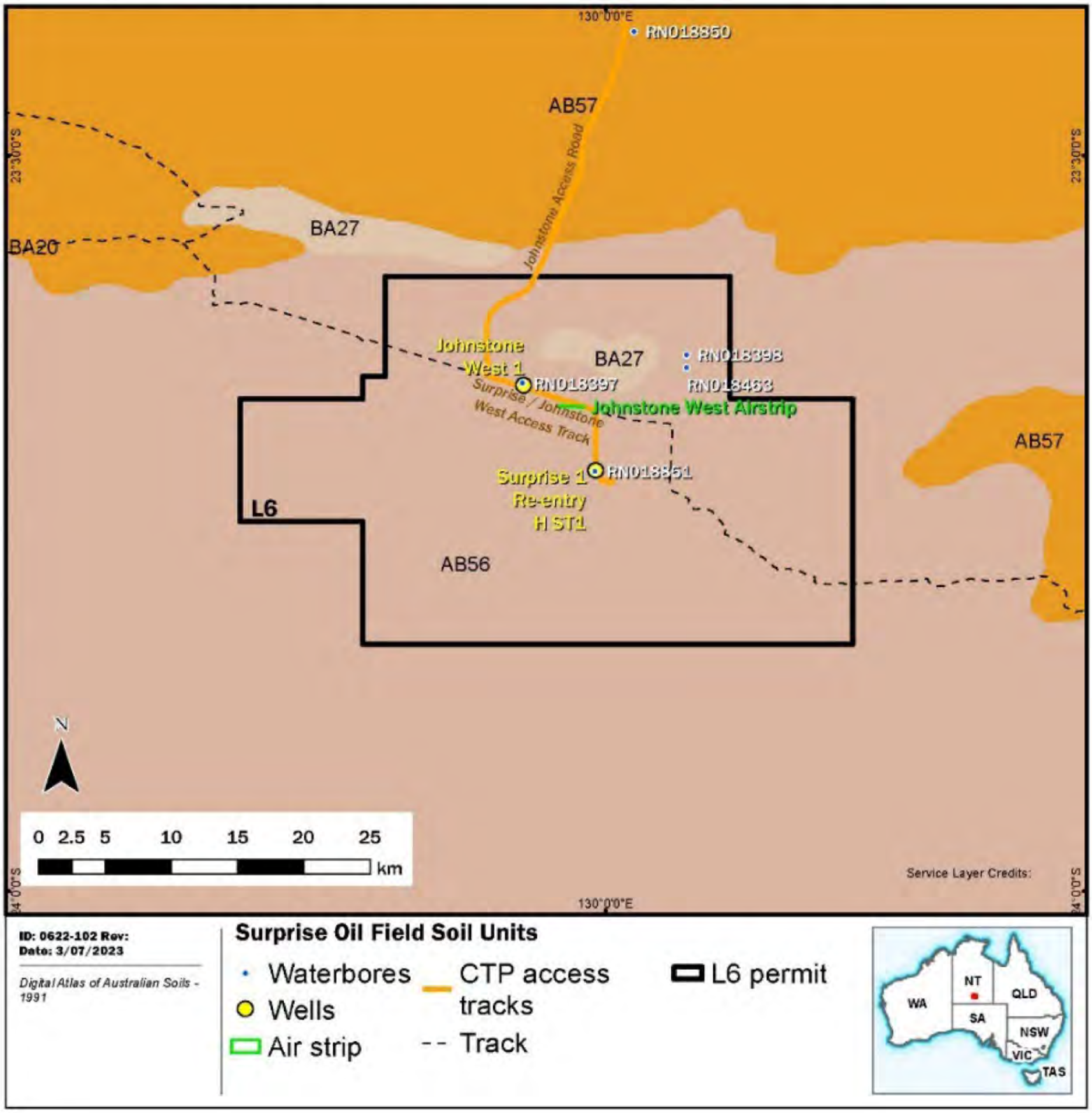
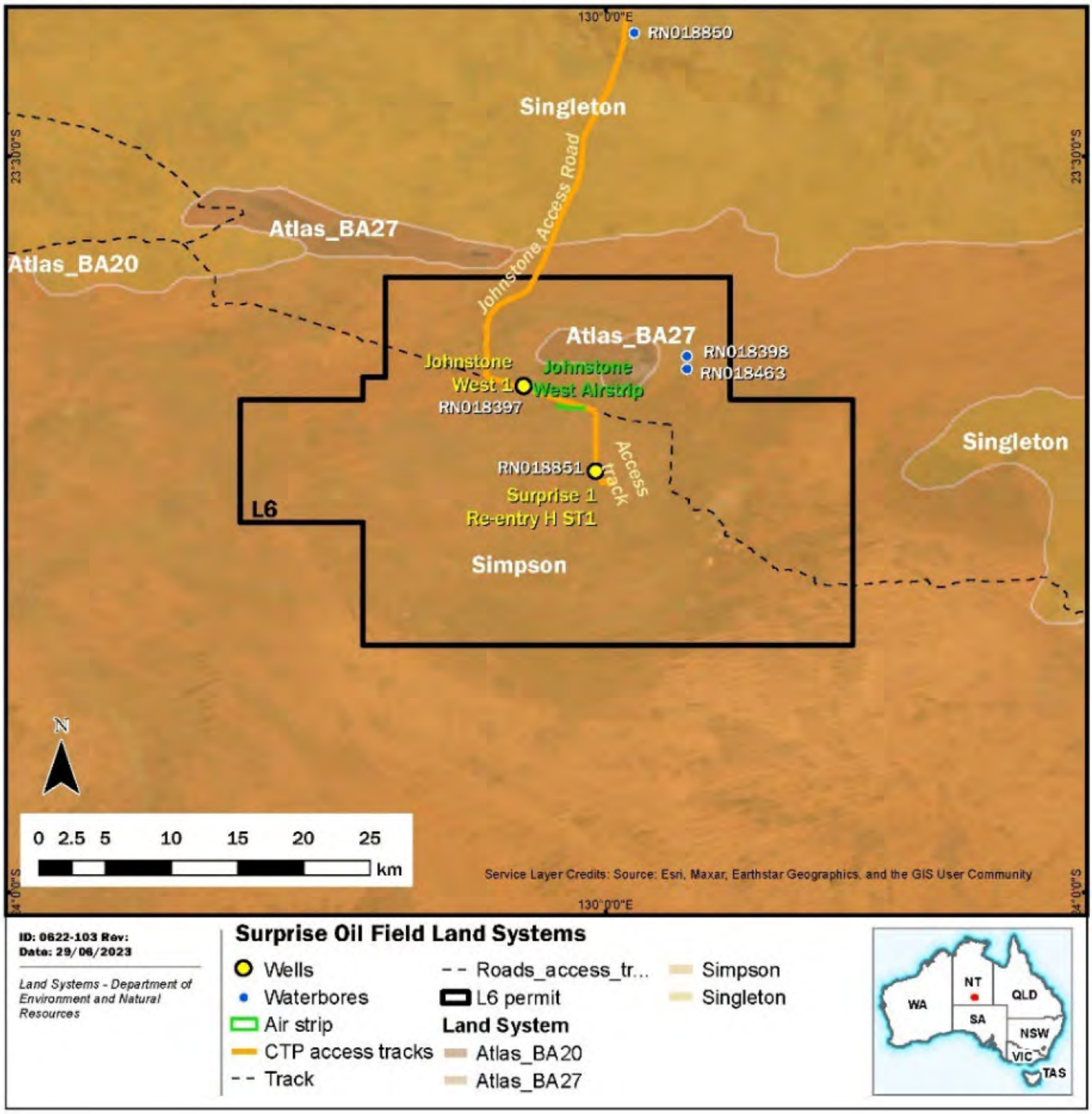


Table 83: Land systems SOF

Extent	Land System	Description	Soils	Erosion Hazard
97%	Simpson	Dune fields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes	Red dune sand	Moderate
3%	Atlas_BA27	Low hills, hills and stony plateaux on sandstone, quartz and conglomerate (deeply weathered in places)	Shallow stony soils	Moderate
<1%	Singleton	Level to undulating sandplains with red sands	Red earthy sands	Moderate



C.5.1.6 Groundwater

L6 straddles the northern edge of the Amadeus Basin, and the SOF is situated over a local north-south anticlinal feature. The surface geology is characterised by Quaternary dune sands running orthogonal to prevailing southeast winds, clay salt pans, gypsum and calcrete which may form local scale aquifers. These deposits may have moderate bore yields (1–5 L/s) with fresh to saline water quality (typically brackish). Where calcrete is present there is a possibility of enhanced bore yields due to cavities.

The recent sedimentary deposits overlie a thick sequence of the Pertnjara Group, Brewer Conglomerate and Hermannsburg Sandstone. Along with the underlying Parkes Siltstone these formations predominantly comprise of claystone, siltstone and shale to form an aquitard unit.

The Mereenie Sandstone is very deep (>1700m BGL) at SOF, and therefore inaccessible by bore. Analysis of the Statement of Bore (*Water Act*, Sec 53) for RN018851 drilled for Central Petroleum in 2012 lithology log reported details of geological strata and standing water level in the borehole Table 84.

The sandstone gravel formation 42m below ground level (BGL) is the target water bearing formation. Standing water level is reported at 16m BGL. Groundwater quality results for the bore are reported in Table 85.

Table 84: RN018851 Water Bore Statement details

From (m)	To (m)	Particulars of strata
0	18	Sand clay
18	36	Limestone
36	42	Clay
42	60	Sandstone gravel
Aquifer: 45m – 47m BGL	Bore screen in this zone	
Standing Water Level = 16m	Yield = 2 L/s	

Table 85: RN018851 Groundwater quality results

Analyte	Unit	SOF
		RN018851
pH		7.9
E.C.	uS/cm	1330
TDS	mg/L	864
Gross alpha	Bq/L	0.41
Gross beta	Bq/L	1.56
Bicarbonate	mg/L	190
Chloride	mg/L	235
Sulphate	mg/L	118
Fluoride	mg/L	1.1
Sodium	mg/L	128
Potassium	mg/L	31
Calcium	mg/L	70
Magnesium	mg/L	38
Iron	mg/L	0.07

Analyte	Unit	SOF
		RN018851
Boron	mg/L	0.5
Selenium	mg/L	0.01
Silica	mg/L	49.3
Strontium	mg/L	0.76
Zinc	mg/L	<LOR
+ other Metals	mg/L	<LOR
Hydrocarbons	ug/L	<LOR
PAHs	ug/L	<LOR
BTEX	ug/L	<LOR

Underlying the Mereenie Sandstone is the Stokes Siltstone and this is considered an aquitard that forms a reservoir seal on top of the underlying Stairway Sandstone petroleum reservoir. Oil production occurs from the Stairway Sandstone at SOF. Table 86 provides a summary of the stratigraphy and recorded groundwater occurrence from the surface down to the Mereenie Sandstone beneath the SOF.

C.5.1.7 Wetlands, springs and aquatic inflow dependent ecosystems

The WOFS provides an indication of surface water presence, with permanence an indication of groundwater discharge. Due to depth to water in the SOF there is limited potential for surface water–groundwater interaction and GDEs. SOF is not located within a Northern Territory Government groundwater management area and does not contain any Nationally Important Wetlands or Key Ecological Features (Marine) according to the EPBC Protected Matters Search Report (PMST).

C.5.1.8 Surface water

There are limited mapped ephemeral streams either within or adjacent to the SOF. None of the SOF infrastructure is located within 5km of a mapped stream (Figure 21). Satellite time series observations show that surface water does not accumulate in SOF.

C.5.2 Natural Environment

C.5.2.1 Bioregions

The SOF is located within the Great Sandy Desert Bioregion which covers an area of 395,250km^2 and is described in Table 87 and is characterised by extensive red sand plains, parallel dune fields that run orthogonal to the prevailing southeast winds, fringing dune fields; extensive sandplains; dry watercourses and saltpans and salt lakes; and remnant rocky outcrops. The arid dune fields and sandplains support sparse shrubland and spinifex hummock grassland, with cane grass on deep sands along dune crests. The swales of claypans and stony plains support a sparse shrubland of acacias, and coolabah woodlands fringe the creeks and flood outs. Vegetation is predominately spinifex grasslands, low woodland and shrubs.

C.5.2.2 Sites of Conservation Significance

The SOF is not located within an identified SOCS (Figure 22).

C.5.2.3 Sites of Botanical Significance

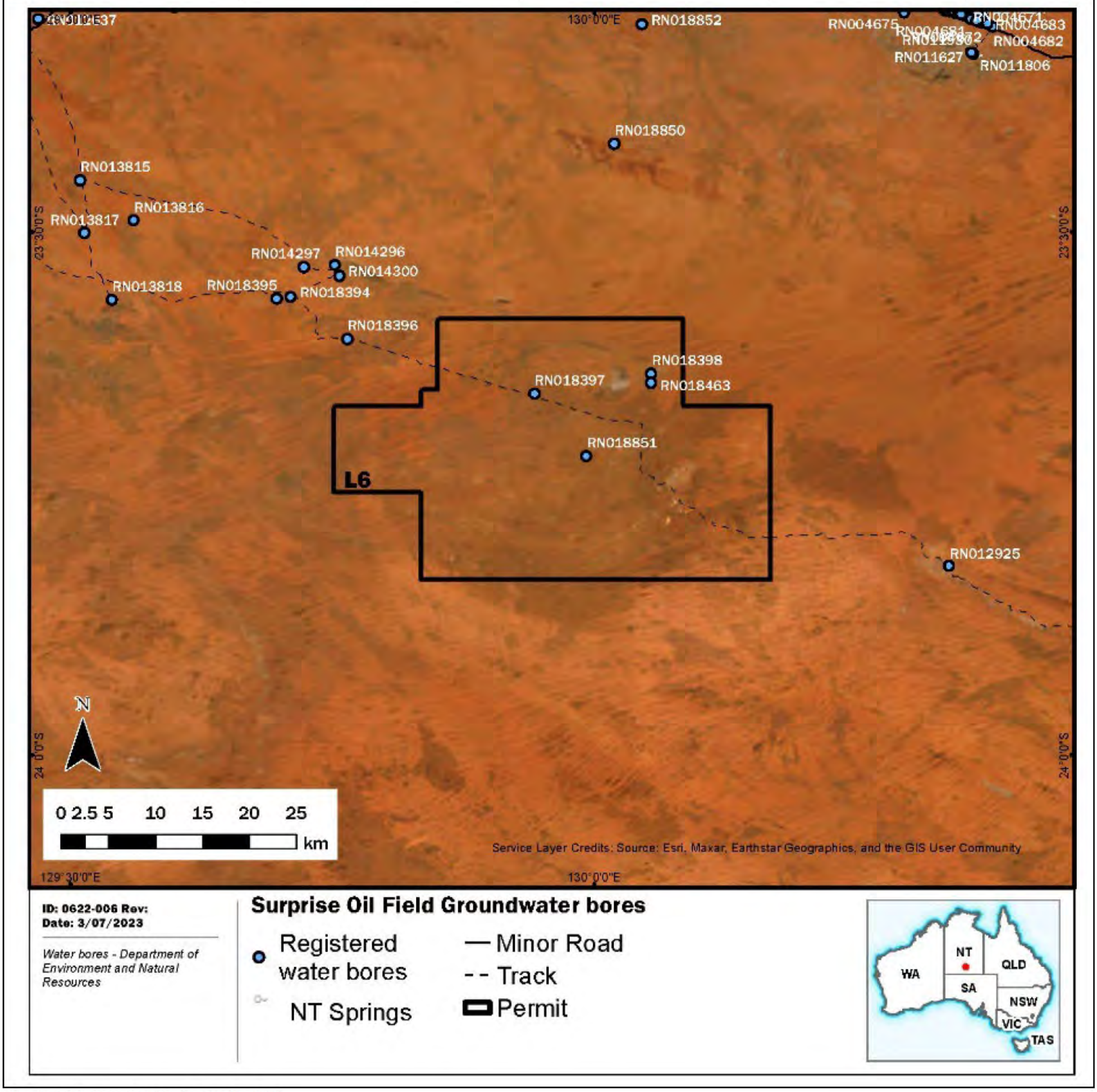
The SOF is not located within a SoBS (Figure 22).

C.5.2.4 Threatened Ecological Communities

There are no listed threatened ecological communities within the SOF operational areas.

Table 86: Stratigraphy and ground water SOF

Formation	Depth[1] (mBGL)	Thickness[2] (m)	Lithology	Groundwater Availability	Water Quality[3]
Quaternary aged sediments	Surficial	70	Dune sands, gypsum, calcrete	Local aquifer	Fresh to saline
Pertnjara Formation	70	710	Sandstone, claystone, predominantly siltstone from 230m	Poor (Aquitard)[3]	Not known
Brewer Conglomerate/ Hermannsburg Sandstone	780	520	Siltstone, claystone, minor sandstone	Poor (Aquitard)[3]	Not known
Parkes Siltstone	1,300	470	Siltstone, minor claystone	Poor (Aquitard)[3]	Not known
Mereenie Sandstone	1,770	510	Porous quartz sandstone	Regional aquifer	Brackish
Stokes Siltstone	2,280	170	Claystone, siltstone	Poor (Aquitard)[3]	Not known
Stairway Sandstone	2,450	> 90 m	Silty sandstone with interbedded siltstone	Oil reservoir	Not known
TOTAL DEPTH	**2,732**				



[1] *Depths and thickness based on Surprise No. 1 well*
[2] *Water quality assessment is made for aquifers under L6 based on bore data and the Mt Rennie Hydrogeological Map*
[3] *Designation of aquitard based on dominant lithology*

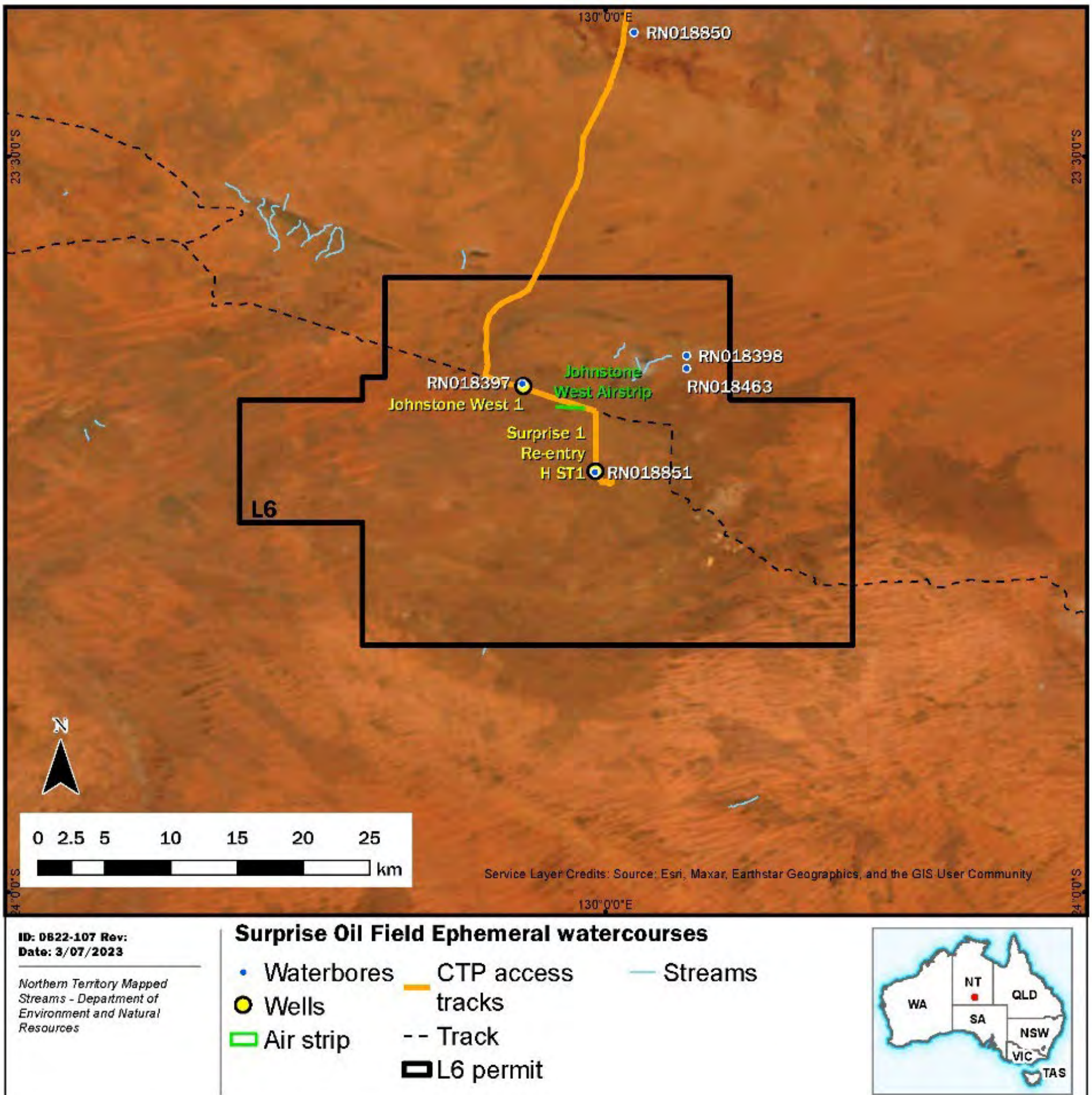
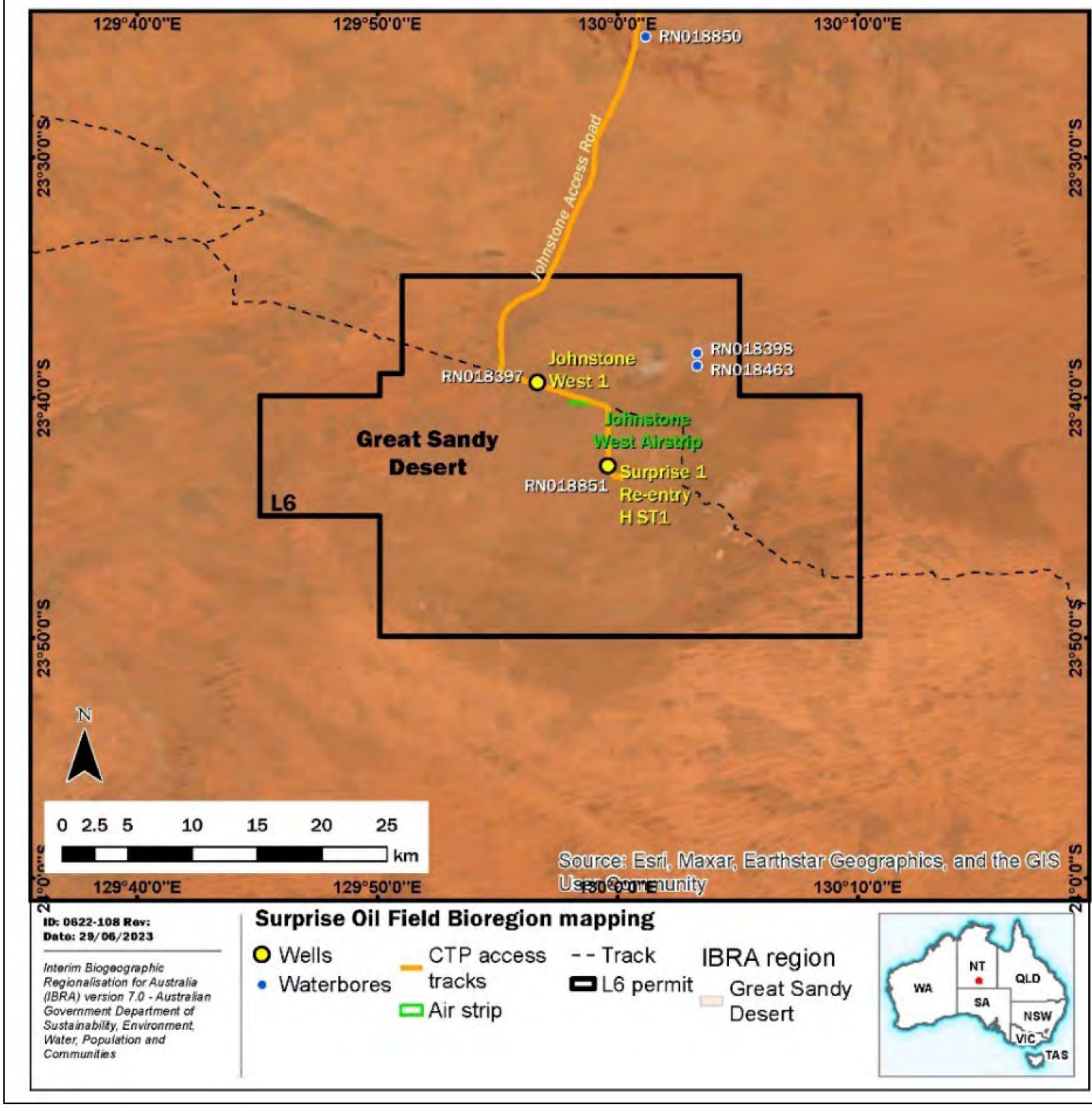


Figure 21: Ephemeral water courses SOF

Table 87: Bioregion SOF

Extent	Bio-region[12]	Topography	Geology	Soils	Vegetation
100%	Great Sandy Desert	Geomorphologically variable complex of low sandstone ranges, weathered tablelands and rounded metamorphic hills, giving rise to undulating plains and low hills with extensive sand plains and sand dunes and flood outs	Lies over the Amadeus Basin and small parts of the Pedirka and Eromanga Basins. Contains sedimentary rocks of Devonian and Cambrian age	Soils are a mix of shallow and deep sands, massive earths, and red duplex saline affected soils.	Dominant vegetation includes hummock grasslands, *Acacia* shrublands and Saltbush / Bluebush open shrublands



[12](Baker, et al., 2005)

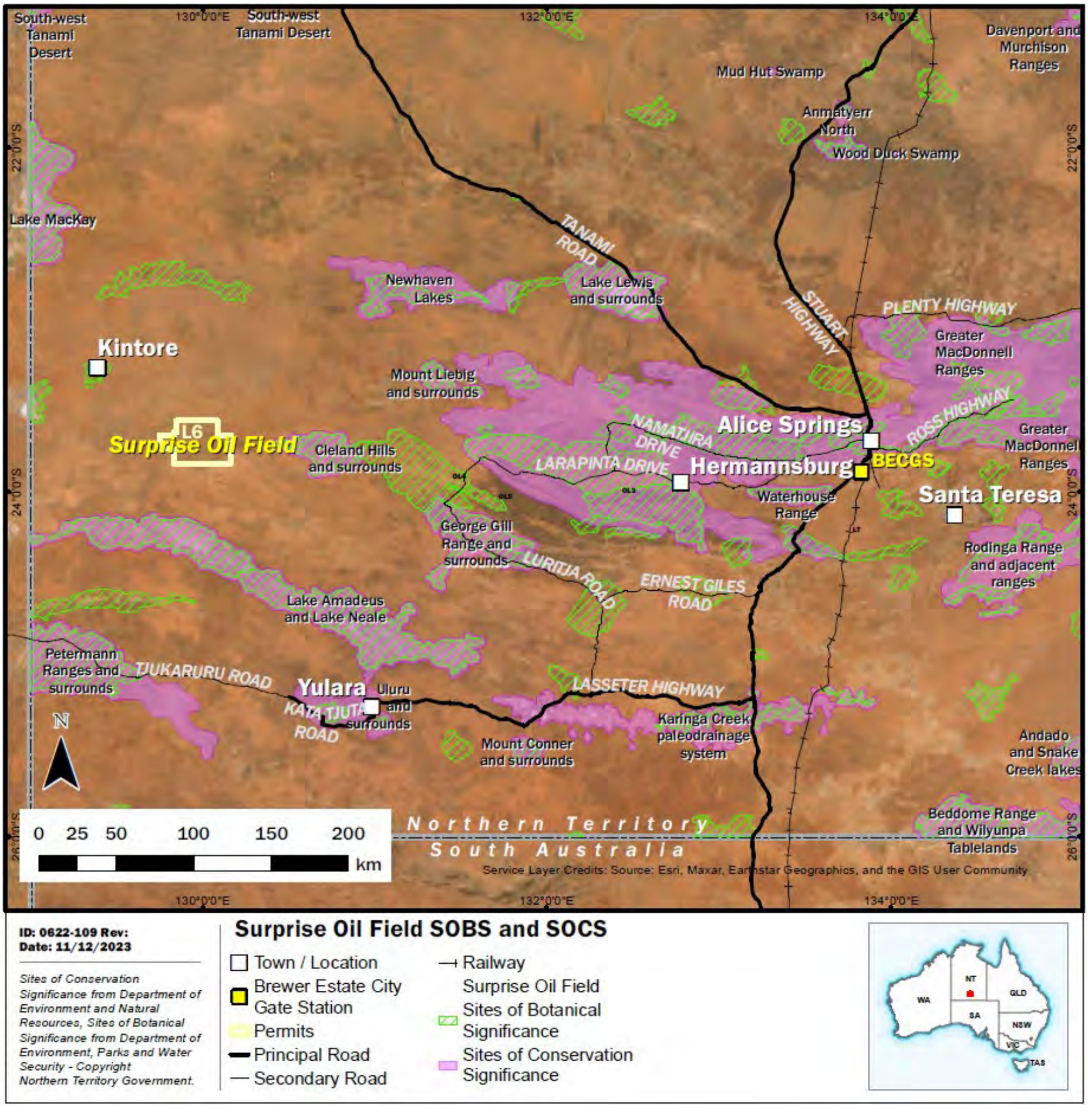


Figure 22: Sites of Botanical and Conservation Significance – SOF

C.5.2.5 Vegetation Communities

Vegetation mapping of the SOF (Table 88) shows the majority of the vegetation is in class 93 with a small area of vegetation class 81 located on the eastern boundary of the lease. All of L7 activities have been conducted within vegetation class 93. Dominated by perennial hummock-forming grasses, typically covering about one-third of the ground surface. All hummock grasses have characteristically spikey leaves and exhibit low (<one m) domed, annular or mat-like growth forms. They are among the most fire-prone desert ecosystems in the world.

The spatial distribution of vegetation and bare patches on the sIopes is the important landscape structural element that causes discontinuity in flow between fine scales and broader scales. Microtopographic effects control vegetation mosaic in this hummock grassland that includes the deep roots of the small trees that develop in the centre of the hummocks. The desert grassland is topographically flat with sandy soils.

The soils have high infiltration characteristics and limited potential for run-off or run-on. On this type of landscape unit, the timing and quantity of rainfall are the important determinants of productivity. The temporal pattern of rainfall determines which group of species responds.

C.5.2.6 Conservation Significant Flora

A flora species is considered in this report to be of conservation significance if it is:

- Listed as Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) under the *Territory Parks and Wildlife Conservation Act* (TWPC Act) and has been recorded in the NT Flora Atlas within a 25km buffer of the OL3 area or has been recorded on field surveys of the area; or
- Listed as CR, EN, VU or Conservation Dependent under the *EPBC* Act and is identified by a Protected Matters Search Tool (PMST) for the area or has been recorded in the NT Flora Atlas within a 25km buffer of the OL3 area; or has been recorded on LES field surveys of the area.

Based on the results of previous field surveys and the PMST report (refer Appendix 2) for the SOF, there are no recorded flora species of conservation significance within the SOF.

C.5.2.7 Conservation Significant Fauna

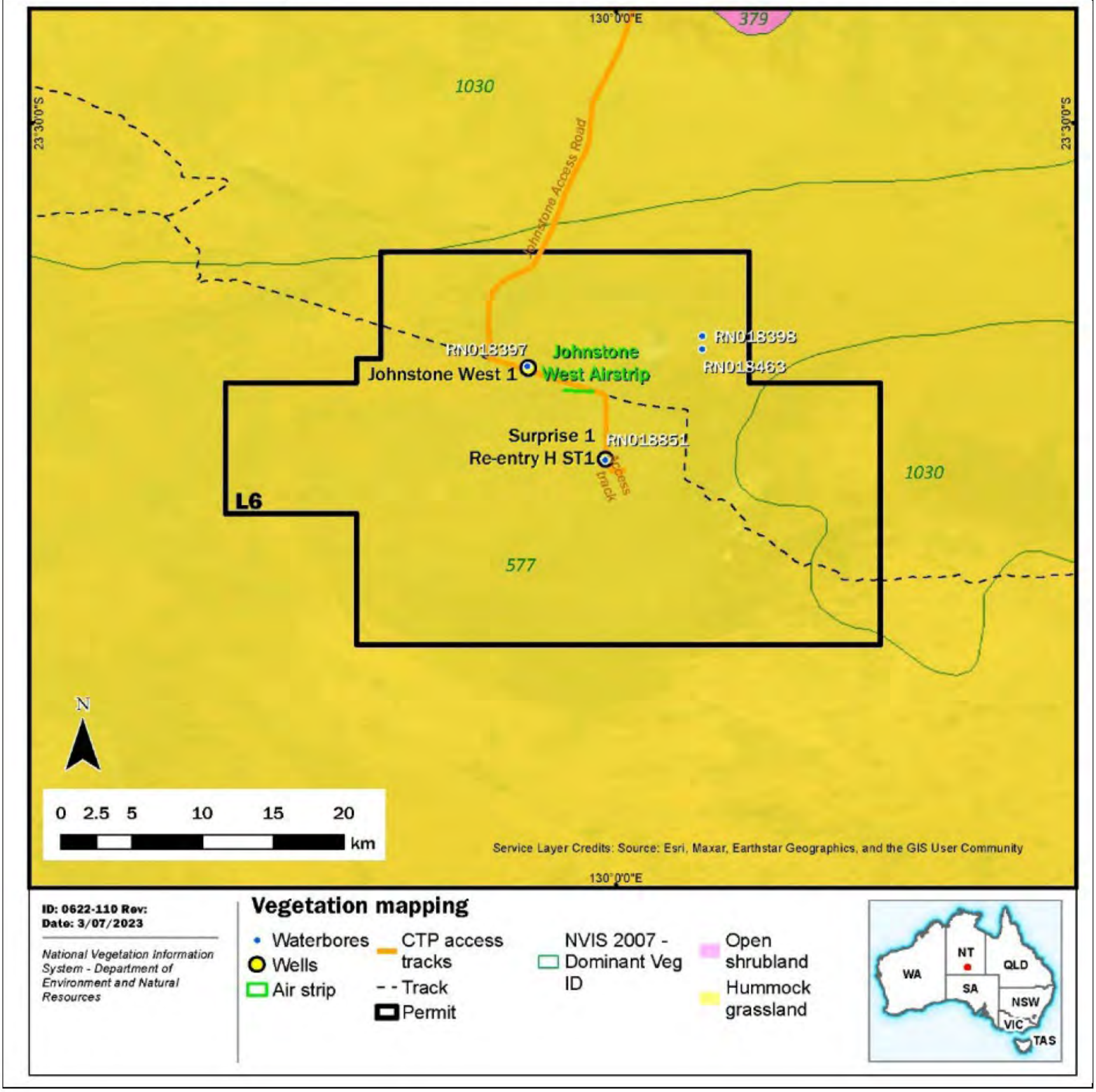
Field surveys have been undertaken of SOF by Low Ecological Services Pty Ltd between 2007 and 2015 and a PMST (dated 5 December 2023). A fauna species is considered in this FEMP to be of conservation significance if it is:

- Listed as Extinct in Wild (EW), Critically Endangered (CE), Endangered (EN), Vulnerable (VU), Near threatened (NT) or Data Deficient (DD) under the TPWC Act and has been either:
    - Recorded in the NT Flora Atlas within a 10km buffer of the respective field; or
    - Recorded during ecological field surveys at respective fields.

Based on the results of desktop searches, ecological field surveys and the PMST report for the SOF, Table 89 provides a summary of fauna species of conservation significance which may be present in the SOF and identifies the likelihood of each species occurring within the SOF.

Table 88: Vegetation SOF

Extent	Broad Vegetation Class4F[13]	Fine Vegetation Class	Fine Vegetation Class Description
89%	Hard Spinifex	9	*Triodia basedowii* hummock grassland with *Allocasuarina decaisneana (*Desert Oak) open woodland over storey between dunes
11%	Hard Spinifex	81	*Triodia basedowii* hummock grassland with *Acacia* tall sparse-shrubland overstorey



[13]Based on (Wilson, Brocklehurst, Clark, & Dickinson, 1991)

Table 89: Threatened fauna SOF

Type	Scientific Name	Common Name	NT Atlas Record[3]	PMST Report	Ecology Survey[5]	TPWC Status[1]	EPBC Status[2]	Habitat in SOF	Likelihood of occurrence in SOF[4]
Bird	*Aphelocephala leucopsis*	Southern Whiteface	No	Yes	No		VU	No	Unlikely
Bird	*Falco hypoleucos*	Grey falcon	Yes	Yes	No	X	X	No	Unlikely
Bird	*Pezoporus occidentalis*	Night Parrot	Yes	Yes	No	CE	EN	No	Unlikely
Bird	*Polytelis alexandrae*	Princess Parrot	Yes	Yes	No	VU	VU	Yes	Potential
Bird	*Apus pacificus*	Fork-tailed Swift	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Motacilla cinerea*	Grey Wagtail	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Motacilla flava*	Yellow Wagtail	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Actitis hypoleucos*	Common Sandpiper	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Calidris acuminata*	Sharp-tailed Sandpiper	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Calidris melanotos*	Pectoral Sandpiper	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Charadrius veredus*	Oriental Plover/Dotterel	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Dromaius novaehollandiae*	Emu	Yes	No	Yes	-	-	Yes	Likely
Bird	*Glareola maldivarum*	Oriental Pratincole	No	Yes	No	-	MIG, MAR	No	Unlikely
Bird	*Ardea alba*	Great Egret, White Egret	No	Yes	No	-	MAR	No	Unlikely
Bird	*Chrysococcyx osculans*	Black-eared Cuckoo	No	Yes	No		MAR	No	Unlikely
Bird	*Merops ornatus*	Rainbow Bee-eater	No	Yes	No	-	MAR	Yes	Potential
Mammal	*Petrogale lateralis MacDonnell Ranges Race*	Black-footed Rock-wallaby	Yes	Yes	No	NT	VU	No	Unlikely
Mammal	*Macroderma gigas*	Ghost Bat	Yes	Yes	No	NT	VU	Nil	Records from pre-1970. Current range restricted to Northern Australia.

Type	Scientific Name	Common Name	NT Atlas Record[3]	PMST Report	Ecology Survey[5]	TPWC Status[1]	EPBC Status[2]	Habitat in SOF	Likelihood of occurrence in SOF[4]
									Will not be considered further.
Mammal	*Macrotis lagotis*	Greater Bilby	Yes	Yes	No	VU	VU	Yes	Potential
Mammal	*Notocytes typhlops*	Southern Marsupial Mole	No	Yes	No	VU	-	Yes	Potential
Mammal	*Liopholis kintorei*	Great Desert Skink	No	Yes	No		VU	Yes	Potential
Mammal	*Lagorchestes hirsutus*	Mala	Yes	No	No	EW	EN	Yes	Unlikely

[1]TPWC Status: ER, Regionally Extinct, CR, Critical Endangered; EN, Endangered; VU, Vulnerable; NT, Near Threatened; DD, Data Deficient; NE, Not Evaluated; LC, Least Concern as listed under the Territory Parks and Wildlife Conservation Act (TPWC).

[2]EPBC Status: EX, Extinct, CR, Critical Endangered; EN, Endangered; VU, Vulnerable; MIG, Migratory; MAR, Marine; WET, Wetland; TER, Terrestrial; (L) MAR, Listed Marine Species as listed under the Environmental Protection and Biodiversity Act (EPBC) using 25km buffer.

[3]Recorded in the NT Fauna Atlas within a 25km buffer of the Larea.

[4]Likelihood of occurrence within L6 determined through consideration of available habitat and existing records within 25km of lease area.

[5]Low Ecological Services SOF 2013 Fauna Survey

C.5.2.8 Introduced flora (weeds)

Previous weed surveys conducted in SOF identified weeds listed in Table 90.

Table 90: Weeds in the environs of respective fields

Scientific Name	Common Name	Priority/ Alert	NT Atlas/ Declared Weed Class	Invasive / WoNS	Survey[1]
Cenchrus ciliaris	Buffel Grass	No	No/ -	Yes/No	Yes

[1]*Detected during annual weeds survey*

C.5.2.9 Introduced fauna (pests)

An introduced fauna species is considered in this FEMP to be of management concern if it is:

- Listed in the NT Fauna Atlas as "Introduced" and has been recorded within a 10km buffer of the DGF or SOF or has been recorded on field surveys of the area; or
- Identified as an invasive species by an EPBC Protected Matters Search Tool report within a 10km buffer of the DGF or SOF or has been recorded on field surveys of the area.

Table 91 lists the introduced fauna species to be of management concern for this FEMP.

Table 91: Introduced fauna (pests)

Scientific Name	Common Name	NT Atlas	PMST	Survey[1]
Camelus dromedarius	Camel	Yes	Yes	No/Yes
Canis lupus familiaris	Domestic Dog	No	Yes	Yes
Felis catus	Domestic Cat	Yes	Yes	High
Mus musculus	House Mouse	Yes	Yes	Yes/No
Oryctolagus cuniculus	European Rabbit	Yes	Yes	Yes/No
Vulpes	Red Fox	Yes	Yes	Yes/No

[1]*NT Fauna Atlas & EPBC PMST, 2022*

C.5.2.10 Fire history

Regional fire history and fire scar mapping was obtained through the Northern Australia and Rangelands Fire Information website and a general review of Landsat Imagery (using Google Timelapse and VegMachine). Table 93 details the recent fire history map of SOF. The SOF area has had broad scale fires in the last three years.

C.5.3 Socio-Economic Environment

C.5.3.1 Surrounding Land Tenure

The Amadeus Basin is a sparsely populated region with Alice Springs being the major centre for the region. The SOF is located in remote and isolated locations many kilometres from the nearest neighbours. Table 92 details the surrounding land tenure.

Table 92: Surrounding Land Tenure

Field	Property Name	Survey Plan Number	Land Tenure	Operation Footprint
SOF	[redacted]	CP 004189	Freehold	All

C.5.3.2 Surrounding Populated Places

The field is in a remote location, far distant from the nearest populated places as shown in the tables below, 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, and Ipolera (Table 94).

SOF is located near the Western Australian boarder approximately 80km south-east of the remote Aboriginal community of [redacted]. At the 2016 census, [redacted] had a population of 410. [redacted].

C.5.3.3 Noise

As noted in Section Surrounding Populated Places above, all fields are located within a sparsely populated region. There are no communities within the area bounded by respective tenements and the nearest sensitive receptor are more than 25km from the noise sources located across the field.

Northern Territory Noise Management Framework Guideline 2018 refers to offensive noise that may cause an environmental nuisance. SOF is in care and maintenance mode and there are currently no operations on-site. The Operator will monitor any complaints regarding noise as part of its stakeholder engagement process.

Given the distance to the nearest receptor and that potential noise generated within each of the fields 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.

C.5.3.4 Cultural heritage

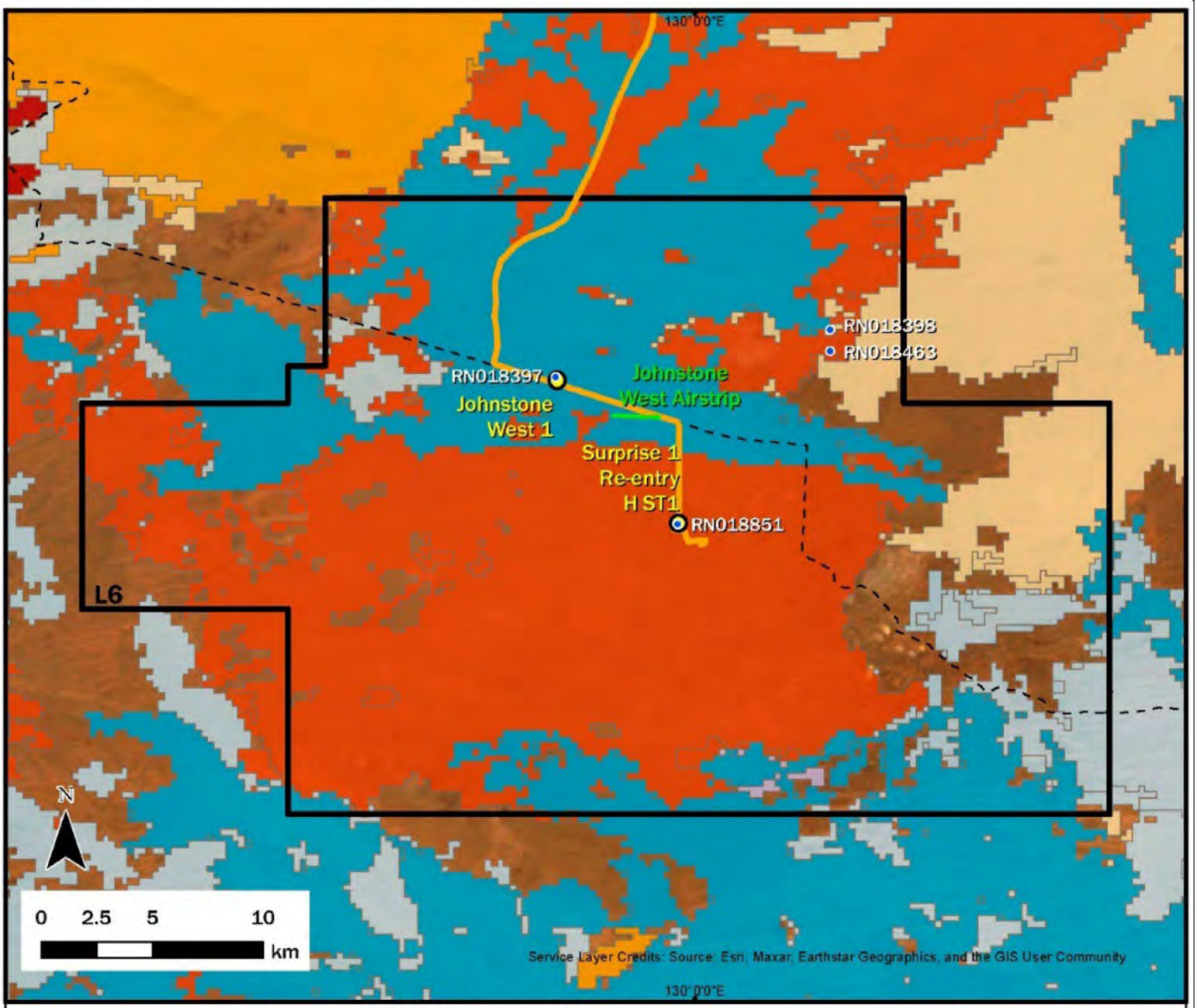
C.5.3.4.1 Historic and natural heritage

SOF 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 of which are within nor adjacent to SOF. No non-public sites were found by the online search.

EPBC PMST for the SOF did not identify any World Heritage Properties, National Heritage Places, Commonwealth Heritage Places or Places on the Register of National Estate within or within a 10km buffer of either field. A Heritage/Archaeological Survey of the Dingo Pipeline Project was undertaken by Tim Hill in December 2013 (Hill, 2013). No archaeological sites were located during the survey.

Table 93: Fire history SOF

SOF Fire History Map
Fire occurred in the north of the SOF area in 2022, and the southern portion in 2021.



ID: 0622-111 Rev:
Date: 3/07/2023

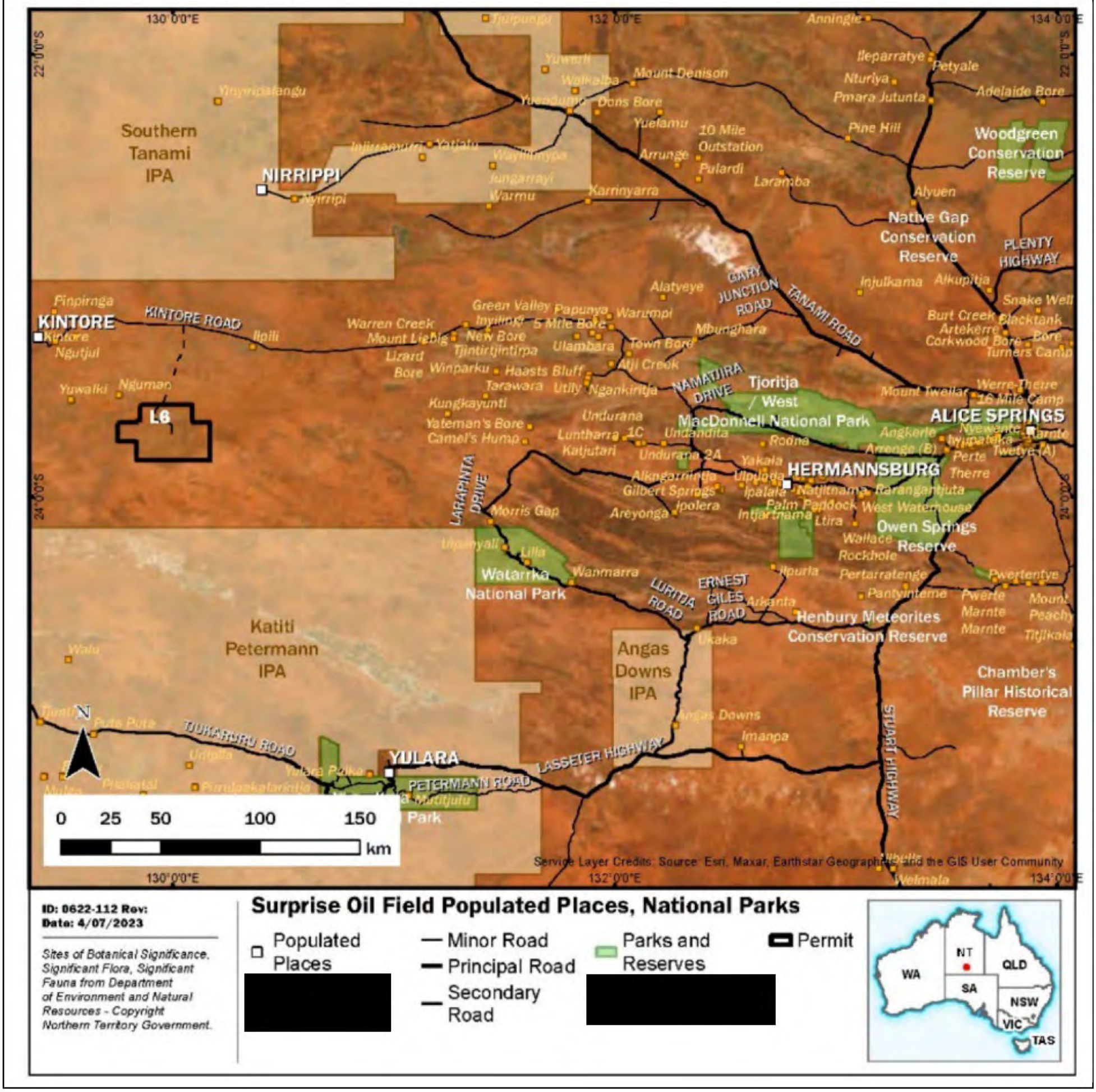
Fire scars - Darwin Centre for Bushfire Research 2023

Surprise Oil Field Fire scars

- Waterbores
- Wells
- Air strip
- CTP access tracks
- Track
- L6 permit
- 2023 fires to 27/6/2023
- 2022 fires
- 2021 fires
- 2020 fires
- 2019 fires
- 2018 fires
- 2017 fires
- 2016 fires
- 2015 fires
- 2014 fires
- 2013 fires
- 2012 fires
- 2011 fires

Table 94: Populated places SOF

SOF – Surrounding populated places
▪ Kintore, approximately 80km to the north-west ▪ Yulara, approximately 200km to the south/south-east ▪ Alice Springs, approximately 450km to the east



ID: 0622-112 Rev:
Date: 4/07/2023

Sites of Botanical Significance, Significant Flora, Significant Fauna from Department of Environment and Natural Resources - Copyright Northern Territory Government.

Surprise Oil Field Populated Places, National Parks

Populated Places [redacted]
Minor Road
Principal Road
Secondary Road
Parks and Reserves [redacted]
Permit

C.5.3.5 Aboriginal archaeological assessment

No new areas of disturbance are proposed for consideration with this EMP as no new archaeological assessment has been conducted.

The Operator has AAPA Authority Certificates in place for the works described in this EMP (AAPA Authority Certificate 202408607 (C2025/036))

Known Aboriginal areas of value are protected under provisions contained in approved Sacred Sites Certificates and the *Heritage Act 2011*.

C.5.3.6 Sacred Sites

The Operator operates the Surprise Field under multiple SSCC clearance certificate 2014-029.

C.6 Engagement and Consultation

C.6.1 Stakeholder engagement

The Operator is 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 of 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 per CLC guidance.

No consultation with the Commonwealth Government was required as it has been determined through an EPBC self-assessment (Appendix 4) that the works are unlikely to cause a significant impact on MNES (PMST dated 5 December 2023). Therefore, the *EPBC Act* will not be triggered.

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

C.6.2 Traditional Owner(s) engagement

The Operator undertakes regular consultation with Traditional Owners primarily through annual community liaison meetings. At these meetings the Operator provides an overview of its ongoing production operations, anticipated field workover programs and other development activities. 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.

C.6.3 Assessment of merit of stakeholder objection or claim

The process that the Operator will undertake in assessing any stakeholder objection/claim that it receives 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 the Operator and that no additional action is required; or
  - If the results confirm that the objection/claim is related to the 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 outcomes of the investigation including any actions that the Operator has/will undertake to address the objection/claim – if required. Following the discussion, a written response will be provided.

C.6.4 Details of changes due to engagement

Any proposed changes in operations, policy or procedures because of stakeholder consultation or other engagement will be considered by the Operator's Management Team. If any changes for merit are deemed necessary, these changes will follow the approved the Operator's management of change (MOC) process and captured in a register.

C.7 Environmental Impacts, Risks and Mitigation

C.7.1 Approach

C.7.1.1 Risk assessment methodology

The Operator's 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 95)
- Recorded in a risk register
- 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 the Operator's Risk Matrix (Section Risk Matrix) 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 determination can then be made about whether the risk is ALARP and acceptable or whether further mitigation is required.

Table 95: 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.

C.7.1.2 ALARP and acceptability

As part of the Operator's risk assessment process, each risk is mitigated to ALARP. The Operator considerers risks having been reduced to ALARP 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, time and resources involved to mitigate it.

To determine whether potential environmental risks and inputs are 'acceptable' is a matter of judgement that depends on issues such as the nature and scale of impacts and the social or economic benefits. The Operator's risk tolerance/acceptance process (Table 96) is utilised to determine whether to accept the assessed residual risk or implement improvement actions.

Table 96: 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 risk 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 being demonstrated through:
    - Alignment with legislative requirements, regulator guidance, stakeholder expectations
    - Adoption of regional strategies and plans
    - Not compromising ESD Principles, and
    - Limiting the nature and scale of the effect on the environment.

C.7.1.3 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 a management control. Additional baseline studies or other safeguards may be required to increase the accuracy of an assessment to determine the acceptability of a risk.

Scientific uncertainty is qualitatively assessed using a generic means of ranking the data available in accordance with the criteria assigned in Table 97. Considerations of scientific uncertainty have been included in the risk assessment.

Table 97: 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 as 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. The precautionary approach to management of the risk is required.

C.7.1.4 Risk assessment summary

The outcomes of the environmental risk assessment are presented in Appendix 1. A summary of the residual risks for SOF activities under the EMP is shown in Table 98. All risks are considered by the Operator to be as low as reasonably practicable and are accepted.

Table 98: Risk assessment summary

	Low	Medium	High	Very High
Count	10	2	0	0

The 'Medium' residual risks for activities under this environment management plan 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 release of hydrocarbons and formation water, including wastewater to ground
- Loss of places or items of cultural significance from fire as a result of activities under this EMP
- Subsurface loss of contaminants during workovers contaminating surface water and/or groundwater and reducing groundwater pressure

C.7.1.5 Environmental management strategy

Based on the results of the risk assessments conducted and the identification of critical controls as detailed in Appendix 1. 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 7.2 to 7.10.

C.7.1.6 Risk Matrix

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

C.7.2 Biodiversity

<table>
<tr><th colspan="6">Environmental performance measures: Biodiversity</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management
▪ Well operations – surface infrastructure
▪ Production facilities – gathering and boosting, oil and gas processing,
▪ Well workover – fluid systems
▪ Rehabilitation
▪ Support activities – chemical storage, workover fluids, waste and wastewater management</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="3">Consequences</td><td colspan="2">Critical controls</td></tr>
<tr><td colspan="3">▪ Loss of vegetation/fauna habitat values from:
- Loss of containment, including spills and leaks, of hydrocarbons, chemicals, workover fluids, 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 or trenches or similar</td><td colspan="2">▪ Weed Management Plan
▪ Progressive Rehabilitation and Closure Plan
▪ Fire Management Plan
▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Erosion and Sediment Control Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The residual risk remains medium based on moderate impacts of loss of conservation significant fauna. The Operator considers that the risk has been reduced to APLARP and acceptable based on the following:
▪ Vehicle movements are a necessary part of operations controls are aligned with industry practice and consistent with ESD principles to co-exist without any long-term impacts to the local environment.
▪ No WoNS or declared weeds in respective fields so risk of weed spread between well sites minimised. Best practice weed management practice areas in place and the Operator seeks to achieve the requirements of key legislation and strategies as outlined in Section 2.
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
</table>

Environmental performance measures: Biodiversity			
Environmental outcome	**Environmental performance standard**	**Measurement criteria**	**Records**
No significant impact to threatened fauna, their habitat and sites of conservation significance	No unauthorised clearing of vegetation or loss of fauna habitat	▪ Areas of known threatened fauna habitat will be sign posted to avoid impacts to 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	▪ Permit to work records ▪ Incident records ▪ Environmental sensitivity maps
	No introduction of new or spread of existing Weeds of National Significance, weed listed under NT legislation or locally significant weed species	▪ Complete annual weed survey ▪ No new WONS, NT listed weed species or locally significant weed species identified ▪ Weed certifications from vehicles, equipment and machinery entering from known weed infestation areas are obtained ▪ Weed hygiene training has been 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 protection of fauna, flora, their habitat and reporting fauna interactions ▪ No incidents recorded in incident management system of driving off designated roads, access tracks and well pads ▪ No incidents within incident management system involving vehicle related fauna strikes with speeds above 70km/hr within the field.	▪ Incident records ▪ Induction and register of participants
	No uncontrolled fires from the Operator's activities	▪ The incident management system shows no recorded incidents of uncontrolled fires starting because of the operator's activities	▪ Incident records
	The Operator's activities will not encourage pest species	▪ The incident management system shows no records of pest species interactions with waste or inappropriate waste storage and handling that encourages vermin access.	▪ Incident records ▪ Inspection records
Environmental monitoring and reporting		See Table 110 for details	
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	

C.7.3 Land

<table>
<tr><th colspan="6">Environmental management strategy: Land</th></tr>
<tr><td>Activities</td><td colspan="3">▪ Civil and project activities – earthworks, land and vegetation management
▪ Well operations –surface infrastructure
▪ Production facilities – gathering and boosting, oil and gas processing,
▪ Well workover – fluid systems</td><td colspan="2">▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities – services, chemical storage, workover fluids, waste and wastewater management</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 rowspan="2">Risk</td><td colspan="3">Consequences</td><td colspan="2">Critical controls</td></tr>
<tr><td colspan="3">▪ Soil/land contamination from:
- Loss of containment, including spills and leaks, of hydrocarbons, chemicals, workover fluids, wastewater, including during wet weather
- Storage, handling, use of fuels, oils and chemicals
- Wastewater 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="2">▪ Spill Management Plan
▪ Wastewater Management Plan
▪ Wet Season Management Plan
▪ Erosion and Sediment Control Plan
▪ Rehabilitation Management Plan
▪ Waste segregation and implementation of waste management hierarchy
▪ Job Hazard Analysis/ Permit to work systems</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that the risks have been reduced to ALARP and no further risk reduction is warranted as:
▪ A strong historical knowledge of the field and the environmental response to land disturbance, erosion and contamination events presents a low level of uncertainty.
▪ Operation of flowlines in accordance with legislative and best practice guides/codes.
▪ Operation of wastewater storage and disposal as per the Code. The ponds were developed prior to the implementation of the Code, no leak detection is in place but a program of regular inspections as part of the Asset Management System has been successfully implemented.
▪ Operation and maintenance of the gathering network in accordance legislative and with best practice industry standards (refer Section 2).
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
</table>

Environmental management strategy: Land			
Environmental outcome	**Environmental performance standards**	**Measurement criteria**	**Records**
No significant long-term impacts on soil stability, soil quality and land formations from the Operator's activities	Erosion and sediment controls in place, including wet weather response.	▪ Records show the erosion and sediment control measures are being implemented ▪ Records show inspections of erosion and sedimentation issues after significant rainfall events ▪ Records show all active work sites inspected for evidence of erosion and sedimentation, including after significant rain events, 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) ▪ Records show restricted use of roads and tracks to operational safety activities across the field after significant rainfall event (>10mm in 24 hours)	▪ Inspection records ▪ Incident records ▪ Weather records
	Disturbance of land remains within existing cleared and operational areas.	▪ 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	▪ Incident records ▪ Induction records ▪ Permit to work records
	No releases of contaminants (including wastes, wastewater, chemicals, hydrocarbons or workover fluids) resulting in long-term contamination of the soil	▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken ▪ The incident management system indicates no releases of contaminants incidents related to wet weather operations ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling, 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 spills resulting in significant, long term impacts on soils and land formations ▪ Records show 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 the operator's activities ▪ Records show progressive rehabilitation has been initiated to reinstate/reduce areas no longer required	▪ Rehabilitation success monitoring ▪ Incident records

Environmental management strategy: Land	
Environmental monitoring and reporting	See Table 110 for details
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

C.7.4 Surface water

<table>
<tr><th colspan="6">Environmental performance measures: Surface water</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, project, borrow pits, mobilisation/demobilisation
▪ Well operations – surface infrastructure, well maintenance and integrity
▪ Production facilities – gathering and boosting, oil and gas processing, condensate and oil storage and loadout
▪ Well workover – fluid systems
▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities – chemical storage, workover fluids, waste and wastewater management</td></tr>
<tr><td>Residual risk</td><td>Low</td><td>Code of Practice</td><td>A.3.4, A.3.8, C.3, C.4.1, C.4.2, C.5, C.7.1, C.7.2</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">▪ Surface water contamination from:
- Loss of containment, including spills and leaks, of hydrocarbons, workover fluids, 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</td><td colspan="2">▪ Well site selection
▪ Spill Management Plan
▪ Wet Season Management Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that the risks have been reduced to ALRA and no further risk reduction is warranted as:
▪ Operation of flowlines in accordance with legislative and best practice guides/codes.
▪ Operation of wastewater storage and disposal as per the Code. The ponds were developed prior to the implementation of the Code, no leak detection is in place but a program of regular inspections as part of the Asset Management System has been successfully implemented.
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standards</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>No significant impact on surface water quality</td><td>No release of contaminants resulting in long term contamination of</td><td colspan="2">▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken</td><td colspan="2">▪ Inspection records
▪ Incident records
▪ Chemical register</td></tr>
</table>

Environmental performance measures: Surface water			
from the Operator's activities	surface waters, including during wet weather operations	▪ The incident management system indicates no release of contaminant incidents related to storage, handling, use or disposal of chemicals, fuels, 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, 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 spills resulting in significant, long-term contamination of surface waters ▪ Records show emergency response plan implemented in the event of a reportable spill or leak	
	Erosion and sediment controls in place	▪ Records show the erosion and sediment control plan is implemented ▪ Records show all active work site inspected for evidence of erosion and sedimentation, including after significant rain events, 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 ▪ Job hazard analysis
	No long-term impacts on surface water from operation of evaporation ponds	▪ Records show freeboard is maintained ▪ No incidents of overtopping from evaporation ponds recorded within the incident management system ▪ Records show inspections of containment integrity are maintained ▪ Records show production needs consider available holding capacity within evaporation ponds, particularly during wet weather	▪ Inspection records ▪ Daily production reports ▪ Incident records
Environmental monitoring	See Table 110 for details		
Corrective actions	▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily ▪ Soil remediation where spills occur to reduce impact to nearby surface water ▪ Review of wet weather procedures and response ▪ Review of storage and handling practices of contaminants ▪ Increased awareness and training		

C.7.5 Groundwater

<table>
<tr><th colspan="6">Environmental performance measures: Groundwater</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Well operations – well barriers, maintenance and integrity
▪ Production facilities – gathering and boosting, oil and gas processing
▪ Well workover – barrier protection, fluid systems, suspension, decommissioning
▪ Support activities – services, chemical storage, workover fluids, waste and wastewater management</td></tr>
<tr><td>Residual Risk</td><td>Low</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 workovers
- Groundwater inflow from workover activities
- Well integrity
- Spill or leak from the use, transportation, treatment, handling and storage of, workover fluids, wastewater, and diesel, fuel, oils and chemicals, including during wet season
- Loss of containment from wastewater ponds
▪ Reduced groundwater availability for wider community from use of groundwater resources to support the Operator's activities</td><td colspan="2">▪ Asset Management System
▪ Wells managed in accordance with DITT approved WOMPs
▪ Implement Emergency Response Plan
▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Groundwater Management Plan</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Operator considers that this risk has been reduced to ALARP and no further risk reduction is warranted based on:
▪ Well operations and workovers will be conducted using extensive best practice controls as outlined in the DITT approved WOMPs for each well. The subsurface loss of containment risks of operations and workovers are generally lower than drilling a new well because cement casing is already in place and there are no open zones, which provides some protection against hydrocarbon migration. Multiple well barriers are used across aquifers to minimise interaction.
▪ 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.
▪ We also note that part of the rationale for conducting the workover activities is to improve well integrity in an aging field. Workovers will ensure well barriers are in-tact so that subsurface loss of containment risks are reduced during the operation of the well
▪ Secondary containment (when in use) will be inspected weekly, unless being operated through the wet season during which period it will be monitored daily.</td></tr>
</table>

Environmental performance measures: Groundwater			
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 workover fluids) resulting in long-term contamination of groundwater resources	▪ Records show all spills remediated immediately on discovery, and where necessary contamination assessment undertaken ▪ The incident management system indicates no releases of contaminants incidents related to wet weather operations ▪ The incident management system indicates no releases from the re-use, recycling, treatment, handling, 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 spills resulting in significant, long-term contamination of ground waters ▪ Records show Emergency Response Plan implemented in the event of a reportable spill or leak ▪ The field Groundwater Management Plan (GWMP) has been implemented*	▪ Inspection records ▪ Groundwater monitoring results ▪ Incident records
	Groundwater extraction does not reduce groundwater availability to surrounding users	▪ Groundwater monitoring records show no significant impact to ground water levels or quality.	▪ Groundwater monitoring results
	Wells are managed under a Well Operations Management Plan to monitor integrity and potential for impact on groundwater	▪ Records show that a DITT approved WOMP is implemented for each well ▪ Records indicate that BOPs and well control equipment is installed, maintained and routinely tested on workover rigs ▪ Records show ongoing maintenance, monitoring and testing processes as specified in WOMPs	▪ Well Barrier Integrity Verification reports ▪ Inspection records ▪ Incident records
Environmental monitoring and reporting	See Table 110 for details		
Corrective actions	▪ Remediate spills and leaks where possible to reduce groundwater impact ▪ Conduct workover to improve integrity of wells, thereby reducing potential for groundwater interaction ▪ Review opportunities for water reduction across field operations and subsequent groundwater extraction reduction.		

** Monitoring undertaken every six months as per the existing field GWMP until the new Groundwater Monitoring Guidelines are released. Thereafter, the monitoring frequency will be reviewed with reference to those included in the Groundwater Sampling and Analysis – Field Guide by Geoscience Australia, Sundaram et al.*

C.7.6 Air and noise

<table>
<tr><th colspan="6">Environmental performance measures: Air and noise</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, borrow pits, wastewater evaporation systems
▪ Well operations – operations, maintenance and integrity
▪ Workovers – well interaction, suspension, decommissioning
▪ Wellhead equipment, safety systems and gathering network replacement
▪ Production facilities –, gathering and boosting, oil and gas processing, venting and flaring, maintenance
▪ Support activities – waste, chemical storage, greenhouse gas emissions</td></tr>
<tr><td>Residual risk</td><td>Low</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="2">Consequences</td><td colspan="3">Critical controls</td></tr>
<tr><td colspan="2">▪ Release of contaminants to air environment through:
- Loss of containment (gas)
- Fugitive emissions/leaks from wells, flowlines and processing equipment
- Air emissions from combustion of fuel/gas
- Flaring and venting of gas and processing by-products
- Emission from release of chemicals, hazardous substances to atmosphere
- Vehicle and heavy machinery movements
- Explosion or fire from the Operator's activities</td><td colspan="3">▪ Asset integrity and maintenance systems
▪ Emergency Response Plan
▪ Methane Emissions Plan/leak detection program
▪ Well Operation Management Plan
▪ Job Hazard Analysis and Permit to Work systems
▪ Flaring (during workovers) is within designated and restricted areas</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">The Code dictates methane emissions for onshore shale gas fields (Clause D.2). SOF is a conventional oil 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>
<tr><td>Environmental outcome</td><td>Environmental performance standards</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>The Operator's activities do not create a measurable decrease in air quality at sensitive receptors</td><td>No release of air contaminants resulting in long term impact to sensitive receptors</td><td colspan="2">▪ Records indicate regular inspections are conducted in line with Well Operations Management Plan and asset maintenance systems
▪ Records of inspection identify asset integrity system and processes are being implemented
▪ Records show that safety critical processes and procedures are in place</td><td colspan="2">▪ Inspection records
▪ Process/metering records
▪ Incident records
▪ Calibration records</td></tr>
</table>

Environmental performance measures: Air and noise			
	No uncontrolled fire or explosion from the Operator's activities	▪ Records show that safety critical processes and procedures are in place as per Integrity Management System ▪ Incident management system shows that 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 is metered and recorded ▪ Calculation of greenhouse gas emissions in accordance with the NGER Measurement Determination	▪ Incident records ▪ NGER Report ▪ Venting records ▪ Flaring records (during workovers)
	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	See Table 110 for details		
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, the Operator is working to meet the requirements of Section D of the Code where relevant to our operations*

C.7.7 Hazards

<table>
<tr><th colspan="6">Environmental performance measures: Hazards</th></tr>
<tr><td>Activities</td><td colspan="3">▪ Civil and project activities – earthworks, land and vegetation management, site mobilisation/demobilisation
▪ Well operations -surface infrastructure
▪ Production facilities – gathering and boosting, oil and gas processing, venting and flaring, oil loadout
▪ Well workover – fluid systems</td><td colspan="2">▪ Wellhead equipment, safety systems and gathering network replacement
▪ Rehabilitation
▪ Support activities –chemical storage, workover fluids, waste and wastewater management</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 rowspan="2">Risk</td><td colspan="2">Consequences</td><td colspan="3">Critical controls</td></tr>
<tr><td colspan="2">▪ Ignition sources present from the Operator's 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">▪ Wastewater Management Plan
▪ Spill Management Plan
▪ Erosion and Sediment Control Plan
▪ Bushfire Management Plan
▪ Methane Emissions Management Plan
▪ Wet Season Management Plan
▪ Asset Management System
▪ Waste management hierarchy implementation</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">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 and the Operator is experienced with operating in the climatic and environmental conditions. Systems and controls are in place to effectively manage operations in the event of natural hazards such as bushfire, wet weather and the occurrence of NORMS.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standard</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>Bushfires are not started from conduct of the regulated activity and infrastructure is protected from fires started outside of the OL areas</td><td>No uncontrolled bushfires caused by the Operator's activities</td><td colspan="2">▪ The Incident Management System shows no fires resulting from the operator's activities
▪ Records show annual fire scar mapping, annual fire load estimates and maintenance of firebreaks are undertaken
▪ Records show emergency response plan implemented in the event of a fire
▪ Records show weather conditions, including current fire danger are reviewed as part of pre-start/toolbox/Job Hazard Analysis/Permit to Work processes</td><td colspan="2">▪ Incident records
▪ JHA records
▪ Daily reports</td></tr>
</table>

Environmental performance measures: Hazards			
		▪ Records show NAFI fire tracking maps are reviewed daily as part of operations where a high fire danger is present ▪ Records show emergency response drills are conducted	
No significant impact on the natural environment from the Operator's 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 in place where required and working as designed	▪ Records show Erosion and Sediment Control Plan 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
The extraction of subsurface equipment, hydrocarbons and water does not result in human health impacts	No impacts from presence of NORMs on environment or human health	▪ Records indicate that NORMS levels are within acceptable limits prior to handling and disposal ▪ Records show licenced waste contractors are used for movement of waste materials.	▪ NORMS testing records ▪ Incident records ▪ Waste tracking records
Environmental monitoring and reporting		See Table 110 for details	
Corrective actions		▪ Maintain capacity in bunds/secondary containment devices ▪ Manage freeboard within wastewater storage ▪ Replace defective fire equipment ▪ Reinstate fire breaks ▪ Reinstate/repair erosion and sediment control devices	

C.7.8 Heritage

<table>
<tr><th colspan="6">Environmental performance measures: Heritage</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – earthworks, land and vegetation management, site mobilisation/demobilisation, borrow pits
▪ Rehabilitation</td></tr>
<tr><td>Residual risk</td><td>Low</td><td>Code of Practice</td><td>A.3.1, A.3.7, A.3.5, A.3.8</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 heritage values or items of significance from:
- Disturbance/exposure of heritage sites/artefacts of cultural significance
- Ignition sources present from the Operator's 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</td><td colspan="3">▪ 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 Bushfire Management Plan
▪ Implement Emergency Response Plan/actions</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">▪ Activities are not being conducted in the cultural heritage 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 low risk. Works are remaining within previously disturbed areas and under permits from CLC (SSCC 2014-029) and AAPA (certificate number JW-1 and S-1: 202002933; and M-1: 202000435).
▪ Fire could spread to culturally significant areas if started by the Operator's 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 the Operator considers that this risk has been reduced to lowest possible and is ALARP and acceptable.</td></tr>
<tr><td>Environmental outcome</td><td colspan="2">Environmental performance standard</td><td colspan="2">Measurement criteria/monitoring</td><td>Records</td></tr>
<tr><td>No significant impact to indigenous and non-indigenous artefacts, Aboriginal Sacred Sites, and</td><td colspan="2">No non-compliance with AAPA Sacred Site Certificates or CLC permits</td><td colspan="2">▪ 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.</td><td>▪ Incident records
▪ Induction (Heritage and Cultural Awareness)</td></tr>
</table>

Environmental performance measures: Heritage			
non-indigenous heritage sites	No unauthorised disturbance of Aboriginal archaeological places/objects and/or Aboriginal Sacred Sites	▪ Incident Management System show no recorded incidents involving damage to Aboriginal archaeological places/objects and/or Aboriginal Sacred Sites ▪ No removal of artefacts in situ without prior approval from Heritage Branch NT	▪ Incident records ▪ Communication minutes with CLC
Bushfires are not started from conduct of the regulated activity and infrastructure is protected from fires started outside of the OL areas	No uncontrolled bushfires caused by the Operator's activities	▪ The Incident Management System shows no fires resulting from the operator's activities ▪ Records show annual fire scar mapping, annual fire load estimates and maintenance of firebreaks are undertaken ▪ Records show emergency response plan implemented in the event of a fire ▪ 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 NAFI fire tracking maps are reviewed daily as part of operations where a high fire danger is present ▪ Records show emergency response drills are conducted	▪ Incident records ▪ JHA records ▪ Daily reports
Environmental monitoring and reporting		See Table 110 for details	
Corrective actions		▪ Consult with Traditional Owners/CLC ▪ Investigate incidents and review and revise procedures	

C.7.9 Community

<table>
<tr><th colspan="6">Environmental performance measures: Community</th></tr>
<tr><td>Activities</td><td colspan="5">▪ Civil and project activities – site mobilisation/demobilisation
▪ Well operations -surface infrastructure
▪ Production facilities – gathering and boosting, gas processing,
▪ Well workover – fluid systems</td></tr>
<tr><td>Residual risk</td><td>Low</td><td>Code of Practice</td><td>A.3.1, A.3.7</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">▪ Ignition sources present from the Operator's 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</td><td colspan="3">▪ 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</td></tr>
<tr><td>ALARP and Acceptability</td><td colspan="5">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 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.</td></tr>
<tr><td>Environmental outcome</td><td>Environmental performance standard</td><td colspan="2">Measurement criteria</td><td colspan="2">Records</td></tr>
<tr><td>The Operator's activities minimise the following:
▪ Reduction in capacity of road infrastructure
▪ Maintain and enhance</td><td>No complaints from stakeholders</td><td colspan="2">▪ Records of the operator's approved journey management plans
▪ Records show Traditional Owners able to access field in liaison with Production Supervisor/Person in Charge
▪ Contact information provided to local communities and stakeholder to facilitate communication
▪ No recorded incidents of work being conducted beyond approved operational areas</td><td colspan="2">▪ Records of the operator's approved journey management plans
▪ Records show Traditional Owners able to access field in liaison with Production Supervisor/Person in Charge
▪ Contact information provided to local communities and stakeholder to facilitate communication
▪ No recorded incidents of work being conducted beyond approved operational areas</td></tr>
</table>

Environmental performance measures: Community			
community relationships ▪ Safety risks to the community	No disturbance to surrounding land uses/access from the Operator's 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 the operator's activities ▪ Records of journey management system implementation	▪ 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 the operator's activities ▪ Records of journey management system implementation
	No impact on regional waste resources and services	▪ Records show only licensed waste contractors are used for waste handling, treatment and/or disposal	▪ Records show only licensed waste contractors are used for waste handling, treatment and/or disposal
	Visitors and contractors are aware of environmental requirements	▪ All visitors and contractors are approved for access and inducted according to their visit requirements.	▪ All visitors and contractors are approved for access and inducted according to their visit requirements.
Environmental monitoring and reporting		See Table 110 for details	
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 ▪ Re-instate areas disturbed beyond approved boundaries	

C.7.10 Cumulative impacts

The cumulative impacts associated with the ongoing operation and well integrity and intervention campaigns are summarised in Table 99 and have been assessed as low. The SOF development is in highly remote locations with no permanent workforce at site. The SOF has been part of the local community since the 2010 and has supported the Traditional Owners through the provision of infrastructure to support their pastoralist activities.

Table 99: Cumulative impacts for SOF

Aspect	Risk rating	Summary
Biodiversity	Medium	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) will be inspected weekly, unless 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. ▪ Operation of assets 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 proposed. ▪ The SOF is currently in care and maintenance. As it is not currently operational, risk to surface water is considered low.
Groundwater	Low	Water is either bought to site by personnel or sourced from a local Operator bore (RN018851) used for bi-annual groundwater monitoring and the camp water supply at SOF. Groundwater bore (RN014297), located approximately 10km north-west of the SOF is a water supply bore for an indigenous outstation at Nguman.
Air and Noise	Low	Well is shut in. No emissions from operations currently.
Hazards	Low	Well is shut in. No emissions from operations currently.
Heritage	Low	The SOF is in care and maintenance with no operational activities taking place.
Greenhouse gas emissions	Low	Well is shut in. No emissions from operations currently.
Community – traffic	Low	▪ Limited traffic except during work program ▪ An additional 10 vehicles per day accessing the respective fields are anticipated during specific work programs such as the well integrity and intervention programs.
Community – tourism	Low	With the isolated location of the wells and supporting infrastructure and no other resource or industrial projects in the area the Operator considers the impacts of ongoing activities to be low.
Community – amenity/visual impact	Low	The majority of infrastructure at the field is not visible or accessible.
Rehabilitation – final land use	Low	Successful rehabilitation is dependent on the vegetation type, soil type and moisture content in the soil which, in turn, is dependent on the timing and amount of rainfall in the region after earth work restoration commences.

C.8 Management Plans

C.8.1 Wet Season Management Plan

A Wet Season Management Plan has been developed and presented below in Table 100 to address the risks and management measures put in place to ensure operations can continue with little impact on gas production or impact on the environment.

C.8.2 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. Table 101 presents the ESCP for SOF.

C.8.3 Weed Management Plan

The Code requires a Weed Management Plan (WMP) that is developed in accordance with the requirements of the *NT Weed Management Planning Guide: Onshore Petroleum Projects.* The Weed Management Plan is provided below in Table 102.

C.8.4 Bushfire Management Plan

The Bushfire Management Plan for the SOF is provided in Table 103 and has been based on the *Bushfire Management Planning Guide: Onshore Petroleum Projects (*DENR, 2020) and the Code.

C.8.5 Rehabilitation Management Plan

The Rehabilitation Management Plan, Table 104 addresses both rehabilitation of decommissioned areas/wells and also the progressive rehabilitation of areas where the disturbance footprint can be reduced without impacting the daily operations of the area.

C.8.6 Wastewater Management Plan

The Wastewater Management Plan (WWMP) is provided in Table 105. 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.

C.8.7 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 106.

C.8.8 Methane Emissions Management Plan

The Methane Emissions Management Plan (MEMP) aims to reduce emissions via emissions detection and management in the gas field. Monitoring and measurement is undertaken to quantify and reduce fugitive methane emissions from the activities. The Plan is presented in Table 107

Table 100: Wet Season Management Plan

Amadeus EMP – Surprise Oil Field
Wet Season Management Plan 2024

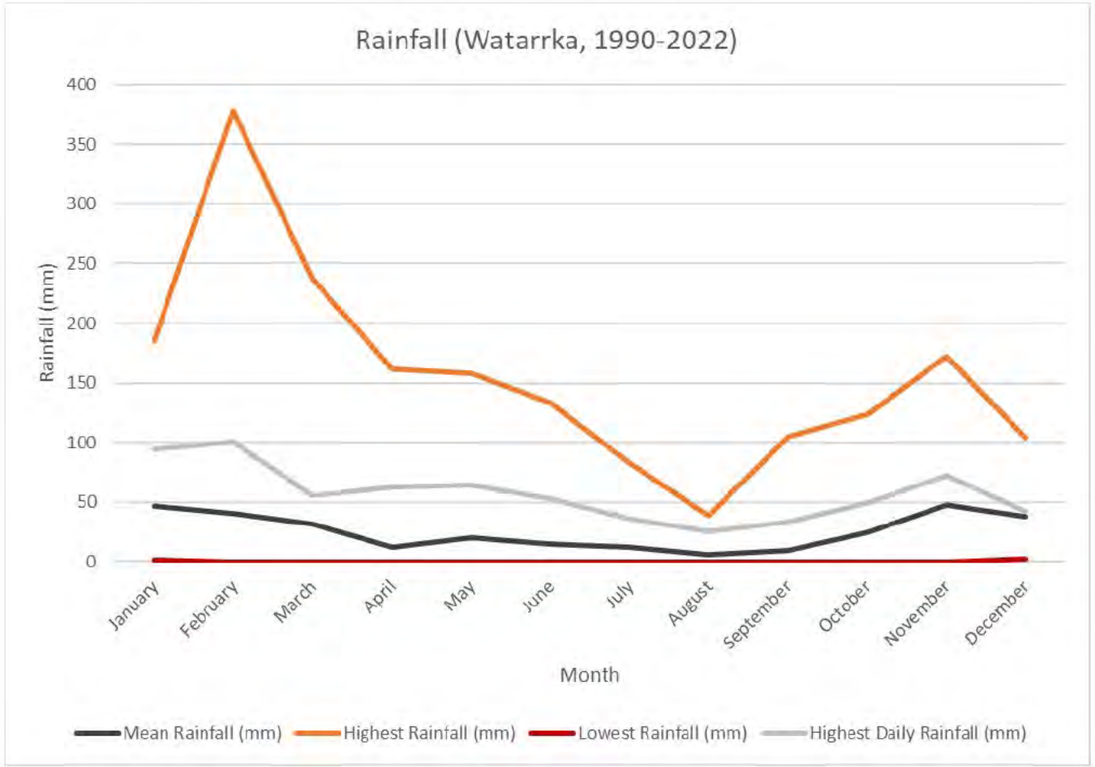
	Owner	Implementation
Position	Risk and HSE Manager	Production Supervisor Ned Garland / Brett Manual

Location of Field	
Property Land Users	SOF operates under L6 production license.
Site Description	The SOF started commenced in 2014 and supported two wells, one of which (s-1) was in production. The field has been shut-in since 2015.

Wet Management Plan	
Purpose	To respond to the risks associated with wet weather on daily operations.
Objectives	Ensure that all 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	• 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.

Wet Season Monitoring			
Monitoring	Information Location/Action	Frequency	Records
Weather forecast	http://www.bom.gov.au/nt/	Daily	Daily Production Report
Road conditions	https://roadreport.nt.gov.au/home	After significant rainfall event	Daily Production Report
Internal roads and access tracks	Visual monitoring for erosion	After significant rainfall event	Daily Production Report



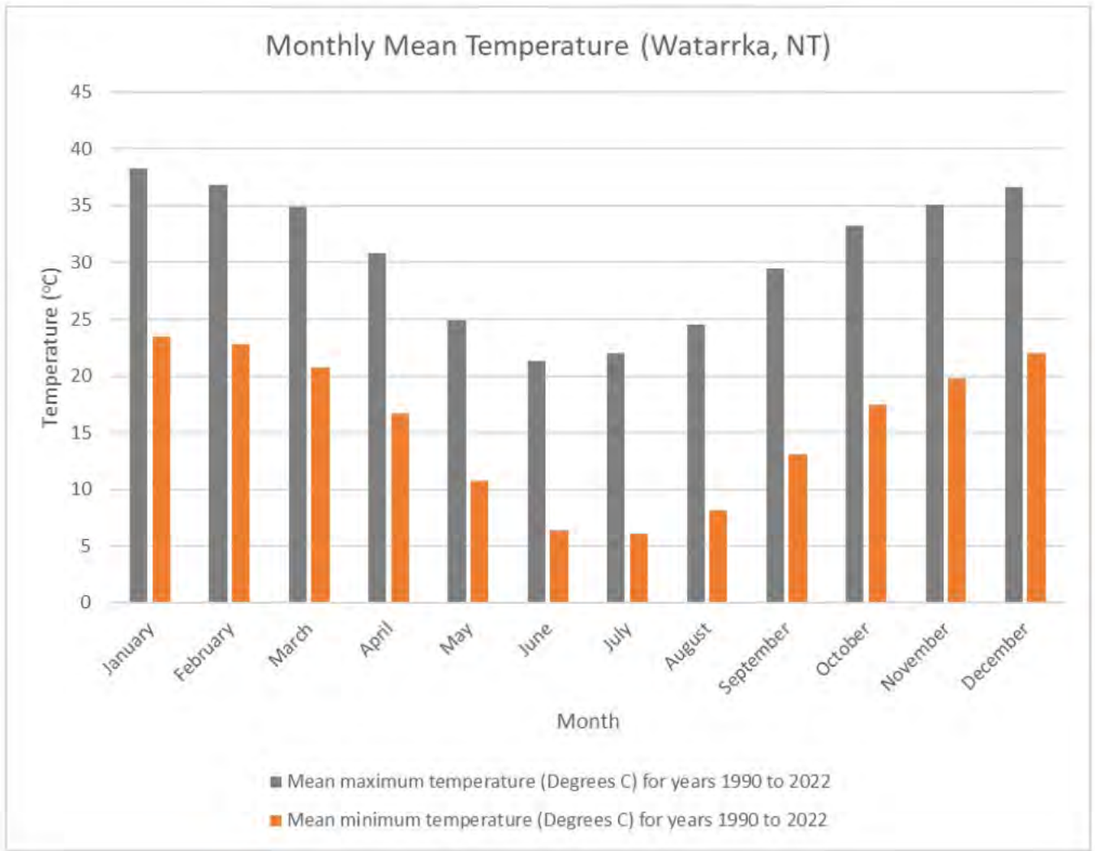


Table 101: Erosion and Sediment Control Plan

Amadeus EMP – Surprise Oil Field
Erosion and Sedimentation Control Plan 2024

	Owner	Field Implementation
ESCP	Risk and HSE Manager	Production Supervisor Ned Garland / Brett Manual
Developed by	Low Ecological Services, on behalf of CP	Bill Low – SQP based on 44 years' experience assessing NT ecology and landforms and development of numerous ESC Plans

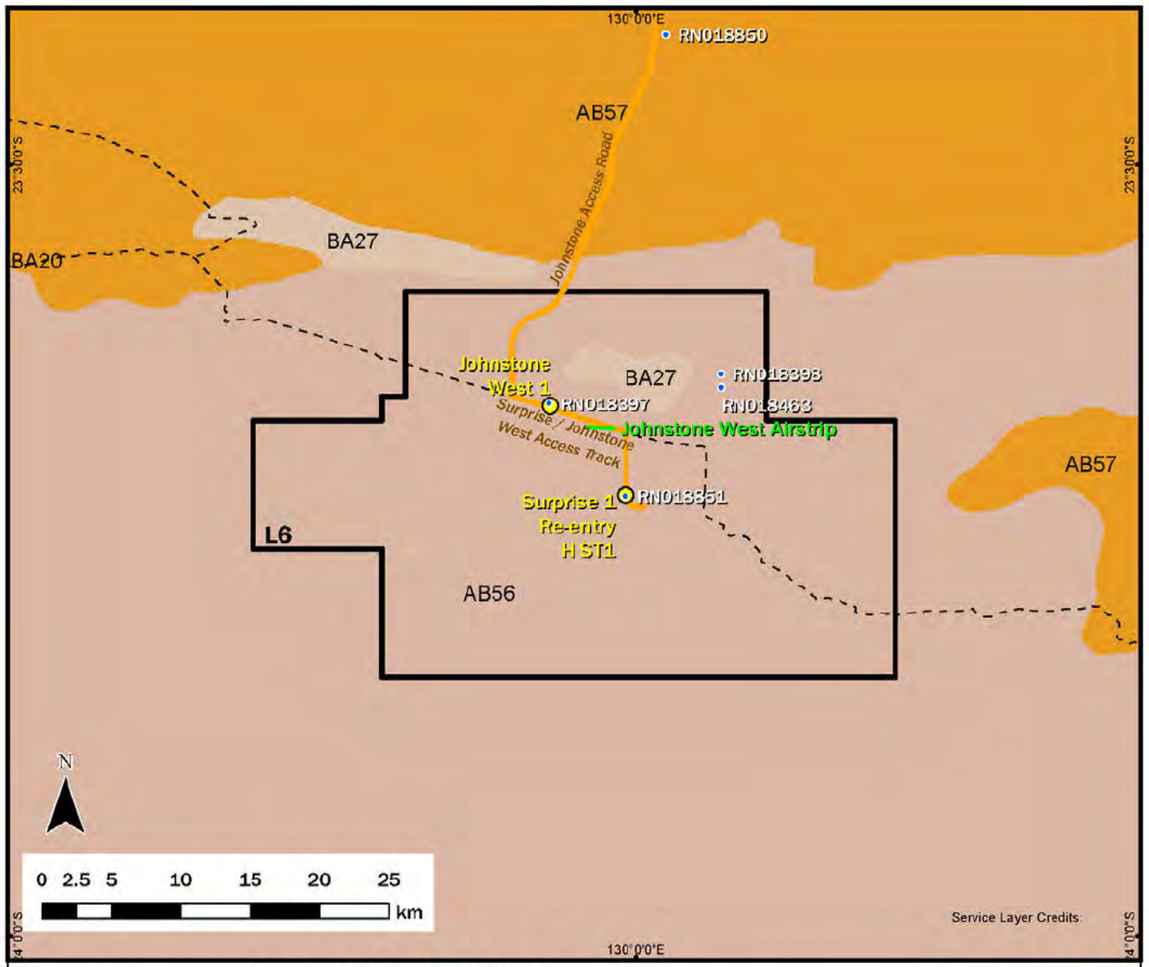
Location of Field	
Property land uses	CP operates the following field: • Surprise Oil Field (L6)
Objectives	To minimise land and water impacts in relation to well activities by preventing erosion and controlling sediment discharge.

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.	
Well pad and operational area maintenance/ upgrade	• 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
Land and vegetation management	• 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.

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)	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		

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* *Developed by: Bill Low – SQP based on 44 years' experience assessing NT ecology and landforms and development of numerous ESC Plans*		

Land Systems					
Land System	Description	Geology	Topography	Soils	Erosion Hazard
Simpson	Desert Dunefields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes	Geomorphologically variable complex of: • Low sandstone ranges • Weathered tablelands • Rounded metamorphic hills, giving rise to undulating plains and low hills with extensive sand plains and sand dunes and flood outs	• Lies over the Amadeus Basin and small parts of the Pedirka and Eromanga Basins. • Contains sedimentary rocks of Devonian and Cambrian age	Red dune sand	Moderate
Atlas_BA27	Low hills, hills and stony plateaux on sandstone, quartzile and conglomerate (deeply weathered in places)			Shallow stony soils	Moderate
Singleton	Level to undulating sandplains with red sands			Red earthy sands	Moderate

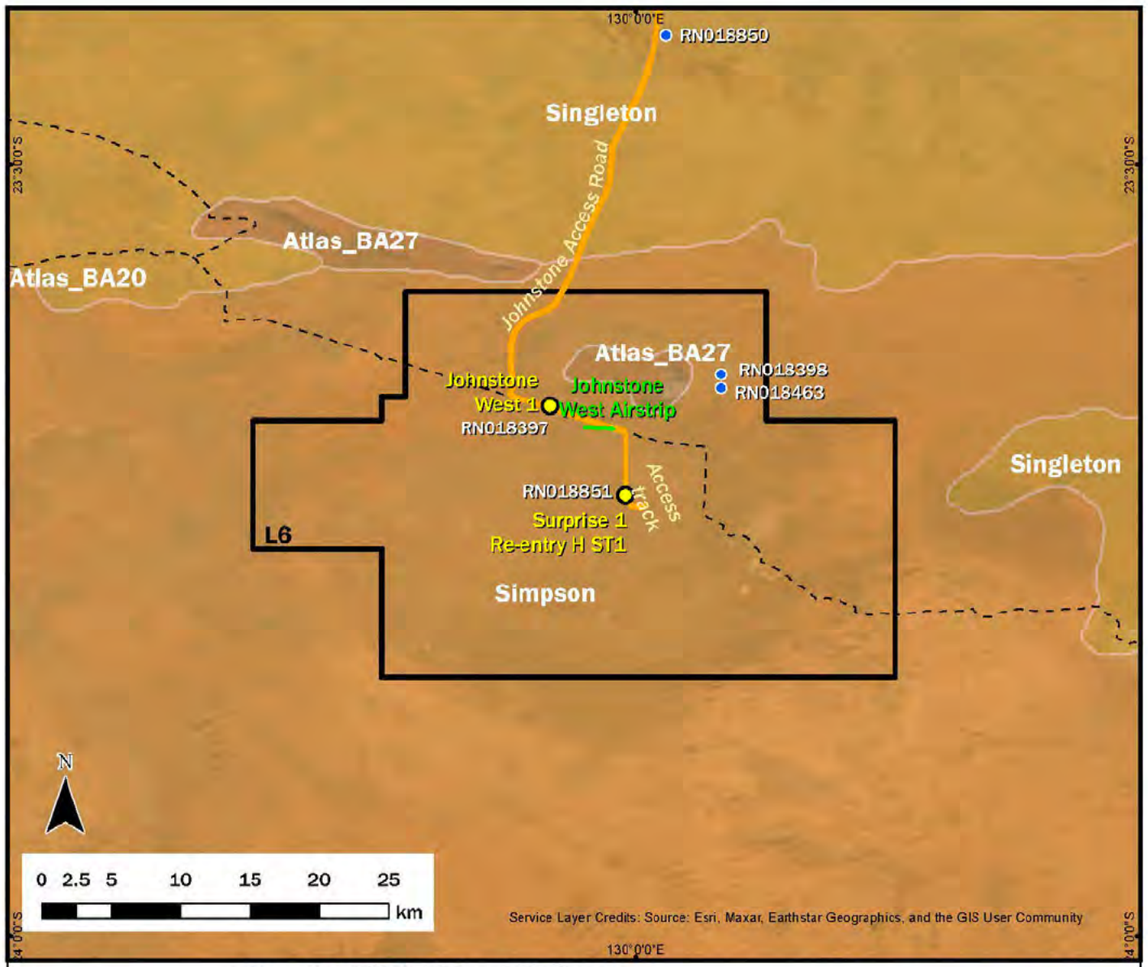


ID: 0622-102 Rev:
Date: 3/07/2023

Digital Atlas of Australian Soils - 1991

Surprise Oil Field Soil Units

- Waterbores
- Wells
- Air strip
- CTP access tracks
- Track
- L6 permit



ID: 0622-103 Rev:
Date: 29/06/2023

Land Systems - Department of Environment and Natural Resources

Surprise Oil Field Land Systems

- Wells
- Waterbores
- Air strip
- CTP access tracks
- Track
- Roads_access_tr...
- L6 permit

Land System

- Atlas_BA20
- Atlas_BA27
- Simpson
- Singleton

Table 102: Weed Management Plan

Amadeus EMP – Surprise Oil Field
Weed Management Plan 2024

	Contact Details	Name
Weeds Officer	EcOz Environmental Consultants on behalf of CP	Tom Reilly

Location of the Field	
Property land uses	SOF operates under L6 production license.
Site Description (pre-disturbance)	The SOF started commenced in 2014 and supported two wells, one of which was in production. The field has been shut-in since 2015.

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 seismic survey 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 Declared Weeds 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	• Use 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.

Notification, Recording and Reporting			
Process Step	Objective	Actions	Frequency
Weed Identification	Weed species and area of infestation are identified and monitored	• Weed surveys undertaken annually by dedicated weeds 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 Weeds 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 Weeds Officer	Ongoing as part of activities
Weed Control	Existing weeds are controlled using effective methods Reduce the density and distribution of weeds on site Chemical control of weeds when plants are actively growing 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 Weeds Officer to be more aware of the spread or containment of existing weeds and the effectiveness of weed control • Ensure target weeds growing seasons are noted and chemical treatment is undertaken when most effective. • Recording of weed control events and information	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 burnt in a burn pit or removed from site (e.g. via waste bins) • It is illegal to transport declared weeds. If declared weeds enter the site, these should be burnt and then buried on site at a depth sufficient to prevent emergence of seeds or seedlings • Chemical containers disposed of correctly	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 Weed Species			
Common Name	Scientific Name	Image	Treatment timing / Description / Control
Buffel grass	*Cenchrus ciliaris*		• November—December • 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. • Apply the principals of the Commonwealth (EPBC Act) buffel grass abatement plan (refer to guiding principles within the plan in Appendix 7). • Foliar spray with Glyphosate (360g/L) Roundup Bioactive® or other aquatic-sensitive Glyphosate product. At least two treatments within a growing season • Residual herbicide: Foliar spraying with Flupropanate at an application rate of 1000L/ha or 1L/10m².
Paddy Melon	*Cucumis myriocarpus*		• September - November • Common and relatively widespread in Australia • Mainly a weed of disturbed sites, roadsides and agricultural areas (i.e. pastures and crops), but is also widespread in rangelands and natural communities (e.g. grasslands and open woodlands). • Physical/manual control • Foliar spray : Garlon + An□evap spray adjuvant 1% or mixture of triclopyr, 2,4-D and metsulfuron • Paddy melons have hairy and waxy leaf surfaces that are hard to wet and penetrate when applying herbicide
Pitted Love Grass	*Eragrostis barrelieri*		• May - November • Flat bright green leaves to 30 cm x 4 mm, spreading to erect. Sheaths bearded. • Grows in moist areas beside watercourses and in gullies. Full sun, semi shade. • Foliar spray Glyphosate (360 g/L) 100mL/10L water Spot spray only Apply to actively growing plants
Caltrop	*Tribulus terrestris*		• May - November • Caltrop is a prostrate annual herb with stems spreading out for up to 2 metres from a woody taproot. • Leaves consist of 4 to 8 pairs of opposite oblong leaflets. The upper surface is dark green, while the lower surface is covered with hairs, • Flowers are small, 8–15mm in diameter and bright yellow with 5 petals, usually lasting only one day. • Hand-pulling Caltrop is effective if the infested area is not too large. • Foliar spray Glyphosate (360 g/L) 100mL/10L water Spot spray only Apply to actively growing plants • The timing of spray applications is critical to ensure that the majority of the weeds have been sprayed before seed set occurs.

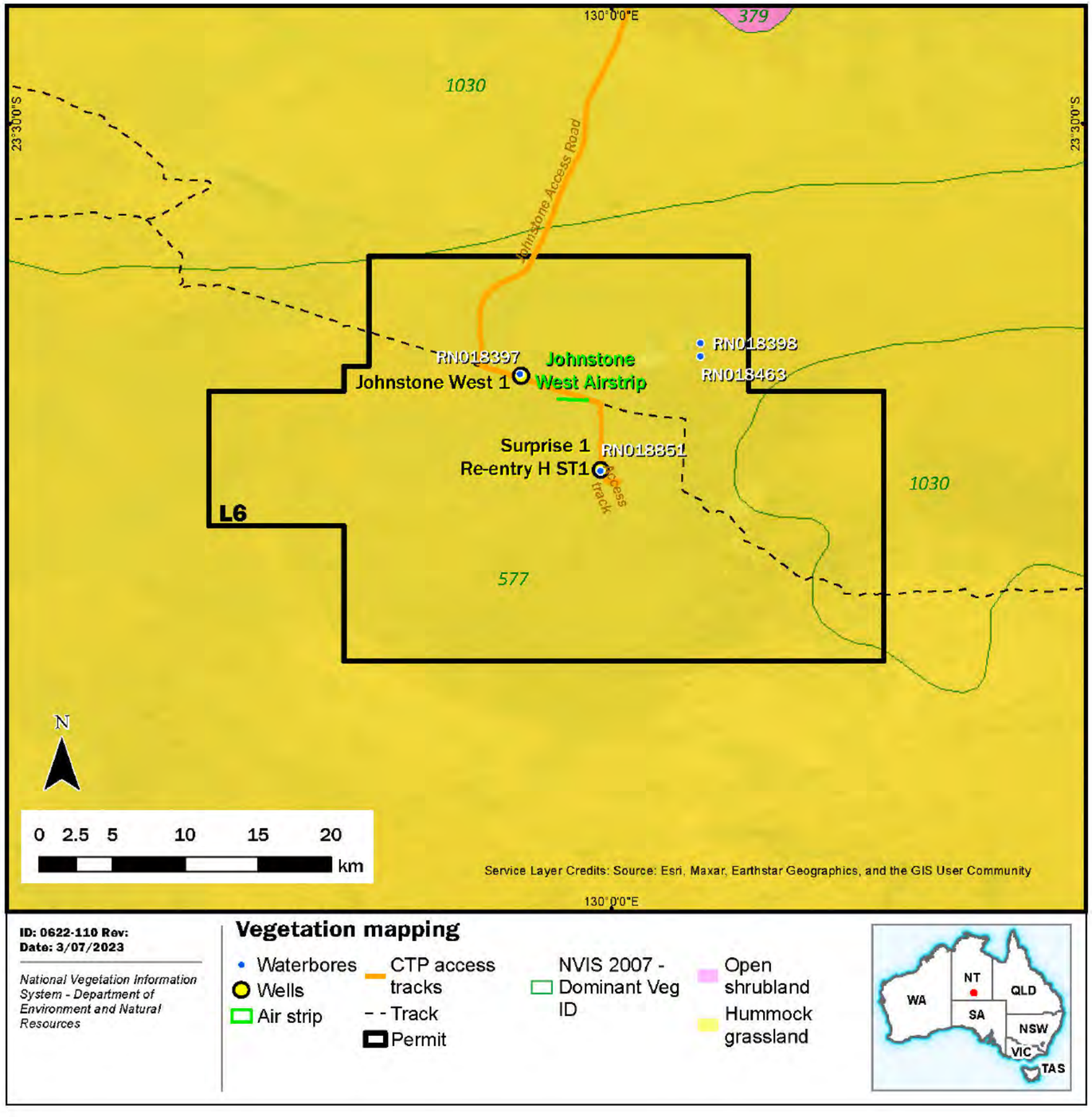


Table 103: Bushfire Management Plan

Amadeus EMP – Surprise Oil Field
Bushfire Management Plan 2024

Location of Field	
Property land uses	SOF operates the field under L7 production license
NT Fire Management Zone	Alice Springs
NT Fire Protection Zone	L6 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

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 • The control of a bushfire rests with the Rural Fire Brigade until the fire reaches 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 • If requested, CP will assist nearby communities in installing firebreaks annually, as an alternative to contributing to firefighting capacity regionally
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

	Position	Name
Bushfire Officer	Production Supervisor	Ned Garland / Brett Manual

Stakeholders	Contact Details
Emergency	000 or 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

Fire Management Zones	Actions
Low Fuel Zone (10m)	• Remove fire fuel load if bushfire risk is high • Use manual/mechanical removal, burns are not the preferred option
Fire Break Zone (4m)	• Only diesel vehicles to be used • Store chemicals in designated areas • Sufficient fire fighting water is available during projects activities • No open flames or fires outside of designated areas (inclusive of flare pits) • Remove vegetation from bare earth fire break area • Use manual/mechanical removal, burns are not the preferred option
Cleared Access Track	• · Remove vegetation from bare earth tracks • · Maintain 4m exclusion zone

Bushfire Management	
Plan	
Map Critical Functions	• Review emergency management structure • Contact and collaborate with neighbours
Identify Threats	• Identify local site conditions and fuel loads • Identify bushfire threats to operations and assets
Assess Risk	• Conduct annual fire mapping • Develop fire fuel load reduction program • Proper storage of flammable chemicals • Vegetation stockpiles are placed at safe distances from potential ignition sources • Update risk assessment
Update Plans	• Update Bushfire Management Plan and Emergency Response Plan
Prepare	
Check Fire Fighting Capability	• Inspect and test critical equipment • Identify staging areas for emergency equipment • Fire fighting equipment located in every vehicle. • Train staff
Reduce Hazard	• Fire fuel load reduction manual/mechanical removal • Controlled burns is not the preferred option • Maintenance of fire breaks and fire access tracks
Test Emergency Plans	• Conduct fire drills • Conduct incident and emergency training with partners
Respond	
Monitor Conditions	• Check NAFI daily
Fire Danger Period	• Permit to burn (including for open flares) required • Check fire danger status daily
Fire Ban Day	• No burns or flaring
Recovery	
Repair and Replace Assets	• Repair and replace damaged assets
Improve Resilience	• Review and improve asset standards for buildings and infrastructure

Seasonal Bushfire Calendar					
Month	Bushfire Risk	**Activities**	Month	Bushfire Risk	**Activities**
Jan	Low	• Map critical functions • Identify threats • Assess risks	Jul	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Feb	Low	• Update plans • Check fire fighting capabilities	Aug	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Mar	Low	• Reduce hazard—start	Sep	Medium	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions
Apr	Medium	• Reduce hazard—end • Test emergency plans	Oct	Low	• Repair and replace assests
May	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions	Nov	Low	• Repair and replace assests
Jun	Dry	• Monitor conditions • Fire Danger Period actions • Fire Ban Day actions	Dec	Low	• Improve resilience

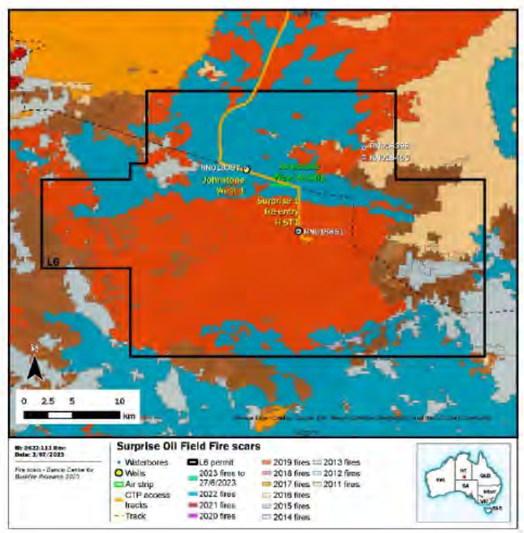


Table 104: Rehabilitation Management Plan

Amadeus EMP – Surprise Oil Field

Rehabilitation Management Plan 2024

	Position	Name
CP Rehabilitation Officer	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)
Developed by	EcOz	Tom Reilly

Location of the Field	
Property land uses	Oil production and compression
Climate	In general, L6 experience a arid climate, with 70% of precipitation occurring between October and March, influenced mainly by monsoonal depression systems in northern Australia
Site Description (pre-disturbance)	The L6 area is located in three land systems: Simpson, Atlas_BA27 and Singleton. The majority of development within the SOF has occurred in the Simpson land system with only the access track from the gazetted road to the tenure boundary being constructed in the Singleton land system.

Rehabilitation Objectives	Actions for Successful Rehabilitation
The objectives of this rehabilitation management plan are to: • Progressively rehabilitate significantly disturbed land which is not required for ongoing activities • Return 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 vegetation condition and land use • Provide an area free of residual contamination • Ensure 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
Climate extremes - 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
Pest animals and lack of existing vegetation - 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
Fire, changed landform, weeds and erosion- 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
Contaminated soil	• Remove, remediate and rehabilitate contaminated areas • Re-spread topsoil evenly across rehabilitated areas

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

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 towards 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 • No declared weed species 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 scarring, 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 • Check for soil inversion issues and map areas of concern • Weed survey	• 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.	• 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

Decommissioning and Rehabilitation Process		
Asset	Specific activities to the asset	General activities across all assts
Well – Sub surface	• Decommissioned in accordance with the principals of the CoP (NTG, 2019) section • B.4.15.1 and specifically the mandatory sections B.4.15.2 and B.4.15.3. • Decommissioning of a well is a regulated activity and this activity will be inan approved Well Operations Management Plan that will be approved by DITT.	• 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.
Well pad, flare pits	• Backfill pits, and water storage, including removal and disposal ofliner materials • Contouring of capping to encourage surface runoff and minimise water pooling • Where incompatible with on-site mix bury cover, implement wastemanagement process for off-site disposal	
Well lease area, including surface infrastructure (wellhead, separator)	• Full decommissioning and rehabilitation: • Wellhead removed and casing cut per the CoP: Surface cement plug detailed in B.4.15.3: Cement plug requirements and validation methods. • A steel marker plate as per the CoP • Filling of cellar • Removal of hardstand materials for use across field or stockpile for future useacross field • Assessment of NORMs of down well and surface equipment • Progressive decommissioning and rehabilitation • Reduction in well lease area size to a sizing approximately 75m x 75m orequivalent to accommodate future well development activities.	
Flowlines (surface and sub-surface)	• Purge of flowline contents. Method depends on material held in flowline (e.g. nitrogen, biocide charged water) • Removal of surface infrastructure (e.g. pipe and struts) • Scraping, grading/re-contour to local landscape and deep ripping toencourage natural regeneration	
Formation Water Tanks	• Disconnection from water gathering network • Transfer water for disposal/evaporation	
Access Roads and Tracks	• Grading and recontouring in line with adjoining environment where landform permits • Where landform involves extensive cut and fill of rock recontouring will be limited to minimise further erosion or landslip potential • Where landform involves sand dunes, removal of hardstand across dune and re- contouring to blend with existing dune and surrounding landform • Construction of erosion controls • Ripping of compacted soils • Natural regeneration	
Evaporation Ponds	• Removal of remaining water either via evaporation or vacuum truck disposal to licenced facility • Where off-site disposal proposed: • Removal of salts and residual solids, reviewing opportunities for beneficial re-use • Removal of liner and leak detection • Assess for land contamination and remediate where necessary • Removal of geomembrane • Remove clay base layer for capping/re-use • Deep ripping of base of pond and mixing with clean soil materials • Backfill pond and re-contour in line with surrounding environment, including capping to divert surface water pooling • Note: the methodology for decommissioning of PV09 is dependent on the outcomes of the Closure Options Assessment and Feasibility Study and is subject to change.	
Gas processing facilities	• Decommissioning would be covered under a separate Decommissioning Plan at the end of life of the production facility	
Administration and Accommodation Facilities	• The following would be considered: • Removal of buildings and foundations • Removal of water and wastewater infrastructure, including pipework and tanks • Removal of concrete surfaces • Removal of communications facilities • Preliminary investigation of site contamination where required	
Water and wastewater infrastructure including bores and dams/ponds (excluding evaporation ponds)	• Water bores will be retained, and licencing transferred to Traditional Owners or returned to Water Resources: • Dewatering of ponds and dams via evaporation or surface irrigation • Push in banks of dams/ponds • Fill void to surface level • Removal of pipelines (above and below surface) • Removal of wastewater treatment tanks	

Activity	Proposed rehabilitation approach	Timing
Analogue sites	• Identify appropriate analogue sites for each of the disturbance areas prior to decommissioning and rehabilitation for monitoring and measurement of rehabilitation success	• Determined as part of PRCP development • Review at first monitoring event and/or first wet season monitoring
Post decommissioning	• Remove above ground infrastructure • Remove waste materials • Treat weeds prior to soil disturbance • Allow fluids to evaporate from sumps, pits, and water storage • Backfill and close sumps and pits • Remove temporary fencing	• Commence within 12 months of well decommissioning and prior to significant soil disturbance
Landform reinstatement	• Reduction in well lease area size to a sizing approximately: - 75m x 75m or equivalent to accommodate future well development activities; or - 2mx2m to accommodate decommissioned well plate. • Any imported gravel material is removed and returned to the source quarry or utilised elsewhere on CP operational sites • Hardstand is deep ripped to relieve compaction, encourage infiltration, and water retention • The site is re-contoured as close as possible to the pre- existing natural landscape • Topsoil is respread evenly over the lease area and lightly scarified to encourage moisture retention and seed capture • Revegetation, refer below • Review weed status and treat as required, refer below	• Commence within 12 months of well decommissioning
Land use	Final land use options will be developed in consultation with the landowners and other relevant stakeholders. These may include: • Pre-disturbance land use • Tourism related activities • Conservation (reserve or park) • Grazing or horticultural activities	• Commence within 12 months of well decommissioning
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 • Deep ripping and contouring of access roads and well leases to as close to natural landform as possible • Ensure all cleared areas have a rough surface to aid in water, seed, and litter catchment • Erosion and sedimentation devices installed and • maintained in accordance with site specific ESC Plan, including temporary and permanent measures	• Commence within 12 months of well decommissioning
Contaminated soil (including drilling fluid sumps)	• Site Contamination - Preliminary site investigation - Undertake remediation of contaminated soil to ensure rehabilitated area is non-polluting and in accordance with the CP Emergency Response Plan • Drilling Sump - Testing of material as per CoP	• Remediation of contamination to be undertaken prior to decommissioning.
Revegetation / Natural regeneration	• Revegetation of decommissioned wells to a 2m x 2m lease size • Revegetation of existing active well leases to a maximum of 75m x 75m • Revegetation of closed lease area access tracks, where suitable • Spread of stockpiled vegetation across reinstated areas to promote natural regeneration, act as erosion control and provide habitat • Reliance on natural regeneration from surrounding environment seedbank • Direct broadscale re-seeding, using local seed collection, where natural regeneration success is low	• Lease - commence within 12 months of decommissioning • All other areas – at completion of infrastructure / area decommissioning
Maintenance	• Weed management via chemical and physical treatment, based on field specific Weed Management Plan prior to rehabilitation activities commencing • Follow-up assessment of weeds via regular surveys and treatment as needed	• As required following monitoring and inspection program

Table 105: Wastewater Management Plan

Amadeus EMP – Surprise Oil Field
Wastewater Management Plan 2024

	Contact Details	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

Location of Field	
Property land uses	SOF operates the field under L6 production license.
Site Description	The SOF started commenced in 2014 and supported two wells, one of which (S-1) was in production. The field has been in care and maintenance mode since 2015.

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

Wastewater Sources				
Activity	Type	Quantity	Target Quality	Management Method
Workover fluid (Groundwater mixed with KCl and biocide)	Workover Fluid	0.063 ML/yr	• pH: 6-10.5 • KCl: 2-5% • Biocide: 0.02% • Conductivity: 8-30 mS/cm	During workover program: • Store onsite in tanks • Re-use After workover program: • Dispose in evaporation pond or offsite facility
Production	SOF is in care and maintenance mode. No formation water is produced.			

Wastewater Risks	
Key Risks	Controls
Spill or leak from the use, transportation, treatment, handling and storage of formation water, fluids and wastewater	• Store liquid wastes in a secured container within a bunded area • 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

Wastewater Monitoring Program and Records				
Type	Requirements	Frequency	Parameters	Records
Workover formation water	• Measure quantity (estimate based on actual workover data) • Measure quality	• Every time wastewater is treated and used • Prior to disposal	• Volume	• Wastewater volumes for re-injection • Wastewater volumes generated during workovers If wastewater to be transported and disposed of offsite • Wastewater volume spilled

Table 106: Spill Management Plan

Amadeus EMP – Surprise Oil Field
Spill Management Plan 2024

	Contact Details	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

Spill Risks	
Key Risks	Controls
Contamination of groundwater	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface and infiltrate to the ground, migrating to shallow, perched aquifers, springs or waterholes. This may affect groundwater quality
Contamination of surface waters	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface and migrate to surface waters and affect surface water quality and ecological values of the habitat
Contamination of soil	Hydrocarbons produced during the operations program have the potential to leak or be spilled at surface. Smaller spills and leaks are likely to be retained in the soil and not migrate to groundwater or surface waters.

Chemicals Storage and Used

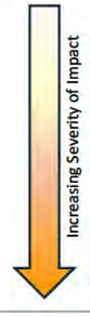
Product Name	Hazardous Material	Dangerous Good	Typical Quantity	Container Size / Type	Storage Location
Anti-corrosives	Yes	Yes	200L	5 – 20 L / Package	BECGS / PVGF
Adhesives/glues	Yes	No	500L	5 – 20 L / Package	
Acetone	Yes	Yes	100L	5 – 20 L / Package	
Thinners	Yes	Yes	200L	5 – 20 L / Package	
Acetylene	Yes	Yes	100L	5 – 20 L / Package	
Bestolife 2000	Yes	Yes	100L	5 – 20 L / Package	
Truck wash	Yes	Yes	100L	5 – 20 L / Package	
Priming fluids	Yes	Yes	200L	5 – 20 L / Package	
Diesel	Yes	Yes	500L	200L / drum	
Pipe cement	Yes	Yes	100L	5 – 20 L / Package	
Coregas	Yes	Yes	100kg	25 kg / Tank	
Degreaser	Yes	Yes	100L	5 – 20 L / Package	
Paint	Yes	Yes	100L	5 – 20 L / Package	
Soaps	No	No	50L	5 – 20 L / Package	
Sealant	No	No	200L	5 – 20 L / Package	
Herbicide	Yes	No	200L	5 – 20 L / Package	
Coolant	Yes	No	100L	5 – 20 L / Package	
Engine oil	No	No	20L–1,000L	5 – 20 L / Package	
Compressor oil	No	No	100L	5 – 20 L / Package	
Hydraulic oil	No	No	100L	5 – 20 L / Package	
Grease	No	No	100L	5 – 20 L / Package	
Nitrogen	Yes	Yes	100kg	25 kg / Tank	
Oxygen	Yes	Yes	100kg	25 kg / Tank	
Propane	Yes	Yes	50kg	25 kg / Tank	
Methanol/ethylene glycol	Yes	Yes	6,000L	5 – 20 L / Package	
Helium	Yes	Yes	100kg	25 kg / Tank	

Location of Field	
Property land uses	CP operates the SOF under L6
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

Spill Scenarios and Management

Activity	Activity Duration	Mechanism	Location	Type	Key Management Control
Chemical storage	Operations/ Workover	• 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 • Workover chemicals • Workover fluids	• Daily visual checks of the chemical storage area • Secondary containment / bunding • Spill kits available • Minimise quantity of chemicals at well site
Handling / mixing of chemicals	Workover	• 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 • Workover chemicals • Workover fluids	• 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 absorbent mats used • Spill kits available
Truck and / or rig refuelling	Workover	• Incorrect refuelling set-up • Poor refuelling practices	• Rig fuel tanks	• General use chemicals (e.g. oil, diesel, hydraulic oils degreasers, pesticides) as per SDS • Workover chemicals	• 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 absorbent mats used • Spill kits available
Chemical transportation to / from location outside of L6	Workover	• Coupling, hosing and pipe failures	• Chemical loading area • Pipework	• General use chemicals (e.g. oil, diesel, hydraulic oils degreasers) as per SDS • Workover chemicals • Workover fluids	• Transport hazardous material within the NT by a licensed NT EPA contractor • Well lease compacted • Spill kits available
Storage of workover fluid in tanks on the well lease	Workover	• Container rupture • Lids / taps not fitted correctly	• Workover fluid tanks	• Workover fluids	• Daily visual checks during activities • Spill kits available • Compacted well lease
Transfer of produced formation water from the wellhead to evaporation ponds by truck	Workover	• Coupling, hosing and pipe failures	• Truck	• Produced formation water	• Operator monitor transfer from tank to truck • Spill kits available • Compacted well lease

Definition of Environmental Harm under the NT *Petroleum Act 1984*



Environmental Harm	• Means: (a)Any harm to or adverse effect on the environment, or (b) 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: (a) 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 (a) that is not trivial or negligible in nature; (b) consists of an environmental nuisance of a high impact or on a wide scale; (c) 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 (d) 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: (a) is irreversible or otherwise of a high impact or on a wide scale; (b) 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; (c) 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 (d) results in actual or potential loss or damage to the value of more than $50 000.

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

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

Types of Incidents	

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 be 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

Definition 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 107: Methane Emissions Management Plan

Amadeus EMP – Surprise Oil Field

Methane Emissions Management Plan 2024

	Position	Name
Owner	Production Supervisor	Ned Garland / Brett Manual

Location of Field	
Property land uses	SOF operates the field under L6 production license.
Site Description	The SOF started commenced in 2014 and supported two wells, one of which (S-1) was in production. The field has been shut-in since 2015.

Methane Management Plan	
Purpose	To monitor and reduce fugitive methane emissions from care and maintenance activities.
Objectives	To reduce fugitive methane emissions through effective detection and management practices across operations activities.

Leak Monitoring

Inspection Frequency	Leak Detection Instruments

• 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 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: annually
  • Low pressure pipelines and fittings: annually
  • Plant including compressors: annually
• 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
	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:

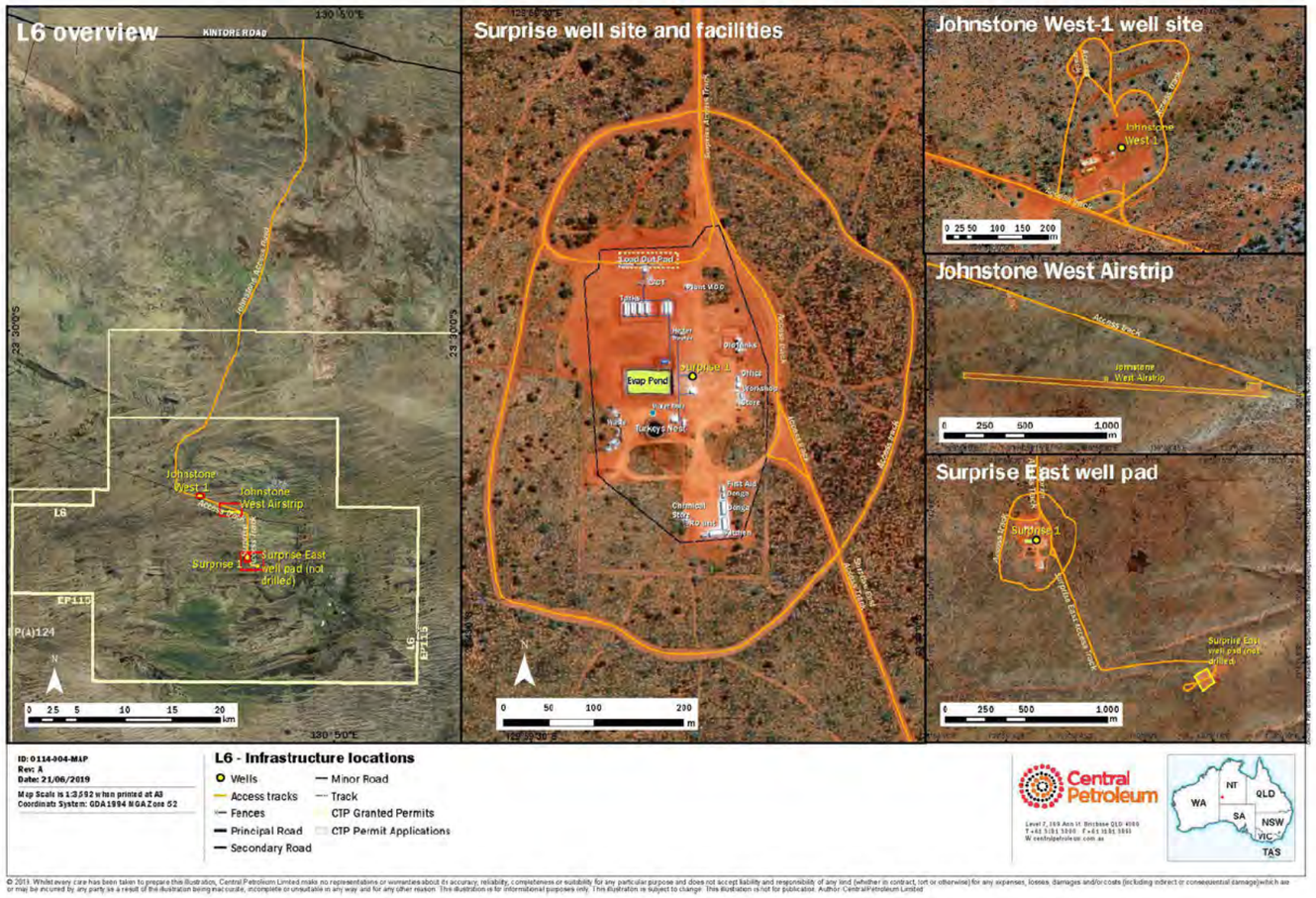
- Prior to commencing monitoring, calibrate and bump test the gas detector according to manufacturer's
- recommendation
- Monitoring is carried out at each well site, along the gathering system (vents, drains, metering instruments, manifolds) and within DGF:
  - Place the probe at the surface of the 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 care and maintenance 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 during workovers and well operations
	  • Leak detection implemented consistent with the Code of Practice.
	  • Ongoing well maintenance as per the Well Operations Management Plan.
		• During workovers, 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 care and maintenance. 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.

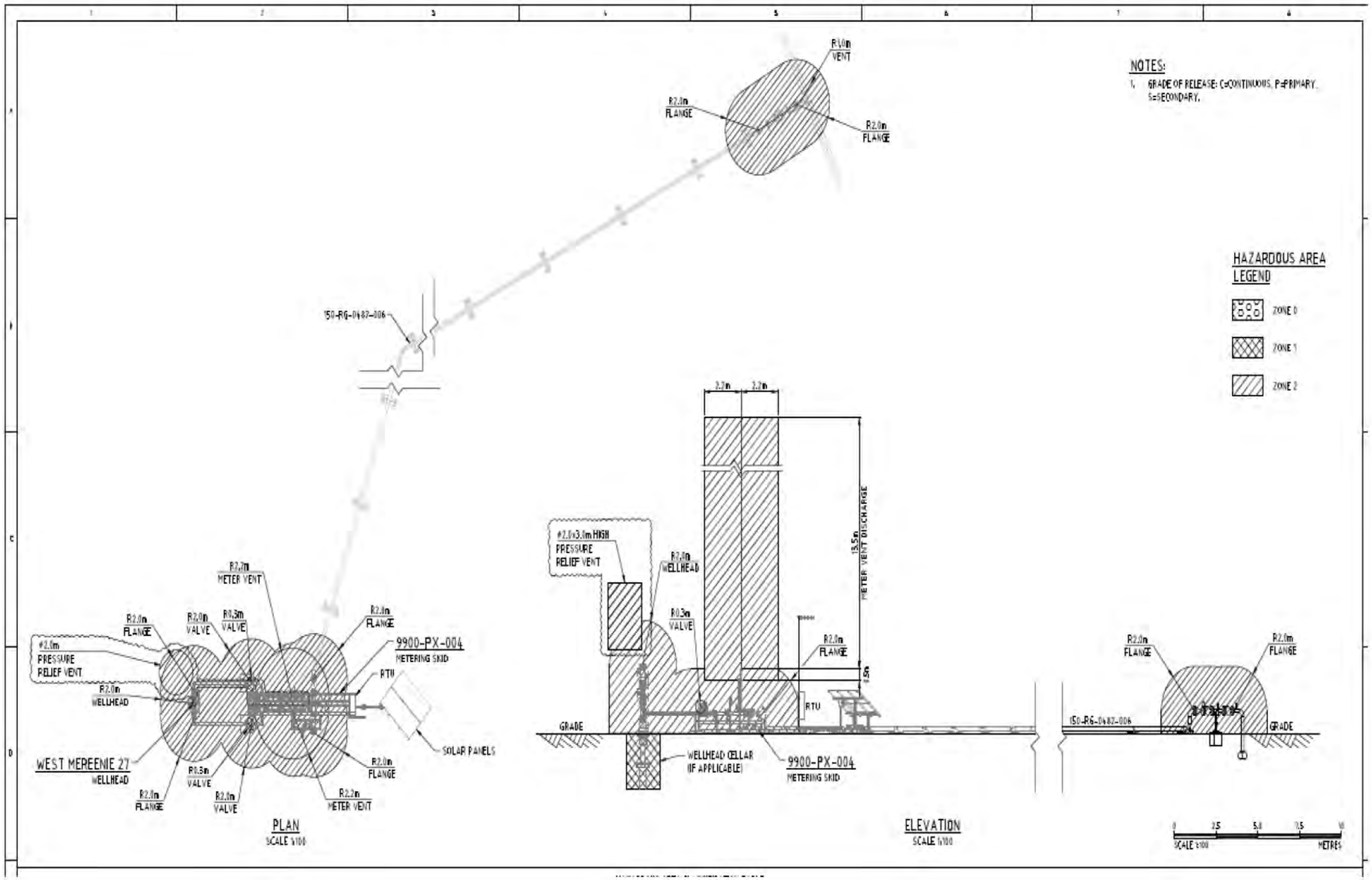
Fugitive methane emissions during operations leading to health and safety hazard including adverse environmental impacts	• All assets to be managed in accordance with the following to mitigate and response to fugitive emissions and leaks:
	  • Permit to work procedure
	  • Asset maintenance system
	  • 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)

Examples of hazardous areas for operator leak detection

Well



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End of Parts A, B and C

9 Implementation Strategy

This section covers the wider context of the EMP implementation and the requirements common across all environmental and operational aspects of the respective fields. Consistent with its 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 7.2 to 7.10 f the respective Part A, B and C.

9.1 Management system

The following components in Table 108 form CP's system for managing environmental compliance and reducing the potential impacts and risks of the activity to ALARP will be built into the work management systems.

Table 108: Environmental risk and compliance elements

Element	Item	Reference
1. Risk	Risk assessment	Appendix 1
2. Legislation	Legislation register	Section 2.1
3. Environmental outcomes and performance	PVGF	Section A.7.2 - A.7.10
	DGF	Section B.7.2 - B.7.10
	SOF	Section C.7.2 - C.7.10
4. Operations	PVGF management plans	Section A.8.1 - A.8.8
	DGF management plans	Section B.8.1 - B.8.8
	SOF management plans	Section C.8.1 - C.8.8
	Well integrity and operations	Well integrity management system WOMP
5. Emergency response	Site specific emergency response plans	Appendix 5
6. Monitoring and reporting	Environmental monitoring and reporting	Table 110

9.2 Roles and responsibilities

The Amadeus field is operated utilising the following management structure (Figure 23), with responsibilities aligned with specific roles detailed in Table 109. However, all personnel have a responsibility to operate in a safe and environmentally responsible manner.

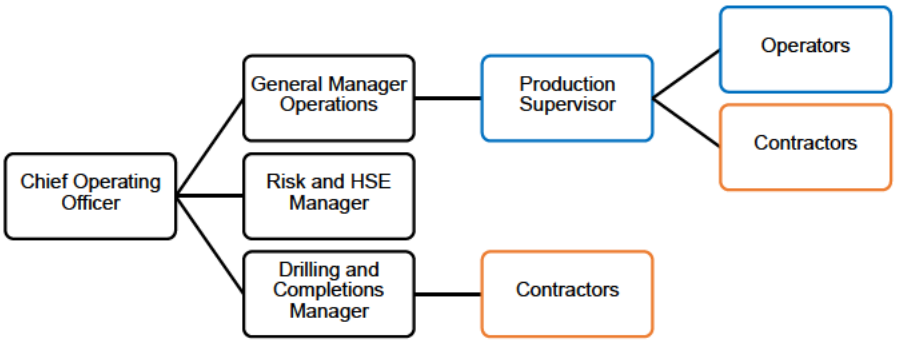

Figure 23: Management structure

Table 109: Roles and responsibilities

Role	Responsibilities	Activities
Chief Operating Officer	Overall operation of the Operator's activities	All
General Manager Operations	Nominated Liaison Officer	Production operations, civil and project activities, support, workovers
Drilling and Completions Manager	Project managing workovers activities	Workovers/Civil and project activities
Risk and HSE Manager	Providing systems, processes and advice to site personnel on the management of risk and the environment.	All
Production Supervisor	Person in charge on-site to operate facilities in a safe responsible manner	All
Operators	Safe operating of the field and infrastructure	Production operations
Contractors	Deliver projects in line with scope and requirements.	Production operations, civil and project, support, workovers

9.3 Training and awareness

The Operator's policies and procedures outlines the training and competency requirements of all personnel (staff, contractors and visitors) to ensure they can fulfil their obligations under this EMP. This enables the Operator to work effectively in developing and promoting measures to ensure a high level of Health, Safety and Environment (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 the Operator's personnel, contractors and visitors is maintained for compliance with the Operator's management system.

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, these are designed for the Operator's 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.

9.4 Emergency preparedness and response

An Emergency Response Plan (ERP) is in place covering the proposed activities within the EMP. 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

When conducting workovers, the development of a program specific ERP is completed in conjunction with the workover contractor, 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 improvements processes to incorporate the latest information arising from incidents, near misses and emergency simulation training sessions.

9.5 Contractor management

Most of the work undertaken under this EMP will be performed by the Operator's personnel using standard work instructions. However, some scopes of work will be undertaken by contractors. Efforts are therefore focused on effective contractor management, to ensure third parties are compliant 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 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 which 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.

9.6 Monitoring and reporting

9.6.1 Monitoring

Environmental monitoring conducted specific to each environmental aspect is outlined in Sections 7.2 to 7.10 of the respective Part A, B and C

Any incident identified from our monitoring activities will be captured in 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 undertaken. All personnel are required to proactively report all incidents, and identification of potential hazards not matter how minor to act as an alert and to maintain a program of continual improvement.

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

Calibration of equipment will be prompted and managed via our asset management system with records and evidence, or currency maintained. In addition, and as per the Code, laboratory analyses will be conducted by a laboratory that has 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 Code.

Monitoring requirements are detailed in Table 110.

9.6.2 Reporting

All reporting under the *CoP, Petroleum (Environment) Regulations, NT Waste Management and Pollution Control (WMPC) Act 1998, the schedule* and other relevant legislation as they relate to this EMP will be provided as per requirements. Any ad hoc reporting such as reportable incidents, and requests for prescribed documents will be provide as per Petroleum (Environment) Regulations.

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

Table 110 details the reporting requirements according to the environmental aspects.

Table 110: Monitoring and Reporting Requirements

Aspect	Record(s)/Report(s)	Type of record/report	Action	Frequency
Biodiversity	Record(s)	▪ Permit to work records ▪ Incident records ▪ Environmental sensitivity maps ▪ Weed declaration certificates ▪ Induction and register of participants		During operations as required (incident records to be submitted quarterly)
		▪ Hazards inspection	▪ Lease area monitoring and inspections (fauna interactions/fencing)	Various – based on activities
	Report(s)	▪ Rehabilitation report	▪ Visual inspection and photo point monitoring ▪ Weed survey ▪ Fire break monitoring ▪ Fire fuel load/mapping review ▪ Fire scar mapping	Annual
Land	Record(s)	▪ Hazards inspection	▪ Weather and road conditions	▪ Daily
			▪ Chemical and waste storage areas/tanks or similar ▪ Secondary containment (when in use)	▪ PVGF: weekly ▪ DGF, SOF: when attending site
			▪ Visual site inspection on erosion and sediment control measures implemented	▪ Civil activities and workovers: daily ▪ Operational areas: monthly ▪ Field: within five days of significant rainfall
		▪ Incident records	▪ Soil contamination assessment incorporating sampling following any Tier 1 spills or spills outside lease areas (as required)	During operations as required (incident records to be submitted quarterly)
		▪ Permit to work records	▪	During operations as required
	Report(s)	▪ Rehabilitation report	▪ Rehabilitation success monitoring – land stabilisation, visual inspection and photo point monitoring	Annual
Surface water	Record(s)	▪ Chemical register ▪ Job hazard analysis		During operations as required

Aspect	Record(s)/Report(s)	Type of record/report	Action	Frequency
		▪ Daily production reports		Daily
		▪ Hazards inspection	Chemical and waste storage areas/tanks or similar ▪ Secondary containment (when in use)	▪ PVGF: weekly ▪ DGF, SOF: when attending site
			▪ Visual monitoring of erosion and sediment controls	▪ Civil activities and workovers: daily ▪ Operational areas: monthly ▪ Field: within five days of significant rainfall
			▪ Evaporation ponds: freeboard levels	PVGF: weekly
		▪ Incident records	▪ Water sampling, where available following a Tier 1 spill and following removal of contamination source	During operations as required
Groundwater	Record(s)	▪ Calibration	In-situ water meter	Prior to use
		▪ Hazards inspection	▪ Chemical and waste storage areas/tanks or similar ▪ Secondary containment (when in use)	▪ PVGF: weekly ▪ DGF, SOF: when attending site
			▪ Evaporation ponds: freeboard levels	PVGF: weekly
		▪ Incident records	▪ Water sampling, where available following a Tier 1 spill and following removal of contamination source	During operations as required
	Report(s)	▪ Groundwater monitoring program	Table 2 – Required Analytes, Preliminary Guideline: Groundwater Monitoring Bores for Exploration Petroleum Wells in the Beetaloo Sub-Basin, DEPWS November 2018	▪ Bi-annual ▪ PVGF (PVL-630-PLN-0001): approved date 16/05/2021 ▪ DGF & SOF (DIN-630-PLN-0003): approved date 16/10/2020
		▪ Well monitoring, surveillance and reporting	▪ Per DITT approved WOMPs ▪ Well barrier integrity verification reports	Annual
Air and noise	Record(s)	▪ Hazards inspection	▪ Routine testing, inspection and maintenance for assets including wells, flowlines, processing plant equipment (as per Asset Management System) ▪ Hydrotest monitoring of assets prior to commissioning (as required)	During operations as required

Aspect	Record(s)/Report(s)	Type of record/report	Action	Frequency
		▪ Process/metering records	▪ Venting records	During operations as required
			▪ Well head pressure	Monthly
			▪ Pressure monitoring of flowlines	Continuous
		▪ Incident records	▪ Recording of unplanned venting events	During operations as required (incident records to be submitted quarterly)
		▪ Calibration records	▪ Plant/well metering and measurement ▪ Leak detection meters	Ongoing and as per NATA required accreditation for metering equipment (refer to Document Number: 1000-070-PLN-0003 in Appendix 6).
	Report(s)	▪ Well monitoring, surveillance and reporting	▪ Per DITT approved WOMPs ▪ Leak detection monitoring program	Annual
		▪ National Greenhouse and Energy Reporting scheme (NGERs)		Annual
Hazards	Record(s)	▪ Incident records ▪ JHA records		As event occurs (incident records to be submitted quarterly)
		▪ NORMS testing records	▪ Per the Operator NORMs plan	▪ During operations ▪ As required during workovers
		▪ Hazards inspection	▪ Monitor long-term and short-term weather forecast ▪ Measure rainfall	Daily
			▪ Chemical and waste storage areas/tanks or similar ▪ Secondary containment (when in use)	▪ PVGF: weekly ▪ DGF, SOF: when attending site
			▪ Evaporation ponds: freeboard levels	PVGF: weekly
			▪ Monitor water volumes entering evaporation ponds	PVGF: daily
			▪ Visual site inspection on erosion and sediment control measures implemented (civil activities)	▪ Civil activities and workovers: daily ▪ Operational areas: monthly

Aspect	Record(s)/Report(s)	Type of record/report	Action	Frequency
				▪ Field: within five days of significant rainfall
			▪ Waste tracking records	Monthly
			▪ Inspect fire equipment functionality (prior to high fire danger season)	Bi-annual
		▪ Rehabilitation report	▪ Fire break monitoring	Annual
Heritage	Record(s)	▪ Incident records ▪ Induction (Heritage and Cultural Awareness) ▪ Communication with CLC ▪ JHA records ▪ Emergency response drills		As required
		▪ Hazards inspection	▪ Weather and road conditions ▪ Current fire danger ▪ NAFI fire tracking maps	Daily
	Report(s)	▪ Rehabilitation report	▪ Fire fuel load/mapping review ▪ Fire scar mapping	Annual
		▪ Incident records	▪ Notify AAPA/CLC of approval and permit breaches as per conditions	During operations as required
		▪ Review of registers and records		Annual
Community	Record(s)	▪ Incident records ▪ Induction		During operations as required
		▪ Hazards inspection	▪ Waste tracking records	Monthly
			▪ Chemical and waste storage areas/tanks or similar	▪ PVG: weekly ▪ DGF, SOF: when attending site
		▪ Stakeholder communication log	▪ Community complaints	Records kept when applicable
		▪ Journey management system	▪ Traffic changes	Weekly
Environmental Performance	Report(s)	▪ Environmental performance report	Records: ▪ Hazard inspections ▪ Work management and maintenance system records ▪ Daily production reports	Annual

Aspect	Record(s)/Report(s)	Type of record/report	Action	Frequency
			▪ Daily environmental checks ▪ Relevant registers e.g. training, waste, chemicals, logistics ▪ NGERS report ▪ Regulatory inspections ▪ Recordable and reportable incidents ▪ Reports provided to DITT and other government agencies	

9.7 Records management

As per the Operator's 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 A.7, B.7 and C.7

9.8 Management of change

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

The MoC process will only be used when optimising environmental outcomes or to improve 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.

9.9 Auditing and assurance

In addition to regular monitoring as set out in this document, audits assessing compliance with this EMP will be undertaken by the Operator or third parties prior to, during and upon completion of the activity and at least annually. Any non-compliances arising from regulated activities will be recorded and corrective actions undertaken to address the gaps. These non-conformances and corrective actions will be recorded, tracked, and reported. Any non-compliance with approved conditions will be reported in the AEPR.

9.10 Corrective action, review and continuous improvement

Corrective Actions

The Operator's incident management procedures and system are designed to:

- Ensure all incidents and hazards are reported in a standard format so that consistency and accuracy of the process is 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 hazards statistics and identify potential trends
- Identify potential suitable corrective actions.

All corrective/improvement associated with incident, hazards, and assurance activities are recorded, tracked by the system and status reported. Any overdue actions are followed up and escalated as required.

Review and Continuous Improvement

Implementation of this EMP will be continually assessed and revised as required based on monitoring and assurance results, feedback, change to the proposed work program or a material increase in risk level.

A formal review and resubmission of this EMP will be undertaken every five years.

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11 Glossary and Abbreviations

Abbreviation	Details
AAPA	Aboriginal Areas Protection Authority
AEP	Annual Exceedance Probability
ALARP	As Low As Reasonably Practicable
APPEA	Australia Petroleum Production and Exploration Association
BECGS	Brewer Estate City Gate Gas
BGL	Below Ground Level
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CCS	Central Compression Station
CE	Critically Endangered
CLC	Central Land Council
Competent person	Means a person who has the necessary ability, knowledge, and the relevant experience to conduct the task or activity
CP	Central Petroleum Limited
CTP	Central Treatment Plant
DC	Direct Current
DCCEEW	Department of Climate Change, Energy, Environment and Water
DD	Data Deficient
DEPWS	Department of Environment, Parks and Water Security
DGF	Dingo Gas Field
DITT	Department of Industry, Tourism and Trade
EC	Electrical Conductivity
EMP	Environment Management Plan
EN	Endangered
EPA	NT Environment Protection Authority
EPBC	Environment Protection and Biodiversity Conservation Act 1999
ESC	Erosion and Sediment Control
ESD	Ecologically Sustainable Development
GHG	Greenhouse Gas
HDPE	High-density Polyethylene
HSE	Health, Safety and Environment
ISO	International Standards Organisation
JW-1	Johnstone West-1
KCl	Potassium Chloride
LCM	Liaison Committee Meetings

Abbreviation	Details
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).
L6	Production Licence 6 for the SOF
L7	Production Licence 7 for DGF
m	Metre
mm	Millimetre
MNES	Matters of National Environmental Significance
NAFI	Northern Australia Fire Information
NGER	National Greenhouse and Energy Reporting
NORM	Normally Radioactive Material
NT	Northern Territory
NTD	Near Threatened
NPI	National Pollution Inventory
OL3	Operating Licence 3 for PVGF
OL4	Operating Licence 4
PJ	Petajoule
PMST	Protected Matters Search Tool
PPE	Personal Protective Equipment
PRCP	Progressive Rehabilitation and Closure Plan
PVGF	Palm Valley Gas Field
PWV	Production Wing Valve
SDS	Safety Data Sheet
S-1	Surprise 1 Re-entry H ST1
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 to soil stability, quality or landform. **Indigenous / non-indigenous artefacts:** An impact that results in the destruction of a known indigenous or non-indigenous artefact. **Natural environment in association with weather events:** No linked exacerbation of extreme weather events (e.g. flood/fire risk) to a regulated activity approved by this EMP resulting in irreversible damage to the environment
Significant Rainfall	Any rainfall event over 10 mm in 24 hours
SoBS	Site of Botanical Significance
SoCS	Site of Conservation Significance
SOF	Surprise Oil Field
SSCC	Sacred Sites Clearance Certificate

Abbreviation	Details
Suitably Qualified Person	A person who has the professional qualifications, training or 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
The Code	Code of Practice: Onshore Petroleum Activities in the Northern Territory
TJ	Terajoule
TPWC	Territory Parks and Wildlife Conservation
VU	Vulnerable
WOMP	Well Operations Management Plan
WoNS	Weeds of National Significance