PEAK HELIUM

Peak Helium

EMP PKH2-3

NT Exploration Permit (EP) 134

Appendices

02 – 10

INGAUGE
Well Engineering & Project Management

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2 Appendix 02 – Project Activities

Peak Helium Pty Ltd

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Appendix 02
Project Activities

Rev	Description	Date	Initiated	Reviewed	Approved
0	Issued for Submission	18/07/2022	Jon Bennett	Katie Robertson Vicky Cartwright Jon Bennett	Jon Bennet
1	Re-issued for Submission	19/08/2022	Trent Smith	Trent Smith Nicholas Fraser Katie Robertson Vicky Cartwright	Jon Bennett
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3	Re-issued for Submission	1/02/2022	-	-	Trent Smith

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2 Project Activities

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This appendix gives an overview of the regulated activities to be carried out by Peak Helium Pty Ltd (Peak Helium) under EMP PKH02-2(EMP).

2.1 2D Seismic Survey

No 2D seismic survey activities will be undertaken under this EMP

2.2 Access Track Construction

2.2.1 Overview

An ecologist will be on-site before or during clearing operations to undertake ground-truthing for ground-disturbing activities in advance of construction. Pre-existing pastoral tracks and repurposed seismic tracks will be primarily utilised to access well pads, limiting the number of new tracks to be constructed and reducing the amount of land clearing required. The construction of access tracks will require vegetation clearing and rootstock removal, potentially including areas within riparian zones. Where this is required, the path of least impact will be selected within the working corridor. Calculations for land clearing associated with access track creation will consider the necessary clearing area needed for intersections and drains. All access tracks are required to be at least 6 metres wide; as such, all new tracks will be constructed to a 6-metre width. The width of pre-existing pastoral tracks varies greatly due to the variability of existing pastoral tracks but in general, they are at least 4 metres wide. Where widening is required for pastoral tracks (pastoral tracks that are not at least 6m already), an overestimate of 2 metres (due to the varying widths of pastoral tracks) will be used for calculations. Seismic tracks were built to a 5-metre width, and therefore, these tracks will need to be expanded another metre. Furthermore, existing tracks may be increased to a maximum width of 15m at intersections to provide vehicles with a safe turning radius and sufficient visibility. If road sections require a wear surface, where practicable, the material will be sourced from local gravel pits and turn out drains constructed; these drains will avoid mature trees, e.g., Desert Oak.

It is important to note that there are areas of the EP that intersect Sites of Conservation and Botanical Significance (SOCS/SOBS). Some access roads and tracks intersect the area of the KCPS; however, no new construction will occur in SOC/SOBS area (see **Section 3.6.2** of the **EMP**) for further detail and mitigation measures that will be in place.

The impact on trees of significance or environmentally sensitive flora or fauna will be minimised as much as practicable during the proposed program. A decision tree for tree clearing when constructing access tracks is shown in **Figure 2.2—1**. No clearing will occur within SOCS or SOBS. There will be a pre-clearing survey conducted for Grey Falcon nests within 300m of all planned activities. Potential habitats for the Princess Parrot will be avoided and clearing and construction activities will be situated to avoid these locations. In the case of Grey Falcon Nests, these will be given a 300m buffer from activities until they are no longer active. **Figure 3.5 – 7** in the EMP shows desk-topped stream crossings of existing pastoral tracks that may require improvement/widening.

2.2.2 Methodology

Timber and vegetation will be cleared from new access tracks or widened existing pastoral tracks and stockpiled or mulched for future rehabilitation activities. To avoid further clearing, cleared timber and vegetation will be stockpiled in a naturally occurring clear area, where one is available in the immediate vicinity.

New access tracks will be formed and compacted using on-site materials; where local materials from gravel/borrow pits are unsuitable, additional materials will be imported. All erosion and sediment control measures will be constructed following **Appendix 05** (Erosion and Sediment Control Plan).

Permits will be applied for any watercourses identified during ground-truthing when there are plans to alter the stability of the bed or banks of a waterway, including the removal of vegetation. This includes the maintenance of the pre-existing tracks, re-establishing seismic tracks or constructing new tracks that cross natural channels in which water flows, whether or not the flow is continuous. Watercourse crossings required will be constructed as perpendicular to the creek as possible and in accordance with **Appendix 05** (Erosion and Sediment Control Plan).

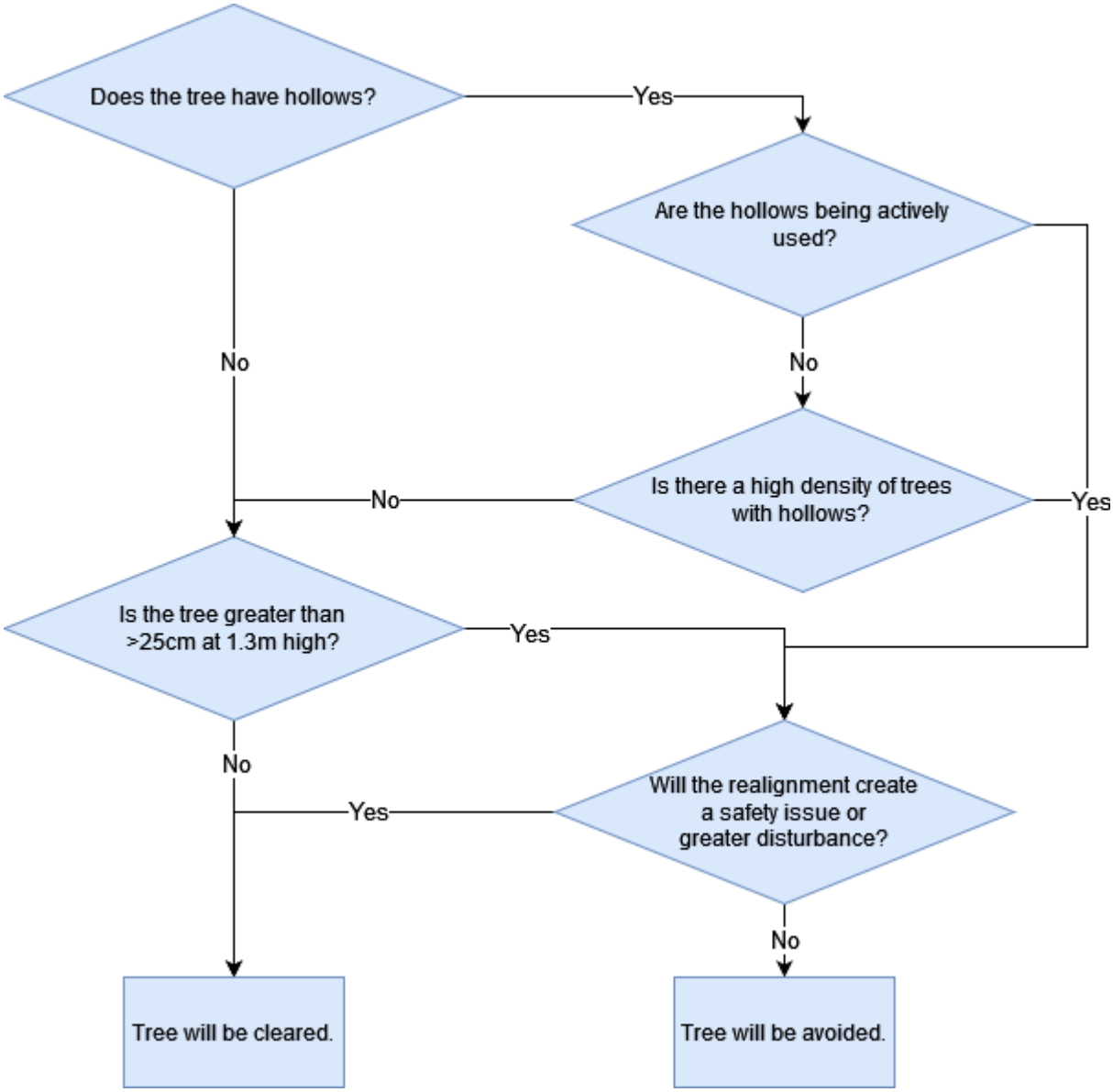


Figure 2.2—1 Tree Clearing Decision Tree for Linear Infrastructure Construction

2.3 Flowline Construction, Operation, and Decommissioning

No flowlines will be constructed, operated, or decommissioned under this EMP.

2.4 Well Pad Construction

2.4.1 Overview

An ecologist will be on-site before clearing operations to undertake ground-truthing in advance of any ground disturbance, to ensure the actual riparian zones, buffers for drainage depressions and ordered streams, the location of sinkholes, the location of Desert Oaks and the density of hollow-bearing trees and their buffers are identified to ensure that regulated activities are avoided in sensitive areas. No clearing will occur within SOCS or SOBS. There will be a pre-clearing survey conducted for Grey Falcon nests within 300m of all planned activities. Potential habitats for the Princess Parrot will be avoided and clearing and construction activities will be situated to avoid these locations. In the case of Grey Falcon Nests, these will be given a 300m buffer from activities until they are no longer active.

Well pads will be constructed as required to provide a safe and efficient workplace for drilling and other well pad regulated activities.

The construction of well pads will include:

- Clearing and levelling the well pad work area.
- Constructing lined pits for the storage of freshwater and drilling by-products.
- Constructing water production bores.
- Installing a drilling cellar and conductor.
- Fencing well pads to prevent livestock and personnel entry.
- Clearing firebreaks.
- Installing erosion and sediment control devices.

2.4.2 Methodology

Vegetation will be cleared from the well pad and stockpiled for future rehabilitation activities.

The well pad will be levelled and compacted using on-site materials as far as practicable.

Pits will be constructed using bulldozers and excavators, with berms consolidated with watering and compaction.

Water production bores will be drilled by a licenced driller in line with permit conditions.

Fire breaks will be constructed and maintained in line with **Appendix 08** (Fire Management Plan).

Erosion and sediment controls will be constructed as per **Appendix 05** (Erosion and Sediment Control Plan).

The well pad will be fenced to exclude livestock; barbed wire will be used in line with local pastoral practices.

2.4.3 Cut and Fill Well Pad Methodology

Where a natural slope is too great for a drilling rig to operate safely, the well pad will be cut and filled to flat, using the methodology below.

Cut and fill will be avoided through placement of well pads in areas with a slope <2%, where a slope of >2% cannot be avoided the controls as listed in the ESCP will be implemented.

2.4.3.1 Vegetation Stockpiling and Dirty Water Filtration

Vegetation will be stripped from the well pad and windrowed along the downslope section of the well pad and fire access track. This has the benefit of filtering any runoff from the well pad during construction and from the well pad fill batters post-construction, as shown in **Figure 2.4—2**.

2.4.3.2 Topsoil and Clean Water Diversion

Topsoil from the well pad shall be stripped and windrowed above the cut batter and fire access track on the upslope extent of the well pad, as shown in the image below and the attached plan. Care should be taken to ensure that water intercepted by the topsoil bund does not drain back onto the pad or to dirty water catch drains.

Figure 2.4—1 Topsoil Windrow Above the Cut Batter Used to Divert Clean Water Away from the Well Pad

2.4.3.3 Levelling the Well Pad

The well pad will be cut and filled to flat, balancing the on-site material volumes to avoid the need to bring or remove material from the well pad. The well pad will be compacted to provide a good working surface and crowned along the Plant North/South Centreline to achieve a 1% fall back to the well pad edge draining to the plant East and West batters.

Both cut and fill batters will be at a 1:1 slope.

The cut batters will be protected from erosion by the topsoil stockpile/clean water diversion bund preventing significant water volumes from washing over them.

The fill batters will be protected by constructing a bund at the top to prevent water from the well pad from running down the batter's face.

2.4.3.4 Well Pad Drainage

Rainfall collected on a well pad is expected to runoff from the compacted areas. Rainwater will drain east and west on the well pad to shallow spoon drains constructed inside the bunds at the top of the fill batters and to the toes of the cut batters. These drains will be contoured to take the runoff to the cut/fill point of the well pad.

2.4.4 Sediment Control

Drains will be installed from the cut/fill point on the pad to type 2 sediment controls, as shown in **Figure 2.4—2**.

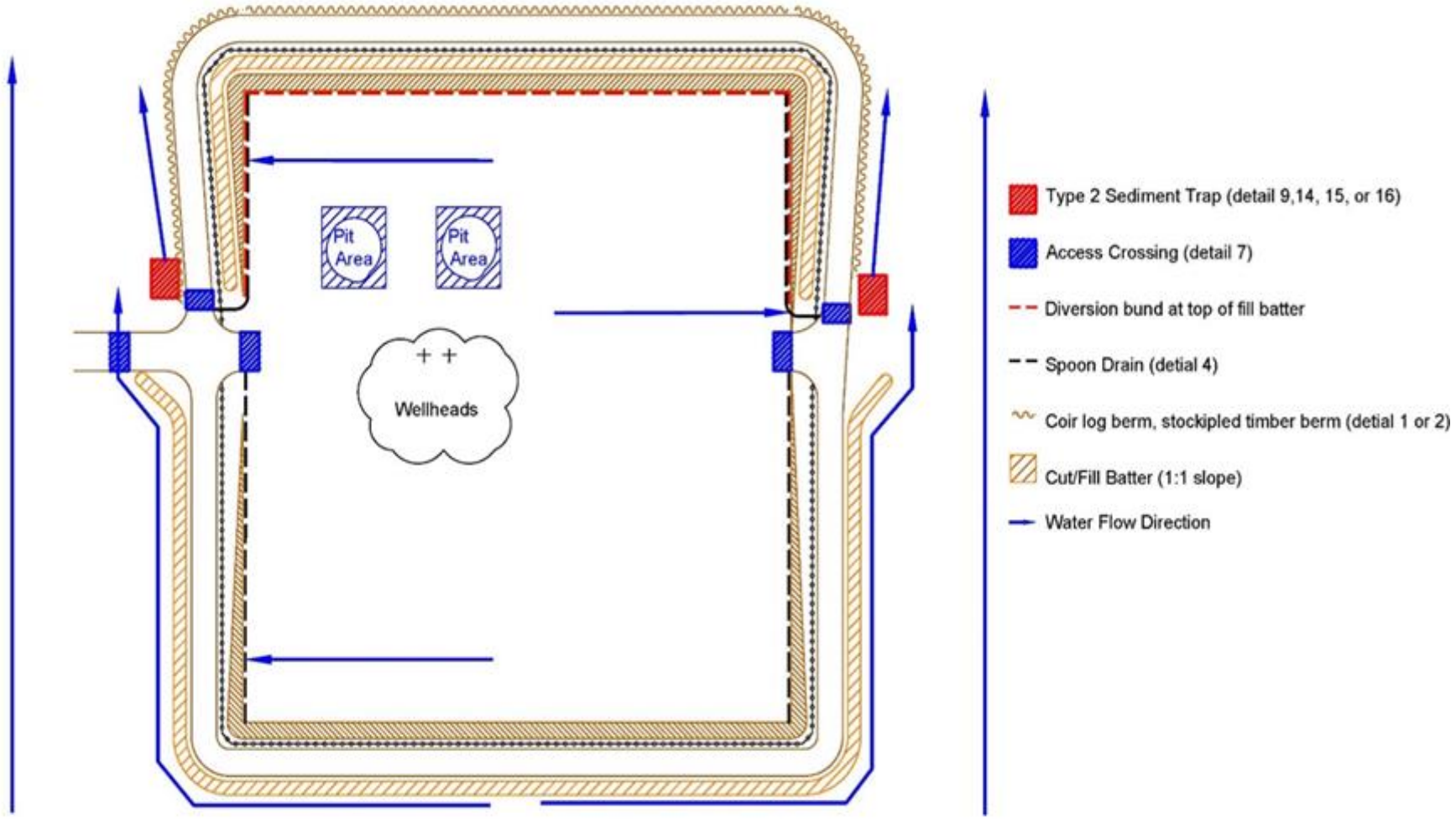


Figure 2.4—2 Cut and Fill Well Pad Layout

2.5 Water Bores

2.5.1 Overview

Water bores are required for/to:

- Provide access to aquifers that could be impacted by regulated activities to establish baseline water qualities.
- The production of water required to carry out regulated activities.

Where water bores are to be drilled for the above purposes:

- A Bore Work Permit will be sought and issued by Water Resources for all water bores drilled.
- All bores will be drilled, commissioned, and tested according to the issued Bore Work Permit conditions by appropriately licenced drillers.
- Water bores will be co-located on the well pads where possible, so no additional clearing will be done beyond the extent required for the well pad. Where this is not possible, water bores will be located adjacent access tracks within the proposed well corridors.

2.6 Freshwater lines

Freshwater lines, if required where a water production bore is not drilled on a well pad, will be run along the surface in a similar manner to pastoralists running freshwater lines.

Where practicable, these freshwater lines will be run on or adjacent to access tracks.

2.7 Campsite/s

Campsite/s are planned to be located within 200 meters of each well pad. Campsite/s will be located on flat ground in areas with limited tree growth to reduce the amount of civil construction, soil disturbance and vegetation clearing. For construction work required to provide a safe location for workers, the construction methodology will be like that of a well pad.

2.8 Gravel / Borrow Pits

2.8.1 Overview

On-site material will be used for the majority of civil construction works. Gravel and/or fill material will be required to give a better running surface on some road sections and may be required to cap some well pads, depending on the on-site material.

An ecologist will be on-site before clearing operations to undertake ground-truthing for ground-disturbing activities in advance of any ground disturbance, to ensure the actual riparian zones and the buffers for drainage depressions and ordered streams, Desert Oak and the location and density of hollow-bearing trees and their buffers are identified to ensure that regulated activities are avoided in sensitive areas. If Grey Falcon nests are discovered in the pre-clearing surveys, these trees will be avoided and given a 300m buffer from any project activities (including clearing).

Where gravel or fill is required, local gravel/borrow pits will be established.

The use and maintenance of these pits will include the following:

- Clearing of vegetation to be stockpiled around the perimeter of the cleared area for rehabilitation.
- Stripping of topsoil (if required):
    - Topsoil will be stockpiled around the upslope side of the gravel / borrow pit to divert overland flow from entering the pit.
    - If there is no topsoil on-site (e.g., Pea Gravel site), a diversion bund will be constructed upslope to divert any overland flow.
- A whoa boy will be constructed on the access track so that water does not flow down the access track into the pit.
- Batters will not be steeper than 1:1 to allow safe passage for animals, and people.
- Gravel/borrow pits will not be fenced.
- Gravel/borrow pits will intentionally be kept wide and shallow to facilitate rehabilitation.

An indicative layout for a gravel/borrow pit is shown in **Figure 2.8—1** and shows dimensions of 100m by 100m including vegetation, topsoil, and diversion bunds. The layout size is to facilitate the predicted extraction volume of 15,000m^3 of gravel/fill from each pit.

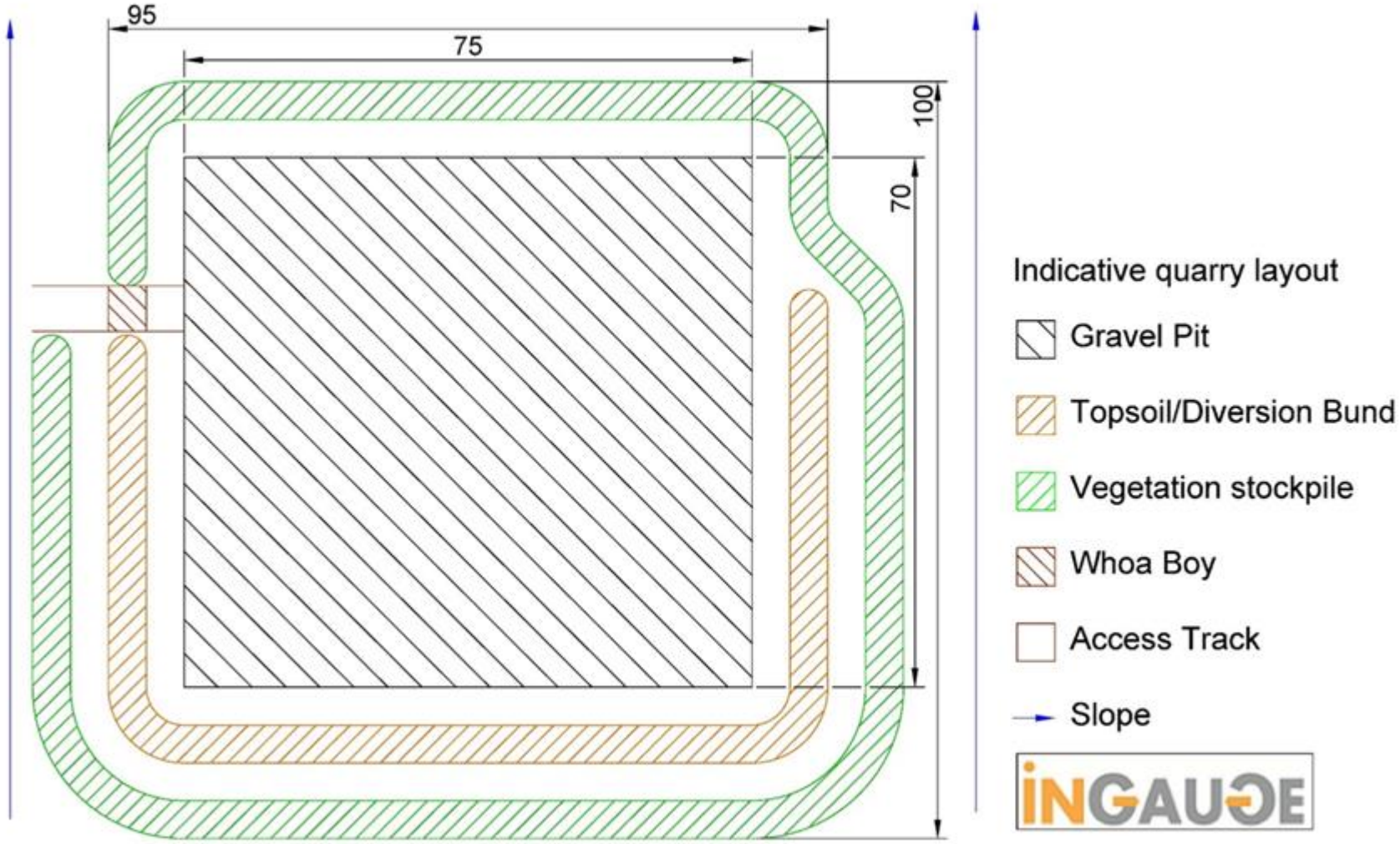


Figure 2.8—1 Indicate Gravel Pit Layout

2.9 Drilling

2.9.1 Overview

There are two potential well designs to be carried out under this EMP:

1. A cased vertical well.
2. A cased horizontal production well with a plugged back open hole vertical pilot.
    - The open hole vertical pilot in this design is drilled and logged to confirm the prognosed formations' depths before being plugged back to the horizontal kick-off point and horizontal section drilled and cased.

The surface section will be the same for both the vertical pilot and the horizontal production hole.

This EMP scope also includes a multi-well pad, where more than one wellbore is drilled from a well pad; the extra complexity of collision avoidance for multi-well pads is covered in **Section 2.9.6**.

2.9.2 Surface Hole Section

The surface hold section will be drilled from the pre-installed cellar and conductor to a depth that isolates any shallow aquifer/s.

During drilling of the Amadeus basin, total drilling fluids losses are generally observed in the shallow aquifers. This scenario is anticipated in current well designs, with high permeability conduits, fractures and cavernous zones expected in karstic formations. Loss of circulation material (LCM) is generally not successful for responding to fluid losses in these formations. When total losses occur, the drilling fluid systems are reduced back to water to maintain dynamic well control while minimising drilling additive losses to the formation.

The 'surface casing' will be installed into the surface hole and cemented (specifically engineered cement) to seal the aquifer off from the rest of the wellbore to prevent fluid crossflow between formations. During cement operations, cement may also be lost to the formation resulting in cement slumping or "patchy" cement sections. If cementing of the surface casing for a well is unsuccessful (i.e., the cement does not return to the surface or slumping is observed), top-up cement job/s will be undertaken. This process involves spotting cement from the surface in the annulus of the surface casing and formation.

2.9.3 Intermediate Hole Section

The surface casing shoe will be drilled out. Drilling will then progress down to the target intermediate hole depth for a vertical well, or the 'kick off' point for a horizontal well. When the intermediate hole section reaches its target depth, the intermediate casing is installed and cemented.

A Formation Integrity Test (FIT) or Leak-off Test (LOT) will be carried out at the intermediate casing shoe to prove integrity before drilling ahead.

2.9.4 Vertical Production Hole Sections

A vertical production hole section may be cased or left open hole; the drilling of either design is the same up until running casing.

Once the intermediate casing is cemented in place, a Blow Out Preventer (BOP) or Annular Diverter will be installed, function tested, and pressure tested to confirm its integrity. The intermediate casing shoe will be drilled out, and a short section of the production hole will be drilled. A FIT or LOT will be carried out at the intermediate casing shoe to prove integrity before drilling ahead. The production hole section will then be drilled to the target production hole depth.

If the production hole section is cased, the casing is installed and cemented. A Cement Bond Log (CBL) will be carried out to verify the production casing cement's integrity.

If a horizontal section is then drilled, the vertical production section will be plugged back to the kick-off point.

If the vertical production section is abandoned and a horizontal production hole section drilled later, the following will apply. The vertical production section will be plugged back a minimum of 200m inside the intermediate casing shoe to suspend the well until future activities occur.

2.9.5 Horizontal Production Hole Section

A horizontal wellbore can be drilled from a dedicated intermediate section or plugged back from a vertical wellbore.

Where a horizontal wellbore is being drilled from a dedicated intermediate section, the following protocol will apply. The intermediate casing shoe will be drilled out, and a short section of the production hole will be drilled. A FIT or LOT will be carried out at the intermediate casing shoe to prove integrity before directionally drilling ahead.

Where a horizontal wellbore is being drilled from the intermediate section of a vertical open hole pilot, the following protocol will apply. The vertical open-hole section will be abandoned and plugged back to above the kick-off point before directionally drilling ahead.

Where a horizontal wellbore is being drilled from the intermediate section of a vertical cased hole pilot, the following will apply:

- The vertical cased-hole section will be abandoned back to the kick-off point, a whipstock set into the intermediate casing, and an exit point milled into the intermediate casing.
- Once the kick-off operation has occurred, the production section will be directionally drilled horizontally within the target formations; the horizontal section length within the target formation will be up to 2,800m.
- When drilling horizontal wellbores or, for that matter, any directional well, standard directional drilling techniques and equipment are employed to enable accurate wellbore direction to be recorded and maintained.

2.9.6 Collision Avoidance on Multi-well pads

An added complexity of multi-well pads is collision avoidance of wellbores; unplanned wellbore collisions can have serious safety and environmental consequences. To minimise the risk of wellbore collision, the position of any existing wellbores and the well being drilled need to be clearly understood and a Separation Factor maintained.

While directionally drilling, standard directional drilling techniques and equipment are employed to enable accurate wellbore direction to be recorded and maintained. A "Separation Factor" for the well is also continually calculated and monitored. The use of separation factors is a standard industry control that has been effectively used for multi-well pad drilling within Australia and internationally.

Industry practice generally maintains a separation factor greater than two between well paths unless an internal risk assessment is carried out to avoid wellbore collision. Separation factors are covered in more detail in **Section 2.9.6.1**.

Peak Helium will follow this industry practice whilst drilling multiple wells on a pad under this **EMP**.

2.9.6.1 Separation Factors

A visual representation of separation factors is provided in **Figure 2.9—2** and **Figure 2.9—3**. The level of uncertainty of a wellbore's position increases along its path, as shown in **Figure 2.9—1**, due to several factors:

- Relative Depth Error:
    - Error in measuring along the hole depth, e.g., stretch in a wireline.
- Misalignment Error:
    - Error due to instrument misalignment in the wellbore.
- True Inclination Error:
    - Error in inclination reading.
- Compass Reference Error:
    - A constant error in direction due to misalignment, e.g., gyro error or error in magnetic declination.
- Drill string Magnetisation:
    - Magnetic interference caused by "hot spots".
- Gyrocompass:
    - Error due to gyron Gimbal drift.

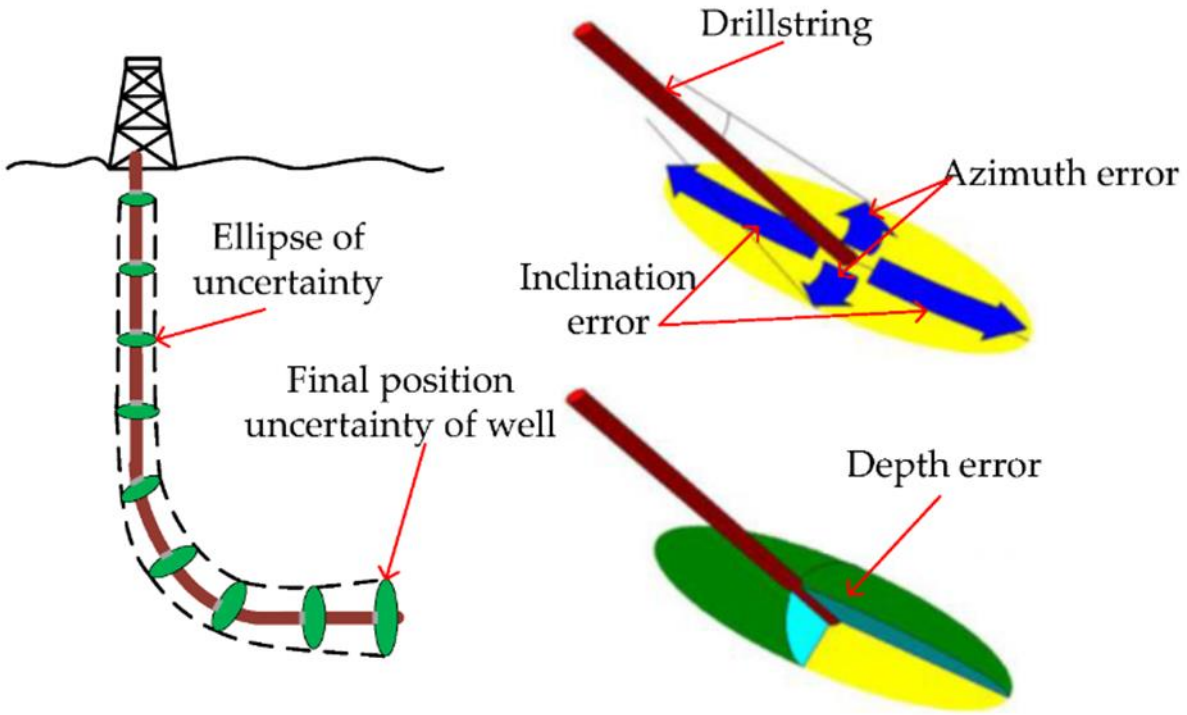


Figure 2.9—1 Wellbore Uncertainty

Because of this increase in uncertainty along the wellpath, a separation factor is used, rather than standard separation distance. The separation factor is a ratio of the centre-to-centre distance of the wellbores over the sum of the uncertainty of both wellbores, as shown in **Figure 2.9—2** Separation Factor

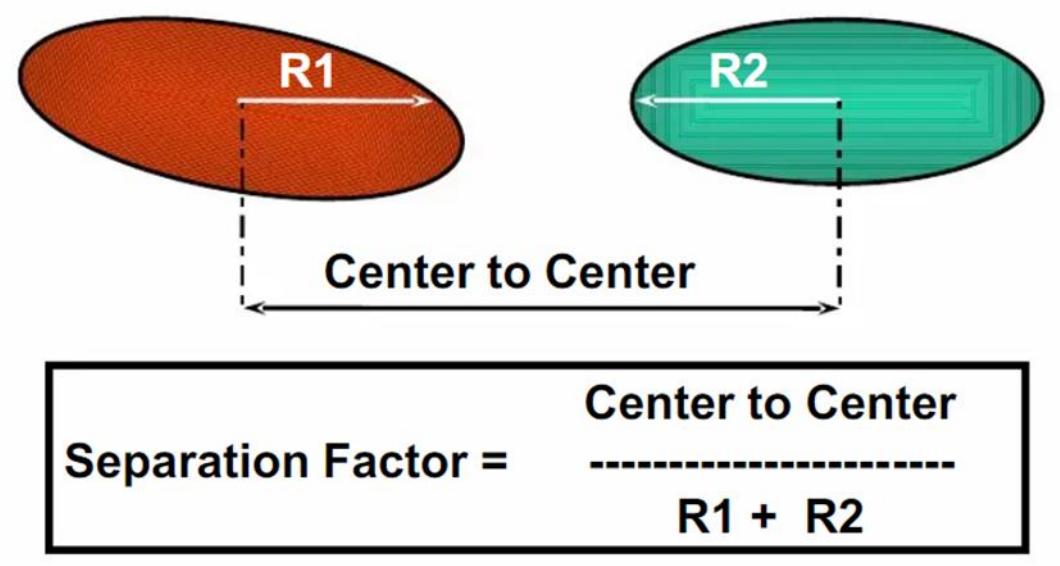


Figure 2.9—2 Separation Factor

As shown in **Figure 2.9—3** separation factor of:

- Greater than 1, the two ellipses of uncertainty do not overlap.
- 1, the two ellipses of uncertainly just touch.
- Less than 1, the two ellipses of uncertainty overlap.

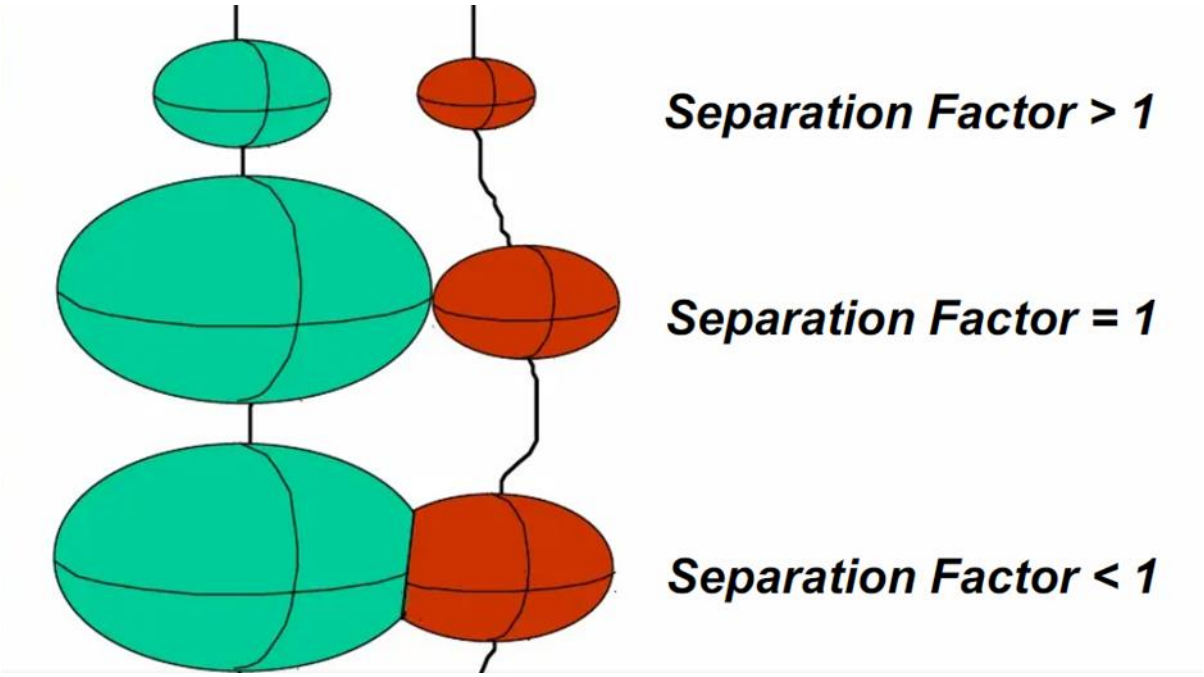


Figure 2.9—3 Separation Factor Comparison

2.10 Drill Stem Testing

2.10.1 Overview

The drill stem test (DST) is carried out to gather well/reservoir data and properties which may be essential for prospect/area evaluation and analysis. In general, tests are performed in open hole, and may use inflatable or conventional weight-set packers.

2.10.2 Surface Pressure for DST

The standard test equipment normally used is rated for 3,000, 5,000 or 10,000 psi. The surface pressure rating of the test head shall be at least 10% higher than the maximum of the following conditions:

- **Condition 1:** SITHP for a gas filled tubing for the highest reservoir pressure to be tested.
- **Condition 2:** The maximum surface pressure that is required to squeeze kill the test zone with the highest reservoir pressure to be tested.

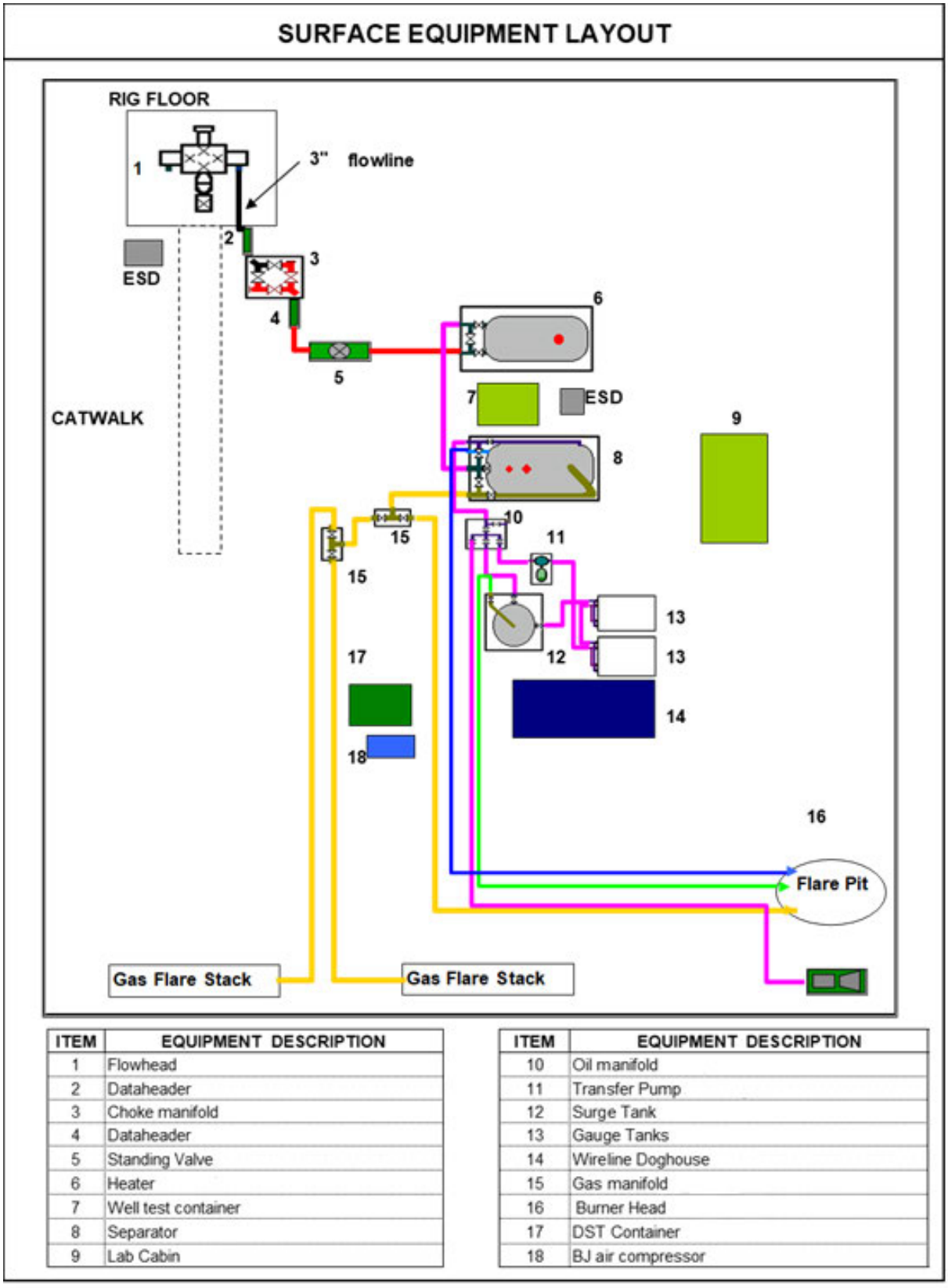
Prior to the DST the test head is required to be pressure tested, together with all other test equipment upstream of the choke. To enable this to occur there needs to be a full opening valve (the Kelly Cock) placed in the string below the test head. Test equipment downstream of the choke is required to be pressure tested to a lesser pressure.

A full function test of all valves and automatic systems shall also be conducted.

There are two types of test head available, one designed for use on a top drive equipped rig, and the other for a Kelly equipped rig. The test head designed for use with a top drive has a flow path through the head. If this type of head is used on a Kelly equipped rig, ensure that there is a valve or plug installed on the top to stop flow out the top of the test head. Pressure testing the test head will also test this valve/ plug.

2.10.3 Test String Configurations

The figure below illustrates the typical standard test string configurations used in onshore operations. This general configuration will vary slightly depending on the Testing Contractor used and the formations being tested. The Testing Programme shall detail any non-standard string configurations requested by the Project Team.



ITEM	EQUIPMENT DESCRIPTION
1	Flowhead
2	Dataheader
3	Choke manifold
4	Dataheader
5	Standing Valve
6	Heater
7	Well test container
8	Separator
9	Lab Cabin

ITEM	EQUIPMENT DESCRIPTION
10	Oil manifold
11	Transfer Pump
12	Surge Tank
13	Gauge Tanks
14	Wireline Doghouse
15	Gas manifold
16	Burner Head
17	DST Container
18	BJ air compressor

Figure 2.10—1 Surface Equipment Layout

2.11 Diagnostic Fracture Injection Test (DFIT)

No Diagnostic Fracture Injection Test activities will be undertaken under this EMP

2.12 Perforation

2.12.1 Overview

The casing at the identified formation is perforated to provide communication between the wellbore and the formation target zones. The perforation selection method will depend on the size, penetration depth, and hole type required to allow recoverable flow.

There are three primary methods of perforation that can be used as described below:

- Hydro-jetting – uses sand and water jetted through small holes in the bottom hole assembly to create holes in the casing across the target formation – there is no perforating charge. Hydro-jetting allows for targeted or pinpoint perforating, making between 3 and 4 holes per event.
- Wireline Conveyed Perforating (WCP) – the most widely used perforating technique in the Cooper Basin. As the name suggests, WCP uses a wireline to deploy the perforating charge.
- Tubing Conveyed Perforating (TCP) – uses the same technology as conventional wireline perforating but is run using a coiled tubing unit or jointed tubing (not wireline). TCP is the preferred perforating method when operating in underbalanced or overbalanced conditions.

2.13 Hydraulic Fracturing

No hydraulic fracturing activities will be undertaken under this EMP.

2.14 Microseismic Monitoring

No microseismic monitoring activities will be undertaken under this EMP.

2.15 Completion

2.15.1 Overview

A completion is a generic term used to describe the events and equipment necessary to leave a wellbore ready for production once drilling operations have been concluded, including but not limited to the assembly of downhole tubulars required to enable safe and efficient production from an oil or gas well.

To facilitate completion production tubing will be run in the well for well testing. This will involve the following activities:

- Ensure the well is dead using appropriately weighted fluid.
- Cleanout the wellbore by running tubing into the well and circulating out any debris from the wellbore, including proppant and plugs.
- Run tubing into the well.
- Land the tubing in a hanger in the wellhead.
- Set a packer to isolate the tubing annulus.
- Install surface master valves and pressure test wellhead seals.
- Install Extended Production Testing (EPT) surface equipment for well testing.

2.16 Flowback

No Flowback activities will be undertaken under this EMP.

2.17 Extended Production Testing Activities

2.17.1 Overflow

Extended Production Testing (EPT) activities are carried out to validate the well production rates. A three-phase separator is connected to the wellhead's outlet; the separator splits the well-produced fluids into gas, oil, and water by gravity level controllers.

Depending on the composition, the gas is directed to flare, water to above-ground enclosed or open topped treatment tanks, and condensate to storage tanks or flare. All gas, water, and condensate flow volumes are measured and recorded. A generic layout of a EPT package is shown below in **Figure 2.17—1**.

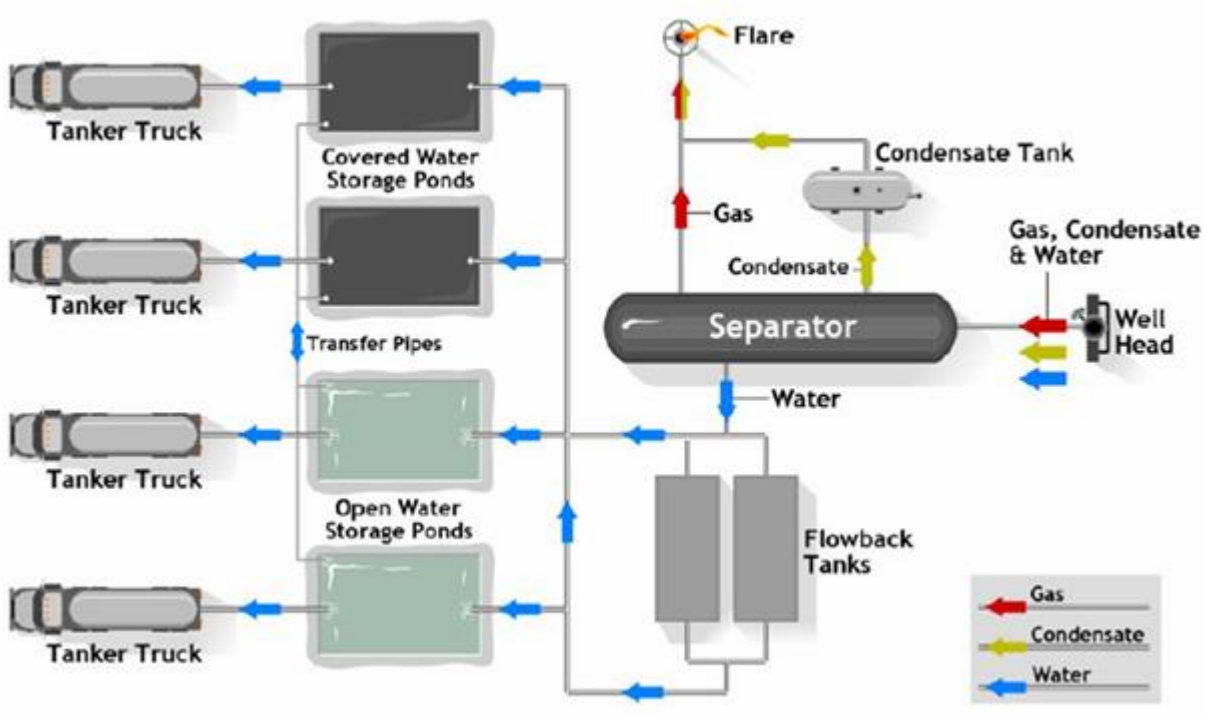


Figure 2.17—1 Example of Well Test Equipment Schematic

2.17.2 EPT Equipment

2.17.2.1 Separator

The separator package splits the comingled flow from the wellbore into gas, water, and condensate. All gas, water, and condensate flow volumes are measured and recorded.

2.17.2.2 AboveGround Enclosed or Open-topped Treatment Tanks

Temporary water storage and treatment tanks will be used on-site in the EPT process. See **Appendix 06** Wastewater Management Plan for more details.

2.17.2.3 Flare

Produced gas and pending results, potentially condensate, during EPT will be sent to a flare system to allow a controlled release and gas burning. It will be equipped with an autoignition system.

2.18 References

Standards Australia. (1994). *Safety signs for the occupational environment* Retrieved from **https://www.standards.org.au/standards-catalogue/sa-snz/publicsafety/sf-005/as--1319-1994**

3 Appendix 03 – Environmental Risk Assessment Framework

PEAK HELIUM

Peak Helium Pty Ltd

EMP PKH2-3

NT Exploration Permit (EP) 134

Appendix 03

Risk Assessment Framework

Rev	Description	Date	Initiated	Reviewed	Approved
0	Issued for Submission	18/07/2022	Trent Smith	Katie Robertson Vicky Cartwright	Jon Bennett
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3 Risk Assessment Framework

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3.1 Environmental Risk Assessment Process

Peak Helium has identified, with the assistance of multi-disciplinary personnel, the consequence, likelihood, and risk of an environmental impact associated with the proposed regulated activities as per ISO 31000.

This included:

- The identification of environmental factors and risk sources associated with the activities of drilling four Helium wells as described in **Appendix 02** Project Activities.
- An analysis and ranking of the potential consequences of an unmitigated risk.
- The identification and evaluation of the relevant section of *the Code of Practice* and additional risk management controls to reduce the risk of impact.
- An assessment of consequence, likelihood, residual risk, ALARP, acceptability and uncertainty [DEPWS et al., 2019; ISO, 2018].

3.2 Environmental Factors

For the purposes of this assessment, the description of the environmental aspect that may be impacted is deemed an Environmental Factor.

Environmental Factors are categorised into themes (Land, Water, Air, People) by the *Northern Territory Environment Protection Authority Factors and Objectives* [NT EPA, 2019].

Environmental Factors are described in **Appendix 01** Description of the Existing Environment, and include:

- Air Quality
- Community and Economy
- Culture and Heritage
- Inland Water Environmental Quality
- Landforms
- Terrestrial Ecosystems
- Terrestrial Environmental Quality

3.3 Risk Source, Potential Impact, and Unmitigated Consequence

A risk source is a planned activity or incident that could cause an environmental impact, defined as '*any adverse change, or potential adverse change, to the environment resulting wholly or partly from a regulated activity*' [NT GOVERNMENT, 2016A]. Regulated activities associated with the proposed development are described in further detail in **Appendix 02** (Project Activities).

Potential sources of environmental impacts were identified during 3rd party site assessments, stakeholder consultations, and via publicly available information.

The unmitigated consequence associated with an environmental impact if the activities were to proceed with no controls is assigned based on **Table 3.5—2**.

3.4 Risk Management Controls

To minimise the potential impact of an unwanted event, the relevant section of *The Code of Practice: Onshore Petroleum Activities in the Northern Territory* (*the Code*) has been identified, as well as additional (preventative, detective, mitigative) risk controls and listed within **Appendix 04** [DENR, 2019].

3.4.1 Code of Practice

For each identified environmental factor, risk source, and potential impact, a corresponding section of *the Code* will be applied to mitigate potential impacts.

3.4.2 Risk Management Controls

Risk controls have been identified to prevent/stop an unwanted event from occurring, detect an event and/or mitigate or reduce the impact of an unwanted event after it has occurred.

Some controls identified are deemed critical controls. Critical controls are those that, if absent, would increase the risk of an environmental impact. Critical controls are identified in the risk assessment and will be monitored for performance as reflected in **Section 8.7** of the **EMP** (Environmental Outcomes, Performance Standards & Measurement Criteria).

3.5 Risk Rating Toolkit

After controls are identified, the Likelihood Classification (**Table 3.5—1**) and Consequence Classification (**Table 3.5—2**) Peak Helium are assessed to determine residual risk and if additional actions are required.

Table 3.5—1 Likelihood Classification

Level	Criteria
Almost Certain	Almost certain to occur within the foreseeable future or the project lifecycle
Likely	Likely to occur within the foreseeable future or the project lifecycle
Possible	May occur within the foreseeable future or the project lifecycle
Unlikely	Not likely to occur within the foreseeable future or the project lifecycle
Remote	Will only occur in exceptional circumstances

Table 3.5—2 Consequence Classification

		Health & Safety	Natural Environment	Reputation	Financial
Critical	**V**	Fatality	• Destruction of sensitive environmental features. • Severe impact on the ecosystem. • Regulatory & high-level Government intervention/action.	Critical impact on business reputation /or international media exposure	Financial loss of $500,000 or over
Major	**IV**	Permanent disabling injury and/or long-term off work	• Long-term impact of regional significance on sensitive environmental features (e.g., wetlands). • Likely to result in regulatory intervention/action.	Significant impact on business reputation and/or national media exposure	Financial loss from $300,000 to $400,000
Moderate	**III**	Injury requiring medical treatment, time off work and rehabilitation	• Short-term impact on sensitive environmental features (e.g., Gibber Plain). • Triggers regulatory investigation.	Moderate to small impact on business reputation	Financial loss from $200,000 to $300,000
Minor	**II**	Injury requiring medical treatment with no lost time	• Impact on fauna, flora and/or habitat but no adverse effects on the ecosystem. • Requires immediate regulator notification.	Some impact on business reputation	Financial loss from $100,000 to $200,000.
Negligible	**I**	Minor injury - first aid treatment	• Negligible impact on fauna/flora, habitat, aquatic ecosystem, or water resources. • Incident reporting according to routine protocols.	Minimal impact to reputation	Financial loss from $0 to $100,000

Residual risk is determined by the combination of likelihood and consequence classification using the Risk Matrix **Table 3.5—3**.

Table 3.5—3 Risk Matrix

Consequence / Likelihood		Negligible	Minor	Moderate	Major	Critical
		I	II	III	IV	V
Almost certain	a	2	3	4	5	5
Likely	b	1	3	3	4	5
Possible	c	1	2	3	3	4
Unlikely	d	1	1	2	2	3
Remote	e	1	1	1	1	3

3.6 As Low As Reasonably Practicable (ALARP)

A risk is managed to ALARP when all the requirements of *the Code* have been met, all reasonably practicable risk management controls have been identified and implemented, and the cost of further reducing the risk is disproportionate to the benefit.

To assist in the determination of ALARP, the below are considered:

- **Good Practice Control Measures**: Legislation, codes, and standards identify the requirements of legislation, codes and standards that are to be complied with for the activity.
- **Good Industry Practice:** Risk management controls, standards and guidelines that may be applied over and above those required to meet the legislation, codes, and standards.
- **Professional Judgement:** Alternative controls identified by personnel with relevant knowledge and experience. The hierarchy of controls philosophy is a system used in the industry to identify effective controls to minimise or eliminate exposure to impacts or risks. This philosophy is applied when formulating control measures for each potential environmental impact or risk.
- **Risk-based tools such as cost-based analysis or modelling:** Probabilistic analyses, such as modelling, quantitative risk assessment and/or cost-benefit analysis to support the selection of control measures identified during the risk assessment process.
- **Precautionary Approach:** Uncertain analysis is replaced by conservative assumptions that will result in control measures being more likely to be implemented.

3.7 Risk Acceptability and Assessment of Scientific Uncertainty

As part of Peak Helium's risk process, risk acceptance is completed following each ALARP assessment.

Residual risk is assessed for acceptability and if additional controls or actions **Table 3.7—1** are required.

Table 3.7—1 Residual Risk Acceptability and Action

Residual Risk	Description of Risk Level	Actions
1	• All controls are well designed and address the root cause/s of the risk. • All controls operate to the required level. • Little or no disruption to operations. • Minimal impact to reputation. • Financial loss from $0 to $100,000 AUS.	• Undertake the activity with the existing controls in place and related work processes. • No further investigation is required.
2	• Majority of controls are well designed and address the root cause/s of the risk. • Majority of controls operate to the required level. • Incidents or events can be managed using simple tools. • Some impact on business reputation. • Financial loss from 100,000 to $200,000 AUS.	• Undertake the activity with the existing controls in place. • No further investigation is required.
3	• Controls can be improved to ensure all root cause/s of the risk are addressed. • Several controls are not operating to the required level. • Moderate to small impact on business reputation. • Financial loss from $200,000 to $300,000.	• Additional controls may be needed. • Ongoing monitoring is required to ensure controls are operating to the required level.
4	• Majority of controls are not well designed and do not address the root cause/s of the risk. • Majority of controls do not operate to the required level and require improvement. • Significant impact on business reputation. • Financial loss from $300,000 to $400,000.	• Improve existing controls and/or implement new controls. • Involve multi-disciplinary team to review existing controls and improve where required.
5	• Controls are not well designed and/or do not address root cause/s of the risk. • Controls do not operate to the required level. • Further controls are required to reduce the risk level. • Activities should not commence until controls are implemented to reduce the risk level. • Critical impact on business reputation. • Financial loss of $500,000 or over.	• Consider alternatives to doing the activity. • Stringent control measures will need to be implemented to ensure safety and business continuity. • Involve multi-disciplinary team to review plan prior to commencing any activity.

Peak considers the resulting residual risk reduced to ALARP and acceptable when *the Code's* requirements have been met and the identified risk controls are in place.

In summary:

- A Level 5 residual risk is unacceptable.
- A Level 3 – 4 residual risk is acceptable if additional actions and assurance are conducted over *the Code of Practice* and risk management controls.
- A Level 1 – 2 residual risk is acceptable.

3.8 Scientific Uncertainty

The Petroleum (Environment) Regulations require an assessment of Scientific Uncertainty. The evaluation of potential impacts and effectiveness of controls must demonstrate that the activities are carried out according to the Ecologically Sustainable Development principles (ESD) to ensure that all works conducted do not impact the environment's future amenities [NT GOVERNMENT, 2016B].

Uncertainty is high where confidence in the available information is low in identifying risk or the effectiveness of management control.

Per the Draft EMP Guidelines, scientific certainty is qualitatively assessed using a generic means of ranking the data available in **Table 3.8—1**.

Table 3.8—1 Acceptability and Scientific Uncertainty

Score (Uncertainty Type)	Acceptability	Uncertainty Description [EFSA, 2009]
Low (A)	• Residual risk is acceptable, and it is assumed that ALARP has been achieved. • Risks are well understood and established practice.	• Comprehensive data with solid evidence in multiple peer-reviewed data. • Little disagreement between authors or experts. • Considerable and consistent on-ground experience and/or monitoring.
Medium (B)	• Residual risk is acceptable, provided that ALARP has been achieved and demonstrated. • Risk type B are typically in areas of increased environmental sensitivity with some stakeholder concerns.	• Some or incomplete data is available. • Evidence provided based on a small number of references. • Authors' or experts' conclusions vary. • Limited on-ground experience and/or monitoring.
High (C)	• Residual risk is intolerable and must not be accepted or approved by Management. • This risk will typically involve sufficient complexity, high potential impact, uncertainty, or stakeholder interest.	• Scarce or no data available; evidence provided in unpublished reports. • Few on-ground observations. • Authors' and experts' conclusions vary considerably.

3.9 References

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4 Appendix 04 – Risk Assessment

Risk #	Environmental Factor	Risk Source	Potential Impact	Unmitigated Consequence	Codes of Practice Section	Risk Management Controls (inc. prevention, detection and mitigation)	Residual Risk			Acceptable Criteria Achieved	Residual risk ALARP and Acceptable Statement	Scientific Uncertainty Ranking
							C	L	R			
1	Air Quality and Atmospheric Processes	Emissions from vehicles, machinery, and well infrastructure during and post activity completion (inc. flaring)	To air quality and volume of green house gas emissions	II	D.5.1 Methane Emissions Management Plan D.5.2 Inspection Frequency and Procedure D.5.3 Standard Lead Detection Instruments D.5.9.4 Other Fugitive Emission Sources Mandatory Requirements	• Vehicle and equipment maintained in accordance with Original Equipment Manufacturer's procedures (Critical Control). • Diesel use recorded for reporting in line with National Greenhouse and Energy Reporting Scheme. • Water bores located on each well pad or within each well pad corridor to reduce vehicle movements for drilling make up water. • Well drilling is kept overbalanced to prevent gas influx from potential methane-bearing geological formations into the wellbore. • Wellheads designed per the NT Code of practice [DEPWS et al., 2009] and API standards. • Gas and condensate encountered during the extended production test to be flared (Critical Control). • Flare designed and operated to achieve 98% combustion efficiency in line with US EPA 40. • Flaring estimated and recorded for reporting as per the National Greenhouse and Energy Reporting Scheme and Petroleum Codes of Practice. • Wellheads maintained and inspected by trained and competent personnel from 7 days of commissioning the well and every six months afterwards using US EPA Method 21 [US EPA, 2017] (Critical Control). • Identified leaks made safe, documented, reported and rectified as per the Methane Emissions Management Plan (**Appendix 10**) and/or escalated as per the Emergency Response Plan (**Appendix 14**).	II	E	1	Yes	• The target formation of this well is helium, not hydrocarbons. The drilling program associated with this EMP is for four wells (total number of wells) of which may be drilled on one pad), and the campsite/s will be located adjacent to the well pads, reducing vehicle movements. Emissions from flaring and vehicle movements are predictable and measurable. The location of activities is >10 km away from the nearest sensitive receptor meaning the likelihood of an impact is remove, given the target formation and limited hydrocarbons anticipated to be encountered, and residual risk of an impact is ALARP and deemed acceptable.	Medium
2	Community and Economy	Movement of heavy and light vehicles, and machinery on public and private roads to and from the Project Area	To public or private roads/infrastructure landowners and community (e.g., degraded roads, dust)	I	A.3.1 Site Selection and Planning 4.3.2 Well Pad Site Selection Requirements	• Monitoring and maintenance of Stuart highway / horseshoe bend intersections to maintain appropriate standards (Critical control). • Verification that access points comply with Traffic Management Plan (**Appendix 13**) concept drawing and that signage in accordance with AS 1742:3-2019 is in place.	II	B	3	Yes	• Land Access agreements and ongoing consultation with pastoralists undertaken to ensure impacts on their activities or public infrastructure are mitigated. These impacts are addressed in the stakeholder agreements and access guidelines, as well as the implementation of the Traffic Management Plan. The increased traffic from the activity will be short-term (months). Consequences from damage to public/private infrastructure from vehicle movements are anticipated to be minor but likely. Given the monitoring and maintenance program detailed in the risk controls, the resultant risk is ALARP and deemed acceptable.	Low
3	Community and Economy	Nuisance (noise and light) from project activities, inc. vehicle movements, construction, drilling, completions, EPT related activities	To landowners and/or community acceptance of activity	II	A.3.1 Site selection and planning A.3.3 Noise	• Consultation with community and landowners on project activities detailed in Stakeholder Engagement Log (**Appendix 11**). • Task focussed lighting will be used, and all boundary lighting will be positioned inwards. • Engines/machinery to be maintained as per planned maintenance system. • Distance to dwellings is greater than 10km.	II	E	1	Yes	• The impact of noise and light on landowners is well known and can and does impact the wellbeing of communities. However, the remote location and separation distances between the activities and sensitive receptors support a small likelihood of noise or light impact. The distance coupled with the transparency of our activities with local stakeholders results in a residual risk that is ALARP and deemed acceptable.	Low
4	Community and Economy	Spread of biosecurity risk material (e.g., weeds and seeds to) or within the Project Area during operations	To land-use practices (e.g., degraded land productivity)	IV	A.3.1 Site Selection and Planning A.3.6 Weed management	• Weed survey conducted before and after any disturbance or clearing operations for the identification and management of weeds (Critical Control). • Weed infestations are mapped, and all personnel and contractors are made aware of any identified infestations to avoid infestation areas. • Training and inductions for project staff and contractors to cover vehicle weed hygiene requirements. • Operational staff to attend weed identification training delivered by the NT Weed Management Branch. • Dedicated weed officer to be nominated. • Vehicle and machinery cleaned down and inspected before mobilisation to the project area (Critical Control). • Vehicles and machinery to have a valid weed hygiene declaration. • Vehicles to stay on cleared/formed access tracks unless involved in clearing. • Where weeds are identified, immediately implement weed control measures in line with Northern Territory Weed Management Handbook. • Monitor well pads, access tracks, campsites and gravel/borrow pits for weeds and implement management strategies up to and during progressive rehabilitation of infrastructure. • Record weed monitoring and survey activities in accordance with the NT Weed Data Collection Guidelines and Notify the NT Weed Management Brand of any new weed incursions. • Creation and implementation of a site-specific Weed Management Plan (**Appendix 09**).	IV	C	3	Yes	• Uncontrolled introduction or spread of weeds can significantly impact land use and communities. • Before seismic activities, the area was scouted by ecologists, weeds were identified, and management plans were put in place. • Before the construction and drilling activities, the weed management plan has been revisited and revised to ensure weeds are known, mapped, avoided, monitored, and managed and that vehicles entering the property are free of biosecurity risk material. • With the addition of training/inductions, the likelihood of impact resulting in a significant impact is unlikely, meaning the risk is reduced to ALARP and acceptable.	Low
5	Community and Economy	Completion of ancillary and regulated activities without input/involvement of local business or people (e.g., environmental assessments, drilling, monitoring)	To local businesses (e.g., loss of potential revenue)	III		• Contracts and procurement process to include agreements for local and indigenous business engagement (Critical Control). • Engage with the Industry Capability Network NT as a Project Owner and the NT Indigenous Business Network to source local an Indigenous content and support for work activities. • Preferential use of local businesses, facilities and suppliers.	III	d	2	Yes	• The construction and drilling activities being completed in the Project Area are limited in time frame and will primarily utilise specialised services and contractors that move from Project Area to Project Area. Given the short time frame to complete the works (months), the likelihood of not engaging local contractors or services is possible. • Where local businesses and services are available outside of the specialist contractors required to complete the works, they will be sought and engaged through the Industry Capability Network and Indigenous Business Network, reducing the risk to ALARP and acceptable.	Low
6	Community and Economy	Ignition sources from people, plant, machinery, or flaring causing bushfire	To community or landholder lively hood (e.g., loss of pasture, dwellings, infrastructure or stock)	III	A.3.7 Fire Management	• Consultation with landowners and community re: fire management obligations and log in Stakeholder Engagement Log (**Appendix 11**). • Indicative well pad and campsite locations to allow for adjustment away from large trees to minimise adjacent fuel load, or large vegetation will be cleared. • Well pad and campsite design to include a ring-fire access trail/break - 10 metres from the fence line (Critical Control). • Creation and implementation of a site-specific Fire Management Plan (**Appendix 08**), including the requirement for annual fire frequency mapping. • Works to occur in alignment with the Alice Springs Fire Management Zone works calendar. • Fire load assessment carried out before construction activities. • Daily bushfire alert monitoring conducted during operations by on-site teams during declared fire danger periods and weekly during non-declared. • Training and inductions to cover designated smoking areas, location of fire fighting equipment, and emergency responses. • Flare used during Extended Production Testing to be located within a 20m fuel load exclusion zone (Critical Control). • Site-specific Fire Management Plans include preparation and planning information, action and mitigation measures, and stakeholder and emergency contact information in case of a fire. • Fire extinguishers and operational radios fitted to all vehicles and equipment. • Water bores available within the immediate proximity of the well pad and/or drilling pits for water (groundwater) storage on each well pad available for firefighting.	III	D	2	Yes	• Uncontrolled bushfires can significantly impact the community, landowners and the environment. • Fire mapping shows that fire is common in the area. However, the well pad locations have not been burned in over ten years. Despite this, fuel loads in the Project Area are determined to be low due to the arid climate. •Therefore the controls, fire breaks, and clearing, in addition to the additional protection, detection and mitigation controls, reduce the risk of fire to ALARP and is deemed acceptable.	Low
7	Community and Economy	The addition of construction infrastructure (e.g., well pads, access tracks, gravel/borrow pits and campsites) to the land	To the previous use of the landscape (e.g., to pastoral use)	I	A.3.1 Site selection and Planning A.3.2 Well pad Site Selection Requirements A.3.9 Rehabilitation	• Land access agreements in place detailing scope and location of activities. • Well pads signed and hazards identified and segregated from the public. • Post drilling activity, before the cessation of activities, drilling pits are re-instated. • Site no longer required for activities - rehabilitated to pre-disturbance conditions or handed back to the landowner. • Stakeholder communication logs maintained (**Appendix 11**).	I	C	1	Yes	• Consultation with pastoralists and relevant stakeholders is undertaken to identify potential impacts on their activities and agree on mitigation. • Use of existing pastoral tracks and infrastructure rehabilitation after cessation of activities will limit what impact remains. Consequences are anticipated to be minor, but possibly resulting in a risk is ALARP and acceptable.	Low
8	Culture and Heritage	Native ground disturbance from the construction of new infrastructure (e.g., well pads, access tracks, gravel/borrow pits and campsites)	To Aboriginal artifacts and/or cultural heritage/sacred sites	IV	A.3.1 Site selection and planning	• Proposed activities and locations cleared by Traditional Owners and included in an AAPA certificate. • Authority Certificate restrictions checked prior to clearing and drilling to verify restricted areas are not breached during project activities. • Authorised access tracks signed and workers made aware that they must stay on designated tracks. • Restricted work areas along dedicated access tracks signposted with AAPA restrictions (Critical Control). • Construction contractors made aware of restricted areas with areas physically flagged off or added as exclusion zones in GPS guidance systems to delineate restricted areas where there is a risk or non-compliance. • Archaeological survey conducted for Seismic to be updated with proposed well pad/s, access tracks, campsites and gravel pit locations (Critical Control). • Well pads, access tracks, campsites, and gravel/borrow pits assessed for artefacts or impact on cultural sites by an archaeologist and realigned where required. • Site selection of well pad, campsite, and gravel/borrow pit locations to be accessed by use of pre-existing tracks and/or surveyed/cleared seismic lines. • Recommendations from Archaeological Report (**Appendix 01.01**) assessed before construction. • Identified artifacts to be identified and mapped, but locations redacted from publicly available reports. Declared areas and sites to be excluded from clearing. • Training and inductions to cover the importance of reporting all potential artefacts or cultural heritage sites as per inGauge's Unexpected Heritage Discovery Procedure.	IV	D	2	Yes	• Before seismic activities, an archaeologist scouted the area, and artefacts and cultural heritage areas were identified and recorded. The archaeologist has reviewed the layout of the access tracks, well pads, campsites and gravel/borrow pits within the cleared seismic lines to verify no impact will occur to the identified artefacts and cultural heritage areas. • With the addition of pre-clearance assurance and training of site personnel in the importance of reporting and ensuring items of cultural significance are left undisturbed, potential impacts are unlikely, resulting in a residual risk that is ALARP and acceptable.	Low
9	Human Health	Nuisance (dust) from project activities inc. vehicle movements, construction, drilling, completions and EPT related activities	To landowners and/or community	I	A.3.1 Site Selection and Planning	• Preferential use of pre-existing tracks to access well pads, campsite and gravel/borrow pits to avoid clearing associated dust. • 60km/hr speed limits on non-gazetted roads and project access tracks. • Dust suppression in areas of high traffic and/or near sensitive receptors, e.g. homesteads and dwellings (note: no homesteads, homes within 10km of activities).	I	A	2	Yes	• Construction activities and vehicle movements will certainly generate dust; however, the locations of sensitive receptors that the dust may impact are >10 km away. Water and water trucks will be made available to suppress dust when required. • Given the remote location of the activities and the availability of water for dust suppression, the risk of impact is ALARP and deemed acceptable.	Low
10	Inland Water Environmental Quality	Loss of well circulation while drilling	To ground water	II	B.4.2 Aquifer Protection B.4.10 Drilling Fluids B.5 BTEX Limits B.4.3 Well Design and Barriers B.4.6 Casing and Tubing B.4.7 Primary Cementing B.4.9 Well Control B.4.17 Groundwater Monitoring	• Well design and hole size informed by Mt. Kitty 1 offset well. • Drilling fluid and Loss Circulation Material additives available to maintain mud weight/consistency to prevent or remediate losses. • Water bore located on-site to provide fresh water for drilling fluid make up water during losses. • Monitoring of drilling fluids for gains/losses and mitigation measures. • Drilling additives selected and utilised based on the manufacturer's recommendations and safety data sheets. • Drilling completed using water-based, not oil-based, drilling fluid additives with the name, type and quantity recorded in daily well-drilling reports (Critical Control). • When drilling through aquifers, non-toxic additives are utilised. • Aquifers isolated behind casing and cement barriers before drilling of target formations. • Drilling fluid additives not to contain BTEX above the levels prescribed in B.5 of the Code. • Collection of a groundwater sample, to be sent to a NATA-accredited laboratory, to establish baseline water quality information prior to drilling.	II	C	2	Yes	• In the event of a loss circulation event, the drilling fluids could be released into groundwater. Given that when drilling through aquifers, drilling fluids are comprised primarily (>95%) of water sourced from onsite and non-toxic additives, the impacts would be minor and localised. • With data from the off-set well incorporated into the planning of this well, fluids and loss circulation material available and monitoring for losses, the likelihood of circulation loss is reduced but still possible; however, the residual risk is ALARP and acceptable.	Low
11	Inland Water Environmental Quality	Loss of well control (subsurface)	To ground water	IV	B.4.1 Well Integrity Management B.4.2 Aquifer Protection B.4.10 Drilling Fluids B.4.3 Well Design and Barriers B.4.6 Casing and Tubing B.4.7 Primary Cementing B.4.9 Well Control B.4.17 Groundwater Monitoring	• A Well Operations Management Plan specific to the well approved by the regulator (Critical Control). • Well plan informed by Mt Kitty 1 offset well, inc. mud weight design above pore pressure, fluid additives on-site to increase mud weight if required, use of industry recognised fluid suppliers, well control training and well control procedures in place. • Peak Helium holds energy and mining co-insurance, including provisions for well control expenses, limited redrilling, seepage and pollution. The insurance amount covers any one accident or occurrence. • Peak Helium Policy documents (ING_STD_WELL CONTROL_Rev 1.0), which are based on conventional well control methods using the Driller's Method to remove an influx and counter an overbalance, are adequate to manage any situation that can be realistically expected to arise in terms of well control. • Spill specific Emergency Response Drills to be conducted in line with the Emergency Response Plan (**Appendix 14**). • Well pad to be placed to avoid Groundwater Dependent Ecosystems.	IV	E	1	Yes	• The offset well data review indicates that due to the highly impermeable nature of the unconventional Basement formation in the Amadeus Basin, the risk of a high flow / high consequence hydrocarbon blowout event is nil to negligible. • Risk controls in place are based on offset well data and good industry practice, reducing the risk to ALARP and acceptable.	Low

Risk #	Environmental Factor	Risk Source	Potential Impact	Unmitigated Consequence	Codes of Practice Section	Risk Management Controls (inc. prevention, detection and mitigation)	Residual Risk			Acceptable Criteria Achieved	Residual risk ALARP and Acceptable Statement	Scientific Uncertainty Ranking
							C	L	R			
12	Inland Water Environmental Quality	Leak in the drilling by-product storage pit liner	To soil or ground water	IV	A.3.8 Containment of contaminants B.4.16 Site material and fluids management C.4.2 Management of produced water and flowback fluid C.7.2 Spill management plan	• Drilling pits will be lined with an impermeable membrane (Aquacon 345) tested for integrity with bore water before use for residual drilling by-products (Critical Control). • During use, the drilling pits will be monitored and inspected daily to verify integrity. • To minimise residual fluid volumes being stored post drilling activity, fluids will be actively re-used. • Post operations, pit integrity and fluid level monitoring post-wet season will be completed both on-site and remotely with level monitoring telemetry. • If a leak is detected, the works are to be stopped, and the Emergency Response Plan (**Appendix 14**) activated. • Pits to be re-instated 12 months post drilling activity in the dry season as per the Waste Water Management Plan (**Appendix 06**).	IV	D	2	Yes	• The primary control to prevent drilling fluids from leaking into the sub-soil and groundwater is through the use of pit liners. • With integrity testing of pit liners before use, monitoring pit fluid levels during drilling and re-using/removing fluids where practicable, the risk of a leak and a leak having an impact is reduced to ALARP and acceptable.	Low
13	Inland Water Environmental Quality	Use of groundwater for construction and drilling activities	To ground water availability for future use	III	A.3.1 Site Selection and Planning B.4.17 Groundwater Monitoring	• Compliance with conditions of ground water extraction licences, granted in accordance with NT Water Act under Water Extraction Licence, and monitoring (Critical Control). • Make up water volume utilized for well operations from the approved water bores drilled for this purpose to be recorded for reporting purposes. • Residual drilling fluids generated during well drilling activities will be re-used by settling out solids in drilling pits (Critical Control). • All water extraction will be monitored by an approved water meter. • No new water bore will be constructed within 1km of an existing water bore.	III	D	2	Yes	• The extraction of groundwater for regulated activities requires all water take activities to be licenced. The proposed take is assessed as a part of the licence application, considering current and future water take levels. • The consequence of an impact on groundwater from use for construction and drilling purpose is moderate to low and unlikely given the productivity of the aquifer the groundwater will be extracted from. Therefore obtaining a licence, pre-testing the well and re-using the drilling fluids as we go reduced the residual risk of an impact to ALARP and is acceptable.	Low
14	Inland Water Environmental Quality	Horizontal well bore collision on multi well pad	To ground water	II	B.4.1 Well Integrity Management B.4.3 Well Design and Barriers	• Separation factors between wellbores >2 are continually calculated and monitored, as detailed in **Appendix 02** (Project Activities). • Continuous positional tracking of the drill bit during directional drilling to respond to vertical and horizontal well deviations. • Each adjacent well will be designed and constructed with multiple casing barriers and specifically-engineered cement in place to protect aquifers. • Well being drilled will have multiple barriers (at least the conductor casing and surface casing) and blowout prevention in place during drilling. • Subsurface collision of a well during drilling is unlikely to result in formation cross flow, with collision likely at depth (below Aquifers) and flow restricted to the well being drilled.	II	E	1	Yes	• Subsurface collision of a well during drilling is unlikely to result in formation cross flow, with collision likely at depth (below Aquifers) and flow restricted to the well being drilled. The consequence of the vertical or horizontal section of the well deviating into the adjacent well during drilling is primarily destruction in asset value (potential plug and abandonment of both wells). • Any cross-flow is likely to be contained within both well bores - with casing and cement isolating the relevant aquifers. Given the continuous logging of the GPS location of the bit, the likelihood is considered remote, ALARP and acceptable.	Low
15	Landforms	The addition of construction infrastructure (e.g., well pads, access tracks, gravel/borrow pits and campsites) to the land	To visual amenity / aesthetics	I	A.3.1 Site selection and Planning A.3.2 Well pad Site Selection Requirements A.3.9 Rehabilitation	• Well pads site selection to consider the line of sight to main roads (Critical Control). • Land access agreements in place detailing scope and location of activities. • Preferential use of pre-existing tracks to access well pads and campsite/s to avoid clearing. • Minimise the land cleared to reduce the impact on the surrounding users of the land. • Use of progressive rehabilitation to ensure that the land can be returned to other users if not required. • Stakeholder communication logs maintained (**Appendix 11**).	I	D	1	Yes	• The proposed activities are located away from major transport routes, homesteads and communities. The consequences of activities may result in minor changes in aesthetics through the visibility of exploration activities (presence of workers and vehicles). • The probability that the activity will result in a loss of visual amenity is considered unlikely, ALARP and acceptable.	Low
16	Terrestrial and Inland Water Environmental Quality, Terrestrial Ecosystems	Disturbances/Impacts on SOCS and SOBS	To Sites of Conservation Significance and Sites of Botanical Significance	III	A.3.1 Site selection and Planning A.3.2 Well Pad Site Selection Requirements	• There will be no clearing activities within the SOCS or SOBS (Critical Control) • Only existing pastoral access tracks will be utilised to traverse SOCS and SOBS. • No access tracks will be widened within SOCS or SOBS (with the exception of the corridor connecting two areas of SOCS/SOBS). • Where SOCS and SOBSs areas are traversed they will be clearly identified, so the site team are made aware and a speed limit of 40km/hr will be implemented. • There will be spill kits available where SOCS and SOBS are being traversed. • There will be no storage of chemicals or fuel in SOCS and SOBS areas. • Transport of chemicals or wastewater on unsealed roads during the wet season is only approved by the supervisor when damage to the roads is assessed as negligible, a spill unlikely, and no significant rainfall events are forecast. (Critical Control) • In the event of a transport vehicle becoming bogged, Emergency Response Plan (Appendix 14) is to be activated, so extraction activities are conducted safely and prevent loss of contents (Critical Control).	III	D	2	Yes	• The Karinga Creek Paleodrainage System and Poona SOCS/SOBS are important national and international sites supporting a myriad of threatened species and species' habitats that may be impacted by development activities. To avoid impact, only pre-existing access tracks will be used to traverse SOCS and SOBS areas and no new construction will occur. In addition, speed limits will be implemented and controls put in place to reduce the potential for spills and the potential impact of a spill if it was to occur. As such, impact on SOCS and SOBS are considered to be unlikely reducing the risk to ALARP and acceptable.	
17	Terrestrial and Inland Water Environmental Quality	Sediment release from cleared infrastructure during project operations on-site	To soil and surface water	III	A.3.4 Erosion and Sediment Control and Hydrology	• Site selection and location of access tracks, well pads, campsite and gravel/borrow pits placed to avoid erosion, e.g. outside of natural flow paths, <2% slope, parallel to dunes, outside of the 1-100 flood zone (Critical Control). • Site selection of access tracks that are not pre-existing, to cross watercourses at right angles with bend and bank contours maintained and to avoid Groundwater Dependent Ecosystems. • Permits applied for approval to interfere with waterways that are crossed along the access tracks to the well pads, campsites or gravel / borrow pits. • Erosion and sediment controls for all project infrastructure (inc. pre-existing tracks) installed and maintained, and monitored as per the site-specific Erosion and Sediment Control Plan (**Appendix 05**) (Critical Control). • Training and inductions to cover the importance of reporting all environmental incidents, inc. spills and sediment releases. • Progressive rehabilitation of sites at the cessation of activity to include temporary Erosion and Sediment Control measures that will be monitored until final rehabilitation.	III	D	2	Yes	• The impact of sediment release from construction sites to waterways is well known, and controls for access tracks, well pads, campsites, and gravel/borrow pits are well documented and tested. • By implementing and monitoring Erosion and Sediment Controls as per IECA's best practice, even during a significant rainfall event, sediment released from the site may only moderately impact the environment depending on the state of controls in place at the time. • Through primary use of existing pastoral tracks (limiting widening to where necessary), site selection of infrastructure on slope <2% with the implementation of best practices controls the risk of an impact with a moderate consequence is unlikely. Coupled with the monitoring and maintenance of controls, including final rehabilitation, the risk of an impact is considered to be reduced to ALRP and acceptable.	Low
18	Terrestrial and Inland Water Environmental Quality	Land disturbance from constructed infrastructure (e.g., well pads impeding the natural surface water flow and increasing sediment load)	To soil and surface water	II	A.3 Surface Activities Mandatory Requirements A.3.4 Erosion and Sediment Control and Hydrology	• Site selection and design of access tracks, well pads, campsite and gravel/borrow pits placed to avoid erosion, e.g. outside of natural flow paths, <2% slope, parallel to dunes, outside of the 1-100 flood zone (Critical Control). • Well pad, campsite, gravel pit perimeter bunds located to divert water from going on-site and facilitate the flow of water from on-site to catchment areas during rainfall events (Critical Control). • Site selection of access tracks that are not pre-existing, to cross watercourses at right angles with bend and bank contours maintained and to avoid Groundwater Dependent Ecosystems. • Erosion and sediment controls for all project infrastructure (inc. pre-existing tracks) installed and maintained, and monitored as per the site-specific Erosion and Sediment Control Plan (**Appendix 05**). • Construction to occur at the end of the wet season to minimise exposure of cleared soil to wet weather. • Infrastructure design in accordance with the NT Land Clearing Guidelines. • Erosion and sediment controls for all project infrastructure installed and maintained as per IECA guidelines and monitored and maintained during operations.	II	D	1	Yes	• Location of a well pad in a natural water flow path can increase natural soil erosion as water diverts around the infrastructure. Site selection and pre-clearance surveys are completed to ensure the potential for this to occur is minimised/eliminated. • Due to the low amount of annual rainfall in the project area zone and the proactive site selection of well pads, campsites, gravel/borrow pits, and campsites, the likelihood of impact from infrastructure impeding natural water flow is unlikely. • With the addition of best practice Erosion and Sediment Control measures, the residual risk of an impact is ALARP and acceptable.	Low
19	Terrestrial and Inland Water Environmental Quality	Overflow of drilling by-product storage pit or tanks, or failure of embankment from flooding or inundation	To soil or surface water	III	A.3.8 Containment of Contaminants C.5.2 Drilling Materials C.7.1 Wastewater Management Plan C.7.2 Spill Management Plan	• Site selection of well pads out of the project area suspected flood zones based on 1 in 100-year ARI Flood modelling. • Well pad, campsite, gravel/borrow pit perimeter bunds located to divert water from going on-site and to facilitate the flow of water from on-site to catchment areas during rainfall events. • Onsite pit for storage of residual drilling material constructed with perimeter bund to prevent water entry from overland flow (Critical Control). • Perimeter bund constructed on the downslope side of the well pad to provide secondary containment if the drilling pit were to overflow. • Drilling material storage pit is designed with a freeboard of 500mm (distance from the top of the pit to the level of the residual drilling material) based on the 1 in 1,000 year Average Recurrence Interval rainfall calculation to ensure the pit does not overflow (Critical Control). • Daily monitoring of weather and for predicted significant rainfall events will be undertaken. • Open and closed top tanks used for fluid storage monitored and maintained with similar freeboard levels as drilling by-product pits if left unattended. • Monitoring of pit and tank fluid levels during operations by sit team. • Post operations pit integrity and fluid level monitoring post wet season completed both on-site and remote. • Drilling pit will be re-instated and stabilised as per the Rehabilitation and Waste Water Management Plans (**Appendix 12 & 06**) 12 months post drilling activity before the wet season. • Creation and implementation of a Spill Management Plan (**Appendix 07**). • Emergency Response Plan (**Appendix 14**) enacted if breach identified.	III	D	2	Yes	• Overtopping of pits and tanks can result in wastewater moving off-location and into waterways adjacent to the well pad, which could have a moderate environmental impact. Site selection of the well pad locations out of areas prone to flooding, constructed 2,500m distance way from the nearest waterway, a pit design to account for freeboard being maintained in 1- 1000 rain events, and site design to capture water that over tops pits reduces the likelihood of an overtopping event with a release off-site to unlikely. • With monitoring in place, the residual risk is reduced to ALARP and deemed acceptable.	Low
20	Terrestrial and Inland Water Environmental Quality	Spills at fluid additive, chemical, produced water or fuel storage and handling points	To soil or surface water	III	A.3.8 Containment of Contaminants B.4.16 Site Material and Fluid Management C.3 Wastewater Management Framework C.4.2 Management of Produced Water and Flowback Fluid C.7.1 Wastewater Management Plan C.7.2 Spill Management Plan	• Bunds/drip trays used when re-fuelling and placed under hose connections and valves. • Drilling and cementing fluid additives stored in/on temporary bunding with a volume greater than 110% of the largest container (Critical Control). • Secondary containment, or dual liners, used at fluid additive, oil and fuel storage areas. Secondary containment will have the capacity to hold 100% of the volume of the largest container stored in the area plus 10% unless the container is already equipped with individual secondary containment. • Secondary containment is monitored daily during the wet season and weekly during the dry season, and damages repaired as soon as practicable. • Routine inspections of additive and chemical storage areas (Critical Control). • Construction of bunded tank pads for produced water, or condensate storage during Extended Production Testing. • Spill kits stocked and available on-site to respond to spills. • Training and induction covering the importance of notifying of all spills and locations of spill kits. • Spills greater than 200 litres reported to the relevant regulatory body. • Creation and implementation of Wastewater and Spills Management Plans (**Appendix 06 & 07**) that describe levels of spills and associated response and incident reporting guidance. • Spill specific Emergency Response Drills to be conducted in line with the Emergency Response Plan (**Appendix 14**).	III	c	3	Yes	• A spill of wastewater, chemical or fluid additive during construction and drilling will be limited to the immediate location of the spill based on the available volumes of material that can spill. • The impact of a diesel spill on soil and groundwater, if left unidentified, can be significant, complex and expensive to rehabilitate. • The containment measures around areas where wastewater, chemicals, fluid additives and diesel are handled, as well as the training of staff in the importance of reporting spills and the locations and use of spill kits, reduces the likelihood of a significant impact to unlikely. As such, the residual risk is reduced to a level deemed ALARP and acceptable.	Low

Risk #	Environmental Factor	Risk Source	Potential Impact	Unmitigated Consequence	Codes of Practice Section	Risk Management Controls (inc. prevention, detection and mitigation)	Residual Risk			Acceptable Criteria Achieved	Residual risk ALARP and Acceptable Statement	Scientific Uncertainty Ranking
							C	L	R			
21	Community and Economy	Wastewater re-use limits ability to disposal of the resulting wastewater at the end of the program.	To landowner and community	II	C.7.1 Wastewater management plan	• Re-use of wastewater limited to drilling fluids that have settled our from drilling pits (Critical Control). • All fluids re-used tracked / monitored (Critical Control).	II	D	1	Yes	• The re-use of fluids is a primary way to limit waste volumes. However, if fluids are not managed and tracked properly, wastewaters can be mixed, which can reduce the ability to manage the resulting waste stream in a cost-effective manner, which may require additional trucking. By limiting the fluids that can be re-used on site to those generated from drilling activities, the circulating system and testing processes on the rig will aid in keeping the resulting waste type within similar (pre-reuse) parameters, therefore reducing the risk of re-use to ALARP and acceptable.	Low
22	Terrestrial and Inland Water Environmental Quality	Spill of fluid additive, chemical or fuel during transport during the dry or wet season	To soil, surface or ground water	III	A.3.8 Containment of Contaminants C.4.2 Management of Produced Water and Flowback Fluid C.7.1 Wastewater Management Plan C.7.2 Spill Management Plan	• Vehicles and equipment maintained as per OEM specifications. • Drilling and cementing additives transported within their original containers. • Residual fluids re-used during operations where practicable to avoid transport to off-site disposal facilities as detailed in the Waste Water Management Plan (**Appendix 06**). • Heavy vehicle operators are trained and licensed to transport chemicals and wastes as per the Dangerous Goods and Waste Management and Pollution Control Act. • Manifests, certificates, and Safety Data Sheets accompany all loads to aid in spill response and reporting in accordance with the Spill Management Plan (**Appendix 07**). • Tankers to have baffles (or similar engineering controls) to prevent dynamic fluid movement during transportation. • Saturated solids, extracted from tanks or drilling by-product pits, are transported in vacuum trucks or closed-top tanks. • Road conditions for heavy vehicle transport will be assessed before mobilisation on unsealed roads. • Transport of chemicals or wastewater on unsealed roads during the wet season is only approved by the supervisor when damage to the roads is assessed as negligible, a spill unlikely, and no significant rainfall events are forecast (Critical Control). • Creation and implementation of Wastewater and Spills Management Plans (**Appendix 06 and 07**) that describes levels of spills and associated response and incident reporting guidance. • In the event of a transport vehicle becoming bogged, Emergency Response Plan (**Appendix 14**) is to be activated, so extraction activities are conducted safely and prevent loss of contents (Critical Control).	III	D	2	Yes	• The transportation of fluids and chemicals is a tightly controlled industry with practices designed to prevent, detect, and respond to transportation spills. All contractors must be appropriately licenced, with National Uniform Legislation in place to offer a high level of regulatory protection. • The risk of a spill during transport is considered similar to bulk diesel and other dangerous goods transportation, a common activity throughout Australia. • The risk of an incident increases when transport occurs on unsealed roads in the wet season, given the potentially variable road conditions and the potential for vehicles to become bogged and damaged, causing a spill. • Where transport on unsealed roads is deemed necessary, for operational purposes, site supervisors engaged by the Interest Holder, or trucking coordinators, are responsible for determining when transport is safe to occur. • To aid in reducing the risk of an environmental impact to as low as reasonably practicable, the approval conditions for this project include confirmation that if the transport was to occur, damage to the roads would be negligible, a spill unlikely, and there would be no significant wet weather events forecast. • With the addition of these approval criteria to the controls listed, and the availability of the Emergency Response Plan/Contingency Plan (**Appendix 14**) to mitigate unforeseen circumstances, the risk is reduced to ALARP and acceptable.	Low
23	Terrestrial and Inland Water Environmental Quality	Vegetation and soil stripping for well pads, access tracks, campsites and gravel/borrow pits increases soil erosion and sediment loss	To soil or surface water	III	A.3.1 Site selection and planning A.3.1 Surface activities mandatory requirements A.3.4 Erosion and sediment control and hydrology	• Site selection and design of access tracks, well pads, campsite and gravel/borrow pits to avoid erosion, e.g., outside of natural flow paths, constructed on <2% slope, tracks parallel to dunes and located outside of the 1-100 flood zone (Critical Control). • Access to well pads, gravel pits and campsites via existing tracks to limit new clearing. • Pre-clearance and site assessments to include larger indicative well pads, campsite/s and gravel pits locations to allow for minor adjustments to clearance locations to minimise environmental impacts during pre-clearance surveys. • Site selection of access tracks that are not pre-existing, to cross watercourses at right angles with bend and bank contours maintained and to avoid Groundwater Dependent Ecosystems. • Ecologists utilised to ground-truth locations in advance of any ground disturbance to ensure: o The actual riparian zones and the buffers for drainage depressions, and stream orders 1 to 4, and the location and density of hollow-bearing trees and their buffers are identified and avoided. o The location well pads and gravel pits will not require clearing of riparian zones or their buffers. • Erosion and sediment controls for all project infrastructure (inc. pre-existing tracks) installed and maintained, and monitored as per the site-specific Erosion and Sediment Control Plan (**Appendix 05**) (Critical Control). • Training and inductions to cover the importance of reporting all environmental incidents, inc. spills and sediment releases. • Avoidance of clearing larger trees (utilising Decision tree). • Low-level watercourse crossings for access tracks to be excavated and backfilled with rock to watercourse bed level. • Topsoil stripped and stockpiled away from water flow paths in berms <1.5m high to preserve seed bank. • Re-instatement of drilling waste pits and campsites/gravel pits to be re-instated to stable landforms when no longer required for operations. • Progressive rehabilitation of sites at the cessation of activity to include temporary Erosion and Sediment Control measures that will be monitored until final rehabilitation (**Appendix 12**). • Monitoring and maintenance of ESC measures and management of weeds until final rehabilitation complete inc. site inspections pre and post rainfall. • Where producing groundwater bores cannot be established on the well pad an alternative location will be located in naturally clear areas adjacent access tracks within the well corridor.	III	D	2	Yes	• The impact of sediment release from construction sites to waterways is well known, and controls for access tracks, well pads, campsites, and gravel/borrow pits are well documented and tested. • By implementing and monitoring Erosion and Sediment Controls as per IECA's best practice, even during a significant rainfall event, sediment released from the site may only moderately impact the environment depending on the state of controls in place at the time. • Through primary use of existing pastoral tracks (limiting widening to where necessary), site selection of infrastructure on slope <2% with the implementation of best practices controls, the risk of an impact with a moderate consequence is unlikely. Coupled with the monitoring and maintenance of controls up to and including final rehabilitation, the risk of an impact is considered to be reduced to ALRP and acceptable.	Low
24	Terrestrial Ecosystems	Entrapment of fauna or stock in drilling by-product storage pit	To fauna or stock	II	A.3.5 Biodiversity protection A.3.8. Containment of contaminants C.2 Water and wastewater to which this Code Applies	• Drilling by-product pits fenced when between operations and reinstatement. • Fauna ladder installed to provide an exit for fauna from pit if they were to fall in (Critical Control). • Monitoring of pit during operations by the site team. • Post operations pit monitoring both on-site and remotely (Critical Control). • Fauna spotters to assist if trapped fauna are identified (where available). • Pit reinstatement to be initiated within 12 months post activity.	II	C	2	Yes	• Fauna and stock can be attracted to fluids contained in drilling pits. Fencing the location and commencement of pit closure within 12 months of activity limits the likelihood of fauna occurrence. • With monitoring, availability of fauna spotters and exit/fauna ladder, the risks of impact are reduced to ALARP and acceptable.	Low
25	Terrestrial Ecosystems	Nuisance (noise and light) from project activities inc. vehicle movements, construction, drilling, completion and EPT related activities	To fauna movements	I	A.3.1 Site Selection and Planning A.3.3 Noise A.3.2 Well Pad Site Selection Requirements A.3.5 Biodiversity Protection	• Well pad, campsite and gravel/borrow pits located outside Sites of Conservation Significance (Karinga Creek Paleodrainage system) and Botanical Significance (Poona). • Well pad, access track, gravel pit and campsite construction to occur during daylight hours. • Well pad and campsite lighting towners positioned inward toward location centre. • Light towers required for 24-hour operations to be directed toward the centre of work locations.	I	A	2	Yes	• It is almost certain that native fauna will be disturbed through transport movements along access tracks and during drilling and well testing activities around the well pad. The Project Area is also located in close proximity to a Site of Conservation and Botanical Significance however, the drilling program avoids this area, with only a small sectioned being traversed on existing pastoral track. The tracks falls within a buffer zone of the SOC and SOB and do not traverse significant lake habitat. • As such, this risk carries a negligible impact that is unlikely to result in a risk, therefore it is acceptable and ALARP.	Medium
26	Terrestrial Ecosystems	Land disturbance from construction of infrastructure i.e. well pads, access tracks, gravel/borrow pits and campsites	To habitat features /areas for flora and fauna	III	A.3.5 Biodiversity Protection	• Well pad, campsite and gravel/borrow pits located outside Sites of Conservation Significance and Botanical Significance (Karinga Creek Paleodrainage system) • An ecologist will be on-site before or during clearing operations to undertake ground-truthing for ground-disturbing activities in advance of any ground disturbance to ensure to enable avoidance of potential threatened species habitat. • Civil works avoid clearance of mature vegetation, e.g. Desert Oak, and avoid clearing or disturbing clusters of 5 or more hollow-bearing trees to maintain potential nesting habitat for the Princess Parrot. • Peak Helium will conduct a pre-clearing survey with ecologists for potential Grey Falcon habitat within 300m of proposed activities. If active nests are encountered, a 300m exclusion zone will be established until the nests are no longer active. (Critical Control) • To aid in the avoidance of potential habitat, indicative infrastructure movement corridors have been assessed and will be utilised to re-align new tracks, well pads and campsites, if required. • Minimise disturbance to dune crests and sand ridges as these areas provide suitable habitat to a variety of threatened species, including the Itjaritjari (Southern Marsupial Mole). If dunes must be crossed, then cross dunes at right angles to minimise erosion potential and disturbance to potential habitats. • An inspection of a 300m radius around well pads and gravel pits will be carried out before construction. • Topsoil stockpiled up to 1.5 meters in height to maintain seed bank to facilitate natural regeneration when re-spread during progressive rehabilitation. • No clearing of riparian zones of their buffers for well pads, campsites and gravel pits. • Buffers distances programmed into GPS with set alarms when approaching riparian/no-go zones, or zones marked off. o 1st order streams and Drainage lines = 25m buffer from the outer edge of drainage depression or riparian vegetation. o 2nd order streams = 50m buffer. o 3rd and 4th order creeks = 100m buffer. o 5th order Rivers = 250m.	III	d	2	Yes	• Through the process of land clearing, potential habitats can be impacted. To limit any impacts, an ecologist will complete pre-clearance land surveys to identify and avoid Desert Oak and clusters of 5 of more hollow-bearing trees and to re-locate other habitat features prior to clearing. • The Project Area is also located in close proximity to a Site of Conservation and Botanical Significance however, the drilling program avoids this area, with only a small sections being traversed on existing pastoral tracks. The track falls within a buffer zone of the SOCS and SOBS and do not traverse significant lake habitat. • Given the use of pre-existing pastoral access tracks and the ability to move well pads, campsites and gravel/borrow pits within the indicative well pad corridors to avoid identified habitats, the risk of impact is moderate, unlikely, ALARP and acceptable.	Medium
27	Terrestrial Ecosystems	Storage of waste or irrigation of grey water and treated sewage effluent attracts fauna or stock	To fauna or stock feeding patterns	I	C.7.1 Wastewater management plan	• Greywater and treated sewage effluent disposal site managed to prevent pooling and runoff/attractants to fauna or stock (Critical Control). • Drilling by-products pits are fenced and monitored post drilling activity and pre-reinstatement. • Solid wastes segregated and stored onsite in vertical side skip bins. • Putrescible waste material stored in fauna-proof containers and will be removed from the site when not in use. • Creation and implementation of mitigation measures described in the Wastewater Management Plan (**Appendix 06**).	I	D	1	Yes	• The population of feral animals may be increased through the provision of access to water and food (from camps). Food scraps and waste will be securely stored for disposal off-site, reducing food availability for pests, and irrigation will be managed to prevent pooling and runoff. • As such, this risk carries a negligible impact that is unlikely resultant in a risk that is acceptable and ALARP.	Low
28	Terrestrial Environmental Quality	Compaction from vehicle and machinery movements on access tracks and well pads	To site rehabilitation	II	A.3.1 Site selection and planning A.3.4 Erosion and sediment control and hydrology	• Preferential use of pre-existing tracks to access well pads and campsites. • Topsoil removed from well pads, stockpiled and stored for progressive rehabilitation (Critical Control). • Access to well pads is limited during wet weather events to critical equipment. • Progressive rehabilitation of sites at the cessation of activity to be cultivated/harrowed to alleviate soil compaction before seeding.	II	D	1	Yes	• During operations, well pads and access tracks will be compacted by light and heavy vehicle movement. Compaction can be rectified with time and mechanical measures and is accounted for in the rehabilitation management plan. • Given the localised area of activities, the potential impact of compaction is anticipated to be minor and easily rectified during rehabilitation activities. Therefore the residual risk of impact is ALARP and acceptable.	Medium
29	Terrestrial Environmental Quality	Pooling or runoff of greywater and treated sewage effluent from irrigation areas	To soil or surface water	III	A.3.1 Site selection and planning A.3.5 Biodiversity protection	• Irrigation completed by use of sprinklers or dispersion hoses to distribute water evenly across disposal area (Critical Control). • Surface irrigation disposal area with a slope <5%, is vegetated and has no vehicle access (Critical Control). • Sewerage wastewater irrigated as per Department of Health code of Practice for On-site Wastewater Management. • Areas appropriately sized and fenced to accommodate irrigation volume and avoid fauna interaction. • Irrigation areas located away from watercourse (>200m). • Waste and Wastewater monitoring as per WWMP (**Appendix 06**). • Wastewater system performance to be monitored in accordance with the manufacturers requirements.	III	E	1	Yes	• The management of sewerage and greywater is in line with various NT wastewater management guidelines. • Due to the temporary nature of the activity, the maximum contamination resulting from sewerage and grey water irrigation is likely to be negligible, with any impacts restricted locally and would be temporary in nature. • Irrigation is away from nearest watercourse (approximately 1000m to the nearest) with the potential contamination of these features considered remote. The resultant risk is acceptable and ALARP.	Low

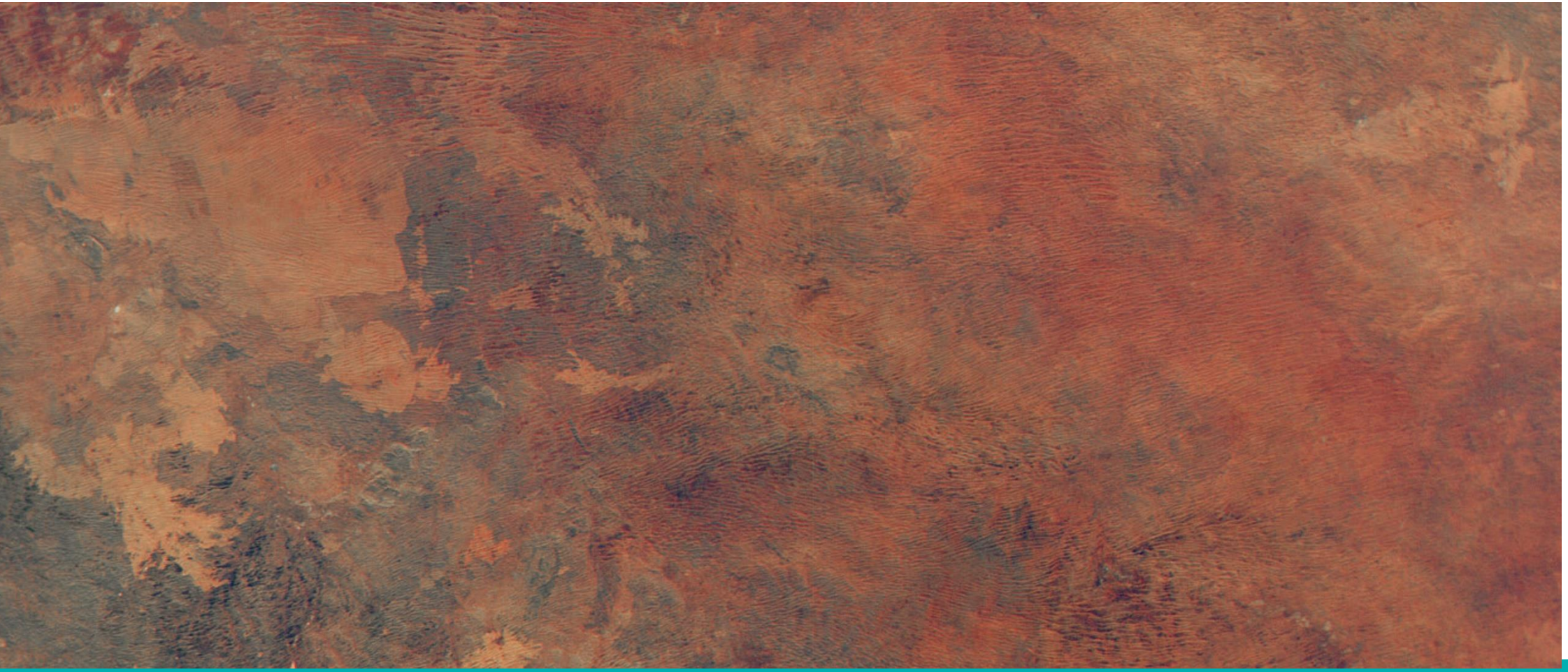
Risk #	Environmental Factor	Risk Source	Potential Impact	Unmitigated Consequence	Codes of Practice Section	Risk Management Controls (inc. prevention, detection and mitigation)	Residual Risk			Acceptable Criteria Achieved	Residual risk ALARP and Acceptable Statement	Scientific Uncertainty Ranking
							C	L	R			
30	Terrestrial Environmental Quality	Spread of biosecurity risk material (e.g., weeds and seeds) to, or within the project area during operations	To native vegetation	IV	A.3.1 Site selection and Planning A.3.5 Biodiversity Protection A.3.6 Weed Management	• Weed survey conducted before and after any disturbance or clearing operations for the identification and management of weeds (Critical Control). • Weed infestations are mapped, and all personnel and contractors are made aware of any identified infestations and to avoid infestation areas. • Training and inductions for project staff and contractors to cover vehicle weed hygiene requirements. • Operational staff to attend weed identification training delivered by the NT Weed Management Branch. • Dedicated weed officer to be nominated. • Vehicle and machinery cleaned down and inspected before mobilisation to the project area (Critical Control). • Vehicles to stay on cleared/formed access tracks unless involved in clearing. • Where weeds are identified, immediately implement weed control measures in line with *Northern Territory Weed Management Handbook* and any relevant Weed Management guidelines (e.g., *Weed Management Plan for Athel Pine 2017-2027*). • Monitor well pads, access tracks, campsites and gravel/borrow pits for weeds and implement management strategies up to and during progressive rehabilitation of the site. • Record weed monitoring and survey activities in accordance with the NT Weed Data Collection Guidelines and Notify the NT Weed Management Brand of any new weed incursions. • Creation and implementation of a site-specific Weed Management Plan (**Appendix 09**).	IV	C	3	Yes	• The uncontrolled introduction or spread of weeds can have an impact on native vegetation and communities. Before seismic activities commenced the area had been scouted by ecologists, weeds identified, and management plans put in place. • Before the construction and drilling activities, the weed management plan has been revisited and revised to ensure weeds are known, mapped, avoided, monitored, and managed, and vehicles entering the property are free of biosecurity risk maters. • With the addition of training/inductions, the likelihood of impact resulting in a significant impact is unlikely, meaning the risk is reduced to ALARP and acceptable.	Low
31	Terrestrial Environmental Quality	Ignition sources from people, plant, machinery, or flaring causing bushfire	To flora and fauna	III	A.3.5 Biodiversity Protection A.3.7 Fire Management	• 10-metre fire break around well pads and campsites. • Creation of site-specific fire management plans (**Appendix 08**) including the requirement for annual fire frequency mapping. • Flares or flare stacks must be designed, prepared and operated following industry standards. • Flare set back distinct from well pad lease and mulched vegetation >20m. • Daily weather and fire danger rating monitoring. • Fire extinguishers and operational radios fitted to all vehicles and equipment. • No burning of waste on-site. • Training and inductions cover: designated smoking areas, location of fire fighting equipment, emergency response. • Designated smoking areas established with appropriate waste receptacles. • Machinery and vehicles should be parked in areas of low fire risk. • On-site water bores able to pump to water trucks are available for fire fighting.	III	D	2	Yes	• Uncontrolled bushfires can significantly impact the community, landowners and the environment. • Fire mapping shows that fire is common in the area. However, the well pad locations have not been burned in over ten years. Despite this, fuel loads in the Project Area are determined to be low due to the arid climate. • Therefore, the controls inc. fire breaks, and clearing, in addition to the additional protection, detection and mitigation controls, reduce the risk of fire to ALARP and is deemed acceptable.	Low
32	Terrestrial Environmental Quality	Vegetation and soil stripping for well pads, access tracks, campsites and gravel/borrow pits increases soil erosion and sediment loss	To site rehabilitation	III	A.3.1 Site selection and Planning A.3.4 Erosion and Sediment Control and Hydrology A.3.9 Rehabilitation	• Site selection and design of access tracks, well pads, campsite and gravel/borrow pits to avoid erosion, e.g., outside of natural flow paths, constructed on <2% slope, new tracks preferentially parallel to dunes and located outside of the 1-100 flood zone (Critical Control). • Access to well pads, gravel/ borrow pits and campsites via existing tracks to limit new clearing. • Pre-clearance and site assessments to include larger indicative well pad, campsite and gravel/borrow pit locations to allow for minor adjustments clearance locations to minimise environmental impacts during pre-clearance surveys. • Site selection of access tracks that are not pre-existing, to cross watercourses at right angles with bend and bank contours maintained and to avoid Groundwater Dependent Ecosystems. • Ecologist utilised to ground-truth locations in advance of any ground disturbance to ensure: o The actual riparian zones and the buffers for drainage depressions, and stream orders 1 to 4, and the location Desert Oak and density of hollow-bearing trees and their buffers are identified and avoided. o The location well pads and gravel/borrow pits will not require clearing of riparian zones or their buffers. • Erosion and sediment controls for all project infrastructure (inc. pre-existing tracks) installed and maintained, and monitored as per the site-specific Erosion and Sediment Control Plan (**Appendix 05**). • Training and inductions to cover the importance of reporting all environmental incidents, inc. spills and sediment releases. • Avoid clearing large trees, specifically the Desert Oak as they may provide nesting habitat for endangered or near-threatened fauna (e.g., the Princess Parrot). • Low-level watercourse crossings for access tracks to be excavated and backfilled with rock to watercourse bed level. • Topsoil stripped and stockpiled away from water flow paths in berms <1.5m high to preserve seed bank. • Re-instatement of drilling waste pits and campsites/gravel pits to be re-instated to stable landforms when no longer required for operations. • Progressive rehabilitation of sites at the cessation of activity to include temporary Erosion and Sediment Control measures that will be monitored until final rehabilitation (**Appendix 12**). • Monitoring and maintenance of ESC measures and management of weeds until final rehabilitation complete, inc. site inspections pre and post-rainfall (Critical Control).	III	D	2	Yes	• The impact of uncontrolled land clearing on-site rehabilitation is well known for access tracks, well pads, campsites and gravel/borrow pits, and rehabilitation methods have been well documented and tested. Through the use of pre-existing tracks, site selection of infrastructure on slope <2%, and the implementation of best practices controls, the risk of not achieving a rehabilitated site that matches the off-site environmental is unlikely. • Coupled with the monitoring and maintenance of controls up to and including final rehabilitation, the risk is considered to be reduced to ALRP and acceptable.	Low
33	Terrestrial Environmental Quality	Access tracks, well pads, camp sites, gravel/borrow pits or water bores handed over to landholder upon cessation of activities before final rehabilitation degrade overtime	To soil and surface water	II	A.3.9 Rehabilitation	• Rehabilitated infrastructure no longer required for the activity handed back to the landowner remediated, in stable condition with site specific reports detailing status of rehabilitation and monitoring program as per Rehabilitation Management Plan (**Appendix 12**) (Critical Control). • Land handed back in stable condition acceptable to the Pastoral land board (Critical Control).	II	E	1	Yes	• Hand over of infrastructure is only an option when the infrastructure is rehabilitated and in a stable condition. In addition, any transfer infrastructure needs to be approved by the Rangelands/Pastoral Management Group, reducing the risk of an unforeseen impact to remote, risk to ALARP and acceptable.	Low

Risk Assessors:			
Name	**Trent Smith**	**Jon Bennett**	**Ibraim Hasnain**
Title	HSE & Compliance Manager	Project Manager	Principle Engineer

5 Appendix 05 – Erosion and Sediment Control Plan

EROSION AND SEDIMENT CONTROL PLAN

PEAK HELIUM PTY LTD EP134 DRILLING PROGRAM



CLIENT: PEAK HELIUM PTY LTD

DOCUMENT NUMBER: 22-0132/R2245

VERSION: A

DATE: 2/12/22

1 SCOPE

Topo were engaged by Peak Helium Pty Ltd (Peak Helium) to develop a CPESC certified Erosion and Sediment Control Plan (ESCP) for works associated with the Exploration Permit (EP) 134 Drilling Program located approximately 160km south of Alice Springs in the Northern Territory. It is understood that the project will commence in December 2022.

1.1. GUIDELINES

This ESCP has been prepared in accordance with the following documents:

- Environmental Assessment Act 1982
- Petroleum Act 1984 and Petroleum Regulations 2020
- Waste Management and Pollution Control Act 1998
- Soil Conservation and Land Utilisation Act 1969
- Best Practice Erosion and Sediment Control (IECA, 2008)
- Soil, land and vegetation guidelines and fact sheets (NT.GOV.AU)
- Land Clearing Guidelines (Department of Environment and Natural Resources)

1.2. OBJECTIVES

This ESCP is part of a hierarchy of documentation prepared to minimise the potential environmental impacts associated with Peak Helium's drilling program. With respect to ESC, this plan has been prepared specifically to assist the project in achieving the following objectives:

1. Ensure that the clearing of native vegetation does not unreasonably contribute to environmental degradation of the locality
2. Avoid impacts on environmental significant or sensitive vegetation
3. Avoid impacts on drainage areas, wetland and waterways
4. Avoid impacts on highly erodible soils
5. Take all reasonable and practicable measures to minimise actual or potential environmental harm resulting from soil or water movement as a consequence of either the construction or operational phases (with regard to soil erosion and land rehabilitation) of drilling
6. Maintain, and where practical, enhance the land use capabilities of disturbed areas with respect to land's soil, water and vegetation attributes
7. Ensure temporary ESC measures do not unreasonably impact upon the economic and safety-related attributes of the project

Preliminary slope data derived from SRTM Digital Elevation Modelling (DEM) identified a number of locations across the project where slopes exceeded 2%, and in places 5%. The Land Clearing Guidelines class slope of 2-3% and >3% as having an associated high and very high risk of erosion, respectively (refer Table 1).

Table 1 - Acceptability of erosion risk associated with clearing works based on slope gradient (DENR Land Clearing Guidelines)

Slope (%)	Erosion risk	Recommendation
0 to 1%	Low	Risk is acceptable; management required.
1 to 2%	Moderate	
2 to 3%	High	Required management is prohibitive; clearing not recommended.
>3%	Very High	

The project has previous demonstrated that exclusion of land with slopes greater than 2% is unfeasible. This ESCP has been prepared to demonstrate how the risk will be mitigated and thus satisfy DENR requirements.

1.3. CERTIFICATION

I **Tom Bailey** certify that this Erosion and Sediment Control Plan (ref: R2245) has been prepared to satisfy the following requirements:

- The intent and minimum standards nominated within the IECA (2008) Best Practice Erosion and Sediment Control Guideline and relevant supporting Appendices (IECA, 2015).

If implemented correctly, it will assist Peak Helium in meeting environmental obligations defined in the *Waste Management and Pollution Control Act 1998* (NT).

CPESC 6374

1.4. REVISION

VERSION	DATE	AUTHOR	REVIEWER	APPROVED
DRAFT	23/06/22	T. Bailey	S. Chamberlain	T. Bailey
A	2/12/22	T. Bailey		T. Bailey

2 PROJECT DESCRIPTION

2.1. LOCATION

EP134 is located east of Erldunda, 160km south of Alice Springs in the Ghan locality of Northern Territory. It lies within the Finke bioregion, stretching across two pastoral stations – Idracowra and Horseshoe Bend.

The site location is presented in Figure 1 below, with access tracks shown in purple and well pad corridors in blue. Note that large portions of the access tracks presented consist of existing roads, station access tracks and rail access tracks.

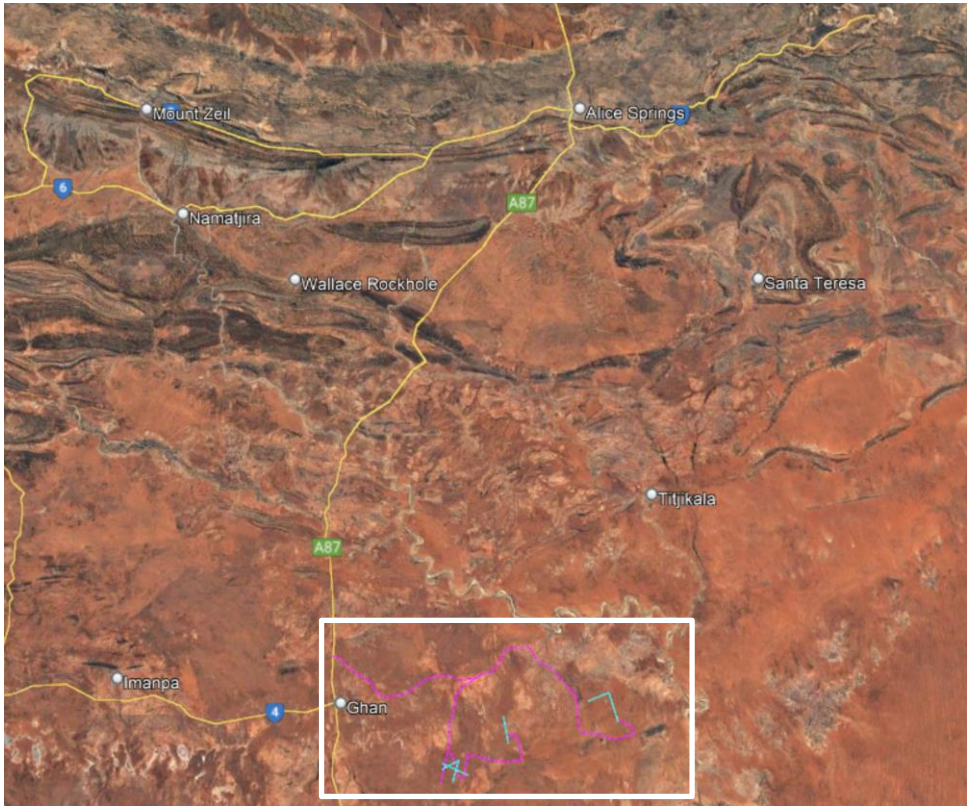


Figure 1 – Site Location

2.2. PROJECT WORKS

Projects works will involve the following major activities:

1. Access track construction
   - New tracks – to be constructed to 6m width
   - Existing 5m wide seismic tracks widened to 6m
   - Existing pastoral tracks 6m or wider used as-is
   - Existing 4m wide pastoral tracks widened to 6m
2. Well Pad Construction
   - Clearing of vegetation and localised earthworks for the drilling of wells. Instalment of a well pad and associated structures and infrastructure
3. Gravel pit construction
   - Extraction area of sourcing material for access track and well pad capping
4. Camp construction
   - Clearing of vegetation and localised earthworks for the construction of accommodation camps to service the nearby well pads

Figure 2 – Typical Access Track Construction

Figure 3 – Typical Well Pad Construction

2.3. CLIMATE

The region experiences an arid to semi-arid climate, which is characterised by hot dry summers and cool dry winters, with a low average annual rainfall. Typically for this region, maximum and minimum temperatures are highest in summer. The closest long-term Bureau of Meteorology weather station is Kulgera (station number 015603) approximately 65 km south-west of the investigation area. Average annual rainfall is highly variable. If heavy rainfall occurs, it is generally in the summer months from November to March and can result in flash flooding in the waterways.

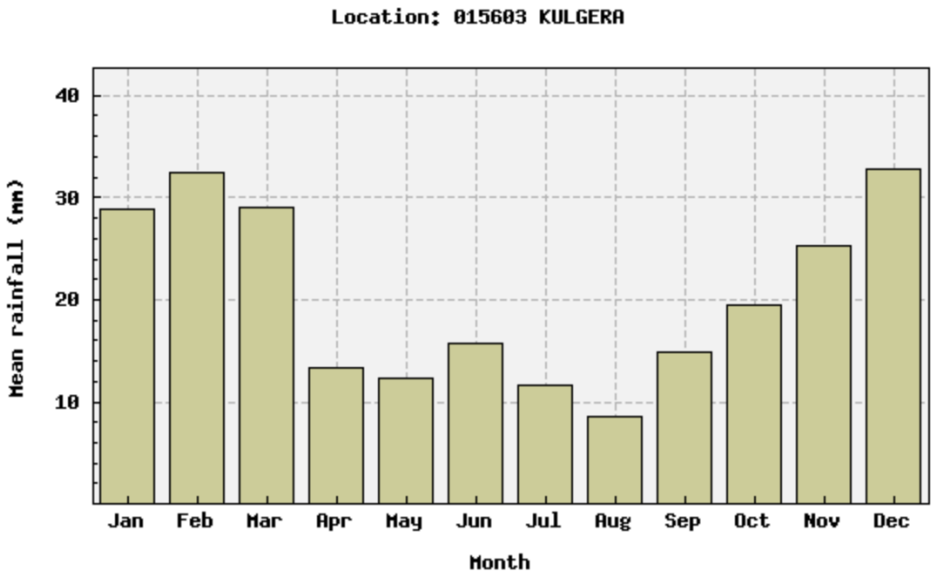


Figure 4 – Historic rainfall (Source: BoM)

2.4. TOPOGRAPHY AND DRAINAGE

The project area is mostly dune systems, which transitions into plains, swales, and depressions as the predominant land formations in the south-western areas. The project area lies within the Diamantina-Georgina Rivers catchment. There are numerous smaller drainages, tributaries, and drainage gullies surrounding the proposed work areas, which have been intentionally avoided. The major watercourses in proximity to the investigation area are Karinga Creek in the west, and Nine Mile Creek in the north-east. All watercourses in the region only flow after heavy rainfall events. The existing track/road crossing Karinga Creek is reportedly in excellent conditions with no upgrades required.

The majority of the site is characterised by dunes of spinifex and low shrubs and trees, with swales between the dunes that have scattered to patchy Desert Oak, and the remaining swales are very similar to sandplains and open plains.

A key consideration in plan development was the orientation of proposed works with respect to local fall, whether it be perpendicular or parallel to slope, or passing diagonally up the slope. The impact that these orientations have on drainage, erosion and sediment control is presented in Appendix A.

Figure 5 – Desert Oak within Dune Swales (Source: EcOz)

It must be noted that the southern access track crosses the Karinga Creek paleo-drainage system Site of Conservation Significance (SOCS). The Karinga Creek paleo-drainage system provides important temporary salt pans and lakes. Access shall only be via the existing formed road.

2.5. SOILS

Studies undertaken by others have identified most well pads, camps and gravel pits are located primarily within the Simpson land system. The Simpson land system consists of dunefields with parallel linear dunes, reticulate dunes and irregular or aligned short dunes. Chief soils consist of red sands.

The south-western well pad and camp is located within the Lindavale land system, which consists of plains, rises and plateaux on weathered and unweathered Cambrian limestone, dolomite, chalcedony, shale, sandstone and siltstone with associated sand sheets. Associated soils consist of sandy and earth soils.

For the purpose of this report, soil maps were extracted from the CSIRO 'Maps of Australian soil loss by water erosion derived using the RUSLE'. This mapping accounts for the erodible properties of the soils described above. These data sets are described in the following publication; Teng H, Viscarra Rossel RA, Shi Z, Behrens T, Chappell A and Bui E 2016 Assimilating satellite imagery and visible-near infrared spectroscopy to model and map soil loss by water erosion in Australia - Environmental Modelling & Software 77: 156-167.

3 EROSION RISK ASSESSMENT

An erosion risk assessment has been conducted using the Revised Universal Soil Loss Equation (RUSLE). The calculated soil loss is then used to determine the level of sediment control required, as well as stabilisation and staging requirements.

$$A = K \times R \times LS \times P \times C$$ **Equation 1 (IECA 2008)**

Where:

A is the predicted soil loss per hectare per year
K is the soil erodibility factor
R is the rainfall erosivity factor
LS is the slope length/gradient factor
P is the erosion control practice factor
C is the ground cover and management factor

Given the scale of the project, including a large spatial distribution of factors that influence soil loss, the most effective method of assessing erosion risk was through the use of GIS mapping. RUSLE data sourced from the CSIRO Data Portal was applied to this assessment, as detailed in the following sections.

3.1. K-FACTOR – SOILS

The soil erodibility factor (K factor) is a measure of the susceptibility of soil particles to detachment and transport by rainfall and runoff. Soil texture is the principle component affecting the K factor, but soil structure, organic matter and profile permeability also contribute.

The K-factors provided by the CSIRO mapping are consistent with those of the Department of Environment and Natural Resources (DENR) for a range of soil families in the Northern Territory. The data provided by the CSIRO is a collection of fine spatial resolution (3 arc sec) digital soil property maps, one for each of the standard depths, and each with an upper and lower confidence limit.

The K-factors across the study area ranged between 0.028 and 0.032 and were adopted for this risk assessment.

3.2. R- FACTOR – RAINFALL

The rainfall erosivity factor (R factor), is a measure of the ability of rainfall to cause erosion. The R factor is defined as the mean annual sum of individual storm rainfall intensity (EI30) values - EI30 being the total storm energy (E) multiplied by the maximum 30 minute rainfall intensity (I30). Under otherwise identical conditions, soil loss is directly proportional to EI30 (Renard et al 1997).

Rainfall data for the site was obtained using the Bureau of Meteorology (BoM) Design Rainfall Data System (2016). Intensity Frequency Duration (IFD) data was extracted over the study area between 286,607 (E), 7,162,050 (N) and 435,827 (E), 7,262,586 (N). Using the ascii data provided, a rainfall map was created representing the spatial variation of rainfall intensity over the study area. Rainfall mapping is presented in Appendix A.

3.3. LS - SLOPE-LENGTH

Slope length and slope gradient have substantial effects on soil erosion by water. The two effects are represented by the slope length factor (L) and the slope steepness factor (S). In application of RUSLE the two are evaluated together as a numerical representation of the length-slope combination (LS factor).

CSIRO mapping was agauin applied for the LS factor, providing data for the combined slope length factor and the slope steepness parameter. The resulting LS map is illustrated in Appendix A. It is noted that contour mulch bunds must be placed at a maximum spacing of 200m on site during clearing works.

3.4. COVER (C) AND PRACTICE (P) FACTORS

Within RUSLE, the C and P factors are used to describe management of the site with respect to reducing soil loss. The C factor measures the combined effect of all the interrelated cover and management variables adopted over the site. It also represents non-structural methods for controlling erosion (i.e. covering exposed areas with various erosion control products to minimise raindrop impact or stabilisation by temporary or permanent vegetation).

The P factor measures the combined effect of all support practices and management variables. P factor is reduced by practices that reduce both the velocity of runoff and the tendency of runoff to flow directly downhill. It also represents structural methods for controlling erosion.

Whilst every effort should be made to retain existing topsoil and ground cover, due to the uncertainty associated with the extents of disturbance, the default C and P factors of 1 and 1.3 have been adopted for the GIS assessment and are therefore a conservative estimate. Default factors of 1 and 1.3 represent compacted and smooth exposed areas.

3.5 ESTIMATED SOIL LOSS

Using Global Mapper GIS software, the aforementioned factors were multiplied to calculate the resulting soil loss for the study area , indicating a very low erosion risk (typically less than 30 t/ha/yr) according to Table 4.4.7 of IECA, 2008. Figure 6 and Table 2 below indicate the determined erosion risk for the site and surrounding areas.

Table 2 – Erosion Risk Categorisation

COLOUR	EROSION RISK (t/ha/yr)
Green	0-10
Yellow	10-20
Orange	20-30
Red	30-40
Dark Red	40-50

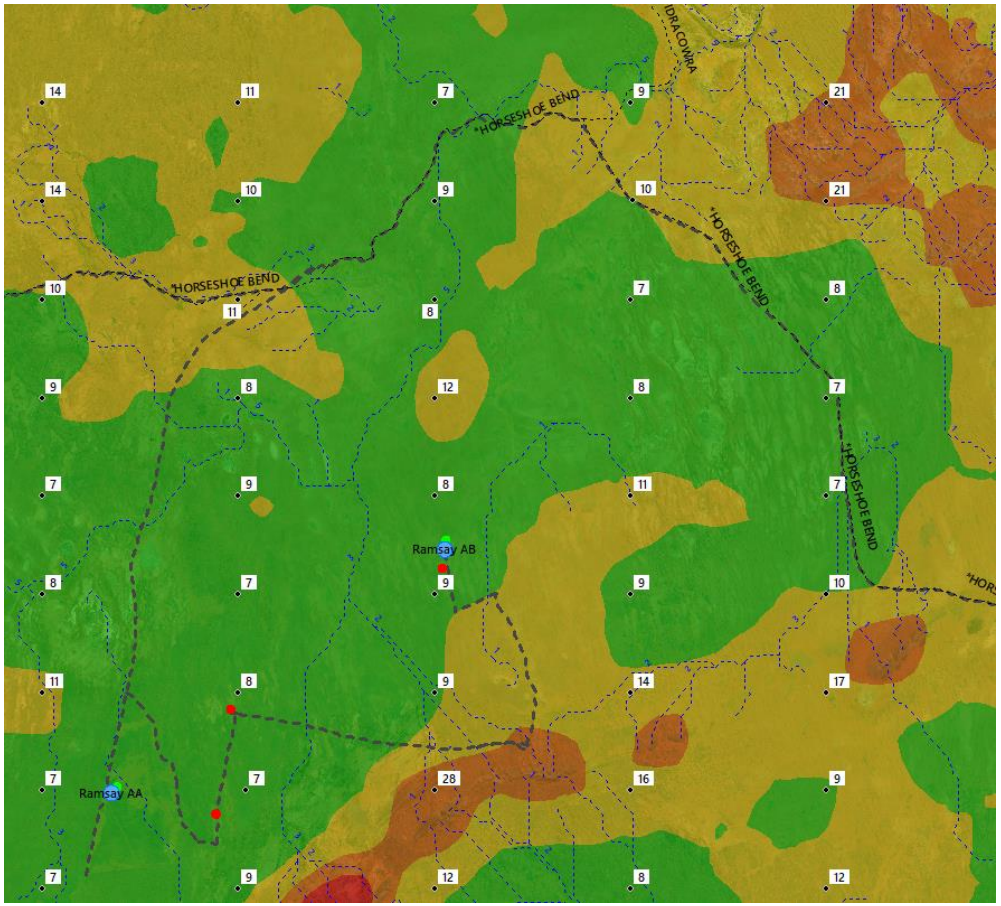


Figure 6 – Erosion Risk

4 SEDIMENT CONTROL

The sediment control standard is typically determined using Table 4.5.1 (IECA, 2008) which defines the sediment control standard based on catchment area and soil loss rate. The revised Table 4.5.1 (IECA, 2008) provided in Appendix B (IECA, 2018) as Table B1 is provide below as Table 3. The revised table includes an additional area limit trigger of 1 hectare to increase the sediment control standard for large sites with an estimated soil loss exceeding 75 t/ha/yr.

Table 3 – Sediment Control Standard (Table B1 Appendix B IECA 2018)

AREA LIMIT (m^2)	SOIL LOSS RATE LIMIT (T/HA/YR)		
	TYPE 1	TYPE 2	TYPE 3
1000	N/A	N/A	All cases
2500	N/A	> 75	75
> 2500	> 150	150	75
> 10000	>75	N/A	75

Based on Table 3 (IECA, 2018), the calculated soil losses (which are very low) permit the use of Type 3 sediment control measures throughout all work areas. Specific Type 3 controls have been selected as suitable depending on the scope of works. For concentrated flow, Type 2 controls have been proposed. Any internal batters or slopes that may affect the soil loss assessment should be stabilised to omit the impact that they have on the sediment control standard.

4.1. ACCESS TRACKS

Where disturbed, it has been proposed that grass, rocks, branches and shrubs be raked to the downslope extent of works, establishing a control similar to a mulch bund. Where installed as a mulch bund, this control is likely to be effective in trapping the coarse sediment (sand particles) comprising the site area.

4.2. WELL PADS, CAMPS AND GRAVEL PITS

Sediment controls installed on the downslope extent of disturbance may include:

Option 1 – Mulch Berm

- Placed along a line of constant elevation
- Be a minimum of 0.5m high
- Ensure 100% contact with soil surface

Option 2 - Rock Filter Dam

- Installed in accordance with the standard drawing
- Integrated into perimeter topsoil bunding

After excavation, the gravel pit itself could be considered a suitable excavated sediment trap (Type 2 sediment control). If stripping and excavation can be completed within a forecast period of dry weather it may be reasonable to omit the temporary mulch berm of coir log sediment traps proposed.

5 EROSION CONTROL

The minimum erosion control requirements for various risk ratings in accordance with IECA (2008) guidelines are presented in Table 4.

Table 4 – Minimum erosion control requirements according to IECA (2008) - adapted from Table 4.4.7

EROSION RISK RATING	SOIL LOSS RATE (T/HA/YEAR)	ADVANCE LAND CLEARING ALLOWED (WKS WORK)	MAX DAYS TO STABILISATION (DAYS - % COVER)	STAGED CONSTRUCTION AND STABILISATION OF EARTH BATTERS >6H:1V	STOCKPILES STABILISED
Very Low	0 to 150	8	30 (60%)		
Low	150 to 225	8	30 (70%)		
Moderate	225 to 500	6	20 (70%)	✓	
High	500 to 1500	4	10 (75%)	✓	✓
Extreme	> 1500	2	5 (80%)	✓	✓

In addition to these requirements, erosion controls shall include:

- Geolocation and warning signals utilised to prevent any disturbance outside the approved clearing limits
- Utilising existing tracks wherever possible
- Adapting the alignment of access tracks within the easement to a path of least disturbance
- Stabilisation of any high traffic areas within well pads and camps using gravel
- Retention of existing ground cover within the camp and pad area (excluding high traffic areas). Any exposed areas are to be stabilised with gravel or soil binder until rehabilitation.
- Low-level watercourse crossings for access tracks to be excavated and backfilled with rock to watercourse bed level
- Well pad locations >50m from a watercourse
- Well pad locations not in areas prone to flooding

It is noted that the proposed well pad, camp, gravel pit and track locations have been specifically selected to minimise disturbance to existing groundcover, slopes and sensitive areas.

5.1. ACCESS TRACK CONSTRUCTION METHODOLOGY

Access track construction is to comply with the following requirements by priority:

1) Erosion control – restricting disturbance to a minimum track width, following a path of least disturbance and complying with erosion control requirements identified in Table 4
2) Drainage control – installing and maintaining track drainage in accordance with DLRM requirements

To address these priorities the following methodology is to be adopted.

Step 1: Assess site and select path of least disturbance for within the corridor.

Step 2: Program alignment into clearing machinery to prevent over-disturbance or intrusion of buffer zones

Step 3: Commence clearing, ensuring timeframes between clearing and scheduled constructions works do not exceed those indicated in Table 4

Step 4: Windrow cleared vegetation on the extent of disturbance

Step 5: Install drainage controls in accordance with the DLRM Road Drainage Factsheet reproduced in Appendix A.

Step 6: Complete works and re-establish minimum ground cover % within minimum timeframes indicated in table 4 through permanent rehabilitation measures approved in the EMP.

Note that the specific details of track construction may vary along the alignment, however this methodology, and the arrangements presented in the drawings in Appendix A shall be adapted and utilised for all scenarios, regardless of whether they are new tracks or widening of existing tracks.

5.2. GRAVEL PITS

Establishment of these pits will include the following;

- Clearing of vegetation, to be stockpiled around the perimeter of the cleared area for rehabilitation
- Stripping of topsoil (if required)
  - Topsoil will be stockpiled around the upslope side of the gravel pit to divert overland flow from entering the gravel pit
  - If there is no topsoil on site a diversion bund will be constructed upslope to divert any overland flow
- A whoa boy will be constructed on the access track so that water does not flow down the access track into the gravel pit or leave the area once disturbed
- Batters will not be steeper than 1:1, to allow safe passage for animals, and people
- Gravel pits will intentionally be kept wide and shallow to facilitate rehabilitation

6 DRAINAGE CONTROL

Drainage control considers three main principles; diverting external flow before it enters site, directing site runoff to an appropriate sediment control, and ensuring runoff is conveyed in a non-erosive manner.

6.1. ACCESS TRACKS

Flow diversion for linear sites is typically achieved using topsoil bunding or excavated catch drains. Given that material on and near tracks is limited, drainage will generally consist of 1) maintaining existing track drainage, and 2) minimising the concentration of runoff on and around the track.

Reference is made the Northern Territory Road Drainage Fact Sheet (Department of Land Resource Management) with detail provided for appropriate controls in Appendix A.

6.2. GRAVEL PITS, CAMPS AND WELL PADS

Specific measures have been described to address drainage control within and around the proposed well pads, camps and gravel pits with the arrangements presented in Appendix A.

Clean Water Diversion

Diversion berms are to be used on the upslope side of the pad/pit to divert runoff around the pad or to dissipate runoff prior to it entering the pad.

Where earthworks are required to level well pads topsoil from the site shall be stripped and windrowed above the cut batter and fire access track, on the upslope extent of the site. Care should be taken to ensure that water intercepted by the topsoil bund does not drain back onto the pad or to dirty water catch drains.

Dirty Water Diversion

Pad runoff is to be dissipated through the use of coir logs or a mulch berm. The control is to be installed along the contour to promote sheet flow leaving the site. Where the berm (or bund) is aligned downslope returns shall be installed to maximise ponding and minimise flow velocity along the berm.

Runoff from pits is expected to pond locally.

Intra-Site Drainage

For flat pads, given the level of disturbance and size of site runoff will be allowed to sheet flow to sediment controls without the installation of intra-site drainage.

Where earthworks are required to level well pads the cut batters will be protected from erosion by the topsoil stockpile/clean water diversion bund preventing significant water volumes from washing over them. Significant volumes of water are expected to runoff from the compacted pad. This water will drain from the well pad to shallow spoon drains constructed inside the bunds at the top of the fill batters and the toes of the cut batters. These drains will be contoured to take the runoff to the cut/fill point of the well pad.

7 ROLES AND RESPONSIBILITIES

Table 6 outlines the responsibilities of project personnel in respect to ESC.

Table 6 - Roles and responsibilities

ROLE	RESPONSIBILITY
Project Manager	+ Overall responsibility for environmental compliance (including ESC implementation)
Construction Superintendent/Manager	+ Notify the Environmental Manager immediately of any non-compliance with ESCP; + Provide resources to ensure installation, maintenance and operation of ESC devices on ground.
Site Supervisor/Foremen	+ Ensure ESC measures are installed prior to commencing any disturbance activities; + Conduct site inspections as required to ensure ESC measures are operational and in good order; + Monitor daily rainfall; + Notify Environmental Advisor when runoff generating rainfall occurs in the previous 24 hours; + Treat, test and dispose of captured runoff as per operation procedures;
Environmental Manager/ Advisor	+ Conduct site inspections and audits as required; + Prepare audit reports based in inspections; + Provide advice, as required regarding ESC site improvement. + Conduct in-situ monitoring as required; + Collect and submit samples to laboratory as required; + Collate results and prepare reports as required; + Maintain current records of rainfall, water quality, treatment practices, discharge activities.
All Personnel	+ Report any damage to ESC devices and any potential or actual environmental harm in line with Duty to Notify under the requirements of the *Waste Management and Pollution Control Act 1998 (NT)*

8 SITE INSPECTION AND MONITORING

Site inspections and monitoring is to be undertaken in accordance with Sections 6.17 and 7.4 of the Best Practice Erosion and Sediment Control Document (IECA, 2008) as detailed below. When a site inspection detects a notable failure in the adopted ESC measures, the source of this failure must be reported, investigated and appropriate amendments made to the site and the ESCP.

ESCPs should be considered live documents that in some instances will require review and updating as site conditions change, or if the adopted measures fail to achieve the required treatment standard.

Best practice site management requires all ESC measures to be inspected at the following frequencies and include the following checks as a minimum:

Daily site inspections (during rainfall)

+ All drainage, erosion and sediment control measures
+ Occurrences of excessive sediment deposition (whether on-site or off-site)
+ All site discharge points (including dewatering activities as appropriate)

Weekly site inspections (even if work is not occurring on-site)

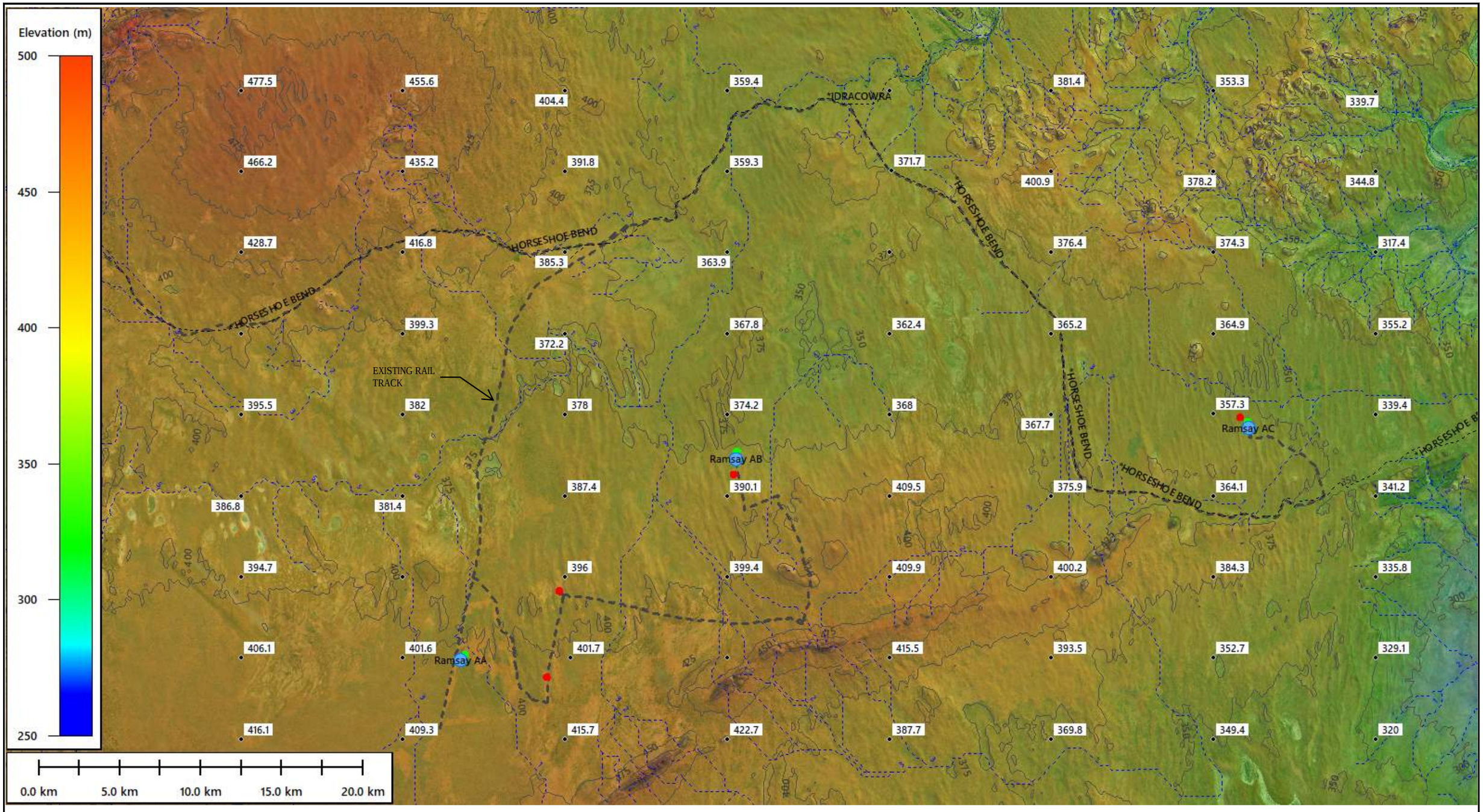
+ All drainage, erosion and sediment control measures
+ Occurrences of excessive sediment deposition (whether on-site or off-site)
+ Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements
+ Litter and waste receptors
+ Oil, fuel and chemical storage facilities

Prior to anticipated runoff producing rainfall (within 24 hours of expected rainfall)

+ All drainage, erosion and sediment control measures
+ All temporary flow diversion and drainage works
+ All drainage, erosion and sediment control measures
+ Occurrences of excessive sediment deposition (whether on-site or off-site)
+ Occurrences of construction materials, litter or sediment placed, deposited, washed or blown from the site, including deposition by vehicular movements

APPENDIX A

EROSION AND SEDIMENT CONTROL DRAWINGS



LEGEND

- ACCESS TRACKS
- WELL PAD CAMPS
- WELL PADS
- CONTOURS (25 m)
- GRAVEL PITS
- NT STREAM ORDER

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

SCALE AS SHOWN

NORTH

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

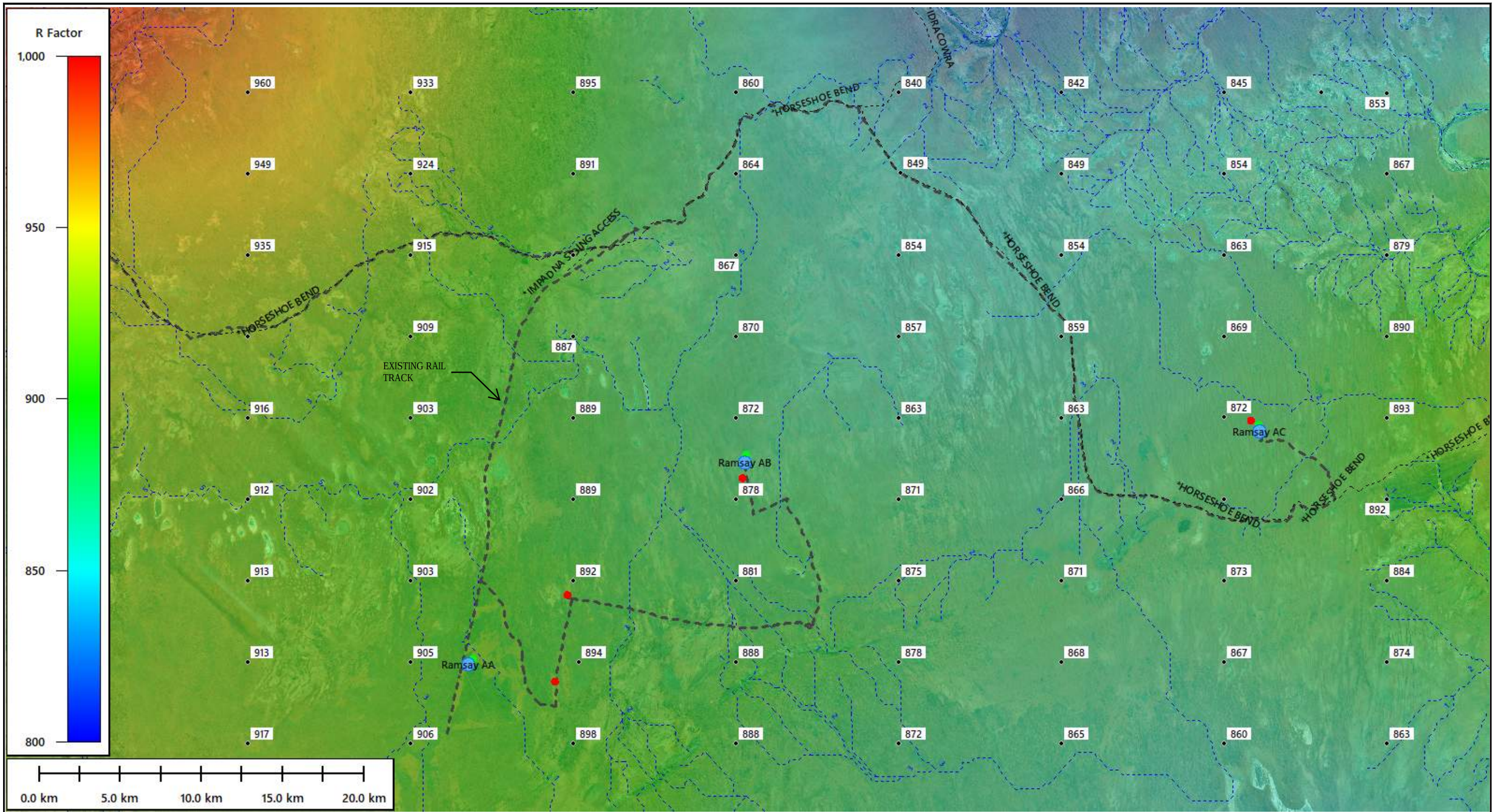
RPEQ / SIGNATURE (IF REQUIRED)

CPESC NO. 6,374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN TOPOGRAPHY AND DRAINAGE

PROJECT No	DRAWING No	REVISION
22-0132	D01	A



LEGEND

- ACCESS TRACKS
- WELL PAD CAMPS
- WELL PADS
- CONTOURS (25 m)
- GRAVEL PITS
- NT STREAM ORDER

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

SCALE AS SHOWN

NORTH

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED)

CPESC NO. 6,374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
RAINFALL EROSIVITY (R FACTOR)

PROJECT No	DRAWING No	REVISION
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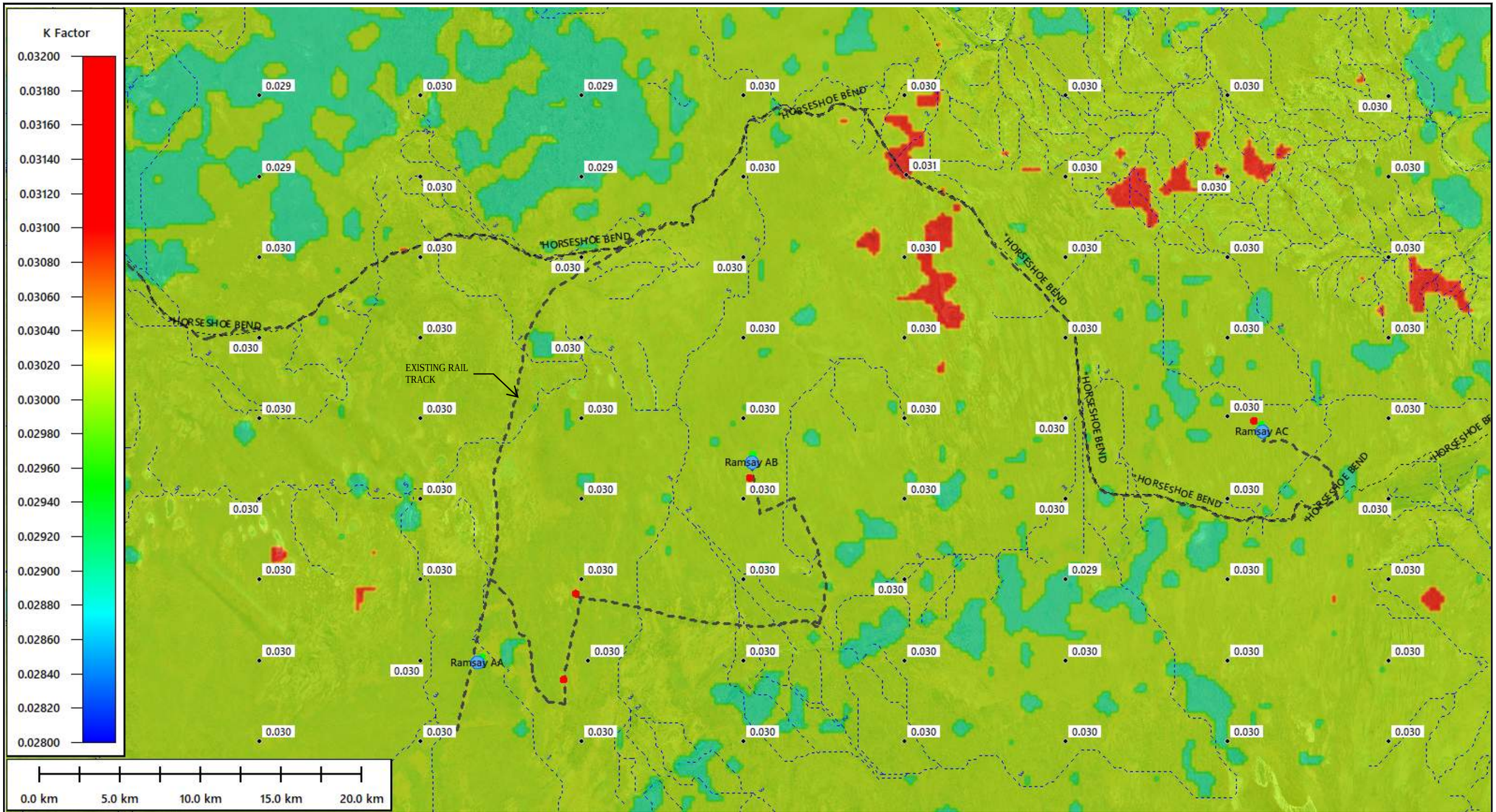

LEGEND

- ACCESS TRACKS
- WELL PAD CAMPS
- WELL PADS
- CONTOURS (25 m)
- GRAVEL PITS
- NT STREAM ORDER

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

SCALE AS SHOWN

NORTH

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED)

CPESC NO. 6,374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
K FACTOR

PROJECT No	DRAWING No	REVISION
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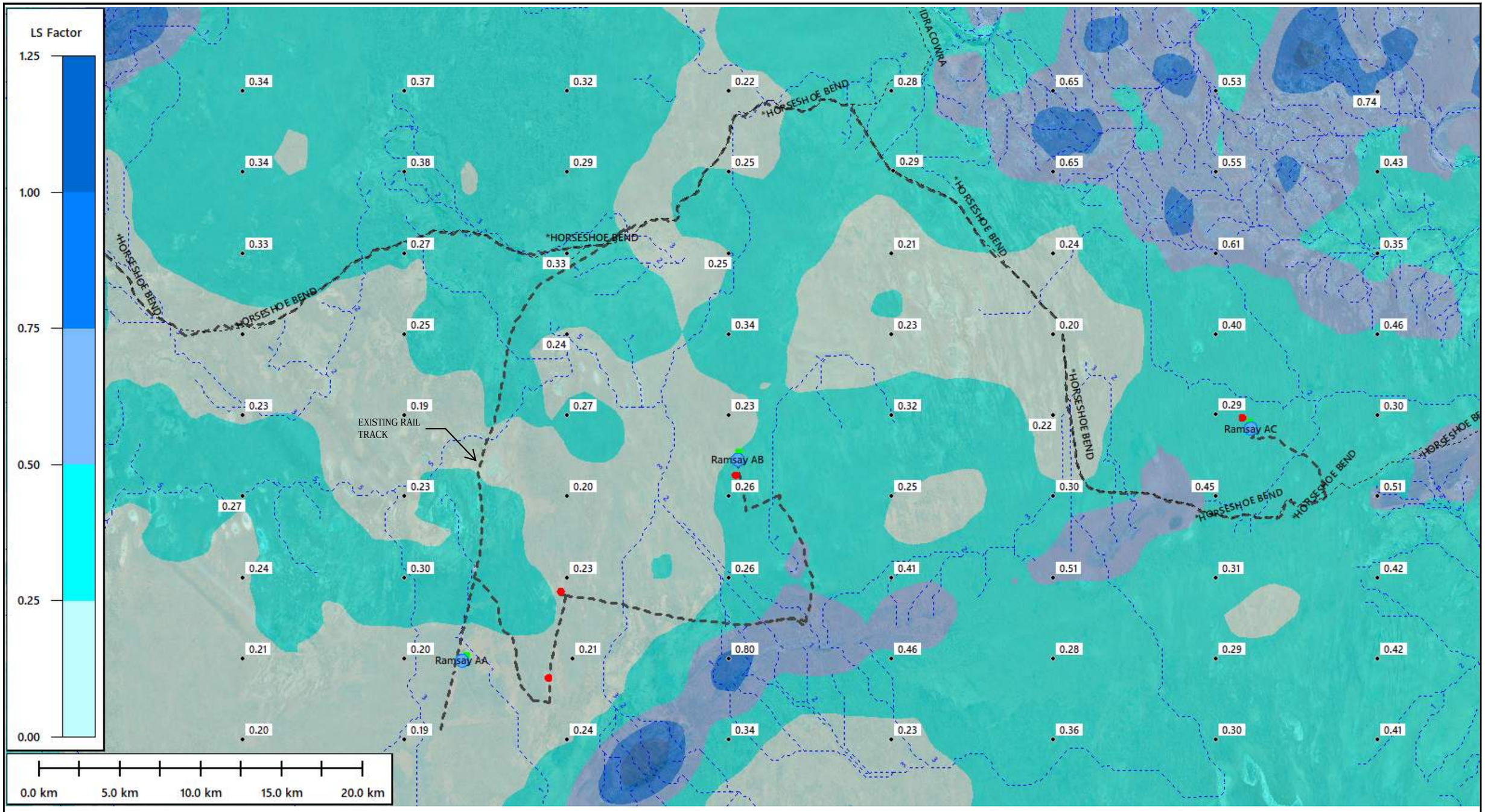

LEGEND

- ACCESS TRACKS
- WELL PAD CAMPS
- WELL PADS
- CONTOURS (25 m)
- GRAVEL PITS
- NT STREAM ORDER

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

SCALE AS SHOWN

NORTH

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED)

CPESC NO. 6,374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
LENGTH & SLOPE (LS FACTOR)

PROJECT No	DRAWING No	REVISION
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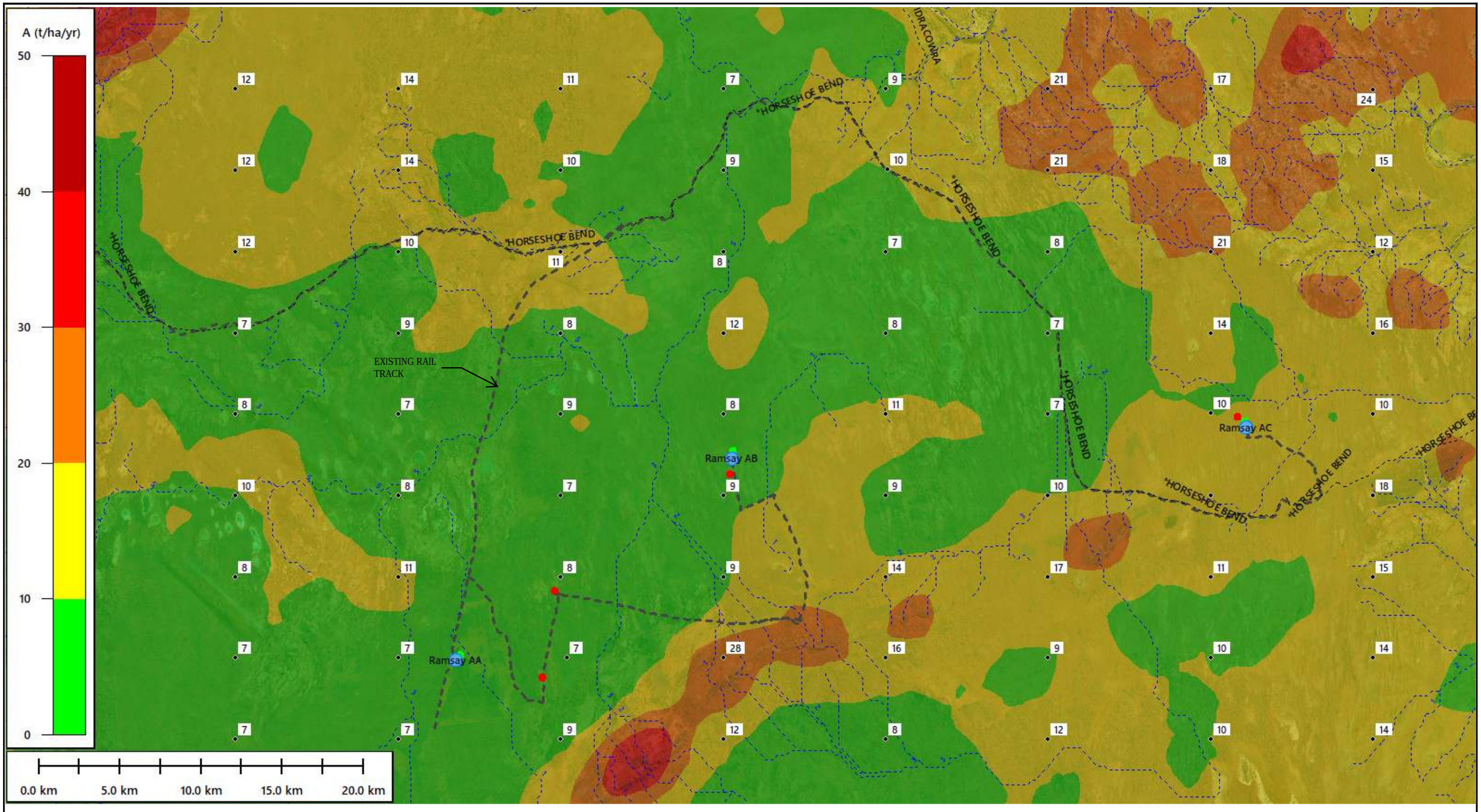

LEGEND

- ACCESS TRACKS
- WELL PAD CAMPS
- WELL PADS
- CONTOURS (25 m)
- GRAVEL PITS
- NT STREAM ORDER

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

SCALE AS SHOWN

NORTH

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED)

CPESC NO. 6,374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
SOIL LOSS ESTIMATE - RUSLE

PROJECT No	DRAWING No	REVISION
22-0132	D05	A

LEGEND

- ACCESS TRACKS
- WELL PAD CAMPS
- WELL PADS
- CONTOURS (1 m)
- GRAVEL PITS
- NT STREAM ORDER

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

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CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED)

CPESC NO. 6,374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
RAMSAY AA SOIL LOSS ESTIMATE - RUSLE

PROJECT No	DRAWING No	REVISION
22-0132	D06	A

LEGEND

- ACCESS TRACKS
- WELL PAD CAMPS
- WELL PADS
- CONTOURS (1 m)
- GRAVEL PITS
- NT STREAM ORDER

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

SCALE AS SHOWN

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ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED)

CPESC NO. 6,374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
RAMSAY AB SOIL LOSS ESTIMATE - RUSLE

PROJECT No	DRAWING No	REVISION
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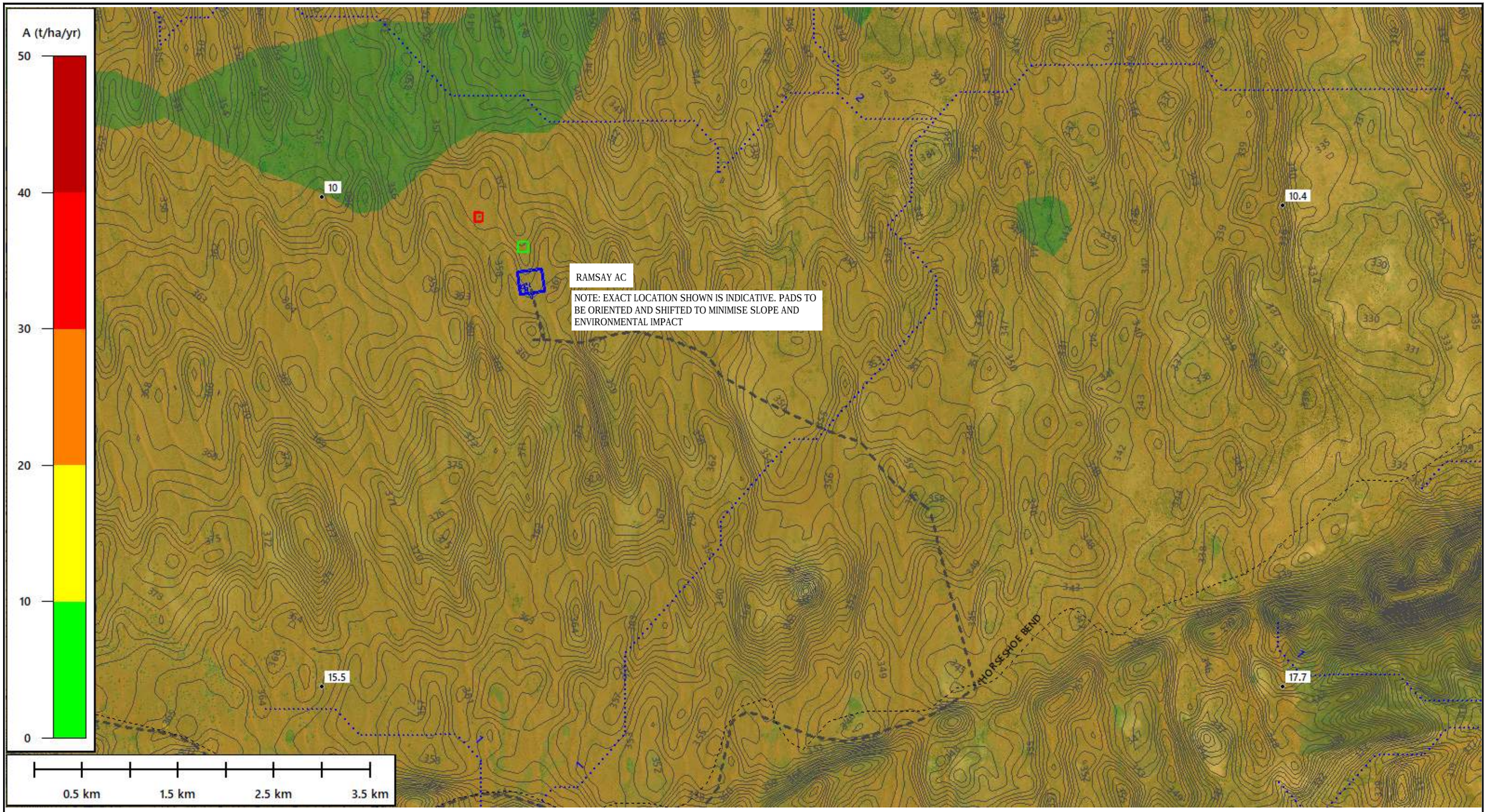


LEGEND

- ACCESS TRACKS
- WELL PAD CAMPS
- WELL PADS
- CONTOURS (1 m)
- GRAVEL PITS
- NT STREAM ORDER

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

SCALE AS SHOWN

NORTH

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

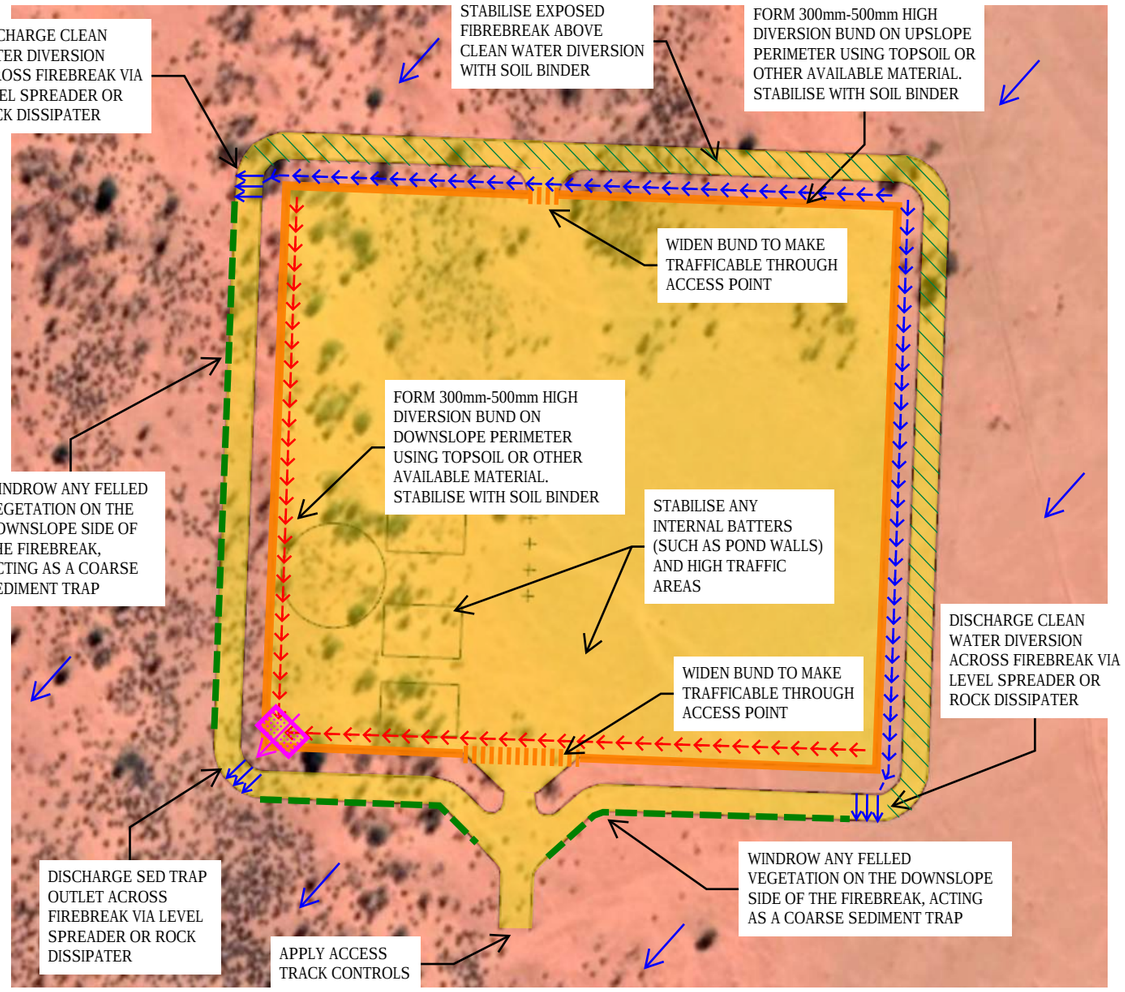
RPEQ / SIGNATURE (IF REQUIRED)

CPESC NO. 6,374

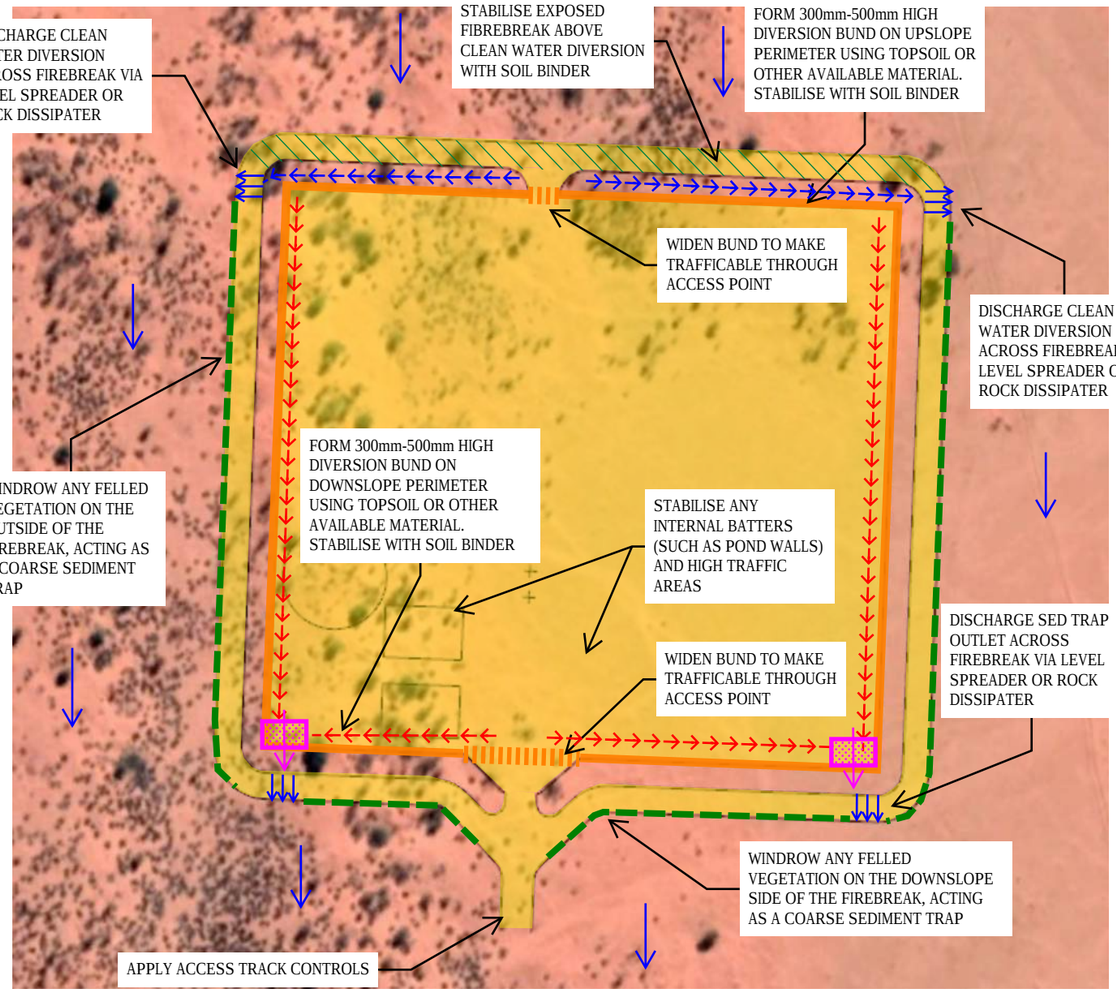
PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
RAMSAY AC SOIL LOSS ESTIMATE - RUSLE

PROJECT No	DRAWING No	REVISION
22-0132	D08	A



WELL PAD ON DIAGONAL SLOPE



WELL PAD ON SIDE SLOPE

LEGEND

- STABILISED BUND
- VEGETATION WINDROW
- CLEAN WATER FLOW
- DIRTY WATER FLOW
- FALL
- TYPE 2 SEDIMENT CONTROL
- EXPOSED AREA
- LEVEL SPREADER OR DISSIPATER
- STABILISED AREA

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED): CPESC 6374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN WELL PAD CONTROLS

PROJECT No	DRAWING No	REVISION
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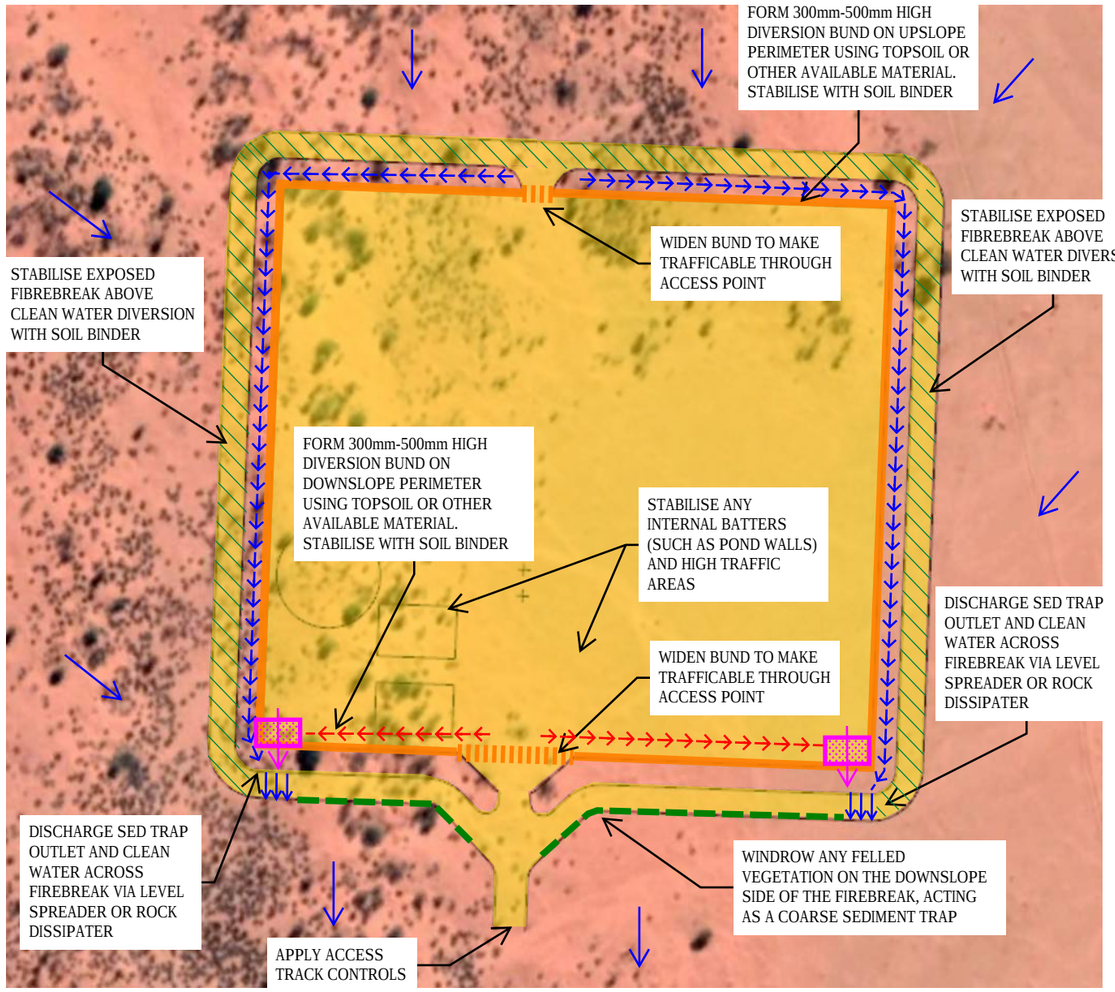
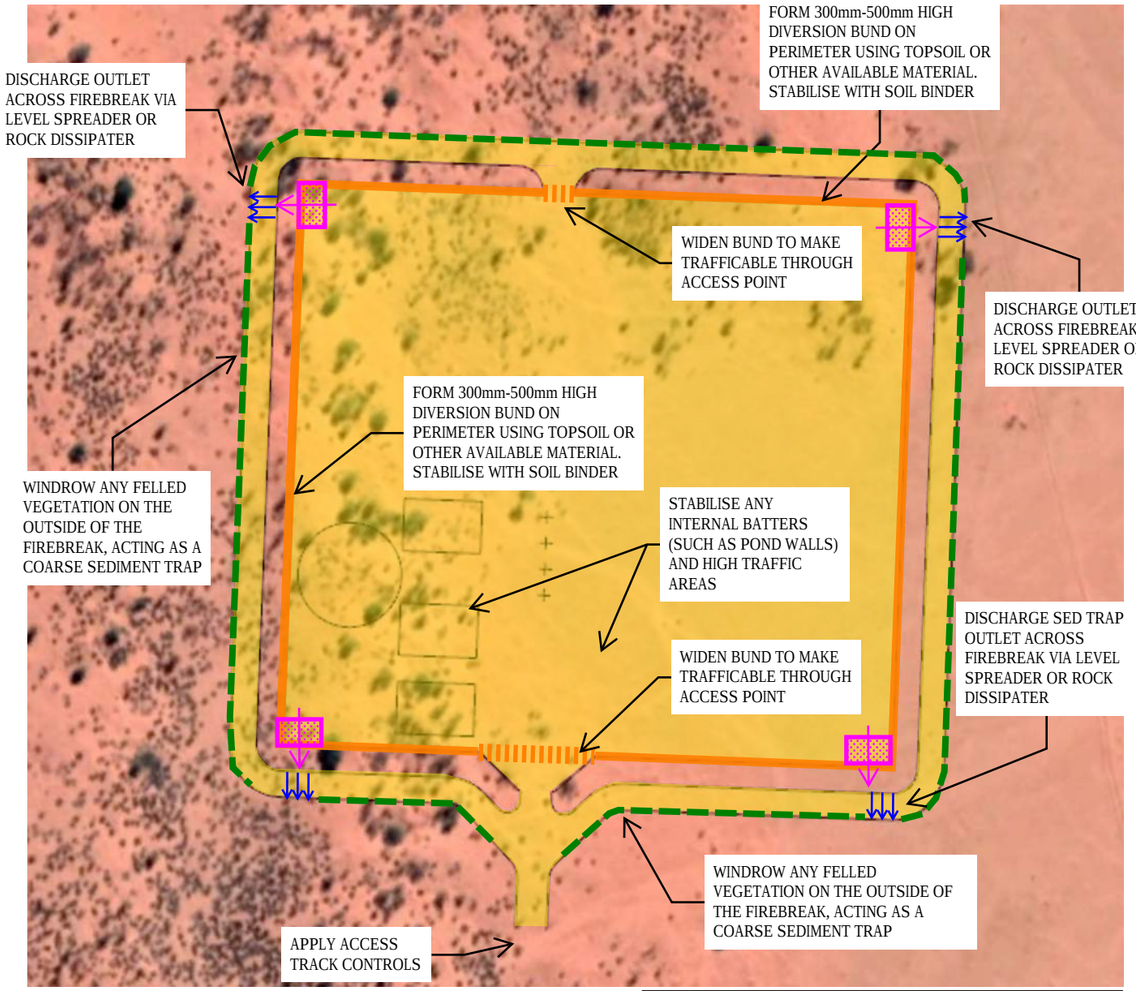


WELL PAD IN SAG

(SUCH AS BETWEEN DUNES)



WELL PAD WITH NO APPRECIABLE FALL

LEGEND

- STABILISED BUND
- VEGETATION WINDROW
- CLEAN WATER FLOW
- DIRTY WATER FLOW
- FALL
- TYPE 2 SEDIMENT CONTROL
- EXPOSED AREA
- LEVEL SPREADER OR DISSIPATER
- STABILISED AREA

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

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CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED): CPESC 6374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN WELL PAD CONTROLS

PROJECT No	DRAWING No	REVISION
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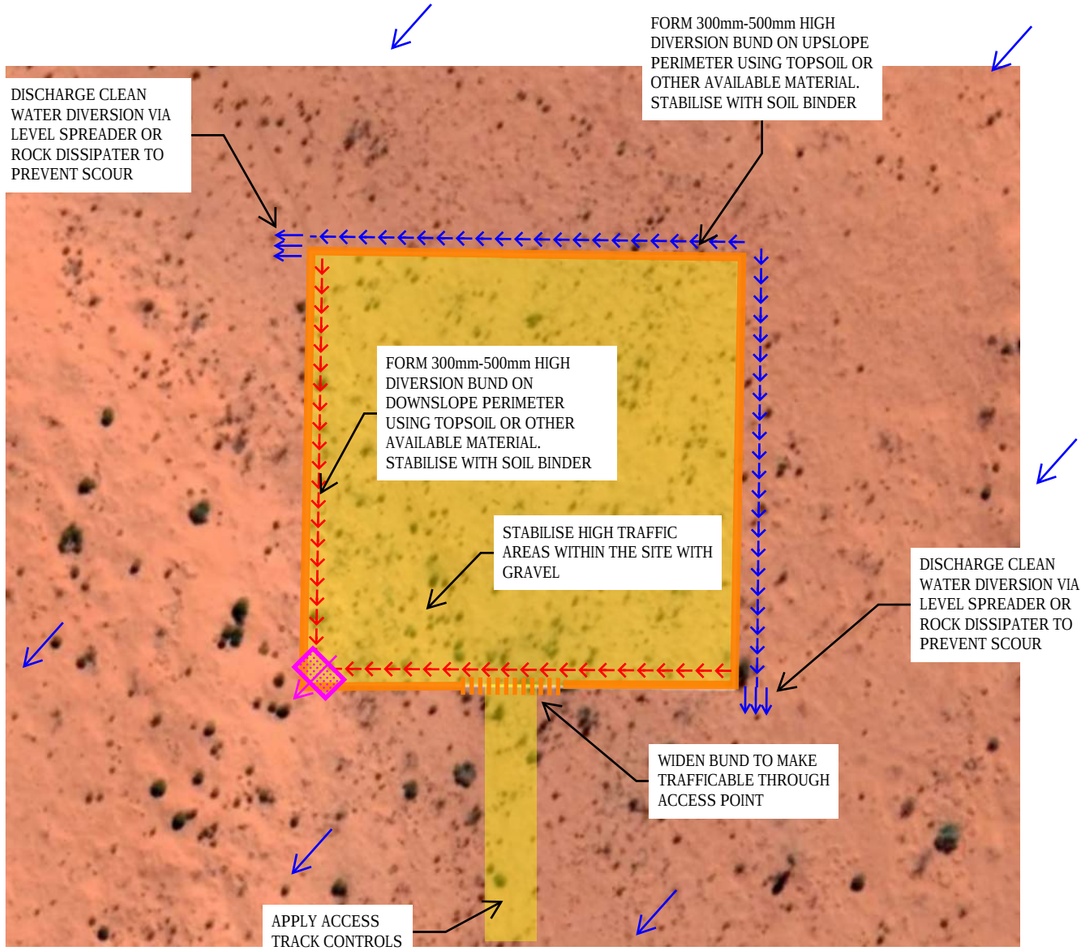
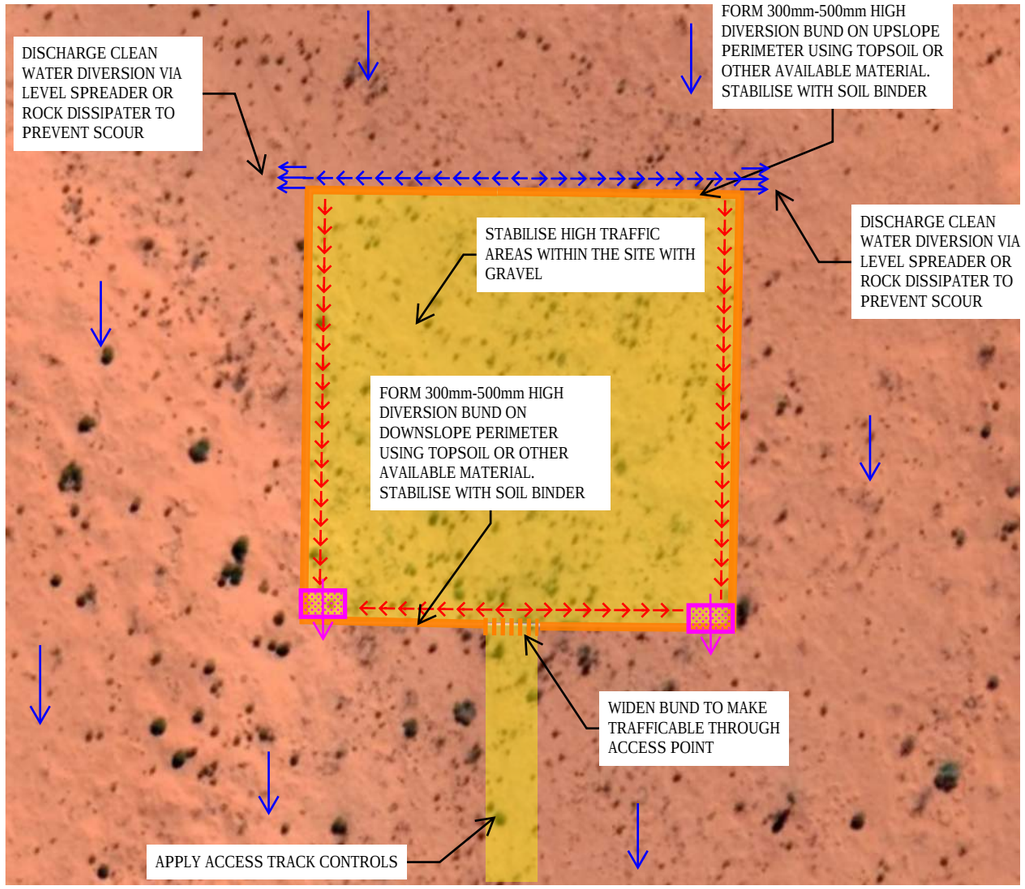


CAMP ON DIAGONAL SLOPE



CAMP ON SIDE SLOPE

LEGEND

- STABILISED BUND
- VEGETATION WINDROW
- CLEAN WATER FLOW
- DIRTY WATER FLOW
- FALL
- TYPE 2 SEDIMENT CONTROL
- EXPOSED AREA
- LEVEL SPREADER OR DISSIPATER
- STABILISED AREA

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

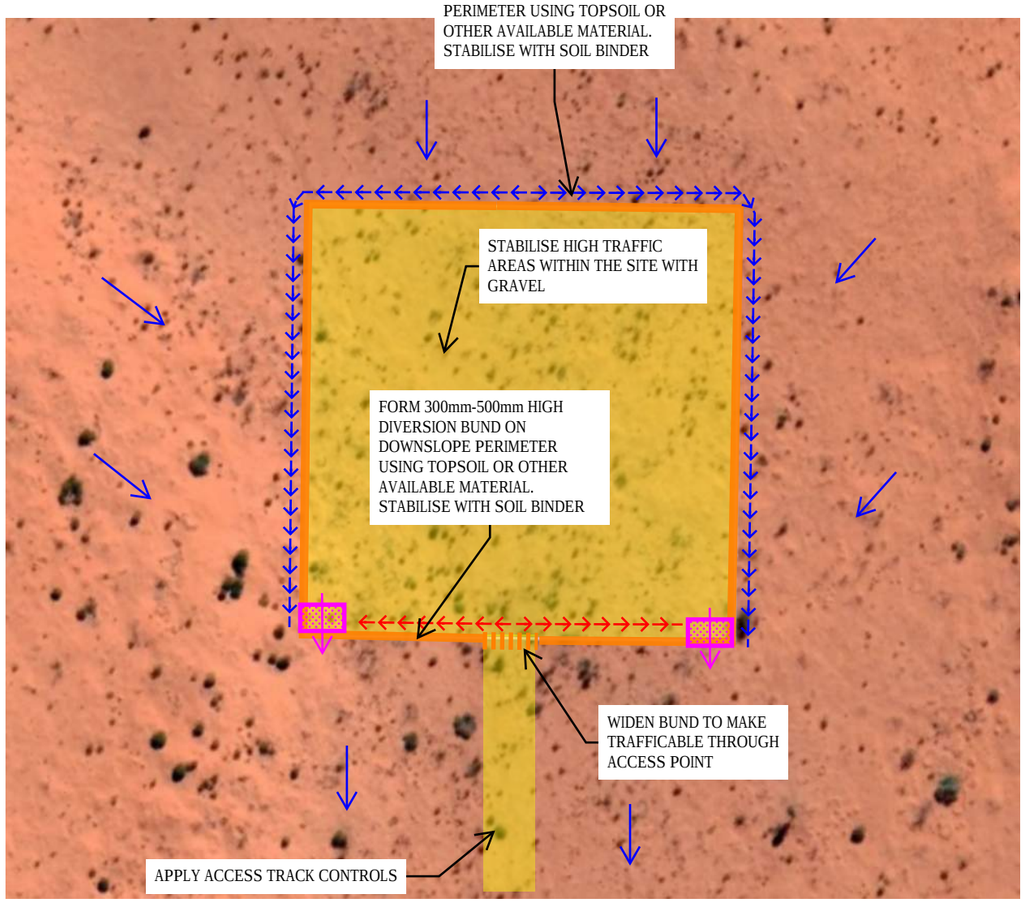
DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED): CPESC 6374

PROJECT: EP134 DRILLING PROGRAM

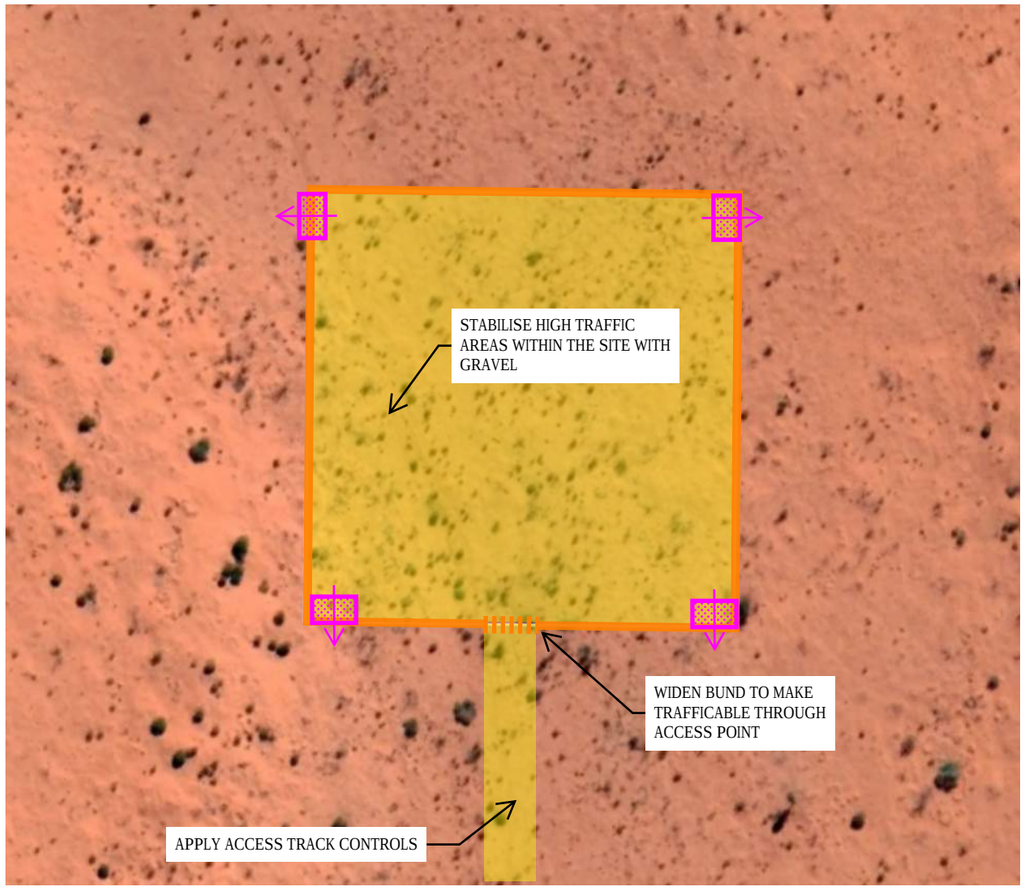
DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN CAMP CONTROLS

PROJECT No	DRAWING No	REVISION
22-0132	D11	A



CAMP IN SAG

(SUCH AS BETWEEN DUNES)



CAMP WITH NO APPRECIABLE FALL

LEGEND

- STABILISED BUND
- VEGETATION WINDROW
- CLEAN WATER FLOW
- DIRTY WATER FLOW
- FALL
- TYPE 2 SEDIMENT CONTROL
- EXPOSED AREA
- LEVEL SPREADER OR DISSIPATER
- STABILISED AREA

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED): CPESC 6374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN CAMP CONTROLS

PROJECT No	DRAWING No	REVISION
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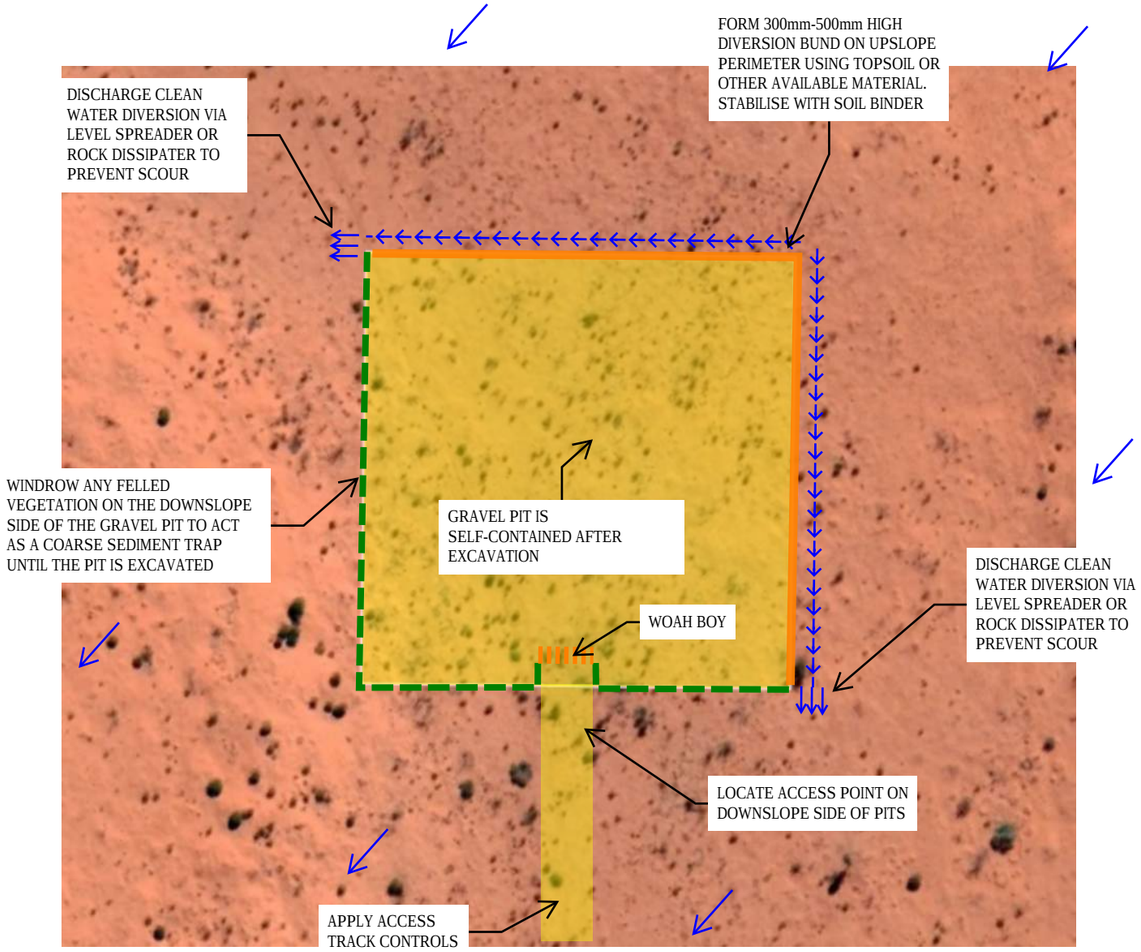
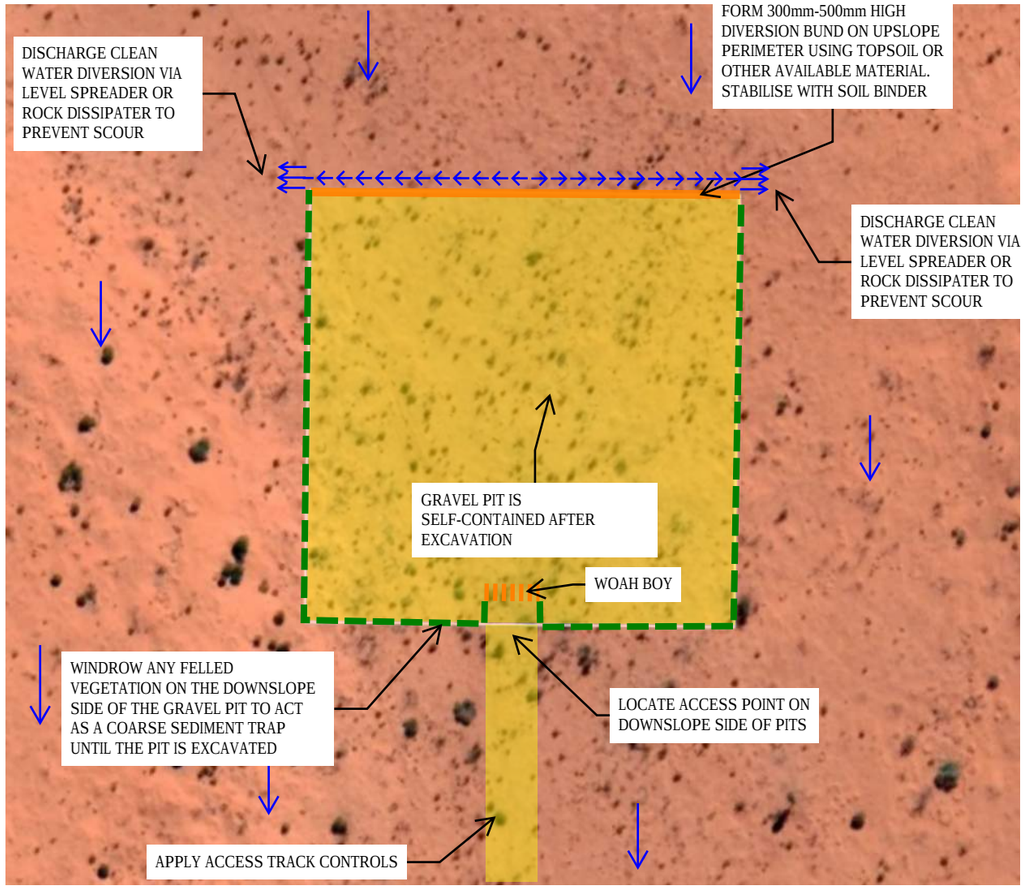


GRAVEL PIT ON DIAGONAL SLOPE



GRAVEL PIT ON SIDE SLOPE

LEGEND

- STABILISED BUND
- VEGETATION WINDROW
- CLEAN WATER FLOW
- DIRTY WATER FLOW
- FALL
- TYPE 2 SEDIMENT CONTROL
- EXPOSED AREA
- LEVEL SPREADER OR DISSIPATER
- STABILISED AREA

TOPO

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

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CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED): CPESC 6374

PROJECT: EP134 DRILLING PROGRAM

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PROJECT No	DRAWING No	REVISION
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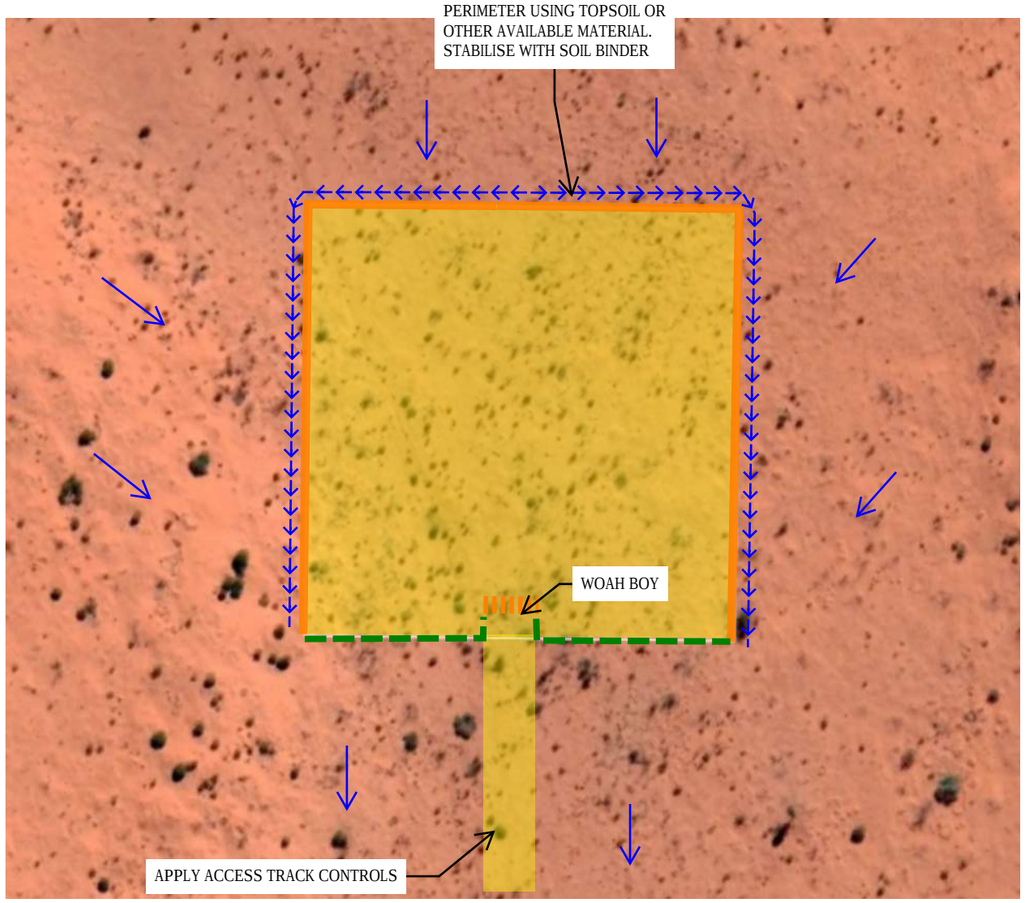
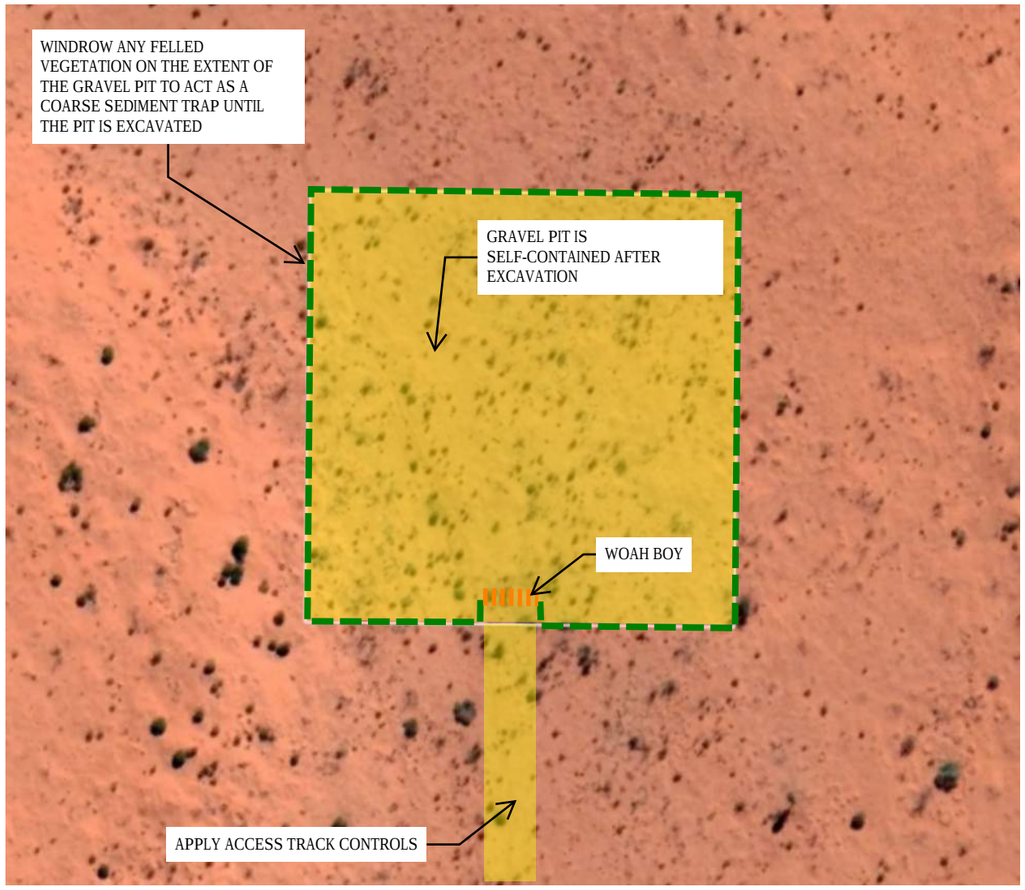


GRAVEL PIT IN SAG
(SUCH AS BETWEEN DUNES)



GRAVEL PIT WITH NO APPRECIABLE FALL

LEGEND

- STABILISED BUND
- VEGETATION WINDROW
- CLEAN WATER FLOW
- DIRTY WATER FLOW
- FALL
- TYPE 2 SEDIMENT CONTROL
- EXPOSED AREA
- LEVEL SPREADER OR DISSIPATER
- STABILISED AREA

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED): CPESC 6374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
GRAVEL PIT CONTROLS

PROJECT No	DRAWING No	REVISION
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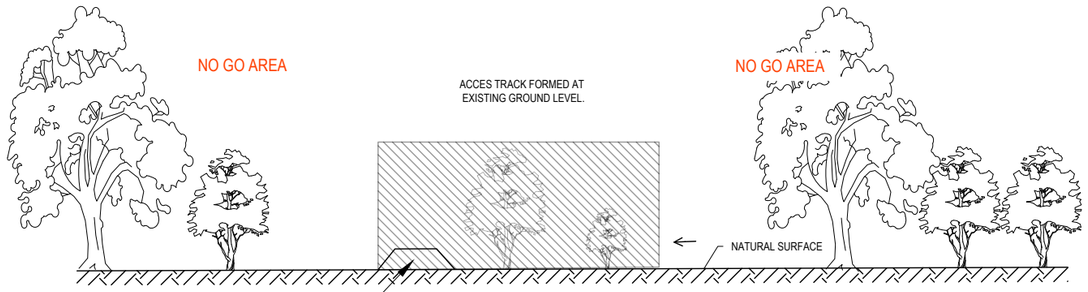

TYPICAL TRACK CROSS SECTION
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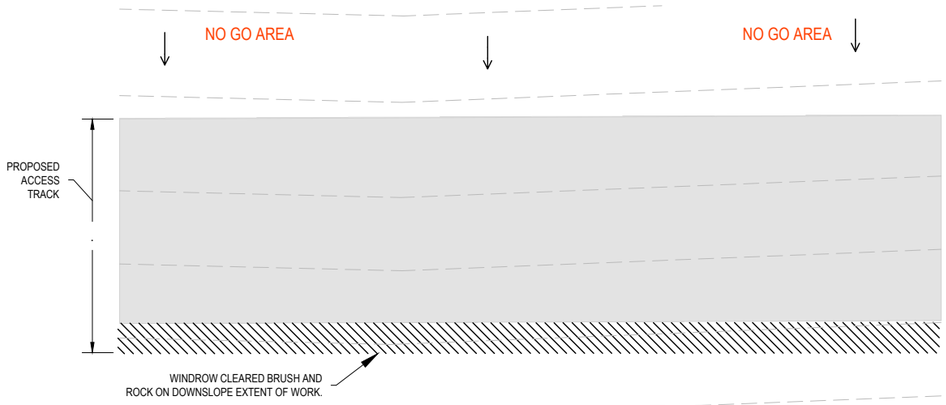
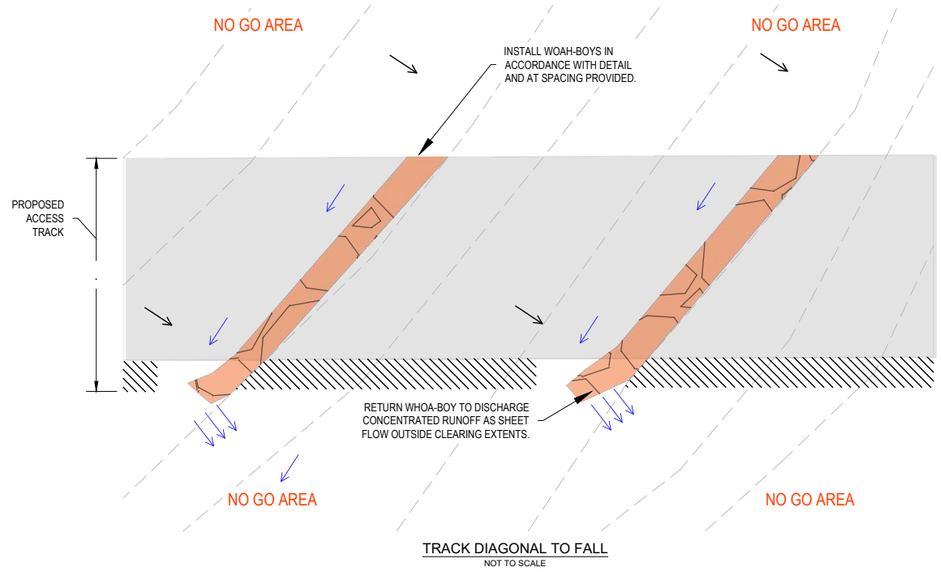


TRACK PERPENDICULAR TO FALL
NOT TO SCALE



TRACK DIAGONAL TO FALL
NOT TO SCALE

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

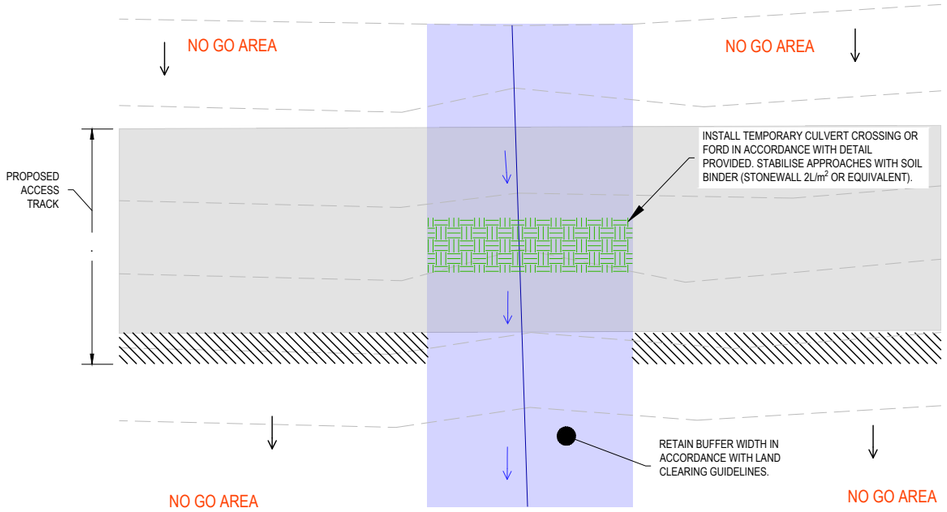
DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED): CPESC 6374

PROJECT: EP134 DRILLING PROGRAM

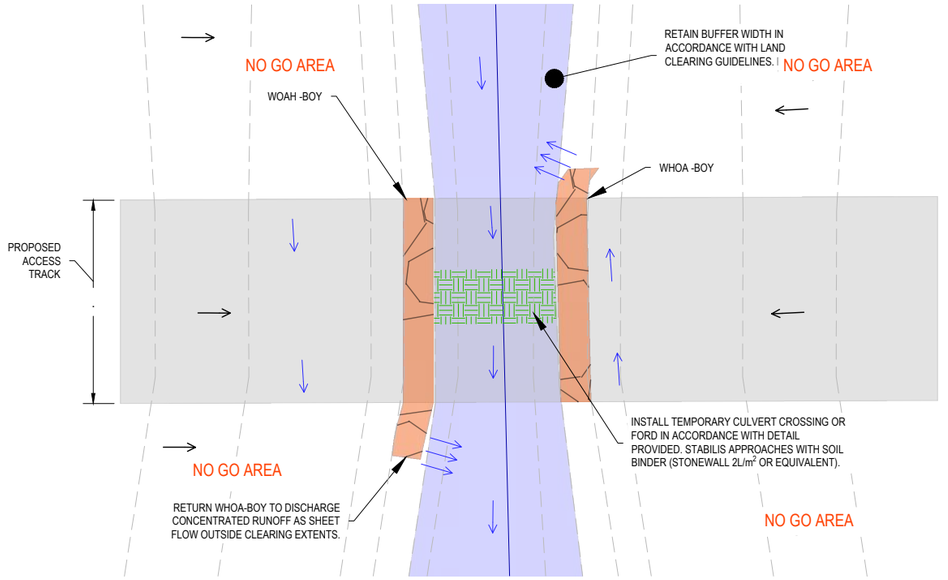
DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
ACCESS TRACK CONTROLS

PROJECT No	DRAWING No	REVISION
22-0132	D15	A



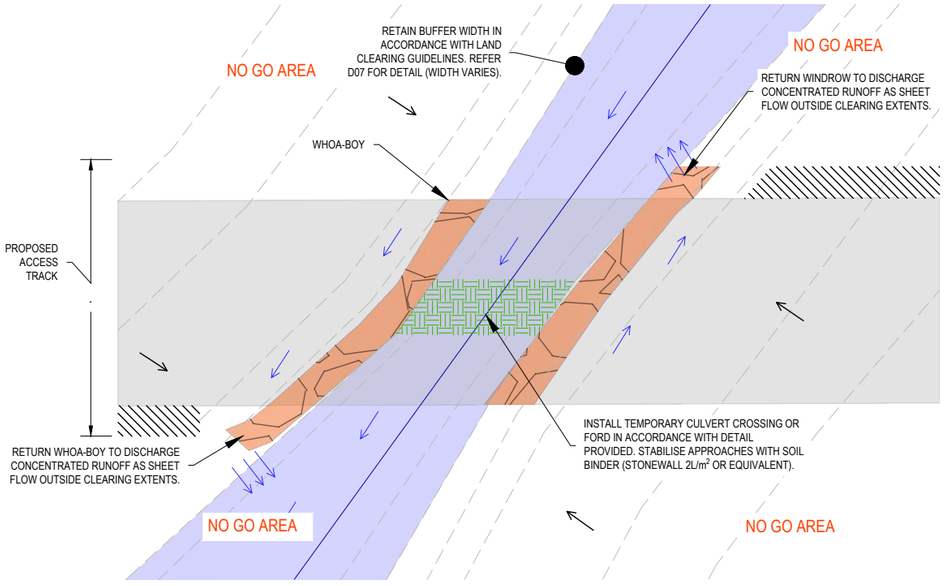
TRACK PERPENDICULAR TO FALL - UNMAPPED FLOW PATH CROSSING

NOT TO SCALE



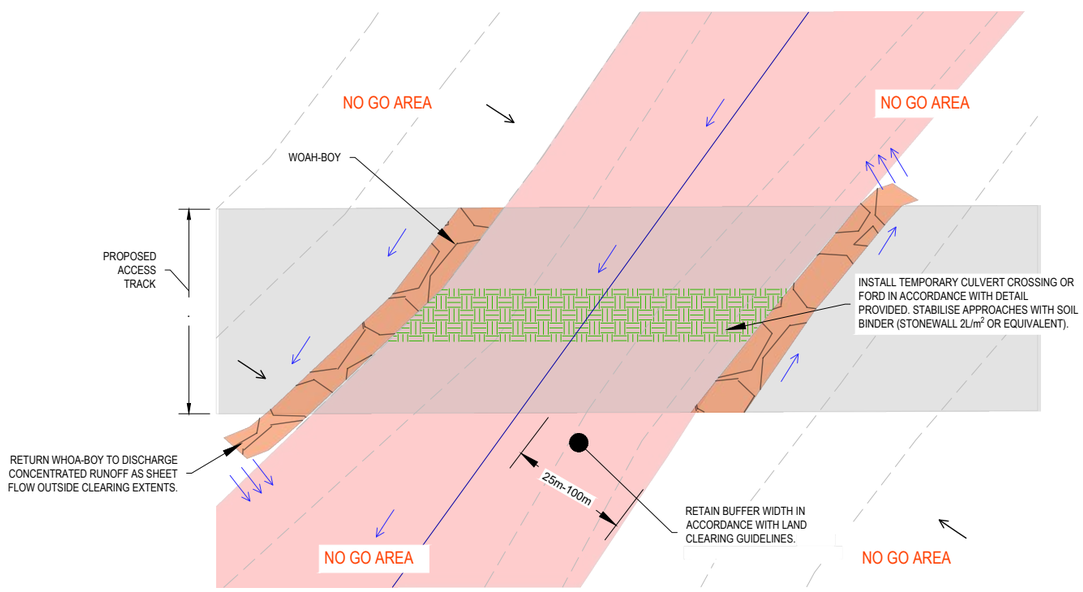
TRACK PARALLEL TO FALL - UNMAPPED FLOW PATH CROSSING

NOT TO SCALE



TRACK DIAGONAL TO FALL - UNMAPPED FLOW PATH CROSSING

NOT TO SCALE



MAPPED WATERWAY BUFFER - TRAFFICABLE WITH NO FORMED BANKS AND NO SURFACE WATER EVIDENT

NOT TO SCALE

TOPO.

REVISION	DESCRIPTION	APPROVED BY	DATE
A	ORIGINAL ISSUE	TB	21-6-2022

A3

ISSUED FOR USE

CLIENT: PEAK HELIUM PTY LTD

DRAWN	DESIGNED	DATE
TB	TB	21-6-2022

RPEQ / SIGNATURE (IF REQUIRED): CPESC 6374

PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
ACCESS TRACK CONTROLS - FLOW PATHS

PROJECT No	DRAWING No	REVISION
22-0132	D16	A

ROAD CROWNING

CROWNING PROVIDES A LOW-GRADE FALL ENABLING DRAINAGE FROM BOTH SIDES OF THE CENTRE OF THE ROAD (SEE FIGURE 1). THIS METHOD IS ONLY EFFECTIVE IF THE CROWN IS SLIGHTLY HIGHER THAN THE NATURAL SURFACE.

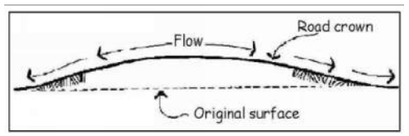


Figure 1: Crowning

ROAD CROWNING SHOULD BE AVOIDED IN AREAS WHERE WATER NATURALLY CROSSES THE ROAD SUCH AS BROAD DRAINAGE FLOORS. FLOODWAYS ARE REQUIRED IN THESE CASED.

INFALL AND OUTFALL DRAINAGE

WHEN ROADS ARE BUILT ACROSS THE SLOPE CONSIDERATION MUST BE GIVEN TO TAKING WATER FROM THE UP SLOPE SIDE OF THE ROAD TO THE DOWN SLOPE SIDE OF THE ROAD. WHEN YOU INSTALL CROSS DRAINAGE YOU MUST MAKE SURE THAT IT DOES NOT CAUSE EROSION OF THE ROAD SURFACE.

CROSSFALL/OUTFALL DRAINAGE

THE SIMPLEST METHOD IS BY PROVIDING THE ROAD SURFACE WITH A CROSSFALL IN THE SAME DIRECTION AS THE SLOPE (OUTFALL DRAINAGE), THEREBY DIRECTING WATER OVER THE ROAD SURFACE TO DISPOSAL AREAS ON THE LOWER SIDE OF THE ROAD (SEE FIGURE 2).

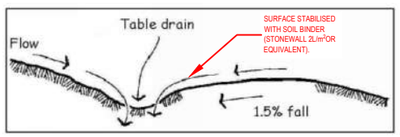


Figure 2: Crossfall/outfall drainage

THE OTHER METHOD IS BY PROVIDING THE ROAD SURFACE WITH INFALL DRAINAGE BACK INTO THE SLOPE, DIRECTING WATER BACK TO THE UP SLOPE SIDE OF THE ROAD (SEE FIGURE 3). IF INFALL DRAINAGE IS NECESSARY THEN TABLE DRAINS, CULVERTS OR INVERTS NEED TO BE CONSTRUCTED. THESE WILL SAFELY DIRECT WATER TO THE DOWN SLOPE SIDE OF THE ROAD.

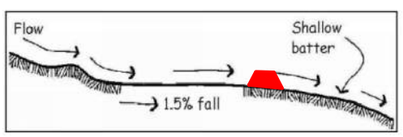


Figure 3: Infall drainage

OUTFALL DRAINAGE IS PREFERRED TO INFALL DRAINAGE AS THERE IS GENERALLY NO NEED FOR OTHER DRAINAGE WORKS SUCH AS CULVERTS, INVERTS, TABLE AND MITRE DRAINS.

WHEN INSTALLING OUTFALL DRAINAGE ON STEEPER SLOPES, BATTERS ON THE DOWNSLOPE SIDE OF THE ROAD MUST NOT BE TOO STEEP. STEEP BATTERS MAY ERODE, IMPACTING ON THE ROAD ITSELF.

THE CROSSFALL OF THE ROAD SURFACE SHOULD BE KEPT AS FLAT AS POSSIBLE TO ENSURE GOOD DRAINAGE. FOR OUTFALL DRAINAGE IT IS RECOMMENDED THAT THE MAXIMUM CROSSFALL SLOPE BE IN THE ORDER OF 1.5 – 2%, WHEREAS INFALL DRAINAGE SLOPES CAN BE AS GREAT AS 4%.

SIDE DRAINAGE

TABLE DRAINS

TABLE DRAINS ARE EXCAVATED OPEN CHANNELS THAT ARE BUILT PARALLEL TO ROADS AND TRACKS. THESE DRAINS DIRECT RUNOFF TO DISPOSAL AREAS FURTHER DOWNSLOPE. TABLE DRAINS SHOULD ONLY BE USED WHEN NATURAL RUN-OFF IS NOT POSSIBLE.

FILL OBTAINED FROM CONSTRUCTING TABLE DRAINS CAN BE USED TO BUILD UP ROAD SURFACES. THE DESIGN OF TABLE DRAINS DEPENDS ON A NUMBER OF FACTORS, INCLUDING THE SIZE AND NATURE OF THE CATCHMENT, THE SLOPE AND WATER VOLUMES AND FLOW. LARGER TABLE DRAINS MAY NEED TO BE DESIGNED BY ENGINEERS OR OTHER SUITABLY QUALIFIED PROFESSIONALS.

TABLE DRAINS SHOULD BE CONSTRUCTED WITH A FLAT BOTTOM (TRAPEZOID SHAPE) (SEE FIGURE 4). IN GENERAL THEY SHOULD BE 0.5 TO 1.0M WIDE AT THE BASE. AVOID USING V SHAPED DRAINS AS THEY MAY CAUSE EROSION IN THE CHANNEL.

WHERE POSSIBLE TABLE DRAINS SHOULD BE REVEGETATED AS SOON AS POSSIBLE AFTER CONSTRUCTION, AND REGULARLY SLASHED. TABLE DRAINS SHOULD NOT BE GRADED.

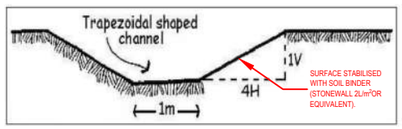


Figure 4: Table & Mitre drain cross section

MITRE DRAINS

WATER SHOULD BE TAKEN OUT OF TABLE DRAINS AT REGULAR INTERVALS USING MITRE (OFFSHOOT) DRAINS. MITRE DRAINS TAKE RUNOFF OUT OF TABLE DRAINS OR DIRECTLY OFF ROAD SHOULDERS WHERE TABLE DRAINS ARE ABSENT. THESE DRAINS DISPOSE OF WATER IN AREAS AWAY FROM THE ROAD (SEE FIGURE 5).

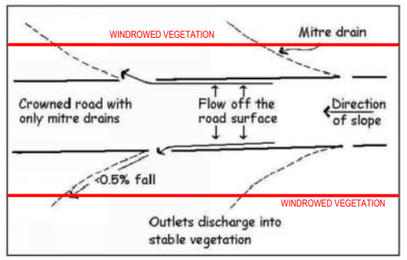


Figure 5: Crowned road with only mitre drains

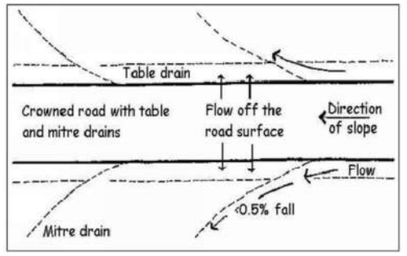


Figure 6: Crowned road witrh table and mitre drains

MITRE DRAINS STOP WATER ACCUMULATING IN TABLE DRAINS OR ON THE ROAD SHOULDER. IDEALLY MITRE DRAINS
SHOULD BE CONSTRUCTED SO THAT THEY HAVE A BROAD FLAT BASE AT LEAST 1M WIDE. MITRE DRAINS ALSO SHOULD NOT BE GRADED TO PRODUCE A V.
MITRE DRAINS SHOULD SLOPE TO DIRECT THE FLOW OF WATER AWAY FROM THE ROAD. TO MINIMISE EROSION THE SLOPE SHOULD BE NO GREATER THAN 0.5% ON ERODIBLE SOILS OR 1% ON STABLE SOILS. MITRE DRAIN OUTLETS EFFECTIVELY CONCENTRATE RUNOFF, FOR THIS REASON THEY SHOULD BE LOCATED IN STABLE UNDISTURBED AREAS.

MITRE DRAIN SPACING IS DEPENDENT ON:

- THE GRADE OF THE TABLE DRAIN OR ROAD
- SOIL TYPE AND ERODIBILITY
- RAINFALL

Table 1: Recommended mitre drain spacing

Slope		Mitre Drain Spacing (m)
%	Gradient	
0.5	1 : 200	170 - 180
1	1 : 100	120 - 130
2	1 : 50	90 - 100
3	1 : 33	70 - 80
4	1 : 25	60 - 70
5	1 : 20	55 - 60
6	1 : 17	50 - 55
10	1 : 10	40 - 45

CROSS DRAINAGE

ENGINEERED, STABLE CROSS DRAINAGE SUCH AS INVERTS, FLOODWAYS OR CULVERTS CAN BE USED TO COLLECT WATER FROM UPSLOPE TABLE DRAINS, OR DRAINAGE LINES. IT IS GENERALLY MORE CONOMICAL AND PRACTICAL TO FORD DRAINAGE LINES USING FLOODWAYS OR INVERTS THAN TO USE MAJOR CULVERTS OR
BRIDGES. ON STEEPER COUNTRY, WHERE CREEKS AND DRAINAGE LINES ARE DEEPER, CULVERTS MAY BE MORE PRACTICAL.

INVERTS AND FLOODWAYS

CARE MUST BE TAKEN IN THE DESIGN AND CONSTRUCTION OF FLOODWAYS AND INVERTS IN ORDER TO CAUSE MINIMAL INTERFERENCE TO NATURAL FLOWS. INVERTS AND FLOODWAYS ARE DESIGNED TO BE TEMPORARILY OVER TOPPED BY WATER FLOW AND MINIMISE BANK AND BED EROSION. THEY SHOULD BE SITED AT LOW POINTS IN THE BANK AND AT RIGHT ANGLES TO THE DIRECTION OF FLOW.

INVERTS

INVERTS SHOULD BE CONSTRUCTED WITH THE FINISHED SURFACE AT, OR JUST BELOW THE LEVEL OF THE EXISTING STREAM BED. CONSTRUCTION OF AN INVERT IS GENERALLY BASED ON EXCAVATING SOFT, ERODIBLE MATERIAL. AT LEAST 300MM SHOULD BE REMOVED, GEOTEXTILE MAY BE NECESSARY AS A BASE. EXCAVATED MATERIAL IS THEN REPLACED WITH COMPACTED GRANULAR MATERIAL TO
PROVIDE A TRAFFICABLE SURFACE (SEE FIGURE 7).

TEXT AND IMAGES SOURCED FROM NORTHERN TERRITORY 'ROAD DRAINAGE FACT SHEET', DEPARTMENT OF LAND RESOURCE MANAGEMENT (www.lrm.nt.gov.au)

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PROJECT: EP134 DRILLING PROGRAM

DRAWING TITLE: EROSION AND SEDIMENT CONTROL PLAN
ACCESS TRACK CONTROLS - DRAINAGE

PROJECT No	DRAWING No	REVISION
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MATERIALS

FIBRE ROLLS: TYPICALLY 200 TO 250mm JUTE, COIR OR STRAW ROLL TIED WITH SYNTHETIC OR BIODEGRADABLE MESH.

STAKES: MINIMUM 25 x 25mm TIMBER STAKES

INSTALLATION

1. REFER TO APPROVED PLANS FOR LOCATION AND INSTALLATION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.

2. WHEN PLACED ACROSS NON-VEGETATED OR NEWLY SEEDED SLOPES, THE ROLLS MUST BE PLACED ALONG THE CONTOUR.

3. IF PLACED ON OPEN OR LOOSE SOIL, ENSURE THE FIBRE ROLLS ARE TRENCHED 75 TO 125mm IN SANDY SOILS AND 50 TO 75mm IN CLAYEY SOILS.

4. ENSURE THE OUTER MOST ENDS OF THE FIBRE ROLLS ARE TURNED UP THE SLOPE TO ALLOW WATER TO ADEQUATELY POND UP-SLOPE OF THE ROLL, AND TO MINIMISE FLOW BYPASSING.

5. WHEN PLACED ACROSS THE INVERT OF MINOR DRAINS, ENSURE THE SOCKS ARE PLACES SUCH THAT:

(I) THE CREST OF THE DOWNSTREAM ROLL IS LEVEL WITH THE CHANNEL INVERT AT THE IMMEDIATE UPSTREAM SOCK (IF ANY);
(II) EACH ROLL EXTENDS UP THE CHANNEL BANKS SUCH THAT THE CREST OF THE FIBRE ROLL AT ITS LOWEST POINT IS LOWER THAN THE GROUND LEVEL AT EITHER END OF THE ROLL.

6. ENSURE THAT THE ANCHORING STAKES ARE DRIVEN INTO THE END OF EACH ROLL AND ALONG THE LENGTH OF EACH ROLL AT A SPACING NOT EXCEEDING 1.2m OR SIX TIMES THE ROLL DIAMETER, WHICHEVER IS THE LESSER. A MAXIMUM STAKE SPACING OF 0.3m APPLIES WHE USED TO FORM CHECK DAMS.
7. ADJOINING ROLL MUST BE OVERLAPPED AT LEAST 450mm, NOT ABUTTED.

MAINTENANCE

1. INSPECT ALL FIBRE ROLLS PRIOR TO FORECAST RAIN, DAILY DURING EXTENDED PERIODS OF RAINFALL, AFTER SIGNIFICANT RUNOFF PRODUCING STORMS OR OTHERWISE AT WEEKLY INTERVALS.
2. REPAIR OR REPLACE DAMAGED FIBRE ROLLS.
3. REMOVE COLLECTED SEDIMENT AND DISPOSE OF IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.

REMOVAL

1. ALL EXCESSIVE SEDIMENT TRAPPED BY THE ROLLS MUST BE REMOVED FROM THE DRAIN OR SLOPE IF SUCH SEDIMENT IS LIKELY TO BE WASHED AWAY BY THE EXPECTED FLOWS.
2. DISPOSE OF COLLECTED SEDIMENT IN A SUITABLE MANNER THAT WILL NOT CAUSE AN EROSION OR POLLUTION HAZARD.
3. THE BIODEGRADABLE CONTENT OF THE STRAW ROLLS MAY NOT NECESSARILY NEED TO BE REMOVED FROM THE SITE.
4. ALL SYNTHETIC (PLASTIC) MESH OR OTHER NON READILY BIO-DEGRADABLE MATERIAL MUST BE REMOVED FROM THE SITE ONCE THE SLOPE IF DRAIN IS ESTABLISHED, OR THE ROLLS HAVE DETERIORATED TO A POINT WHERE THEY ARE NO LONGER PROVIDING THEIR INTENDED DRAINAGE OR SEDIMENT CONTROL FUNCTION.

Source: www.austieca.com.au/documents/item/124

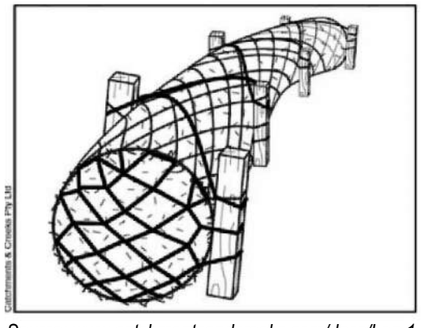
DRAINAGE CONTROL

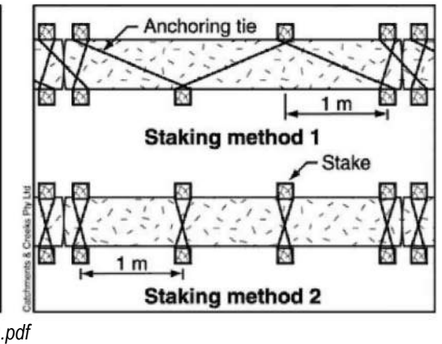
IN THIS CASE, COIR LOGS WILL ALSO BE USED AS DRAINAGE CONTROL. THIS HAS BEEN CONSIDERED A PREFFERED OPTION OVER CUTTING A DRAIN OR INSTALLING A BUND, BOTH OF WHICH REQUIRE SOIL DISTURBANCE. WHERE COIR LOGS ARE USED AS DRAINAGE CONTROL:

1. THE ENDS OF THE FIBRE ROLLS MUST BE STRAIGHT TO ALLOW WATER TO FLOW PAST THE ROLLS TO A LEVEL SPREADER.
2. ENSURE THE FIBRE ROLLS ARE TRENCHED 100mm INTO THE SOIL.
3. FIBRE ROLLS MUST BE OVERLAPPED AT LEAST 450mm IN THE DIRECTION OF THE FLOW AND NOT ABUTTED.
4. THE FLOWPATH ALONG THE ROLLS MUST BE CHECKED AFTER RAINFALL TO ENSURE EXTERNAL RUNOFF IS NOT ENTERING THE ACTIVE WORK SITE. AN ADDITIONAL ROW OF LOGS WILL NEED TO BE PLACED IF THIS IS THE CASE.

Source: www.westernexcelsior.com/products.html

Source: www.catchmentsandcreeks.com/docs/Log-1.pdf





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COIR LOG OPTION FOR BUNDING

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6 Appendix 06 – Waste & Wastewater Management Plan

Peak Helium Pty Ltd

EMP PKH2-3

NT Exploration Permit (EP) 134

Appendix 06

Waste and Wastewater Management Plan

Rev	Description	Date	Initiated	Reviewed	Approved
0	Issued for Submission	18/07/2022	Trent Smith	Katie Robertson Vicky Cartwright Jon Bennett	Jon Bennett
1	Issued for Re-Submission	19/08/2022	Trent Smith	Nick Fraser Artur Shapoval	Jon Bennett
2	Issued for Re-Submission	16/01/2023	Katie Robertson	Nick Fraser Audrey Santiaguel Vicky Cartwright Trent Smith	Trent Smith
3	Issued for Re-Submission	01/02/2023	Nicholas Fraser	Trent Smith	Trent Smith

Prepared For Peak Helium Pty Ltd

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6 Waste and Wastewater Management Plan

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6.1 Introduction

Peak Helium has created this Waste and Wastewater Management Plan (WWMP) to be used in conjunction with the Environmental Management Plan PKH02-2 and its revisions (herein referred to as the EMP).

This plan's objective is to provide the management strategy for Peak Helium's waste and wastewater management during the regulated activities under the EMP.

6.1.1 Wastewater Management Framework

The Waste and Wastewater Management Framework seeks to:

1. Describe the relevant activities, environmental risks, and impacts involved in managing waste and wastewater.
2. Define the methods and approaches used to store, treat, and reuse water and ultimately dispose of either on-site or off-site.
3. Estimate the quality and quantities of water and wastewater from the activities and derived solids that will be removed from the site.
4. Monitor, manage, and report waste and wastewater.

6.1.2 Waste Management Hierarchy

The following hierarchy of principles outlined in the *National Waste Policy* will be used to achieve optimal environmental outcomes [AUSTRALIAN GOVERNMENT, 2018]:

1. **Avoid**: eliminate or substitute an activity that results in waste.
2. **Reduce**: lower wastewater generation as part of a process or activity.
3. **Reuse**: use of wastewater for the same or alternative petroleum activity without treatment or with minimal treatment.
4. **Recycle**: beneficial reuse of wastewater for another purpose without treatment or with minimal treatment.
5. **Treatment**: bring wastewater back into use through treatment to improve water quality or to make quality suitable for disposal.
6. **Disposal**: disposal of waste if there is no viable alternative.

It is important to note that the opportunities for the avoidance, reduction and recycling of wastewater generated during the activities are limited and are restricted primarily to maximise the reuse and recycling of fluids where possible.

6.2 Management

6.2.1 Activity Description

This section describes the activities that will generate waste and wastewater. Activities are included where waste is proposed to be handled, stored, or transported away from the location of the activity.

Activities that generate waste are summarised in **Table 6.2—1** and described briefly in the following sections. A more detailed explanation of the proposed activities is covered in **Appendix 02** (Project Activities).

Table 6.2—1 Waste Types

Waste Source	Waste Type
Domestic Activities • Camp • Rig offices	• Greywater. • Sewage effluent. • Kitchen waste. • Recyclables (glass and cans).
Civil Construction Activities	• Chemical bags and cardboard packaging materials. • Scrap metals. • Timber pallets (skids). • Vehicle tyres. • Oily rags, filters.
Drilling and Completions Activities	• Residual drilling and completions fluids. • Drill cuttings. • Cement returns. • Used additive and chemical containers. • Oily rags, filters.
Extended Production Testing Activities	• Produced fluid.
Ancillary Activities to: • Drilling • Production Testing	• Chemical bags and cardboard packaging materials. • Scrap metals. • Used chemical containers and fuel drums. • Chemical wastes. • Timber pallets (skids). • Oily rags, filters.

6.2.2 Domestic Activities

Accommodation and messing facilities will be provided from an on-site temporary campsite/s located on designated pre-cleared pads. The campsite/s will be equipped with a fully self-contained Sewage Treatment Plant (STP), furnished with an irrigation sprinkler system, and fenced to avoid fauna interaction.

All camp wastewater produced from laundry, showers, kitchen, and treated sewage will be irrigated away from the camp onto a suitable area as per *the Code of Practice for Small On-Site Sewage and Sullage Treatment Systems and the Disposal or Reuse of Sewage Effluent* [DOH, 2014]. The disposal areas will be located away from water bodies and operated to minimise spray drifting and ponding. The designated area will be fenced to exclude livestock access.

6.2.3 Waste Characteristics and Volumes

Table 6.2—2 presents the anticipated volumes and chemical characteristics of wastewater generated during the project activities. See **Table 6.7—1** for Management Measures.

Table 6.2—2 Wastewater Volumes and Characteristics

Waste	Volume Anticipated per Well	Total Estimated Off-site Disposal Volume per Project	Characteristics
Residual Drilling Fluids	2.360 ML	~0.5ML Note: 95% anticipated to be evaporated	Hazardous chemical additives possible, e.g., to treat bacteria and control pH. Note: chemicals additives are mixed with a high percentage of water >90%. **Fluids:** • Approximately >90% ground/bore water. • Chemical fluid additives* (See **Section 6.14.1** for a list and description). **Cuttings:** • Formation solids generated during the drilling process. **Cement Returns:** • Residual cement and cement post-well cementing activity (non-hazardous).
Residual Solids Examples: • Cuttings • Cement Returns	~800 m^3	~3200 m^3 Volume anticipated to be buried on-site	

Waste	Volume Anticipated per Well	Total Estimated Off-site Disposal Volume per Project	Characteristics
Completion Fluids	~0.080 ML	~0.016 ML max 95% of volume anticipated to be evaporated	• Hazardous chemical additives possible e.g., to treat bacteria. • Note: chemicals additives* are mixed with a high percentage of water >90%.
Produced Fluids (not anticipated)	up to 1ML	~0.2 ML 95% of volume anticipated to be evaporated	Formation water.

*The chemical fluid additives used in drilling and completions fluids (and their potential to be hazardous) are based on an assessment of representative Safety Data Sheets (SDS) within their functional group, for example:

- Bactericide (Hazardous).
- Alkalinity pH Control (Hazardous).
- Viscosifiers (Generally non-hazardous).
- Weighting Agent (Non-hazardous).
- Lost Circulation Material (Non-hazardous).

Corrosion inhibiter (Hazardous) Additives are selected and managed in accordance with the manufacturer's recommendations and the SDS. The name, type and quantity of each chemical used on the well will be recorded as per the Well Operations Management Plan. Additives will not contain benzene, toluene, ethylbenzene, or xylene (BTEX) above the levels prescribed in section B.5 of *the Code*.

Further detail on the potential for additives to be hazardous, environmental considerations and recommendations for handling and storage is covered in the Spill Management Plan (**Appendix 07**) **Section 7.15**.

6.3 1 in 1,000 Average Rainfall Interval, and Freeboard Management

6.3.1 Evaporation

The Interest Holder has used SILO's Morton's Shallow Lake evaporation data to calculate evaporation in the Project Area [SILO, 2021, 2022]. Monthly evaporation depth totals have been listed in **Table 6.3—1** for the 10th, 50th and 90th percentiles (P10, P50 and P90). Summation of the P10 values for the three wettest months (Dec, Jan, Feb) gives a value of 563mm. By assuming the three-monthly (Dec, Jan, Feb) evaporation total as 450mm instead, our freeboard calculations will be overestimates.

Table 6.3—1 Kulgera Average Monthly Evaporation

Evaporation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ann
P10 (mm)	**200.5**	**165.3**	152.3	109.8	73.3	56.7	67.6	94.7	124.9	162.0	183.0	**197.4**	1587.5
P50 (mm)	225.9	190.3	176.1	124.4	87.7	65.8	76.5	106.8	143.1	186.9	199.1	218.8	1801.4
P90 (mm)	242.7	206.5	186.2	133.0	94.6	71.2	84.0	115.1	153.5	196.3	211.7	237.1	1931.8

6.3.2 Wet Season

6.3.2.1 1 in 1,000 Average Rainfall Interval

Consistent with industry-accepted methodology associated with practices such as dam risk assessments (which calculate the wet season based on geographical location), three months was determined to be an applicable period of time to model a 1 in 1,000-year rainfall event.

The highest three-month rainfall periods **Figure 6.3—1** were used, and a Log Pearson III distribution was fitted to the data. This analysis allowed us to extrapolate the 1,000-year, three-month duration wet season.

The median highest predicted 1 in 1,000-year total rainfall in three months, within the wet season, for **Figure 6.3—1** is 524mm. However, confidence bounds show that rainfall could be up to 577mm. These calculations do not allow for any evaporation.

Figure 6.3—1 shows the Log Pearson III distribution plots for 1 in 1,000-year events, with 10% uncertainty bounds.

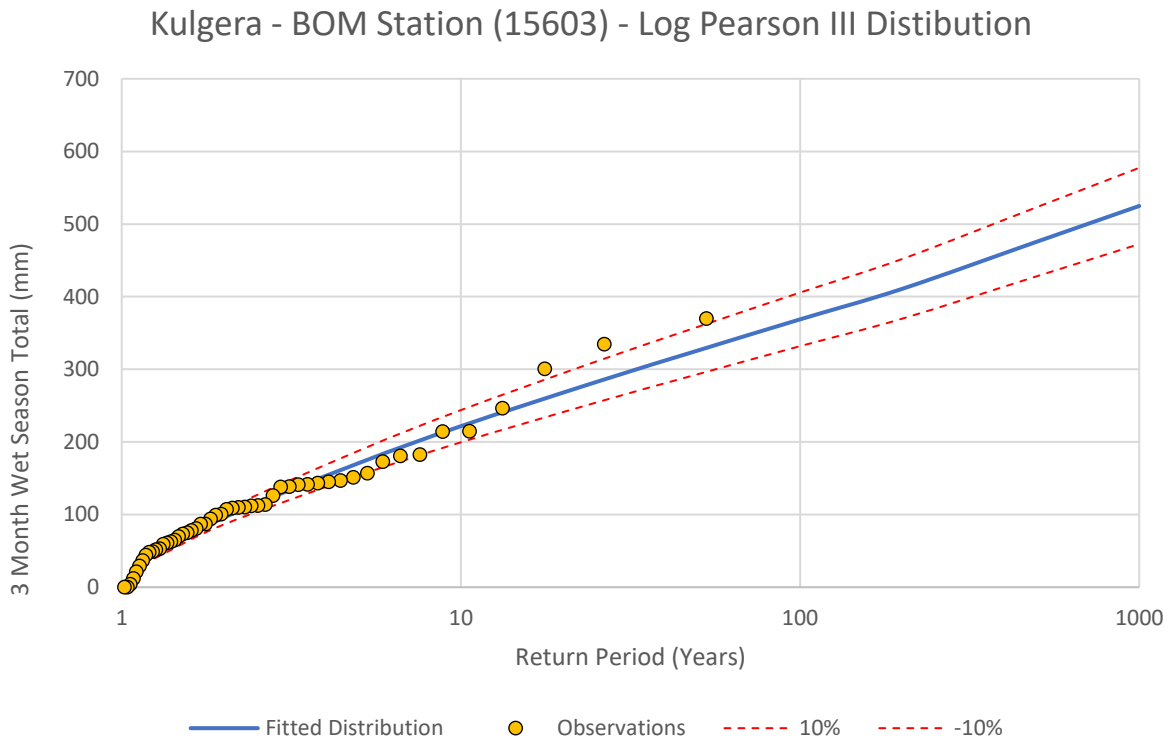

Figure 6.3—1 1:1000-year Rainfall Events (Wet Season)

6.3.2.2 Freeboard

Based on the most conservative values and P10 evaporation of 450mm factored into the 90-day extreme rain event, a freeboard of 500 mm will be applied to all open pits and unattended open-top tanks to minimise the risk of overtopping.

6.3.3 Dry Season

6.3.3.1 1 in 1,000 Average Rainfall Interval

Kulgera weather station has recorded rainfall data since 1968 (52 years). The highest cumulative rainfall over a three-month period (during the dry season) was determined to be an appropriate period to model a 1 in 1,000 dry season rainfall event.

The median highest predicted 1 in 1,000-year total rainfall in three months, within the dry season, is 370mm, as show in **Figure 6.3—2**. 10% confidence bounds indicate that this could be up to 407mm, noting that calculations do not allow for any evaporation.

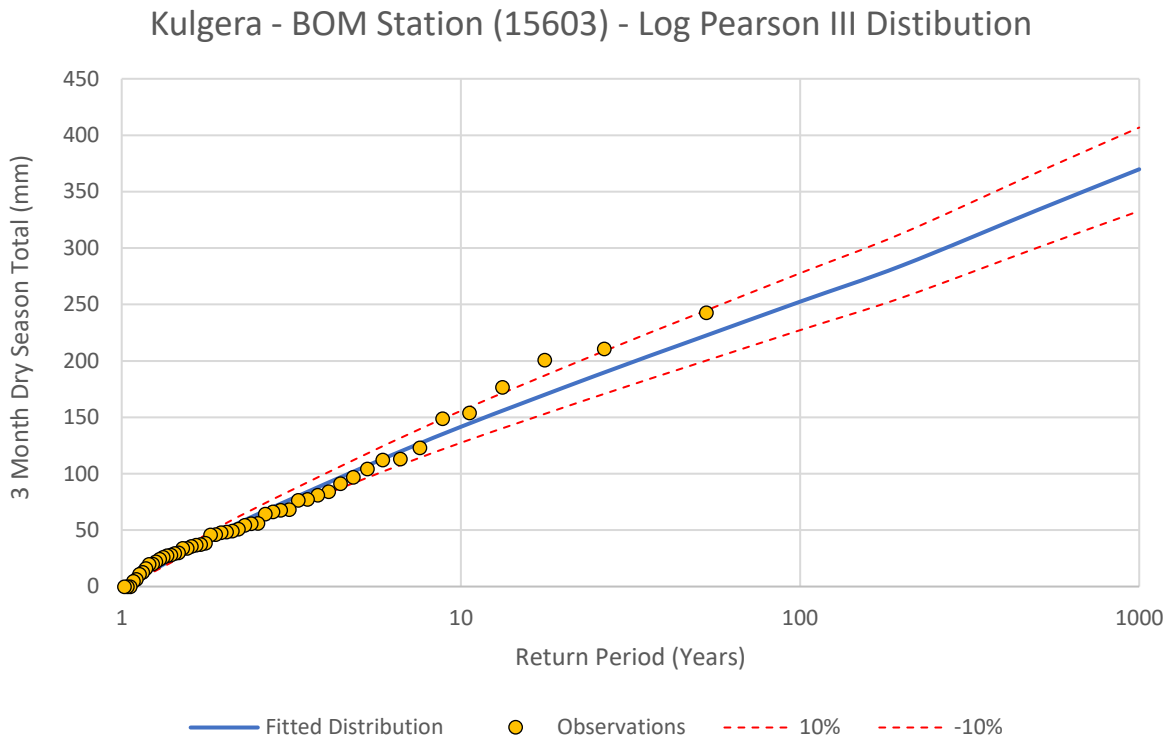

Figure 6.3—2 1:1000-year Rainfall Events (Dry Season)

6.3.3.2 Freeboard

Due to the lack of historically significant rain events, Peak Helium will use 0.5m (500mm) of freeboard during the dry season. Should a 1 in 1,000-year Dry Season rainfall event occur (e.g., 370mm of rainfall), the remaining freeboard (assuming that existing fluid levels before the rainfall event were at the 0.5m freeboard level) would be 0.08m (80mm), which would be sufficient remaining freeboard to avoid overtopping.

6.3.4 Freeboard Management

All pits and open-topped tanks will be operated with sufficient freeboard available to accommodate the total rainfall anticipated based on a 1 in 1,000-year Average Recurrence Interval (ARI) relevant to the appropriate season. Freeboard for tanks and pits will be set and managed according to the season, as shown in **Table 6.3—2** below.

Table 6.3—2 Wastewater Storage Freeboard

Storage	Wet and Dry Season
Drilling By-product pit	0.5m
Open-topped treatment tank	0.5m
Above ground enclosed storage tanks	0.5m

6.4 Wastewater Risk Assessment

The Code of Practice: Onshore Petroleum Activities in the Northern Territory (the Code) [DEPWS et al., 2019] details the controls required to prevent environmental harm, including:

- Implementing a well operations management plan designed to ensure the risk of the well to surrounding aquifers is mitigated, including the requirement for multiple verified well barriers containing steel and cement.
- Using above-ground enclosed storage tanks.
- Requiring secondary containment for all pumps and high-risk spill locations.
- Prohibiting wastewater discharges and reinjection.
- Developing a Spill Management Plan (**Appendix 07**).
- Implementing freeboard requirements to accommodate a 1:1,000 ARI total Wet Season.

The environmental impacts and risks associated with the management (treatment, handling and reuse) of wastewater in this Project are deemed to be reduced to As Low As Reasonably Practicable (ALARP) and acceptable based on the identification and implementation of multiple controls detailed in **Appendix 04** (Risk Assessment) this plan, **Appendix 06** (Spill Management Plan), and the **EMP**. The environmental performance standards (**Table 8.7** of the **EMP**) outline the measurement criteria of critical controls to ensure that risks are being reduced to a level that is ALARP and acceptable during and post operations.

6.5 Groundwater Investigation

The Project Area is located within the Neoproteroic – Palaeozoic Amadeus basin, which has a 7-8km sedimentary thickness in some areas. Two hydrogeological environments have been identified within the basin, sandstone and fractured rock aquifers [DENR, 2022; J. W. LLOYD et al., 1987]. The basin's sandstone aquifers include the Pacoota Sandstone, the Mereenie Sandstone, and the Hermannsburg Sandstone aquifer.

The area has a moderate to high level of groundwater salinity [G. A. YOUNG et al., 1987], which coincides with the presence of the Karinga Creek Paleodrainage System, a series of more than 100 saline lakes spanning from Horseshoe Bend and Curtin Springs pastoral stations [L. HARRISON et al., 2009].

Figure 6.5—1 shows the major aquifer systems of the region.

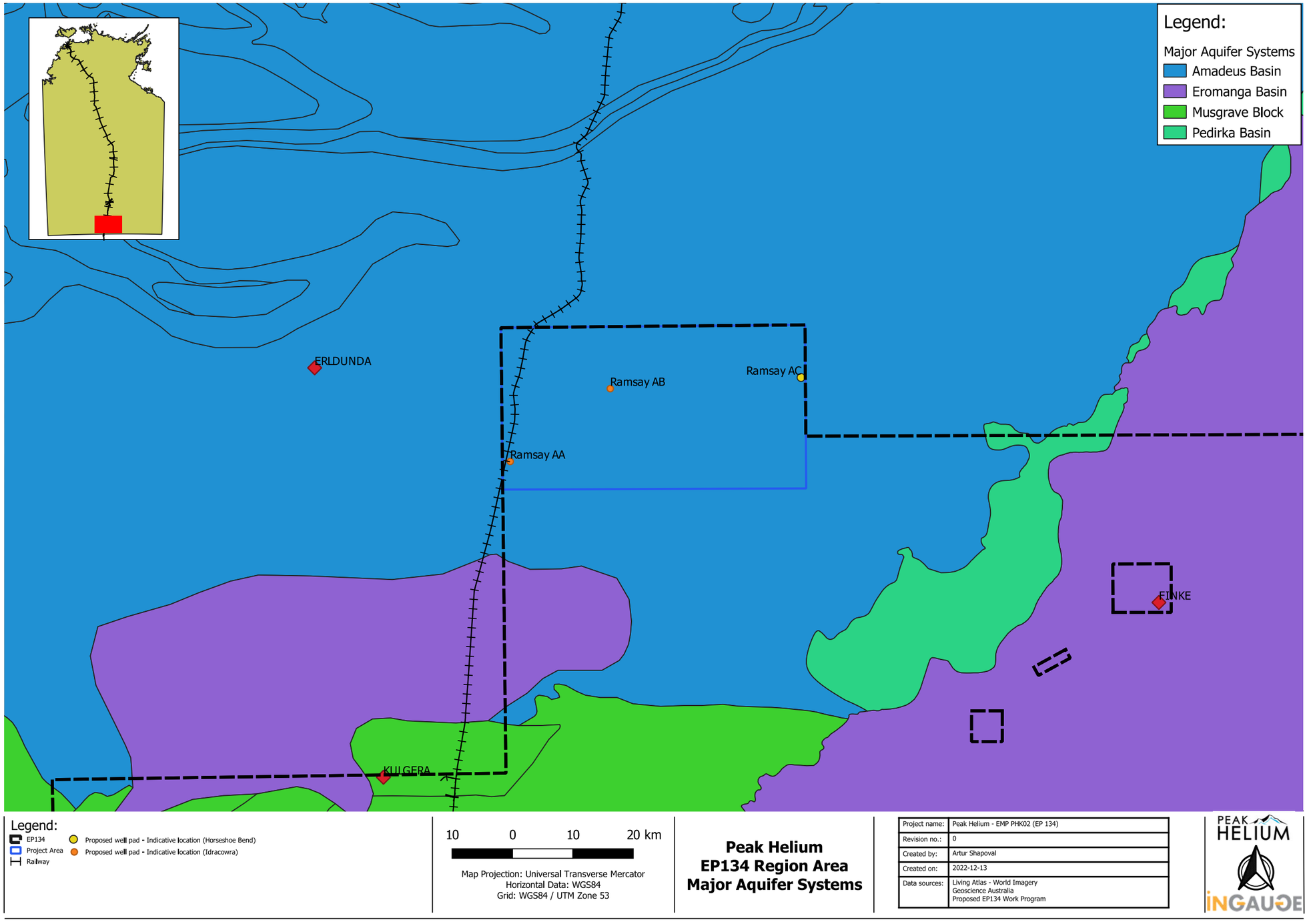

Figure 6.5—1 Major Aquifer Systems of the Region

6.5.1 Location

The project area falls in the Georgina-Diamantina catchment within the Lake Eyre drainage basin.

EP 134 is not within a water allocation plan area. Any guidelines published by the Northern Territory Government relating to groundwater monitoring parameters, methodologies, frequencies, reporting and data submission for petroleum operations will be followed.

6.5.2 Data Management and Reporting

Peak Helium will provide laboratory reports to the relevant regulator, where required, after each sampling occasion. Sampling, chain of custody, and results data will be provided in the format and frequency as agreed with the regulator. Further detail regarding reporting and publication mechanisms will be developed in consultation with the industry, including appropriate units, file formats and data transfer protocols.

6.5.3 Water Extraction

All water extraction for the EMP PKH02-2 and its revisions will be conducted according to the approved groundwater extraction licence in accordance with *Water Act 1992* Northern Territory [DEPWS, 1992].

Groundwater will be stored for use in one of two constructed pits on-site.

Controls to maintain the quantity and quality of water include:

- Minimising water use to only cover what is needed to perform the activities.
- Adhering to the groundwater extraction licence.

6.6 Waste Management

6.6.1 Waste Storage

Waste streams will be stored as per **Table 6.6—1**.

Table 6.6—1 Waste Storage and Treatment

Waste	Storage Method
Domestic Wastewater: • Greywater • Sewage Effluent	• Reticulated collection for disposal via irrigation. • Appropriately designated collection and storage bins for off-site disposal.
Domestic Waste: • Putrescible • Municipal • Recyclable	• Appropriately designated collection and storage bins for off-site disposal.
Residual Drilling Fluids	• Stored in lined pits for re-use, evaporation or off-site disposal. • On-site re-use options to be assessed by a Suitably Qualified Person (SQP). • Transport off-site requires assessment (inc. NORMs)
Drill Cuttings	• Stored in lined pits for off-site disposal or mix, bury and cover if approved by an SQP.
Completions Fluids	• Stored in above-ground open-topped or above-ground enclosed storage tanks on bunded tanks pads or lined pits for evaporation or off-site disposal.
Produced Fluids (not anticipated)	• Stored in open-topped tanks and/or above-ground enclosed storage tanks on bunded tank pads for evaporation or storage prior to off-site disposal.
Produced Condensate	• Stored in designated double-lined storage tanks as per AS1940 located on bunded tank pads.
Ancillary Activities	• Appropriately designated collection and storage bins.

The following wastewater containment structures will be installed and used to minimise, or avoid, the risk of wastewater interaction with soil, surface, and groundwater:

- Pits (**Figure 6.11—1**) – that will be:
    - Constructed with up to 4,500 m^3 of capacity.
    - Constructed with 500mm high bunds along the edges to prevent the entry of overland flow.

- Lined with an impermeable membrane (Aquacon 345), which meets the criteria for any residual drilling fluids and cuttings with the following specifications:
  - An impermeable membrane with a coefficient of permeability of less than 10-9 m/s tested following AS 1289.6.7.2 and with resistance to tearing >0.5kN (ASTM D 4073); static puncture >0.5kN (ASTM D 4833) and tensile strength >20 kN/m (ASTM D 7275) in Section C.4.1.2 (b) of *the Code*.
- Marked with the appropriate freeboard for the season to ensure capacity is available.
- Fitted with fauna ladders.

- Above-ground open-topped treatment tanks – that will be:
  - Designed and constructed following the relevant Australian Standards (including AS1554.1 and AS3990),
  - Designed to withstand bushfires and have a <10m fire break
  - Designed to meet local wind loading conditions
  - Designed with outer walls/framework with no clear access points for fauna
  - Installed on pads that are constructed as per vendor requirements to ensure stability
  - Fitted with a secondary liner to contain spills if the primary liner develops a leak
  - Fitted with a leak detection system between the primary and secondary liner to alert of leaks in the primary liner
  - Fitted with level monitoring equipment that includes a high-level alarm calibrated for the appropriate freeboard for the operational status
  - Designed and operated to prevent overtopping.
  - Marked with the appropriate freeboard for the operational status.

- Above-ground enclosed storage tanks - that will include the same controls as open-topped tank as well as:
  - Fitted with floating cover to prevent the entry of rainwater
  - Fitted with vents that prevent the build-up of explosive gasses.

- Condensate storage tanks – that will be:
  - Designed and constructed following the relevant Australian Standards (AS 1940) [ME/17 FLAMMABLE AND COMBUSTIBLE LIQUIDS, 2004].
  - Installed on pads constructed per vendor requirements to ensure stability.

- Fitted with level monitoring equipment that includes a high-level alarm calibrated for the appropriate freeboard for the operational status. This equipment is designed and operated to prevent overtopping.
- Marked with the appropriate freeboard for the operational status.

To minimise the risk of overflowing fluids from pits and tanks, the following will be carried out:

- Monitoring of pit and tank integrity and fluid levels during site operations.
- Cessation of production testing if the total volume of produced fluid exceeds the available open-topped or above-ground enclosed storage tank storage capacity.
- Written notification to DEPWS within 48 hours of tank capacity exceedance, along with the proposed method to return to proposed activities.
- Cessation of drilling activities if the freeboard is not maintained in the drilling pits.
- Removal of fluids from open topped treatment tanks to enclosed storage tanks or placing lids or enclosing open topped treatment tanks 8 hours prior to a significant rain event.
- Rainwater captured on top of an above-ground enclosed storage tank lid to be removed without damaging the lid material by use of a pump under site supervision.

6.6.2 Significant Rainfall Event Response

Peak Helium's strategies for detecting and responding to predicted significant rainfall events, focusing on the defined wet season, are covered in this section.

Maintaining the freeboard in drilling pits and open-topped treatment is critical in reducing the environmental risks associated with overtopping.

If a significant rainfall event, defined as a rainfall forecast published by the BOM which is greater than 300mm of total rainfall predicted over a 4-day period, is forecast by the BOM – produced fluid will be stored in an above-ground enclosed tank at least 8 hours in advance of the event as per *the Code* C.4.2.2.

Environmental performance standards and measurement criteria to achieve the desired environmental outcomes are listed in **Section 8.7** of the **EMP** main body.

As per conditions C.7.1.1 (a) ii and iii, Peak Helium will ensure that freeboard is maintained in drilling pits by:

- Monitoring, in line with condition C.5.5 (b) of *the Code*, of stored volume and available freeboard of all open pits.
- Determining the 'calculated post significant event freeboard' if a 'significant rainfall event' is forecast by the BOM by subtracting the event forecast from the current freeboard.

If the 'calculated post significant event freeboard' is less than the freeboard requirements shown in **Table 6.3—2**:

- Peak Helium will transfer/remove fluids to other pits, or tanks to ensure freeboard is maintained. Environmental performance standards and measurement criteria for significant rainfall events can be found in **Section 8.7** of the **EMP** main body.

Further explanation of 'significant rainfall events' and their likelihood can be found in **Appendix 01**.

.

6.7 Waste Management

Waste will be minimised as per **Section 6.1.2**. **Table 6.7—1** presents the considerations to be implemented.

Table 6.7—1 Waste Management

Waste Stream	Avoid	Reduce	Reuse	Recycle	Treat	Dispose
Greywater and Sewage Effluent	• Cannot avoid.	• No practical method of reducing.	• Not proposed.	• Not proposed.	• Treated on-site and irrigated.	• Greywater and treated sewage effluent is irrigated. • Sewage will be transferred to a licensed facility.
Residual Drilling Fluids	• Only water-based drilling mud is planned. • Non-aqueous drilling mud will not be used.	• Evaporation from pits.	• Store fluids in the drilling pit. • Allow solids to settle and reuse fluids in place of groundwater for makeup fluid.	• Not proposed.	• Evaporation from pits.	• Drilling fluids will be evaporated as much as possible. • Pending the weather window and freeboard requirements, the remaining fluid will be appropriately transported and disposed of at a licensed facility or buried with drill cutting pending sampling results.
Drill Cuttings	• Cannot avoid.	• Mud weights are designed specifically for gauge wellbore, therefore minimise excess cuttings.	• Not proposed.	• Not proposed.	• No proposed.	• Cuttings to be buried on site, pending sampling results, and approval from DEPWS.
Cement Returns	• Cannot avoid.	• Not proposed.	• Not proposed.	• Not proposed.	• Not proposed.	• Cement returns added to drill pit and managed with drill cuttings.
Completions Fluids	• Cannot avoid.	• Evaporation from open topped tanks or pits.	• Not proposed.	• Not proposed.	• Evaporation from open topped tanks or pits.	• Transported off-site by licensed contractors to a licensed disposal facility or added to the drilling pit and managed with the residual drill fluids.
Produced Fluid	• Cannot avoid.	• Evaporation from open topped treatment tanks.	• Not proposed.	• Not proposed.	• Evaporation from open topped treatment tanks.	• Produced volume will be limited in volume during the EPT test/not anticipated. Any water generated will be evaporated as much as possible. The remaining fluid will be appropriately transported and disposed of at licenced facility.
Chemicals	• Cannot avoid the use of some chemicals.	• Reuse of drilling fluids reduces the consumption of chemicals	• Chemicals returned to supplier.	• Not proposed.	• No treatment of chemicals is proposed under this EMP.	• Disposed of chemicals in a licensed facility.

Waste Stream	Avoid	Reduce	Reuse	Recycle	Treat	Dispose
		and, therefore, the production of waste.	• Excess chemicals are to be returned to the supplier or used for other operations.			
Dirty water	• Divert storm water off site through choir logs / mulch berms.	• Diversion berms around the well pad and pits to prevent water run-on to site.	• Not proposed.	• Not proposed.	• Not proposed.	• Water that has come in contact with chemicals or wastewater to be disposed in accordance with the requirements of that chemical or wastewater.

6.7.1 Treatment and Disposal

Wastewater will be stored and treated as per **Table 6.7—2** to decrease waste volumes and off-site transport and disposal requirements.

Wastewater fluids generated from the activities will be assessed and either be removed from the Project Area for disposal or reduced by evaporation or reused.

The primary avenue to manage drilling, completions and produced fluids generated during the Activities is evaporation. The estimated volume of fluids that will be evaporated prior to tank removal and/or pits closure is 95%. To maximize evaporation, open topped treatment tanks will be used when no forecasted significant rain events (as per **Section 6.6.2**) are forecast, and these tanks will be enclosed with lids to reduce the addition of water via rainfall.

Table 6.7—2 Waste Treatment and Disposal Methods

Waste	Treatment and Disposal Method
Domestic Waste • Putrescible • Municipal • Recyclable	• Transported off-site by a licensed contractor. • Disposed of in licensed disposal facility.
Greywater	• Reticulated collection, on-site treatment, and disposal via irrigation.
Residual Drilling and Completions Fluids*	• Evaporated on-site as much as possible. Estimated - 95% of the volume. • Residual fluids trucked off-site to a licensed disposal facility.
Drill Cuttings*	• Leachability testing of drill cuttings and muds will be undertaken in accordance with the Australian Standard Leaching Procedures (Australian Standards AS 4439.2 and 34439.3) by a NATA accredited laboratory. • Cuttings blending and burial in situ subject to sampling results, independent suitably qualified third-party environmental advice (to meet the requirements of C.4.1.2 (f) of *the Code*), and government approval—otherwise, isolation and removal by a licensed transporter to a licensed disposal facility.
Produced Fluid**	• Not anticipated. But to be reduced if encountered by evaporation. Estimated 95% of the volume. • Residual fluids trucked off-site to a licensed disposal facility.
Produced Condensate	• Flared on site, or • Transported off-site by a licensed contractor.
Ancillary Activities	• Transported off-site by a licensed contractor to a licensed disposal facility.

Waste	Treatment and Disposal Method
Used Chemicals and Fuel Drums	• Collected for disposal at an approved landfill, or • Returned to the supplier for recycling.
Listed Waste	• Collected in designated area for disposal, following the *Waste Management and Pollution Control Act*. • A licensed company will carry out transportation and disposal following the regulation.
Other Waste • General • Food • Empty IBCs • Metals • Plastics • Batteries • Tyres	• Transported off-site to a licensed disposal/recycling facility.

*An assessment of environmental impacts and environmental risks posed by the drill cuttings and residual drilling fluids will be carried out before disposal. The disposal options will consider the environmental assessment results.

**Produced fluid will be stored in open-topped treatment tanks to enhance evaporation and tanks will be enclosed or fluids will be transferred to above-ground enclosed storage tanks pending significant rainfall forecast.

6.7.2 Reuse

The primary avenue to reuse waste fluids is during drilling activity. However, given the limited volume of make-up water required to drill and complete a well, the volume of water estimated to be recycled is approximately 25% of what is required to drill a well. To enable reuse and recycling centrifuges will be used on the drill rig to remove solids and/or the solids will be settled out in the drill pits and reused.

6.7.3 Transportation

As per Section C.5.2(C) of *the Code*, all residual drilling fluid and cuttings will be tested before off-site disposal and transport. Residual drilling fluid and cuttings will be tested (as verified by an SQP) for:

- Naturally occurring radioactivity material (NORM) to determine correct waste classification under the *Radiation Protection Act 2004* (NT) [DOH, 2004].
- Correct waste classification as required by the *Waste Management and Pollution Control (Administration) Regulations 1998* [NT GOVERNMENT, 1998].

Furthermore, Peak Helium will:

- Use licensed transport providers under the *Waste Management and Pollution Control Act 1998* [DEPWS, 1998].
- Use wastewater storage and treatment facilities licensed per the relevant state or Territory.
- Transport wastewater interstate to a licensed storage and treatment facility if no licensed facility is available in the NT.
    - When wastewater is required to be transported interstate, a consignment authority as per the *National Environmental Protection (Movement of Controlled Waste Between States and Territories) Measure 1998* (NEPM) will be implemented [SEWPAC, 1998].
    - Peak Helium will apply for an interstate waste transport consignment authority as per before transportation occurs.
- Where applicable, track and document wastewater disposal as per the requirements of the *Radiation Protection Act 2004* [DOH, 2004].
- Transport of chemicals or wastewater on unsealed roads during wet season conditions only to occur with approval by the Site Supervisor when damage to roads is assessed as negligible, a spill is unlikely, and no significant rain events are forecast.
- Activate the Contingency Plan/ Emergency Response Plan (**Appendix 14**) if a vehicle becomes bogged so that extraction activities are conducted safety and prevent loss of contents.
- Where applicable, minimise waste material and chemical volumes, including non-waste chemical volumes, to assist with transport requirements and avoid excessive vehicle movements.

6.7.3.1 Waste Tracking

The movement of all wastewaters will be documented and available upon request. Tracking will be carried out following:

- The *NT Waste Management and Pollution Control Act 1998* [DEPWS, 1998].
- The *National Environment Protection (Movement of Controlled Waste Between States and Territories) Measure* 1998 (NEPM) [SEWPAC, 1998].
- The *Radiation Protection Act 2004* [DOH, 2004].
- *The Code* Section C.6.
- The **EMP**.

Tracking of water and wastewater will include:

- Volumes of produced fluid from each well.
- Volumes of water transferred into each tank.
- Estimates for evaporation rates from each tank.
- Volumes of water planned to be and actually reused in drilling activities.
- Volumes of water and wastewater used for other purposes e.g., drilling activity.
- Volumes of water and wastewater removed from stie and its destination (inc. details of the licence number of licensed waste transporters).

All wastewater tracking documents in a chain of custody system.

Annual wastewater tracking documentation will be reported annually to the Minister as per the EMP Monitoring Program.

6.7.3.2 Wastewater Flowlines

There will be no wastewater flowlines constructed or operated under this EMP.

6.8 Wildlife, Stock, and Human Interaction

Management and control methods will be implemented to minimise the risk of wildlife, stock, and human receptors interacting with stored waste. Control measures will comprise fencing, signage, and fauna-proof containment as necessary. **Figure 6.11—2** presents an indicative well pad layout showing waste storage locations. Examples of locations include:

- **Work area(s)**: where drilling, completion and EPT activities will be carried out.
- **Water tank(s)**: indicative location for open-topped tanks that store produced fluid.
- **Pit(s)**: lined earth bund structures used to store groundwater and drilling by-products (**Figure 6.11—1**).

Wastewater treatment tanks, pits, and the surrounding lease area will be monitored during operations to detect any fauna interaction with wastewater. However, the risk of interaction is considered low based on the implementation of numerous initiatives, including:

- Ensuring wastewater treatment tanks have outer walls/frameworks with no clear fauna access points.

Control measures to prevent large wildlife, stock, and human receptors from interacting with wastewater include, but are not limited to:

- Tank pads and treatment tanks that are fenced and signposted.
- Open-topped treatment tanks high enough to prevent interaction with non-flying fauna species.
- Installation of fauna ladders in open pits.
- Installation of fauna ladders in open-topped treatment tanks if containing wastewater on on-manned sites.

Ongoing bird or fauna mortality monitored daily during operations and weekly post operations. If >7 fauna impacted and/or >1 threatened fauna impacts further mitigation measures will be considered, depending on the species when fauna mortality is triggered. These mitigation measures could include:

- Relocation of nests in consultation with Parks and Wildlife specialists.
- Installation of small fauna-proof barriers.
- Installation of reflective flicker-tape to assist bats in detecting barbed wire strands.

6.9 Measurement Criteria

To meet Environmental Performance Standards associated with wastewater management as outlined in the **EMP Section 8.7**, the following controls will be in place:

- Drilling activities will be completed using water-based drilling fluids chemical additives and will not contain BTEX.
- Drilling activities will be completed using water-based drilling fluid additives that are selected in accordance with the designed function, the manufacturer's recommendations and SDS.
- The name, type and quantity of drilling fluids additives are recorded in daily well reports.
- A perimeter bund will be constructed around drilling by-product storage pits to prevent overland flow from entering pit/s.
- Drilling pits will be lined with impermeable liner.
- 500mm of freeboard maintained in drilling by-product storage pit/s.
- Drilling, completions, and cementing additives will be stored in/on temporary bunding with a volume greater than 110% of the largest container in accordance with the requirements of the SDS.
- Treated sewage effluent and greywater irrigation on vegetated land with a slope of <5%.
- Waste volumes will be reduced through active reuse, recycling, or on-site disposal by use of centrifuge, treatment system or testing (leachate) as per approval conditions.
- Drilling by-product storage pit/s will be sampled for off-site transport or mix bury and cover initiated 12 months post-drilling activity.
- Hazardous materials register to be maintained during site operations.

6.10 Monitoring

6.10.1 Monitoring Plan

A waste monitoring plan will be implemented as per **Table 8.5 – 2 Monitoring Plan** of the **EMP** which includes:

- Drilling by-product pit and produced fluid tanks levels monitored daily during operations and with telemetry post operations.
- Waste and wastewater volume and destination recorded at the time of transport by on-site personnel.
- At the time of well suspension and assessment of the potential accumulation of NORM in well equipment assessed and measures put in place to reduce risks to HSE as per B.4.15.5(b) of the Code.
- Fauna interactions monitored weekly during operations and non-operation until drilling pit closure.
- Weekly monitoring of storage areas during operations and post operations if chemicals, fluids, fuel, or additives stored on unmanned sites.
- Post re-instatement of pits:
    - NORMS as per C 5.2 of *the Code*.
    - Leachability testing as per C.4.1.2 of *the Code*.
    - Analytes as per Table 9 of *the Code*.

6.10.2 Monitoring Methodology

Records regarding waste transfer to licensed facilities will be maintained per requirements under the *NT Waste Management and Pollution Control Act 1998* [DEPWS, 1998].

Samples will be collected as per the following methodology (as verified by an SQP):

- Pit characterisation:
  - *AS4482.1- 2005: Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil* [EV/9 SAMPLING AND ANALYSIS OF SOILS AND BIOTA, 2005].
  - *National Environment Protection (Assessment of Site Contamination) Measure* [ASC NEPM, 1999].
- Fluid monitoring:
  - *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* [ANZECC et al., 2000].
  - *AS/NZ5667.1:1998: Water Quality Sampling Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples* [EV/8 METHODS FOR EXAMINATION OF WATERS, 1999].

Sampling procedures will include the following components:

- All field measurements and sampling to be undertaken by suitably qualified personnel and to use equipment that is properly maintained, laboratory checked and calibrated in line with manufacturer's specifications.
- Each sample will have a unique identification number that can be cross-referenced to the monitoring location and sampling time.
- Sample preservation measures must be documented and comply with analytical laboratory requirements and relevant standards (e.g., AS/NZS 5667.1:1998).
- Chain of Custody (CoC) procedures will be followed following section 3.7 of *Monitoring and Sampling Manual 2009 — Environmental Protection (Water) Policy* [DES, 2009].
- Sample analysis will be undertaken by a National Association of Testing Authorities (NATA) laboratory approved for that analysis.
- QA/QC protocols (such as trip blanks) and samples will be sent to duplicate laboratories where a NATA-accredited analysis is unavailable.

6.11 Well Pad Layout and Pit Profiles

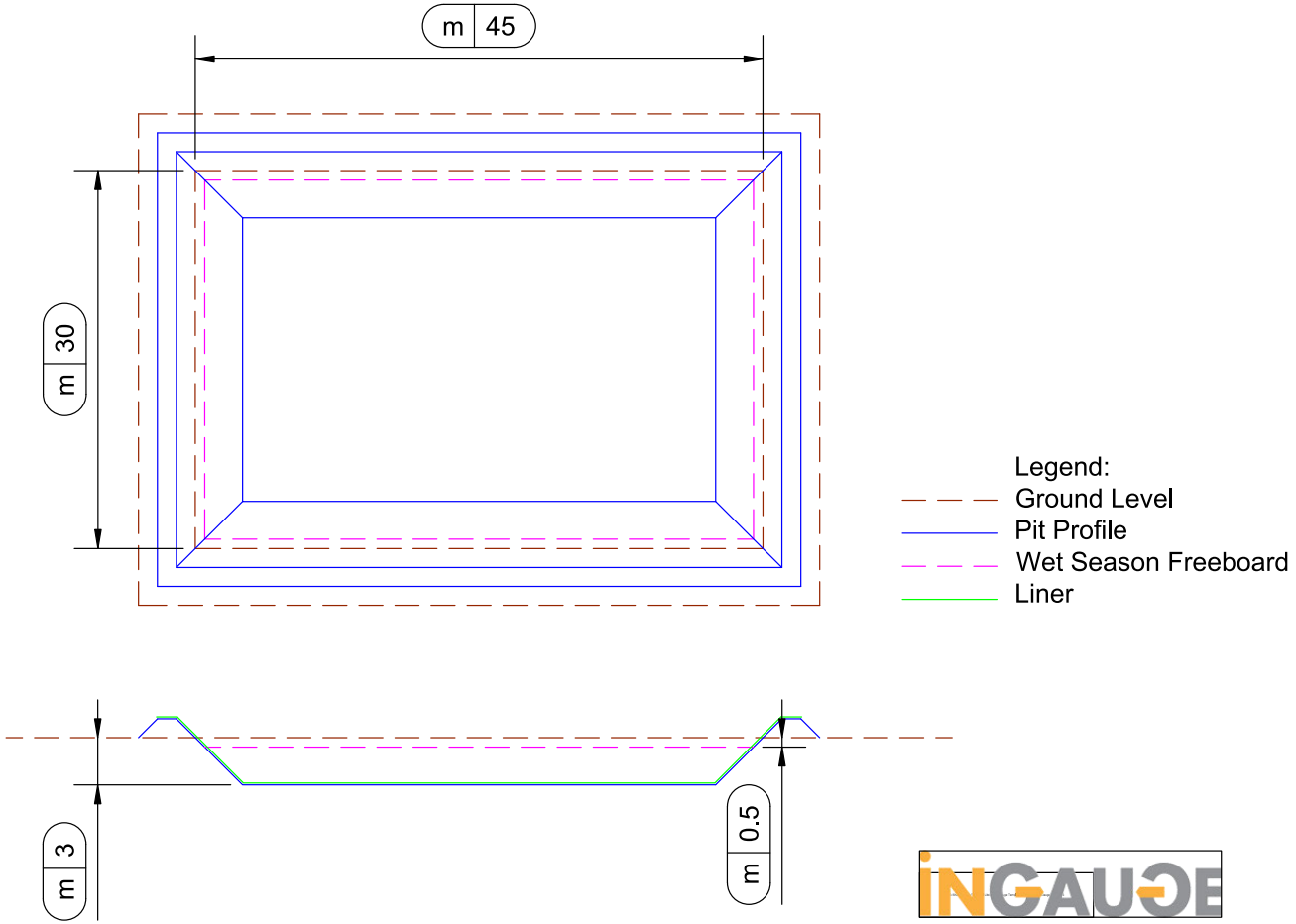

Figure 6.11—1 Indicative Pit Profile

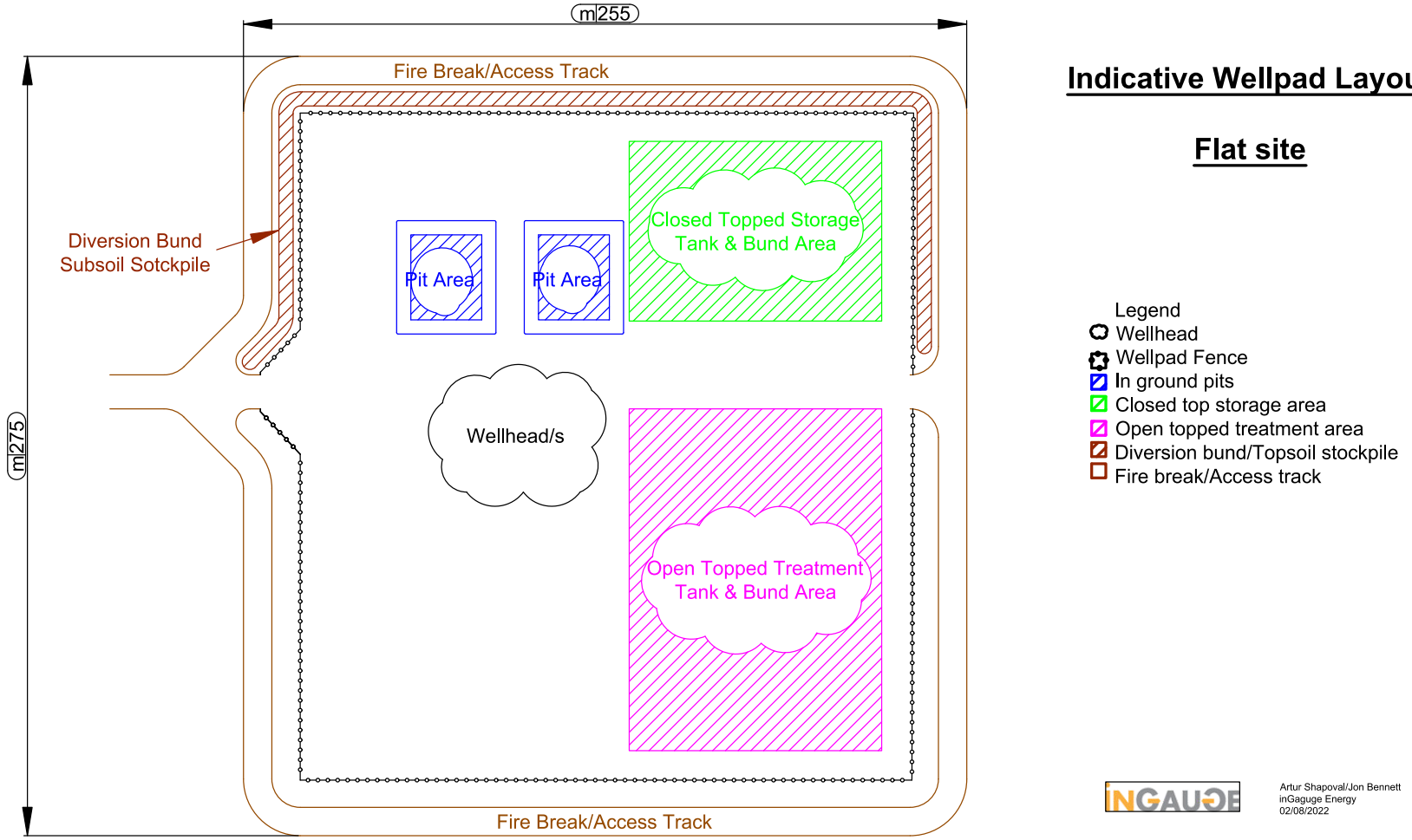

Figure 6.11—2 Indicative Well pad Layout, Flat Site

6.12 Fluid and Cementing Additives

For an indicative list of drilling, completion, fluid, and cement additives, refer to **Appendix 07** (Spill Management Plan) **Section 7.15** (Chemical Tables).

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7 Appendix 07 – Spill Management Plan

Peak Helium Pty Ltd

EMP PKH2-3

NT Exploration Permit (EP) 134

Appendix 07
Spill Management Plan

Rev	Description	Date	Initiated	Reviewed	Approved
0	Issued for Submission	18/07/2022	Trent Smith	Katie Robertson Vicky Cartwright	Jon Bennett
1	Issued for Re-Submission	19/08/2022	Trent Smith	Katie Robertson Vicky Cartwright	Jon Bennett
2	Issued for Re-Submission	16/01/2023	Katie Robertson	Nick Fraser Vicky Cartwright	Trent Smith
3	Issued for Re-Submission	01/02/2023	-	-	Trent Smith

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INGAUGE
Well Engineering & Project Management

7 Spill Management Plan

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7.1 Purpose

This Spill Management Plan has been developed to support the activities covered in the Peak Helium EMP (EP 134).

This plan has been developed following the *Code of Practice: Onshore Petroleum Activities in the Northern Territory* herein referred to as *the Code* [DEPWS et al., 2019].

7.2 Key Legislation

Key legislation and documents consulted in developing this plan are provided below:

- ***Petroleum (Environment) Regulations 2016*** [NT GOVERNMENT, 2016]: requires regulated activities to assess the environmental impacts and risks regarding any action proposed, including the prevention of a spill of the chemical or other substance.
- ***Code of Practice: Onshore Petroleum Activities in the Northern Territory*** [DEPWS et al., 2019]: covers the management of chemicals and wastewater on-site, including the use of secondary containment, lined tanks and spill management plan.
- ***Transport of Dangerous Goods by Road and Rail (National Uniform Legislation) Act 2010*** [DEPARTMENT OF THE ATTORNEY-GENERAL AND JUSTICE, 2010]: covers the transportation of goods by road in the NT and also covers licences for vehicles and drivers carrying dangerous goods.
- **The *Code of Practice of On-site Wastewater Management*** [DoH,2014]: provides standards and guidance to ensure the management of on-site wastewater.
- ***Workplace Health and Safety (National Uniform Legislation) Act 2011*** [DEPARTMENT OF THE ATTORNEY-GENERAL AND JUSTICE, 2011]: covers the storage and handling of chemicals on site.
- ***Waste Management and Pollution Control Act 1998*** [DEPWS, 1998]: covers the requirements for the transportation and disposal of waste within the NT, including the requirements for contractors, vehicles and facilities managing listed wastes to be licenced.

7.3 Potential Spill Materials

Table 7.3—1 below provides information about how fluids, chemicals and wastewater will be stored, transported and transferred during the activities.

Table 7.3—1 Estimated Volumes of Chemicals and Wastewater Associated with the Activity, per Well Pad

Item	Estimated Volumes on Site	Storage Location	Containment	Management
Diesel Fuel	50,000L per well pad	Fuel storage tanks	Secondary containment (double-skinned tanks)	• Bulk fuel will be stored within tanks equipped with safety features such as double skins or temporary bunding. • Spill, leak, and drip trays will be used to address the immediate risk associated with refuelling operations. • Any unused fuel at the end of the program will be transported from the site.
General Equipment Maintenance Chemicals: • Hydraulic oil • Lubricants • Degreasers, etc.	2,000L per well pad	Storage tanks & drums	Secondary containment (double-skinned tank or bunded containment area / bunded pallet storage)	• General equipment maintenance chemicals, including lubricants and liquid chemicals, will be transported and stored within their original containers or in tankers equipped with safety features such as double skins (or temporary bunding). • Spill, leak and drip trays will be used to address the risk of minor drips and spills associated with filling operations. • Any unrequired general equipment maintenance chemicals will be transported from the site in suitable containers at the end of the programs.
Drilling, Completions and Cementing Additives	25,000L per well	Storage tanks, drums & bags	Secondary containment for liquid additives	• Additives will be transported in their original containers. • Liquid drilling and completions additives will be stored in/on temporary bunding, with a volume greater than 110% of the largest container. • Drilling fluids shall not contain benzene, toluene, ethylbenzene, or xylene (BTEX) above the levels described in section B.5 of *the Code*. • Any additives that are not required will be transported from the site at the end of the program in suitable containers.
Residual Drilling Material	5,000L per well	Mud tank system	Engineered rig tanks	• Drilling and completions rigs have open-topped tank systems designed to mix and circulate fluids. Tank volumes are monitored by rig crews during operations and emptied into pits on-site at the completion of activities. • Drilling and completions fluids will be made up of groundwater and drilling additives, and the residual drilling fluids (fluids no longer required for drilling purposes) will be stored in engineered, lined pits. • Drill cuttings are brought to the surface during drilling activities and will be stored in lined pits along with the residual drilling and completions fluids. • Reuse, treatment and disposal options are covered in **Appendix 06**.
		Pits	Engineered lined pits	
Produced Fluid	1ML per well	Above-ground enclosed storage tanks and open-topped treatment tanks	Secondary containment (dual liners) and/or bunded tank pad	• Produced fluids generated during the Extended Product Testing (EPT) will be stored in above-ground enclosed storage tanks and/or evaporated in open-topped treatment tanks, as accordance with *the Code.* • Open-topped treatment tanks will be designed and operated for the period that treatment infrastructure contains wastewater to accommodate the total rainfall anticipated based on the 1:1000 Average Recurrence Interval (ARI), and fluids will be moved to above-ground enclosed storage tanks, or tanks enclosed, 8 hours prior to a Significant Rainfall Event (SREs).
Condensate and Oil	50,000L per well	Condensate storage tanks	Secondary containment (double-skinned tanks)	• Secondary containment in double-skinned tanks or temporary bunding. • Appropriately transported and disposed of at the end of the programs.
Greywater and Sewage	25,000L	Greywater treatment system	Secondary containment (double-skinned tanks)	• Secondary containment in double-skinned tanks. • Irrigation within a designated wastewater irrigation area as per the *Code of Practice of On-site Wastewater Management* [DoH,2014].

7.3.1 Transport

Transport of chemicals or wastewater on unsealed roads during the wet season will only be approved by the Site Supervisor when damage to roads is assessed as negligible, a potential spill as unlikely, and no significant rainfall events are forecast.

The Contingency/Emergency Response Plan (**Appendix 14**) will be available for an immediate coordinated response to spill scenarios.

7.3.2 Fuels

Bulk fuel will be stored within tanks equipped with safety features such as double skins or temporary bunding. Spill, leak, and drip trays will be used to address the immediate risk associated with refuelling operations.

Any unused fuel at the end of the program will be transported from the site.

7.3.3 General Equipment Maintenance Chemicals

General equipment maintenance chemicals, including lubricants and liquid chemicals, will be transported and stored within their original containers or tankers equipped with safety features such as double skins (or temporary bunding).

Spill, leak, and drip trays will be used to address the risk of minor drips and spills associated with filling operations.

Any unrequired general equipment maintenance chemicals will be transported from the site at the end of the program.

General equipment and maintenance chemicals are not anticipated to be hazardous, but all must be stored and handled in accordance with the relevant Safety Data Sheets (SDS) to limit the potential for environmental harm.

7.3.4 Drilling, Completions and Cementing Additives

Drilling, completions and cementing additives are used during the activities, and their use generates waste. Additives are selected and managed in accordance with the manufacturer's recommendations and SDS. The name, type and quantity of each chemical used on the well will be recorded as per the Well Operations Management Plan (WOMP). Peak Helium's management strategy for waste generated from the use of drilling, completions and cementing additives is presented in **Appendix 06** (Waste and Waste Wastewater Management Plan).

Some chemical fluids additives/materials used in drilling and completions prior to use in the well can be considered hazardous and may cause environmental harm if not handled as per their SDS. No drilling additives to be used in the process will contain benzene, toluene, ethylbenzene, or xylene.

Additives to be used are classified based on their functional group (indicative list below) and have been assessed for their potential to contain hazardous chemicals as per representative chemical additives SDSs, for example:

- Bactericide (hazardous).
- Alkalinity pH Control (hazardous).
- Viscosifiers (non-hazardous).
- Weighting Agent (potentially hazardous).
- Lost Circulation Material (non-hazardous).
- Corrosion inhibiter (hazardous).

To prevent environmental harm from the storage, handling and transport of hazardous chemicals, they will be managed in accordance with their SDS, which will be made available with the chemicals during transport at storage and handling locations. There will be a hazardous chemical register on-site. There will also be spill kits available at handling and storage locations.

The hazardous chemical assessment of materials used and produced (as described above) is presented in **Table 7.15—1** and **Table 7.15—2**.

Controls to prevent environmental harm from additives that are hazardous or potentially hazardous are listed in **Appendix 04** (Risk Assessment) and throughout this Appendix (see **Section 7.8**), and the EMP.

7.3.5 Residual Drilling and Completion Fluids, Cuttings and Cement Returns

Drilling and completions fluid will be made up of groundwater and drilling and completions additives, and the residual drilling fluids (fluids no longer required for the activities) and cement returns will be transferred by the rig equipment for storage and management in engineered tanks or lined pits under site supervision.

Residual drilling and completions fluids, cuttings, and cement returns are described in the EMP as drilling by-products. Drilling by-products can cause environmental harm if released to the ground or water. Additives used in drilling and completions fluids can be considered hazardous, but as the resulting by-product is primarily water and earthen cuttings, the resulting mixture is not considered to be hazardous.

Reduction, reuse, and treatment options for the fluids and solids components of the by-products are described in **Appendix 06** - **Table 6.7-1**.

7.3.6 Hydraulic Fracture Fluids

No hydraulic fracturing will be undertaken under this EMP.

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7.3.7 Produced Fluid

Produced fluid generated during the EPT will be stored in above-ground enclosed storage tanks and treated in open-topped treatment tanks, in accordance with *the Code* requirements. See **Appendix 06** (Wastewater Management Plan) for further information.

Fluids transferred to tanks will be completed during EPT operations by the use of EPT equipment and will be under the supervision of the EPT supervisor.

Produced fluid (formation water) is not considered hazardous but may cause environmental harm if a large quantity is spilled on the site. Controls to reduce the risk of this to ALARP are listed throughout the **EMP**, this Appendix, **Appendix 04**, and **Appendix 06**.

Open-topped fluid treatment tanks will be designed and operated for the period that treatment infrastructure contains wastewater to accommodate the total rainfall anticipated based on the 1:1,000 Average Recurrence Interval (ARI). Upon the identification of a significant rain event, treatment will cease, and tanks will be enclosed, or fluids will be transferred to above-ground enclosed storage tanks as per *the Code*.

7.3.8 Greywater and Sewage

Accommodation and messing facilities will be provided from temporary on-site camp/s located at designated, pre-cleared campsite/s. The campsite/s will be equipped with a fully self-contained sewage treatment plant (e.g., Ozzi Kleen) furnished with an irrigation sprinkler system.

All treated wastewater produced from laundry, showers, kitchen, and treated sewage will be irrigated in an appropriately sized, designated area 50-100m away from the camp. The designated irrigation area will be fenced to exclude livestock access and have vegetation capable of enabling a high evapotranspiration rate, as per the *Code of Practice for Small On-site Sewage and Sullage Treatment and the Disposal or Reuse of Sewage Effluent* [DOH, 2014]. The designated area will be checked to ensure pooling is not occurring. Solid and macerated sewage will be transported to a licenced facility for disposal.

7.4 Potential Spill Scenarios

Table 7.4—1 presents the potential spill scenarios associated with the proposed activities and key controls to reduce the risk of spills to As Low As Reasonably Practicable.

These scenarios include:

- Spills of chemicals and wastewater during transportation by heavy vehicles or transfer to tanks/pits (on and off-site).
- Tank, drilling pit, and containment vessel overflows and structural failures.
- Spills of additives, chemicals or wastewater during handling and storage activities on-site.

The Well Operations Management Plan (WOMP) covers containment loss due to well barrier failure.

Table 7.4—1 Potential Spill Scenarios

Spill Scenario	Activity Duration	Mechanisms	Estimated Quantity	Quality of spill	Location	Key Management Controls
Spills During Fueling	• Civil construction – 21 days per well pad. • Drilling – 45 days per well. • Testing – 365 days per well.	• Spill during fuel transfer.	<1,000L	• Diesel.	• Access track during construction. • Wellpad during construction.	• Drip trays when refuelling. • Spill kits are available on-site.
Additive, Chemical or Wastewater Spills (during handling, treatment, and storage)	• Drilling – 45 days per well. • Completions – 4 days per well. • Well testing –365 days per well.	• Container rupture. • Spill during chemical handling and mixing.	<1,000L	• Drilling, completion and cementing additives. • Produced fluid. • Additives as listed in **Table 7.15—1** and **Table 7.15—2**.	• Chemical storage area. • Drilling or completions rig • Drilling pits. • Well test equipment.	• Secondary containment to be deployed under high-risk spill/leak storage and handling areas. • Routine inspections of a additive and chemical storage and holding areas inc. wastewater transfer point and additive and chemical mixing areas during operations. • Spill kits available on-site.
Additive, Chemical or Wastewater Spill (during transport)	• Drilling chemical: transfer- 7 days of a bulk chemical transfer, generally pre-drilling. • Wastewater: disposal over four weeks- up to 50 truck movements total over the duration.	• Transport spill. • Traffic accident (total or partial release).	25,000L (1 truckload)	• Wastewater. • Various chemical additives as listed in **Table 7.15—1** and **Table 7.15—2** Indicative Cementing Additives.	• Access tracks. • Along public roads.	• All transport companies to be appropriately licenced to transport associated chemicals and waste as per the *Dangerous Goods and Waste Management and Pollution Control Act* [DEPWS, 1998; DEPARTMENT OF THE ATTORNEY-GENERAL AND JUSTICE, 1998]. • Transport vehicles will be maintained as per OEM specifications.
Leakage • Pipes • Hoses • Fittings	• Drilling – 45 days per well. • Completions 4 days per well. • Testing – 365 days per well.	• Coupling, hoses, or valve failure.	<5,000L	• Residual drilling by-products (drilling fluids, cuttings or cement). • Produced fluid. • Various chemical additives, as listed in **Table 7.15—1** and **Table 7.15—2**.	• Drilling and completions fluid mixing and transfer areas on the drilling rig. • Production test equipment. • Wastewater storage equipment. • Wastewater treatment equipment.	• Secondary containment to be deployed under high-risk spill/leak storage and handling areas. • Routine inspections of additive and chemical storage and handling areas, including wastewater transfer point/s, and additive and chemical mixing areas during operations. • Spill kits available on-site.
Drilling Pit Overflows or Failure	• During and post activities (timing detailed above) up to 12 months post activity.	• Overfilling of a pit. • Structural failure of the embankment.	>5,000L	• Residual drilling by-products. • Produced fluid.	• Drilling pits.	• Daily inspection of pit integrity and freeboard during operations. • Freeboard maintained at 500mm post drilling activity to prevent overflow based on a 1-1000 year rainfall event. • Well pads are bunded and capable of holding the carrying capacity of any overflow from the drilling pit.

7.4.1 Leak Worse Case Scenarios

Table 7.4—2 Worst-case Scenarios

Leak	Total Volume that Could be Lost	Maximum Likely Time to Locate the Leak	Risk
Produced Fluid from Tank	1ML	~12h	• In the event of an above-ground enclosed or open-topped storage tank failure, all wastewater will be contained within secondary containment. As a contingency, there will be leak detection between liners and/or the bunded tank pad will be designed with the capacity to contain the total tank volume.
Pits	10,000L	~12h	• This would require that the pit be full and the earthen bund wall fails catastrophically. The liner in the earthen bund means that a washout of the wall from overflow is an unlikely scenario.
Additives	1,000L contained within bund.	~2 hours, chemical additives are in regular use.	• In case of a leak, it will be contained within the bunded area. Chemicals are in regular use and removed from the site as personnel are demobilised from the site.
Hydraulic Oil	3,800L contained within bund.	~2 hours	• Removed from the site as personnel are demobilised from site.
Diesel Fuel	50,000L (size tank) contained within a temporary bund.	~2 hours, fuel is in regular use during the day.	• It is a theoretical scenario as the diesel is contained in double bunded vessels. Fuel is removed from the site as personnel are demobilised from the site.
Gas Emissions	3MMscf	Immediately as the EPT is permanently manned and monitored.	• Total greenhouse gas emissions for the project are low compared to total NT and Broader Australia Greenhouse gas emissions. • The worst-case percentage of total NT and Australian GHG emissions is estimated at 2.6% and 0.078%, respectively.

7.5 Potential Receptors

Appendix 01 of the EMP describes the environment at the Project Area, including environmental and cultural sensitivities, which have the potential to be impacted by a spill.

Maps are provided throughout the **EMP** and Appendices illustrating the separation distance between project activities and sensitive receptors, including:

- Heritage sites
- Communities
- Protected areas (including those detailed in **Section 7.8.1**)
- Watercourses

7.5.1 Groundwater

Chemicals and fuels used during the civils, drilling, completions, and extended production test activities may result in accidental releases to the surface and infiltrate the ground, migrating to shallow groundwater and affecting groundwater quality.

These potential releases, whilst unexpected, are considered to have a low probability of occurrence and are constrained by the **EMP** requirements managing risk, existing legislative requirements, and the ongoing mitigation of potential impacts.

7.5.2 Surface Water

Spills to the surface have the potential to migrate to surface waters such as ephemeral watercourses and thus have the potential to affect surface water quality and the ecological values of that habitat. Well pads bunded and located away from surface water features to reduce risk.

7.5.3 Soil

For smaller spills and leaks (<1,000L), migration is likely to be contained within the surface soils and would be readily removed, contained, or remediated.

7.6 Risk Assessment

The risk of spills associated with the proposed activities is covered under the *EMP*, see **Appendix 04**.

7.7 Chemical Risk Assessment

No hydraulic fracturing activities will be undertaken under this EMP.

7.8 Control Measures

The key control measures to manage spills associated with the regulated activities in the EMP are summarised below.

The key management controls include but are not limited to the following:

- All drilling and completion fluids, chemical additives, oil and fuel storage will be equipped with secondary containment (or dual liners), as per *the Code*.
- Secondary containment will have sufficient capacity to hold 100% of the volume of the largest container stored in the area, plus 10%, unless the container is equipped with individual secondary containment (Section A.3.8 (g)(i) of *the Code*).
- Drilling pits will be lined with Aquacon345, which meets the C.4.1.2 requirements for an impermeable membrane.
- Drilling pits will be constructed and managed with enough freeboard to manage a 1:1,000 ARI during the wet season (~500mm).
- Drilling pits will have a raised bund of 0.5m to prevent overland flow from adding any additional water to the pits.
- Tank pads will be designed and constructed to prevent spills of hazardous chemicals; this includes compacting the tank pad surface to 100kPa to reduce infiltration.
- Monitoring to detect spills will follow **Section 7.11** of this Appendix.
- All handling and fluids transfer activities completed during operations will be supervised by the Site Supervisor.
- Transport of chemicals or wastewater on unsealed roads during wet season conditions is only to occur with approval by the Site Supervisor when damage to roads is assessed as negligible, a spill is unlikely, and no significant rain events are forecast.
- Spill kits are readily available at each worksite while operational and on all mobile service trucks or vehicles where hydrocarbons and chemicals are stored or used.
- Inspection reports and maintenance records of secondary containment shall be kept and available for review upon request (Section A.3.8 (k) of *the Code*).

- Spill-specific contingency/emergency response drills are to be conducted in line with the Emergency Response Plan/Contingency Response Plan (**Appendix 14**)
- Materials that escape from primary containment or are otherwise spilled onto secondary containment will be removed as soon as possible (Section A.3.8 (j) of *the Code*).

7.8.1 Site-Specific Control Measures for SOCS and SOBS

It is important to note that the Karinga Creek Paleodrainage System (KCPS) Site of Conservation Significance (SOCS) and Botanic Significance (SOBS) and the Poona SOBS occur within the EP. Therefore, site-specific controls to prevent any impacts from spill-related incidents on these SOCS/SOBS have been developed and will be implemented. These additional controls include:

- No new access tracks will be constructed within SOCS or SOBS.
- Where SOCS and SOBSs areas are traversed, they will be clearly identified, so that the site team are made aware, and a speed limit of 40km/hr will be implemented.
- There will be no storage of chemicals or fuels within SOCS or SOBS.
- There will be spill kits available where SOCS and SOBS are being traversed.
- Transport of chemicals or wastewater on unsealed roads during wet season conditions only to occur with approval by the Site Supervisor when damage to roads is assessed as negligible, a spill is unlikely, and no significant rain events are forecast.
- In the event of a transport vehicle becoming bogged, the Emergency Response Plan (**Appendix 14**) is to be activated so that extraction activities are conducted safely and prevent loss of contents.

A comprehensive list of mitigative controls relevant to the SOCS and SOBS is presented in **Appendix 04** (Risk Assessment).

7.9 Secondary Containment

Section A.3.8 (f) of *the Code* states that 'Any hazardous chemicals or those that may cause environmental harm are to be stored within secondary containment'.

As per *the Code* (Section A.3.8 (g)), secondary containment must meet all of the following criteria:

- Sufficient capacity to hold 100% of the volume of the largest container stored in the area plus 10% unless the container is equipped with individual secondary containment.
- Permeability able to contain materials or waste until it can be removed or treated.
- Provide for separation of clean and dirty water.
- Be compatible with the material or waste stored or used within the containment.
- Be resistant to physical, chemical and other failures during handling, installation and use.
- Be maintained in good order at all times.

Peak Heium will implement all requirements under *the Code* for secondary containment through the use of (but not limited to), double-lined or double-walled storage tanks and bunds.

7.10 Spill Response and Management

The following section provides an overview of the response to spills during activities under the EMP. Where the spill results from an emergency, the Contingency/ Emergency Response Plan (**Appendix 14**) will take precedence over this plan.

7.10.1 Initial Spill Assessment

When a spill occurs, the site supervisor will conduct the spill's initial assessment to identify the potential hazards, type, location, and required assistance. The assessment will:

- Determine the safety hazard to immediate response personnel and whether additional resources (e.g., emergency services, specialised equipment, or advice) are required to manage the spill safely.
- Determine the spill movement, including factors affecting the movement.
- Determine the spill response priorities as per **Table 7.10—1**.
- Evaluate the hazardousness of the material, including any potential risks associated with chemical mixing, such as oxidising and reducing agents.
- Determine the appropriate spill category and the type of response required as per **Section 7.14**.
- Determine the physical volume, state and location of the spill.

Table 7.10—1 Spill Response Priorities

Spill Priority	Response
People and Communities	• Muster and evacuate (if deemed necessary). • Account for all people and determine missing persons. • Stop unauthorised access. • Provide a technical resource to the Emergency Services (if required). • Protect the community (e.g., prevent incident escalation, increase community awareness).
Environment and Sacred Sites	• For emergencies that are safe to manage, on-site personnel will respond with available resources to limit the extent of the impact on the environment or a protected site. • For larger incidents or where it is unsafe for on-site personnel to respond, trained people will be mobilised to control and contain the emergency to minimise the impact on the environment or protected site.
Regulators	• Notify Regulators as per incident reporting requirements.
Assets	• Monitor automatic shutdown of the equipment or part thereof or initiate manual shutdowns where it is safe to do so. • Mobilise Emergency Services to intervene.
Reputation	• Notify neighbours (if required).

7.10.2 Spill Response Actions

Drilling and EPT contractors working under this EMP will develop generic spill containment clean-up procedures aligning with this plan's requirements. These guidelines shall be adapted (where appropriate) to consider the site and chemical-specific hazards associated with each spill event. The procedures shall consider the following generic spill containment and response items in their development:

- Move all people out of harm's way.
- Prevent people, livestock and wildlife from accessing hazardous material through fencing or other barriers.
- Alert others nearby.
- Assess the situation:
    - Determine what substances are involved. The substance must be known before taking any action (refer to SDS).
    - Assess the potential receptors (people and the environment) and if additional support is required.
- Where applicable, remove any possible risk-escalating factors (e.g., ignition hazards for inflammable/combustible spills).
- Approach from up-wind to reduce fume risks and isolate the spill source (close containment valve or similar).
- Ensure appropriate control requirements are met (e.g., PPE, first aid support) before conducting spill clean-up.
- If it is safe and possible to do so, stop the source of the leak and contain the spill using on-site equipment to prevent the spill from exiting the site boundary or entering a waterway or sensitive feature.
- Recover any free liquid and contaminated material as soon as practicable to mitigate infiltration.
- Store contaminated material in a manner to minimise the risk of additional contamination.
- For level 2 spills and higher, the Project Manager shall be notified as soon as it is safe to do so, but within 2 hours (spill levels are defined in **Section 7.14.1** of this document).
- The Project Manager is to ensure that appropriate external (DEPWS/DITT) incident reporting requirements are actioned per **Section 7.14.2** Incident Reporting of this document.
- For level 2 spills and higher, the Project Manager will seek expertise on whether additional testing and remediation are required upon completion of the initial containment and clean-up. This consideration will be undertaken following the *National Environment Protection Assessment of Site Contamination Measure* [ASC NEPM, 1999]. Spill levels are defined in **Section 7.14.1** of this document.

- Upon rectifying a reportable spill, an incident investigation shall be completed as per the *Petroleum (Environment) Regulations 2016*; this shall include the following:
    - An investigation into the incident.
    - Actions taken to mitigate the impact.
    - Ongoing monitoring and maintenance to ensure the site is stable and non-polluting.
    - Actions taken to prevent future similar incidents from occurring again.

7.10.3 Contaminated Material Disposal

Contaminated material disposal will consider the following principles while being completed:

- The storage of contaminated material must be undertaken in a manner that minimises additional contamination.
- Off-site disposal must be undertaken following the *NT Waste Management and Pollution Control Act 1998* [DEPWS, 1998].
- All listed waste transportation shall be undertaken by licenced contractors and be tracked and disposed of at approved waste management facilities.

7.11 Monitoring and Inspection

Monitoring measures used to manage risk during the proposed activities are presented in **Section 8.5.4** of the **EMP** (Monitoring) and include, but are not limited to, the following:

The frequency and method of spill monitoring:

- Monthly visual inspections of chemicals, fluids, fuel, or additives storage locations when stored on site.
- Weekly visual inspections of secondary containment, when in use, during the dry season (Section A.3.8 (i) of *the Code*).
- Daily visual inspections of secondary containment, when in use, during the wet season for damage, spills or water for management (Section A.3.8 (i) of *the Code*).

The purpose of spill monitoring:

- To identify spills/leaks and respond) to prevent environmental harm (see **Section 7.10.2**).
- All spills and leaks are to be responded to and cleaned up. See **Section 7.14** for Spill Reporting requirements.

Note: if secondary containment is found to be damaged, it must be repaired as soon as practicable.

The minimum volume of a leak that would be identified:

- Chemicals and additives (visual: ~10 Litres).
- Fluids/fuel (vidual: ~10 Litres).
- Drilling fluids stored in sumps (visual: ~5,000-10,000 Litres; remote ~5,000-10,000 Litres).
- Produced fluids stored in tanks (visual: ~5,000-10,000 Litres; remote ~10-100 Litres).

7.12 Roles and Responsibilities

The roles and responsibilities set out below are specific for the people responsible for managing and leading spill responses.

Site Supervisor

- Initial spill response.
- Liaise with contractors in charge of the work program to initiate spill assessment.
- Engage emergency services (if required). Coordinate immediate spill clean-up operations. Notify the project manager.

Project Manager

- Implementation of the Spill Management Plan.
- Coordinate remediation and rehabilitation requirements.
- Assess the reportability of spills.
- Interface with government and regulatory bodies for communication and consents.

Emergency Team

- Provide Emergency Response support for spill management activities.

Other (including contractors)

- All personnel, including contractors engaged to perform project activities, must comply with the Spill Management Plan and *the Code* [DEPWS et al., 2019].

7.13 Implementation

All personnel, including contractors engaged to perform project activities, must comply with this Spill Management Plan and *the Code*.

7.14 Spill Reporting

7.14.1 Spill Rating

Table 7.14—1 summarises the spill classification based on the volume and location of the spill.

The potential spill hazards to people and the environment will be assessed to ensure incident-specific hazards and risks are considered in the spill response. This table is a guide to the categorisation of potential spill scenarios. Different spill levels may trigger alternative incident reporting requirements. When classifying spills and determining the reporting requirements, Ministerial conditions, environmental outcomes, and performance standards criteria should also be considered when determining whether the event is a recordable or reportable event.

The Spill Levels are:

- **Level 1:** Spills that can be contained within a specific site and cleaned up by the operator without external resources. Spills on this level are likely to be less than 200L, require less than one day of cleaning time and are considered a non-recordable incident under the Petroleum (Environment) Regulations.
    - Spills that fall into the 'Not recordable' classification will be recorded in Peak Helium's incidents management system.
- **Level 2:** Spills that require additional resources to clean up or have not been completely contained within the site boundary. Spills on this level are classified as recordable incidents under the *Petroleum (Environment) Regulations* [NT GOVERNMENT, 2016]. They will be reported through a recordable incident report notification to DEPWS and potentially under the *Waste Management and Pollution Control Act* (WMPCA) [DEPWS, 1998] pending the incident investigation.
- **Level 3:** Substantial additional resources are required to manage this spill. In general, it involves more than a week of clean-up and is classified as a reportable incident under the Petroleum (Environment) Regulations.
    - Spills on this Level are reportable incidents and may require notification under the WMPCA.

Table 7.14—1 Spill Assessment Reporting

Description of Receiving Environment	Spill (L)		
	20-200L	200-2,500L	>2,500L
Bund or contained within an impervious area.	Not Recordable	Not Recordable	Not Recordable
On-site (lease pad, camp pad, hardstand, road or work area) compacted or sealed surface.	Level 1	Level 1	Level 2
Off-site permeable surfaces – areas adjacent to lease pads, camp pads, and roads where spills have moved beyond the approved activity area.	Level 1 / Level 2	Level 2	Level 3
Sensitive environmental and cultural features such as waterways, drainage lines, wetlands, highly-valued habitats, sacred sites, or where the spill has or has the potential to cause material or serious environmental harm.	Level 2	Level 2	Level 3

Spills of Dangerous goods or wastes off-site may need to be reported under the *NT Dangerous Goods Act* [DEPARTMENT OF THE ATTORNEY-GENERAL AND JUSTICE, 1998] or the *Waste Management and Pollution Control Act* 1998 [DEPWS, 1998].

7.14.2 Incident Reporting

Incidents may require reporting under *the Petroleum (Environment) Regulations* and the *Waste Management and Pollution Control Act* [DEPWS, 1998; NT GOVERNMENT, 2016].

7.14.2.1 Petroleum (Environment) Act Incident Reporting

7.14.2.1.1 Reportable Environmental Incident Reporting

The Petroleum (Environment) Regulations define a reportable incident as an incident arising from a regulated activity that has caused or has the potential to cause material environmental harm or serious environmental harm as defined under the Petroleum Act.

An interest holder must notify (this may be verbally or in writing) DEPWS of a reportable incident as soon as practicable but no later than two hours after the first occurrence of the incident or after the time the interest holder becomes aware of the incident.

DEPWS can be notified through the DEPWS onshore gas non-compliance hotline on 1800 413 567.

A written report within three days must follow up any verbal report to DEPWS following the *Petroleum (Environment) Regulations 2016*.

7.14.2.1.2 Recordable Incidents

The *Petroleum (Environment) Regulations 2016* define a recordable incident as 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.
- Has resulted in a contravention of an environmental performance standard specified in the current plan for the activity.
- Is inconsistent with an environmental outcome specified in the current plan for the activity.
- Is not a reportable incident.

These types of spills are typically a level 2 type spill as defined in **Table 7.14—1**.

An interest holder must notify (this may be oral or in writing) DITT of a recordable incident as soon as practicable but no later than 15 days after the reporting period (agreed period or every 90 days after the day on which the EMP is approved).

7.14.2.2 Waste Management and Pollution Control Act Incident Reporting (WMPC Act)

Following the WMPC Act, where contaminants or waste are not confined within the land on which the petroleum activities are undertaken (i.e., the approved disturbance areas where the petroleum activity is occurring), Peak Helium will notify the EPA of any incident causing or threatening to cause pollution as soon as practicable hours after becoming aware of the incident.

7.14.2.2.1 Notifiable Incidents

Under the WMPC Act, a notifiable incident is defined as an incident that causes, threatens, or may threaten to cause, pollution resulting in material environmental harm or serious environmental harm. The notification must include the following details:

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

The notification shall be made to the NT EPA Pollution Hotline 1800 064 567 as soon as practicable but no later than 24 hours after the first occurrence of the incident or after the time the interest holder becomes aware of the incident.

7.14.3 Communication

Spill prevention and monitoring strategies will be communicated to personnel via:

- Site inductions.
- Safety Meetings.
- Toolbox Talks.
- Daily Meetings.

7.15 Chemical Tables

Drilling and completions fluids are selected and used in accordance with their designed function, the manufacturer's recommendations, and relevant Safety Data Sheets (SDS). Drilling fluid requirements are covered in the WOMP. The WOMP will be compiled by Peak Helium and accepted DITT before the regulated activities under this EMP are carried out. Peak Helium will notify DEPWS when DITT accepts the WOMP.

The below table provides an indicative list of additives that may be used on the wells being drilled under this EMP to enable an assessment of what chemicals may be hazardous or have the potential to cause environmental harm. The hazardous chemical analysis was conducted by reviewing representative SDS for chemical additives within a primary function/description category. If a functional group contains additives that were deemed hazardous, then the environmental/disposal considerations were added along with the recommended handling and storage considerations (in addition to the requirement for secondary containment) to enable safe use on site.

It is to be noted that the below list is not a complete list of what may be used on the well. However, all additives used on a well will not contain BTEX, and will be used in accordance with the manufacturer's recommendations and in accordance with the SDS, and the names and volumes will be recorded.

7.15.1 Indicative Drilling and Completion Fluid Additives

Drilling and completions additives to achieve the described function, will change based on the supplier of the additives.

Table 7.15—1 Indicative Drilling and Completion Fluid Additives and their Potential to be Hazardous

Primary Function (Group) Description	Description	Example Additives Names	Hazardous Y/N	Typical Environmental/Disposal Considerations (If Hazardous)	Recommended Handling and Storage Considerations (If Hazardous)
Alkalinity pH Control	pH Buffering Agent	• Lime	**Y**	• Prevent product from entering drains and waterways. • Contain spillage, then collect and place in suitable containers for reuse or disposal. • Avoid generating dust.	• Store in a cool, dry, well-ventilated area, removed from incompatible substances • Incompatible (violently) with acids (e.g., nitric acid), maleic anhydride, nitroethane, nitromethane, nitroparaffins, nitropropane and phosphorus.
		• Caustic Soda	**Y**	• Dispose of contents in accordance with local, regional, national, and international regulations. • Contact with water causes violent frothing and spattering.	• Store in a well-ventilated area. • Keep the storage container tightly closed. • Reacts with metals (aluminium, tin, and zinc to generate flammable and explosive hydrogen gas).
		• Citric Acid	**Y**	• Do not let the product enter drains. • For containment, if contaminated with other materials, collect as any solid in suitable containers. • For cleaning up, recover the product by vacuuming, shovelling, or sweeping, and place it in an appropriate container to be disposed of at an appropriate disposal facility.	• When heated, the material emits irritating fumes • Store tightly closed in a dry, cool, and well-ventilated place. • Protect from moisture. • Incompatible materials (Alkalis and caustic products).
		• Magnesium Oxide	**N**	-	-
Bacteriacides	Biocide	• Glut 9 • THPS20	**Y**	• Disposal: For lesser amounts, absorb with sand, vermiculite or similar and dispose of at an approved landfill site. For larger amounts, contact the manufacturer for additional information. • Prevent contamination of drains or waterways.	• Store in a cool, dry, well-ventilated area, removed from incompatible substances, heat or ignition sources and foodstuffs. • Incompatible with oxidising agents (e.g., hypochlorites) and acids (e.g., nitric acid).
Calcium Carbonate	Sodium Bicarbonate	• Soda Ash	**N**	-	-
	Potassium Carbonate	• Potassium Carbonate Anhydrous	**Y**	• Prevent from entering drains, ditches, rivers or the sea. • For clean-up, sweep up (avoid generating dust) and remove to a suitable, clearly labelled container for disposal in accordance with local regulations.	• Store in a cool, dry place. Keep containers always closed. Store at room temperature (15 - 25 °C). Keep away from direct sunlight • Use only outdoors or in a well-ventilated area. Should avoid moisture. • The constituents may react with aluminium, alkaline earth metals in powder form, non-metals (heat), carbon/heat, fluorine, alkali metals, non-metallic oxides (heat), organic nitro compounds, halogenated hydrocarbons, acids, concentrated sulfuric acid, strong oxidising agents.
Corrosion Inhibitor	Phosponate corrosion inhibitor with O_2 scavenger	• Ancor 1, Cl 100, Cl1000	**Y**	• Avoid discharge into drains/sewers or waterways. • May form explosive dust air mixtures. • For cleaning up, recover the product by absorbing it with sand, shovelling, or sweeping. Use of water wash down after spill clean is not recommended.	• Store in a cool, dry place. • It is stable under normal storage conditions in a steel drums/barrels. • Not compatible with strong oxidising and reducing agents.

	Catalyzed Amonium Bisulfate, Oxygen Scavenger OS-I	• Safe Scav*Na, Sodium Sulphite	**Y**	• Do not allow the product to enter drains, sewers, or watercourses. • For cleaning up, absorb the spillage with suitable absorbent material. Shovel into dry containers. Flush the area with water.	• Store in a cool and well-ventilated place. Store in closed original container at temperatures between 5°C and 30°C. • Slowly releases sulphur dioxide when in contact with air. Ventilate well.
	Zinc Oxide	• H2s Scavenger	**Y**	• Marine Pollutant. • Prevent product from entering drains and waterways.	• Store in a cool, dry, well-ventilated area, removed from incompatible substances. • Incompatible with metals if heated and with acids (e.g., nitric acid).
Defoamer	Drilling Defoaming Agent	• COHO Defoam X, Anti-Foam XLRT	**Y**	• Prevent product from entering drains and waterways. • For cleaning up, contain spillage, then cover/absorb spill with non-combustible absorbent material (vermiculite, sand, or similar).	• Store in a cool, dry, well-ventilated area. • Store below 30°C. Do not freeze. • Incompatible with oxidising agents (e.g., hypochlorites) and acids (e.g., nitric acid).
Filtrate Reducers	Fluid Loss Reducer	• Flo-trol	**N**	-	-
	High-Temperature Viscosifier and Filtrate Reducer	• Driscal D	**N**	-	-
Foaming Agents	Drilling Foaming Agent	• Drillfoam	**N**	-	-
Lost Circulation Material	Organic LCM used to prevent and cure fluid losses Cellulose Fibre	• Fiber C,M,F	**N**	-	-
		• Quickseal C, M, F	**N**	-	-
Lubricants	Spotting Agent	• Pipefree	**N**	-	-
	Extreme Pressure Lubricant	• NXS-Lube, Interflon EP	**N**	-	-
Polymer Stabiliser	HT Polymer Stabiliser	• TEA	**N**	-	-
Shale Control Inhibitors	Calcium Chloride	• Calcium Chloride	**Y**	• Do not let the product reach drains or waterways. • Dispose of in accordance with all local, state and federal regulations.	• Store in a cool, dry, well-ventilated area. Keep containers tightly closed when not in use. • Store in the original packaging as approved by the manufacturer. • Reacts with acids. Reacts with strong bases.
	Encapsulating Agent	• PHPA	**N**	-	-
	Drilling Fluid Additive	• PAC LV	**N**	-	-
		• Sodium Polyacrylate	**N**	-	-
Surface Active Agent	Specialised Well-displacement Surfactant	• Deepclean	**Y**	• Contains butyl glycol – Hazardous. • Do not allow to enter drains, sewers, or watercourses. • Spill clean-up: Dike far ahead of larger spills for later disposal. Absorb spillage with suitable absorbent material. Shovel into dry containers. Flush the area with water.	• Materials to avoid are strong oxidising substances, strong reducing agents, strong acids, and strong alkalis. • Store in tightly closed original container in a dry, cool and well-ventilated place. Keep away from heat, sparks, and open flame. • Harmful if inhaled.

Thinners	Dispersant	• Drill Thin • SAPP (Sodium Acid Pyrophosphate)	**Y**	• Very toxic to aquatic life with long-lasting effects. • Prevent product from entering drains. Prevent further leakage or spillage if safe to do so. • For cleaning up, contain and sweep/shovel up spills with dust binding material or use an industrial vacuum cleaner. Transfer to a suitable, labelled container and dispose of it promptly as it is hazardous waste.	• Avoid the formation of respirable particles. • Avoid exposure. • Obtain special instructions before use. • Keep container tightly closed in a dry and well-ventilated place. • Prevent the formation of dust. • Avoid strong oxidising agents, and store in the original packaging as approved by the manufacturer.
		• Thinsperse	**N**	-	-
Viscosifier	Polyanionic Cellulose	• Strata Vanguard, Frac Attack, Squeeze N Lock	**N**	-	-
	Thickening Agent	• Xanthan Gum	**N**	-	-
	Thickener in lubricating greases	• Bentonite 13A	**Y**	• Prevent this material from entering waterways, drains and sewers.	• Use in a well-ventilated area. Keep containers sealed when not in use. • Prevent the buildup of dust in the work atmosphere. • Do not breathe dust/fume/gas/mist/vapours/spray. P281 Use personal protective equipment as required. • May cause cancer by inhalation. • May cause damage to organs through prolonged or repeated exposure by inhalation.
Weighting Agent	NaCl	• Salt	**N**	-	-
	Processed Barites	• Barite, Barium Sulphate, Baryte	**N**	-	-
	Sized Calcium Carbonate	• Calcium Carbonate	**N**	-	-

As per Clause B.4.10.2(a) of *the Code*, additives must be selected and managed to ensure they are used in accordance with the manufacturer's recommendations and relevant safety data sheets (SDS).

7.15.2 Indicative Cementing Additives

Table 7.15—2 Indicative Cementing Additives

Primary Function/Description	Chemical Code	Hazardous	Environmental Considerations (If Hazardous)	Handling and Storage Considerations (If Hazardous)
Antifoam Agent	D175A, D047	N	-	-
Bentonite Extender	D20	N	-	-
Calcium Chloride	S001	N	-	-
Cement Retarder	D110	N	-	-
Silica	D066	N	-	-
Calcium Chloride	S001	N	-	-
Uniflac-S	D167A	N	-	-
Low-Temperature Liquid Dispersant	D145A	N	-	-
Uniflac-S D67A	D167	N	-	-
Liquid Retarder, Low Temperature	D081	N	-	-
Low temp Solid Dispersant	D202	N	-	-
Uniflac-L D168	D168	N	-	-
MUDPUSH* II Spacer D182	D182	N	-	-
Retarder	D013	N	-	-
Mid-Range FLAC D255	D255	N	-	-
TIC Dispersant	D065	N	-	-
Uniflac-L D168	D168	N	-	-
Liquid Retarder	D081	N	-	-
Weighting Agent **Barite D31 4.1**	D031	N	-	-

Note: Schlumberger product names are listed here. Halliburton and other cementing service company blends are very similar, but they use their labelling for the same products. The list above gives a good indication of what could be added.

7.16 References

DEPWS. (1998). *Waste Management and Pollution Control Act 1998*. Department of Environment, Parks and Water Security.

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ASC NEPM. (1999). *National Environment Protection (Assessment of Site Contamination) Measure*. National Environment Protection Council.

8 Appendix 08 – Fire Management Plan

PEAK HELIUM

Peak Helium Pty Ltd

EMP PKH2-3

NT Exploration Permit (EP) 134

Appendix 08

Fire Management Plan

Rev	Description	Date	Initiated	Reviewed	Approved
0	Issued for Submission	18/07/2022	Trent Smith	Katie Robertson Vicky Cartwright	Jon Bennett
1	Issued for Re-Submission	19/08/2022	Trent Smith	Katie Robertson Vicky Cartwright	Jon Bennett
2	Issued for Re-Submission	16/01/2023	Katie Robertson	Nick Fraser	Trent Smith
3	Issued for Re-Submission	01/02/2023	-	-	Trent Smith

Prepared For Peak Helium Pty Ltd

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INGAUGE
Well Engineering & Project Management

8 Fire Management Plan

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8.1 Introduction

This Fire Management Plan outlines the fire risk and management strategies for the regulated activities associated with Peak Helium EP 134 located within the Alice Springs Fire Management Zone.

8.2 Analysis of Baseline Information

Baseline fire information has been sourced from *The North Australia and Rangelands Fire Information* (NAFI) website [NAFI, 2021] and assessed. NAFI is independent; funded by the Commonwealth of Australia through the Department of Industry, Science, Energy and Resources. It is managed through the Darwin Centre for Bushfire Research as a branch of the Charles Darwin University's Research Institute for the Environment and Livelihoods. The NAFI is the most reliable source of Northern Territory (NT) bushfire data. Data obtained through the NAFI website has been reviewed and analysed, and the results are presented below.

8.2.1 Fire Frequency

The Location of the Regulated Activities has been burnt between zero and three times between 2000 and 2021, as shown in **Figure 8.2—1**.

8.2.2 Last Burn

The Location of the Regulated Activities was last burnt between nine and 20 years ago, as shown in **Figure 8.2—2**.

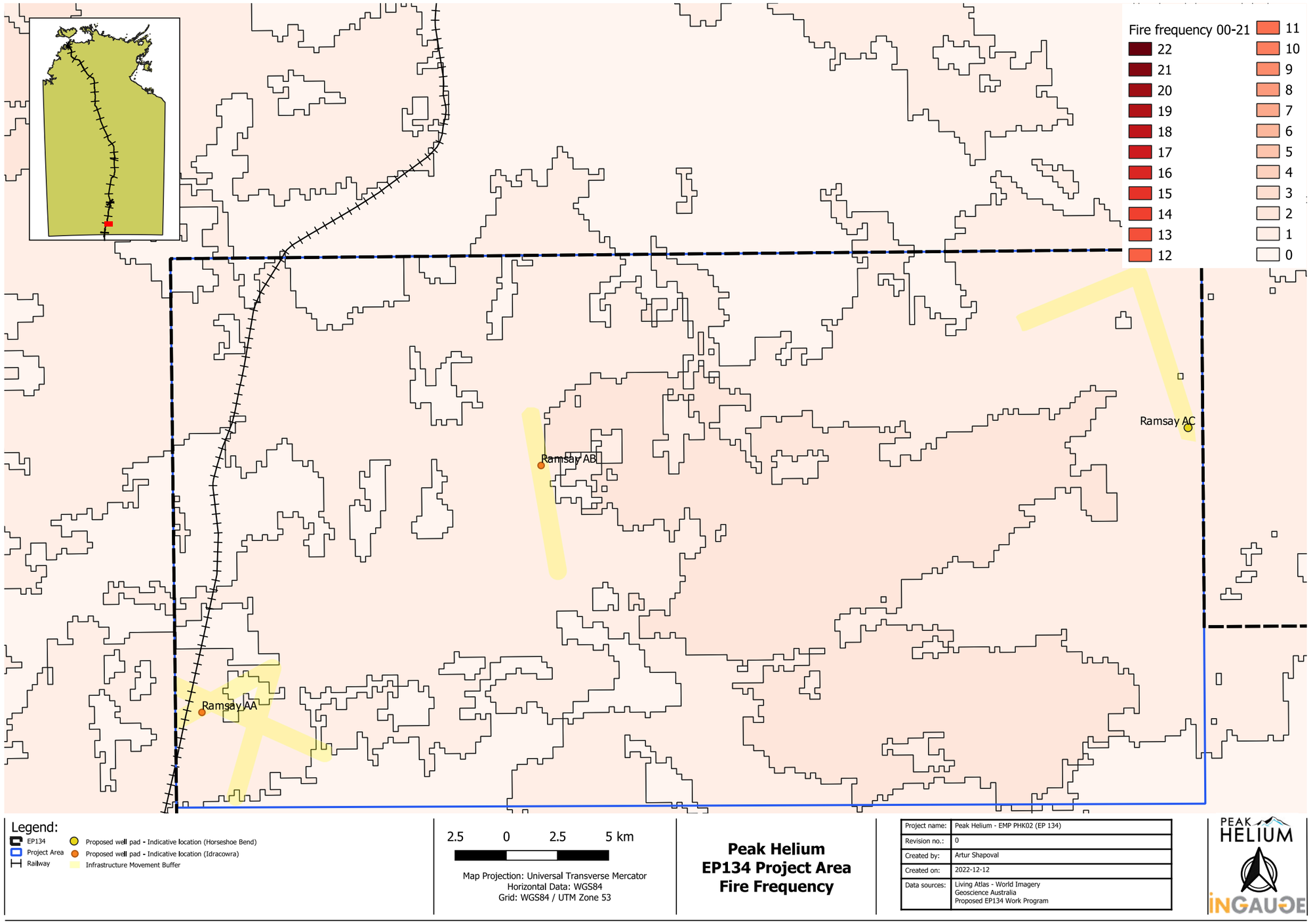


Figure 8.2—1 Long Term Fire Frequency

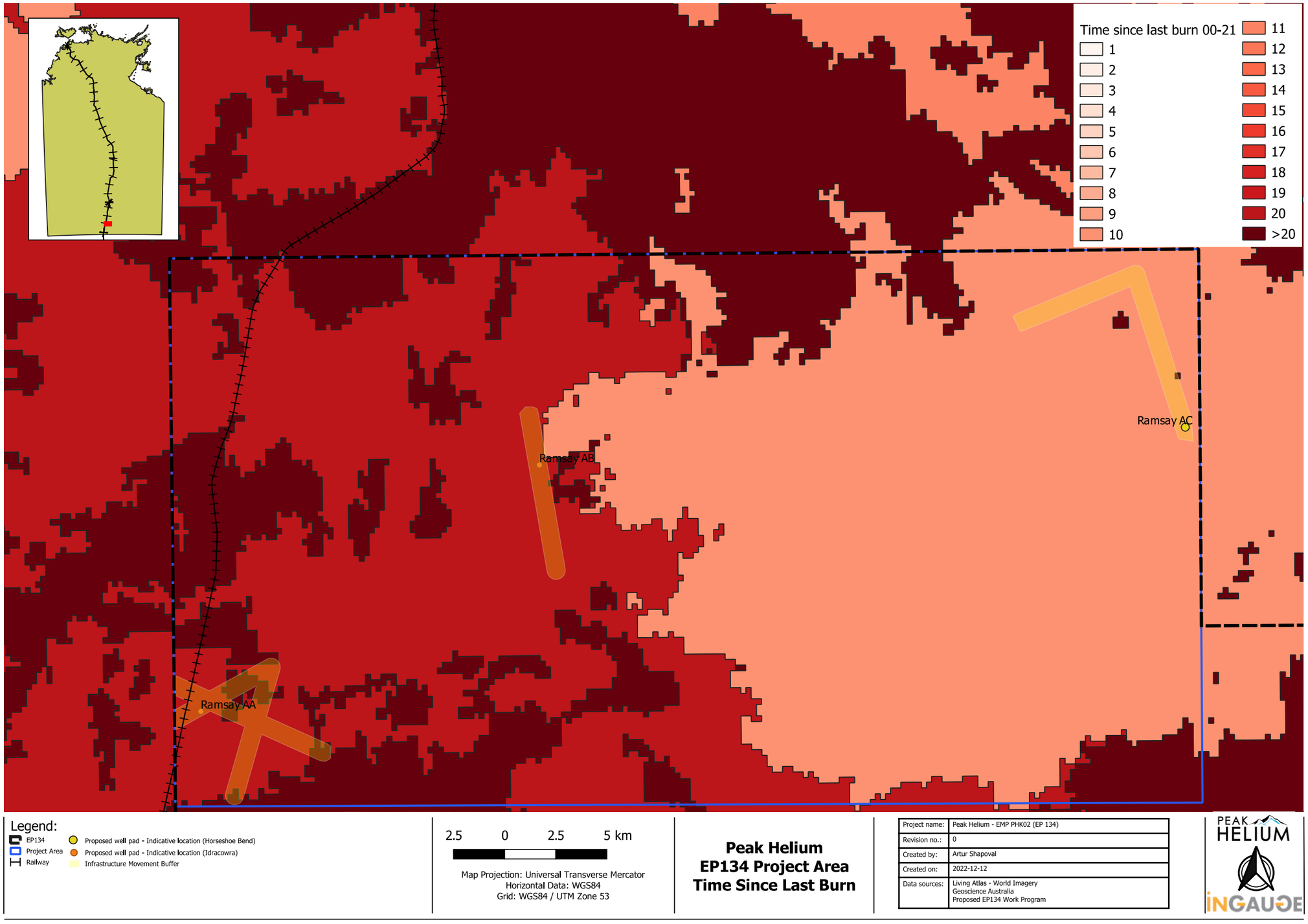


Figure 8.2—2 Time Since Last Burn

8.3 Impacts of the Proposed Activities on the Existing Fire Management

The Project Area lies within the Alice Springs Fire Management Zone in the Northern Territory. The Department of Environment and Natural Resources, *Alice Springs Bushfires Management Plan* (ASPBMP) has been developed in line with the *Bushfires Management Act*, to support community-wide fire management within the Alice Springs Fire Management Zone 2016 [DEPWS, 2016, 2018; NT GOVERNMENT, 2018].

EP134 is primarily pastoral lease. The fire management objectives are in place to support this land use. Appendix B of the ASPBMP summarises these [DEPWS, 2018].

Peak Helium proposes to use flares in its activities, except when there are fire bans in place. Peak Helium will apply for the relevant permits if necessary. Suggested well pad fire exclusion methods involve using reduced fuel load areas and fire access trails around well pads. Outside of the well pad, there will be no impact on fire management. This approach is consistent with the ASPBMP and the fire management objectives for petroleum exploration [DEPWS, 2018].

8.4 Coordination with the Landholder and other Land Users

Peak Helium has ensured that the project does not affect the Land Managers' fire management obligations and strategies, through the land use agreement process.

The proposed activities are expected to commence as per **Section 3.2** of the EMP.

8.4.1 Seasonal Conditions and Fire Load Assessment

Fire load assessment will be carried out at civil construction works and ongoing throughout site operations.

8.4.2 Fire Access Trails and Fire Breaks

Fire access trails and Fire breaks will be constructed around each well pad and campsite during civil construction works and maintained during operations as required.

8.4.3 Controlled Burns

There is currently no need for controlled burns for the works under these EMP. Appropriate discussions with landholders and the Alice Springs Fire Management Zone team at DEPWS will occur if conditions change.

8.4.4 Monitoring of Bushfire Alerts

Refer to the Monitoring and Tracking (**Section 7.5.2**) of the Environmental Management Plan for Monitoring of bushfire alerts. Refer also to Secure NT (Fire Bans) https: //securent.nt.gov.au/alerts.

8.4.5 Fire Control Measures

Peak Helium will have fire response equipment on-site during civil construction activities and establish and maintain fire breaks. All other activities will be carried out within the confines of the fire breaks and fire access trails.

8.4.6 Annual Fire Mapping

Annual fire mapping to monitor changes to fire frequency in the Project Area will be conducted.

8.5 Infrastructure Design, Construction, and Operation

The well pads are designed with a ring-fire access trail/fire break ~10m from the fence line. The area between the fire access trail and the fence line will have large vegetation removed to create a reduced fuel load area, to minimise the risk of causing a fire in the surrounding environment.

To reduce the risk of fire, all plant and equipment will be operated and maintained in line with manufacturers' requirements. Plant equipment includes spark arrestors on vehicles and diesel generators; manufacturer's maintenance requirements extend to implementing appropriate maintenance schedule.

The Extended Production Test Flare system will be installed and operated with a 20m fuel load exclusion zone.

8.6 Emergency Contacts

Table 8.6—1 Emergency Contact Details

Entity	Contact Details
Bushfire NT Head Office	0889220840 – 0889220844 **Bushfires.nt@nt.gov.au**
Bushfire NT Alice Springs	0889523066
National Response Centre	1800076251
Emergency	000 or 112 (mobile)
NAFI North	**http://www.firenorth.org.au/nafi3/**
Secure NT (Fire Bans)	**https://securent.nt.gov.au/alerts**
Fire Incident map	**https://pfes.nt.gov.au/incidentmap/**

8.7 Fire Management Plan

Peak Helium has created a one-page tailored fire management plan for each well pad and campsite activity.

8.7.1 Well Pad Ramsay AA Fire Management Plan

BUSHFIRE MANAGEMENT PLAN 2022

WELL PAD: RAMSAY AA EP134

Stakeholder	Contact Details	Name
Peak Helium Drilling Manager		
Alice Springs Fire Station	(08) 8951 8823	
EMERGENCY	000 or 112	
Bushfires NT Alice Springs	0400 761 255 or 0440 770 899	
Wildlife Information NAFI – North Australian Fire Information Secure NT (Fire Bans)	www.firenorth.org.au/ https://securent.gov.au/alerts	
DEPWS	(08) 8999 5511	
Land Managers		
Bushfire NT Head Office	(08) 8922 0844	
National Response Centre	1300 560 647	

Location of EP 134 Well Pad: Ramsay AA

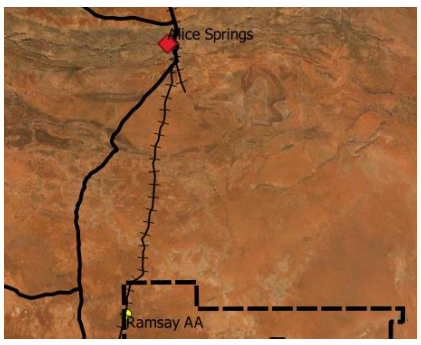


Figure 8.7—1 RAA Location of Well Pad

Property Land Uses:

- Helium exploration, cattle

Property Aim:

- Undertake the construction and drilling activities with minimal impact on primary uses.

Fire Management Objectives:

- Protect the well pads, campsite/s and associated infrastructure.
- Coordinate fire management actions with station landholder.
- Prevent any human-induced bushfire ignitions that cause loss of life, or property or environmental harm.
- Manage fuel loads to reduce the rate of spread and intensity of bushfires, while minimising pastoral or environmental/ecological impacts.

Preparedness Planning

Based on the Australian Fire Danger Rating System (AFDRS).

Moderate: Plan and prepare

- Stay up to date and be ready to act if there is a fire.

High: Be ready to act

- Be alert for fires in your area.
- Decide what you will do if a fire starts.
- If a fire starts your life and property may be at risk.
- Avoid bush fire risk areas.

Extreme: Take action now to protect your life and property

- These are dangerous fire conditions.
- Check your bush fire plan and that your property is ready fire ready.
- If a fire starts, take immediate action. If you and your property are not prepared to the highest level, go to a safer location well before the fire impacts.
- Reconsider travel through bush fire risk areas.

Catastrophic: For your survival leave bush fire risk areas

- These are the most dangerous conditions for a fire.
- Your life may depend on the decisions you make, even before there is a fire.
- Stay safe by going to a safer location early in the morning or the night before.
- Homes cannot withstand fires in these conditions. You may not be able to leave, and help may not be available.

EP134 Fire Management Zones

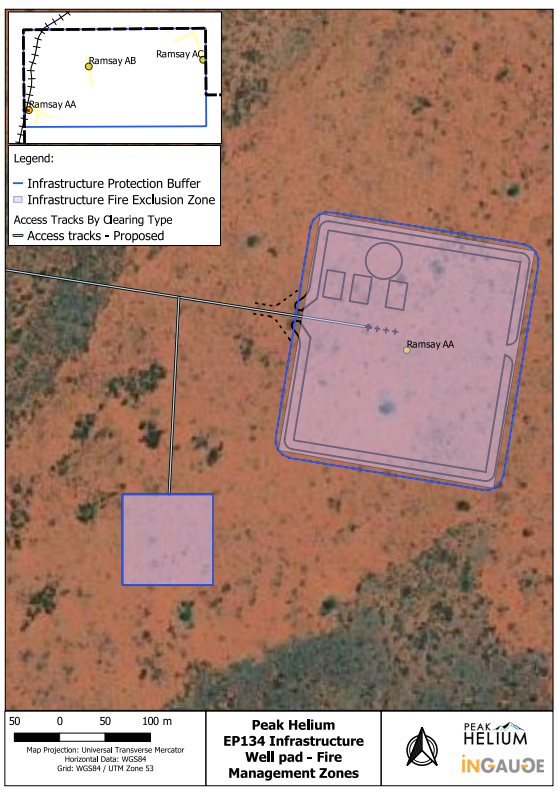


Figure 8.7—2 RAA Fire Management Zone

Fire Management Actions and Mitigation Measures

Infrastructure Protection Buffer	• Protect infrastructure by maintaining 10 metre bare earth buffer around well pads and campsite/s
Infrastructure Fire Exclusion	• Ensure all vehicles are fitted with fire extinguishers, and that all firefighting equipment and water supplies are checked regularly. • Ensure all staff/contractors are trained in operation of firefighting equipment and aware of this Plan • Site Supervisor to monitor NAFI regularly and liaise with Station manager if fire threatens infrastructure.
Fire Access Trails	• Co-locate fire access tracks with facility access tracks. • Monitor access roads for weeds, and spray, grade, or slash where appropriate.
Wildfire/Bushfire Response	• Wildfire is an uncontrolled fire in an area of combustible vegetation. • They are generally started by people or lightening. • Monitor NAFI, fire weather, and look for smoke. • Liaise with neighbour if fire nearby. • Prepare firefighting equipment. • Follow directions of Site Supervisor. • Call **000** if unable to control.

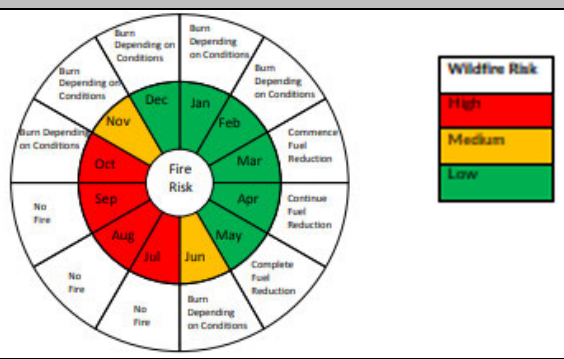
Bush Fire Responder Actions

Remove yourself and others from potentially dangerous situations. Raise the alarm with the Peak Helium Site Supervisor and Identify:

a. Location b. Immediate threats c. Fire characteristics (what is burning, direction and speed of travel) d. Weather – wind strength and direction.

- If possible, wait in a safe location for directions from the Site Supervisor, or the Pastoralist and communicate this fact.
- The Peak Helium Site Supervisor will escalate the emergency as per the Site Emergency Response Plan.

Annual Works Calendar



8.7.2 Well Pad Ramsay AB Fire Management Plan

BUSHFIRE MANAGEMENT PLAN 2022

WELL PAD: RAMSAY AB EP134

Stakeholder	Contact Details	Name
Peak Helium Drilling Manager		
Alice Springs Fire Station	(08) 8951 8823	
EMERGENCY	000 or 112	
Bushfires NT Alice Springs	0400 761 255 or 0440 770 899	
Wildlife Information NAFI – North Australian Fire Information Secure NT (Fire Bans)	www.firenorth.org.au/ https://securent.gov.au/alerts	
DEPWS	(08) 8999 5511	
Land Managers		
Bushfire NT Head Office	(08) 8922 0844	
National Response Centre	1300 560 647	

Location of EP 134 Well Pad: Ramsay AA

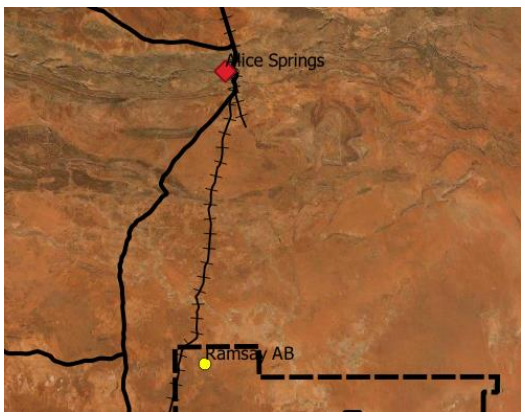


Figure 8.7—3 RAB Location of Well Pad

Property Land Uses:

- Helium exploration, cattle

Property Aim:

- Undertake the construction and drilling activities with minimal impact on primary uses.

Fire Management Objectives:

- Protect the well pads, campsite/s and associated infrastructure.
- Coordinate fire management actions with station landholder.
- Prevent any human-induced bushfire ignitions that cause loss of life, or property or environmental harm.
- Manage fuel loads to reduce the rate of spread and intensity of bushfires, while minimising pastoral or environmental/ecological impacts.

Preparedness Planning

Based on the Australian Fire Danger Rating System (AFDRS).

Moderate: Plan and prepare

- Stay up to date and be ready to act if there is a fire.

High: Be ready to act

- Be alert for fires in your area.
- Decide what you will do if a fire starts.
- If a fire starts your life and property may be at risk.
- Avoid bush fire risk areas.

Extreme: Take action now to protect your life and property

- These are dangerous fire conditions.
- Check your bush fire plan and that your property is ready fire ready.
- If a fire starts, take immediate action. If you and your property are not prepared to the highest level, go to a safer location well before the fire impacts.
- Reconsider travel through bush fire risk areas.

Catastrophic: For your survival leave bush fire risk areas

- These are the most dangerous conditions for a fire.
- Your life may depend on the decisions you make, even before there is a fire.
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- Homes cannot withstand fires in these conditions. You may not be able to leave, and help may not be available.

Ep134 Fire Management Zones

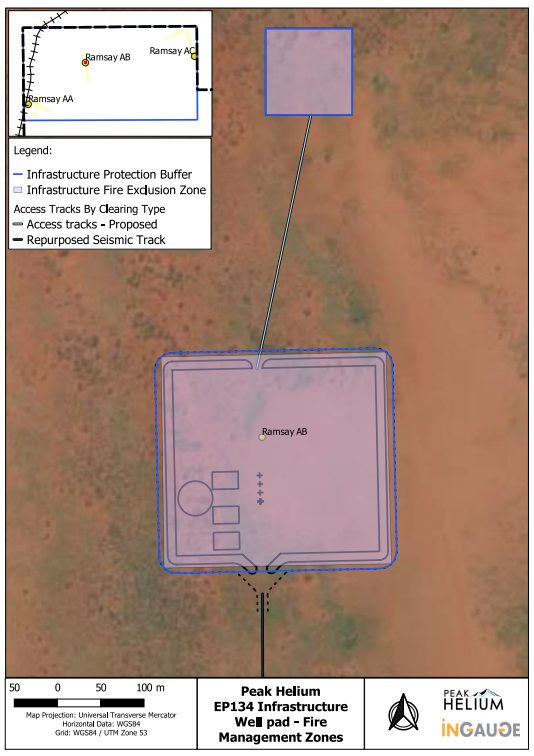


Figure 8.7—4 RAB Fire Management Zone

Fire Management Actions and Mitigation Measures

Infrastructure Protection Buffer	• Protect infrastructure by maintaining 10 metre bare earth buffer around well pads and campsite/s
Infrastructure Fire Exclusion	• Ensure all vehicles are fitted with fire extinguishers, and that all firefighting equipment and water supplies are checked regularly. • Ensure all staff / contractors are trained in operation of firefighting equipment and aware of this Plan • Site Supervisor to monitor NAFI regularly and liaise with Station manager if fire threatens infrastructure.
Fire Access Trails	• Co-locate fire access tracks with facility access tracks. • Monitor access roads for weeds, and spray, grade, or slash where appropriate.
Wildfire/Bushfire Response	• Wildfire is an uncontrolled fire in an area of combustible vegetation. • They are generally started by people or lightening. • Monitor NAFI, fire weather, and look for smoke. • Liaise with neighbour if fire nearby. • Prepare firefighting equipment. • Follow directions of Site Supervisor. • Call ooo if unable to control.

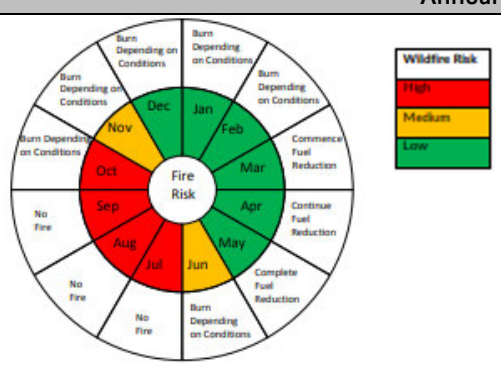
Bush Fire Responder Actions

Remove yourself and others from potentially dangerous situations. Raise the alarm with the Peak Helium Site Supervisor and Identify:

a. Location b. Immediate threats c. Fire characteristics (what is burning, direction and speed of travel) d. Weather – wind strength and direction.

- If possible, wait in a safe location for directions from the Site Supervisor, or the Pastoralist and communicate this fact.
- The Peak Helium Site Supervisor will escalate the emergency as per the Site Emergency Response Plan.

Annual Works Calendar



8.7.3 Well Pad Ramsay AC Fire Management Plan

BUSHFIRE MANAGEMENT PLAN 2022

WELL PAD: RAMSAY AC EP134

Stakeholder	Contact Details	Name
Peak Helium Drilling Manager		
Alice Springs Fire Station	(08) 8951 8823	
EMERGENCY	000 or 112	
Bushfires NT Alice Springs	0400 761 255 or 0440 770 899	
Wildlife Information NAFI – North Australian Fire Information Secure NT (Fire Bans)	www.firenorth.org.au/ https://securent.gov.au/alerts	
DEPWS	(08) 8999 5511	
Land Managers		
Bushfire NT Head Office	(08) 8922 0844	
National Response Centre	1300 560 647	

Location of EP 134 Well Pad: Ramsay AA

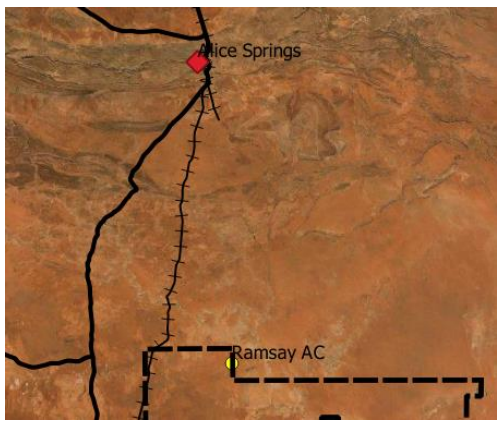


Figure 8.7—5 RAC Location of Well Pad

Property Land Uses:

- Helium exploration, cattle

Property Aim:

- Undertake the construction and drilling activities with minimal impact on primary uses.

Fire Management Objectives:

- Protect the well pads, campsite/s and associated infrastructure.
- Coordinate fire management actions with station landholder.
- Prevent any human-induced bushfire ignitions that cause loss of life, or property or environmental harm.
- Manage fuel loads to reduce the rate of spread and intensity of bushfires, while minimising pastoral or environmental/ecological impacts.

Preparedness Planning

Based on the Australian Fire Danger Rating System (AFDRS).

Moderate: Plan and prepare

- Stay up to date and be ready to act if there is a fire.

High: Be ready to act

- Be alert for fires in your area.
- Decide what you will do if a fire starts.
- If a fire starts your life and property may be at risk.
- Avoid bush fire risk areas.

Extreme: Take action now to protect your life and property

- These are dangerous fire conditions.
- Check your bush fire plan and that your property is ready fire ready.
- If a fire starts, take immediate action. If you and your property are not prepared to the highest level, go to a safer location well before the fire impacts.
- Reconsider travel through bush fire risk areas.

Catastrophic: For your survival leave bush fire risk areas

- These are the most dangerous conditions for a fire.
- Your life may depend on the decisions you make, even before there is a fire.
- Stay safe by going to a safer location early in the morning or the night before.

Homes cannot withstand fires in these conditions. You may not be able to leave, and help may not be available.

Ep134 Fire Management Zones

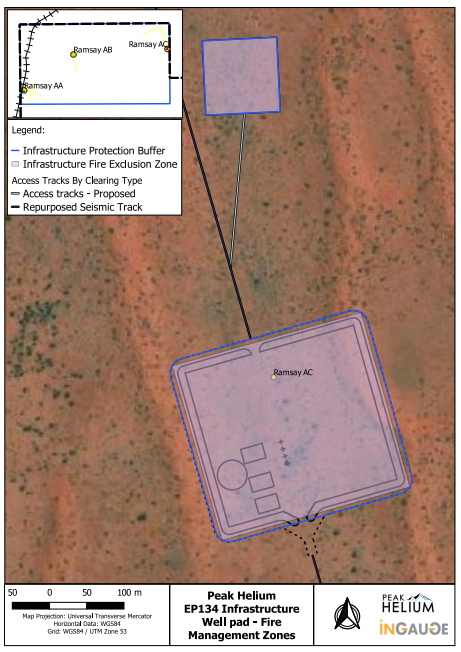


Figure 8.7—6 RAC Fire Management Zone

Fire Management Actions and Mitigation Measures

Infrastructure Protection Buffer	• Protect infrastructure by maintaining 10 metre bare earth buffer around well pads and campsite/s
Infrastructure Fire Exclusion	• Ensure all vehicles are fitted with fire extinguishers, and that all firefighting equipment and water supplies are checked regularly. • Ensure all staff / contractors are trained in operation of firefighting equipment and aware of this Plan • Site Supervisor to monitor NAFI regularly and liaise with Station manager if fire threatens infrastructure.
Fire Access Trails	• Co-locate fire access tracks with facility access tracks. • Monitor access roads for weeds, and spray, grade, or slash where appropriate.
Wildfire/Bushfire Response	• Wildfire is an uncontrolled fire in an area of combustible vegetation. • They are generally started by people or lightening. • Monitor NAFI, fire weather, and look for smoke. • Liaise with neighbour if fire nearby. • Prepare firefighting equipment. • Follow directions of Site Supervisor. • Call ooo if unable to control.

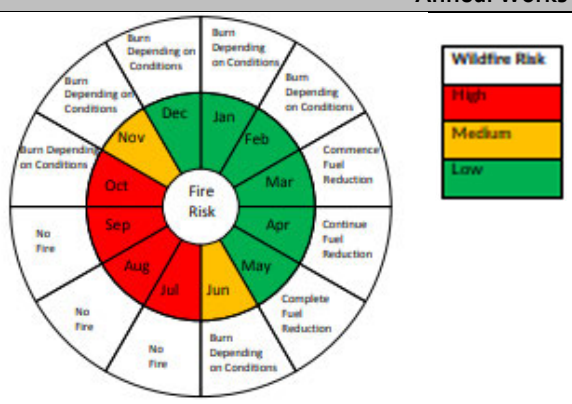
Bush Fire Responder Actions

Remove yourself and others from potentially dangerous situations. Raise the alarm with the Peak Helium Site Supervisor and Identify:

a. Location b. Immediate threats c. Fire characteristics (what is burning, direction and speed of travel) d. Weather – wind strength and direction.

- If possible, wait in a safe location for directions from the Site Supervisor, or the Pastoralist and communicate this fact.
- The Peak Helium Site Supervisor will escalate the emergency as per the Site Emergency Response Plan.

Annual Works Calendar



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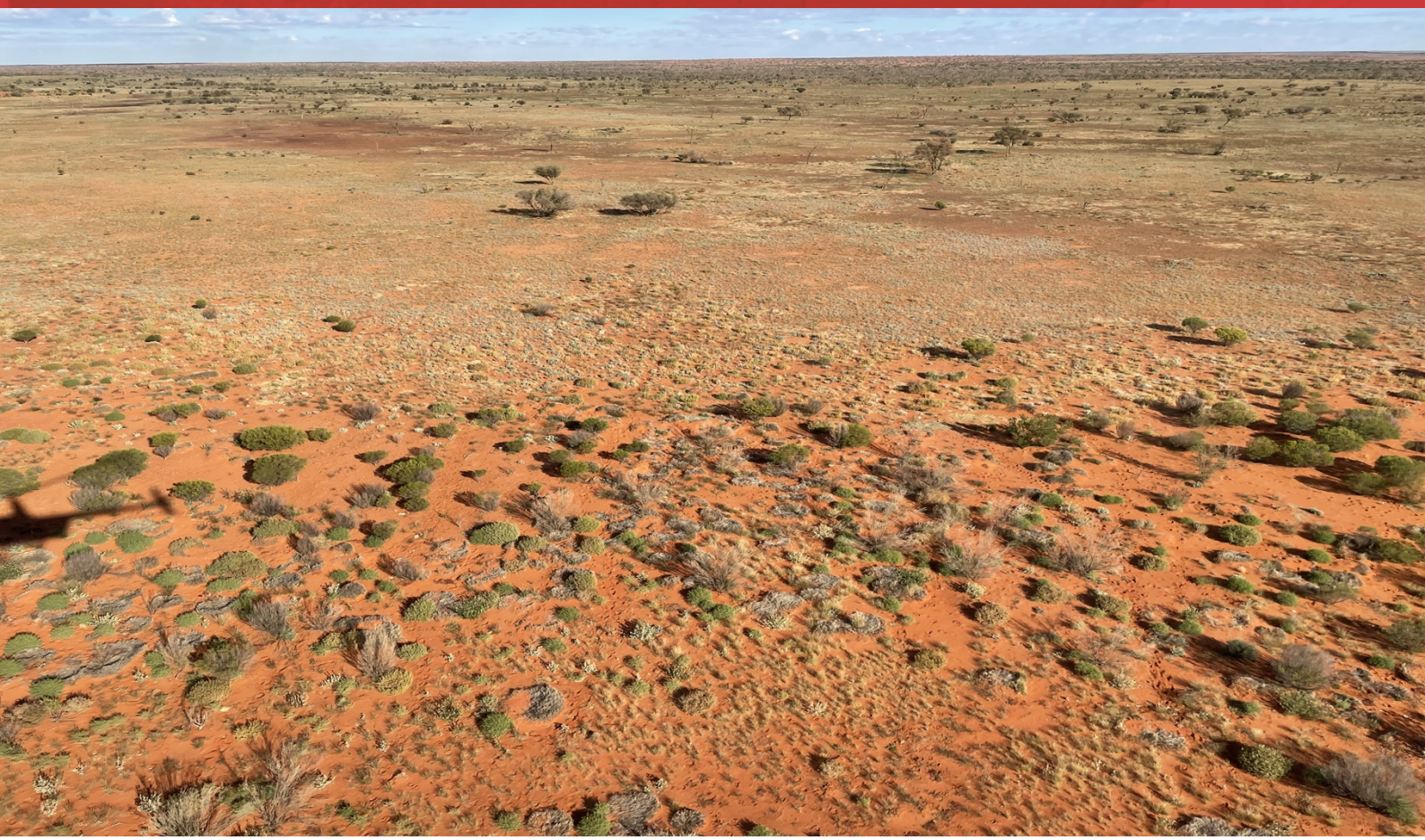
9 Appendix 09 – Weed Management Plan

Weed Management Plan
EP 134 Seismic Survey 2021

PEAK HELIUM



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RELIANCE, USES and LIMITATIONS

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1 INTRODUCTION

Peak Helium is a leading helium explorer in Australia, with a focus on exploring and developing its highly prospective Amadeus Basin pure helium permit. Peak Helium operates exploration permit (EP) 134 (project area), located over pastoral leases, approximately 275 km South of Alice Springs in the Northern Territory (NT). The southern boundary of EP 134 borders on the NT/ South Australia (SA) border.

In 2021, Peak established approximately 120 km of seismic lines under the approved EMP – 2021 Seismic Exploration Environmental Management Plan EP134 dated December 6 2021 (PRK1-6). Peak Helium now plan to undertake drilling of four wells on three well pads between September 2022 and September 2023. These works will be regulated through an Environmental Management Plan (EMP) approved by DEPWS. EcOz were engaged to prepare this Weed Management Plan, which is required under the Petroleum (Environment) Regulations (the Regulations).

1.1 Scope and objectives

The scope of this weed management plan is to outline the weed management measures that will be implemented to prevent the introduction and spread of weeds during the works associated with the project.

The objectives of this weed management plan are to:

- Comply with all applicable legislation, regulations, conditions and regional weed management plans.
- Address the specific weed management requirements of station owners.
- Provide controls for all project activities to avoid introducing new weed species into the project area.
- Avoid or control the spread of existing weed species into new areas within the project area.
- Detail the monitoring, reporting and incident response procedures appropriate for the management measures.

The weed management plan is applicable to all activities associated with drilling activities on EP 134 and will be used by all personnel (including contractors) involved in project activities.

1.2 Dedicated weed officer

The *Scientific Inquiry into Hydraulic Fracturing* recommended a dedicated weed officer for each gas field. To ensure necessary weed management outcomes, the weed officer must have relevant skills and experience and availability to successfully manage weed related issues for the project. Contact details for Peak Helium's' weed officer for the project are:

Jed Farley inGuage OCR	Mobile: 0459 165 778 Email: Jed.farley@ingauge.com.au

2 PROJECT AREA

2.1 Project components

Key components associated with the project are described below and shown in Figure 2-1. The 'project area' refers to the physical footprint of the proposed activities.

2.1.1 Drilling of wells

Peak Helium propose to drill three wells. Well pads will be approximately 300 m x 300 m. Exact locations for these well pads have not yet determined. Instead, an indicative corridor has been identified, and environmental constraints have been identified to inform planning and mitigate impacts to environment and archaeology. The indicative corridors are centred on the seismic lines, and a buffer of 500 m either side, totalling a 1000 m wide corridor.

The well pads will be located within the proposed indicative corridors (Subject areas A, B and C), as shown in Figure 2-1. To undertake these works the following key activities are required:

- Vegetation clearing
- Grading, excavation, stockpiling, compaction of soil material
- Re-spreading of any removed vegetation on the well pads following completion of the program, to promote regeneration
- Upon completion, removal of all surface infrastructure and rehabilitation.

2.1.2 Borrow pits

Peak Helium propose to construct four gravel pits. These borrow pits will be approximately 116 m x 100 m and three of the gravel pits will be located within indicative corridors, as shown in Figure 2-1. Borrow pit 2 will be located within the previous seismic line corridor works area as shown in Figure 2-1. Borrow pits will have material excavated from the pits for use within the project areas. On completion of the drilling works, borrow pits will be re-formed into a stable surface that blends into the natural surrounding environments. Any removed vegetation and topsoil will be re spread over the area to promote regeneration of the area.

2.1.3 Access tracks

The main access tracks are existing (either station tracks or seismic lines). The creation of some small access tracks will be required within the corridor area to access the borrow pits (Figure 2-1), but the seismic line will provide suitable access to well pads and camps.

General maintenance of tracks may be required during and following project activities, undertaken in agreement with Station owner. This may include grading, patching and watering.

To minimise damage to access tracks works will cease if there is a forecast for 50 mm of rain or more within the next 48 hours.

2.1.4 Campsites

There will be three campsites constructed as part of the drilling works. Campsites will be established at each of the drill sites. Campsites will be approximately 100 m x 100 m and will be located nearby the well pads, within the proposed indicative corridors, as shown in Figure 2-1. Campsites will be established in areas where minimal clearing is required.

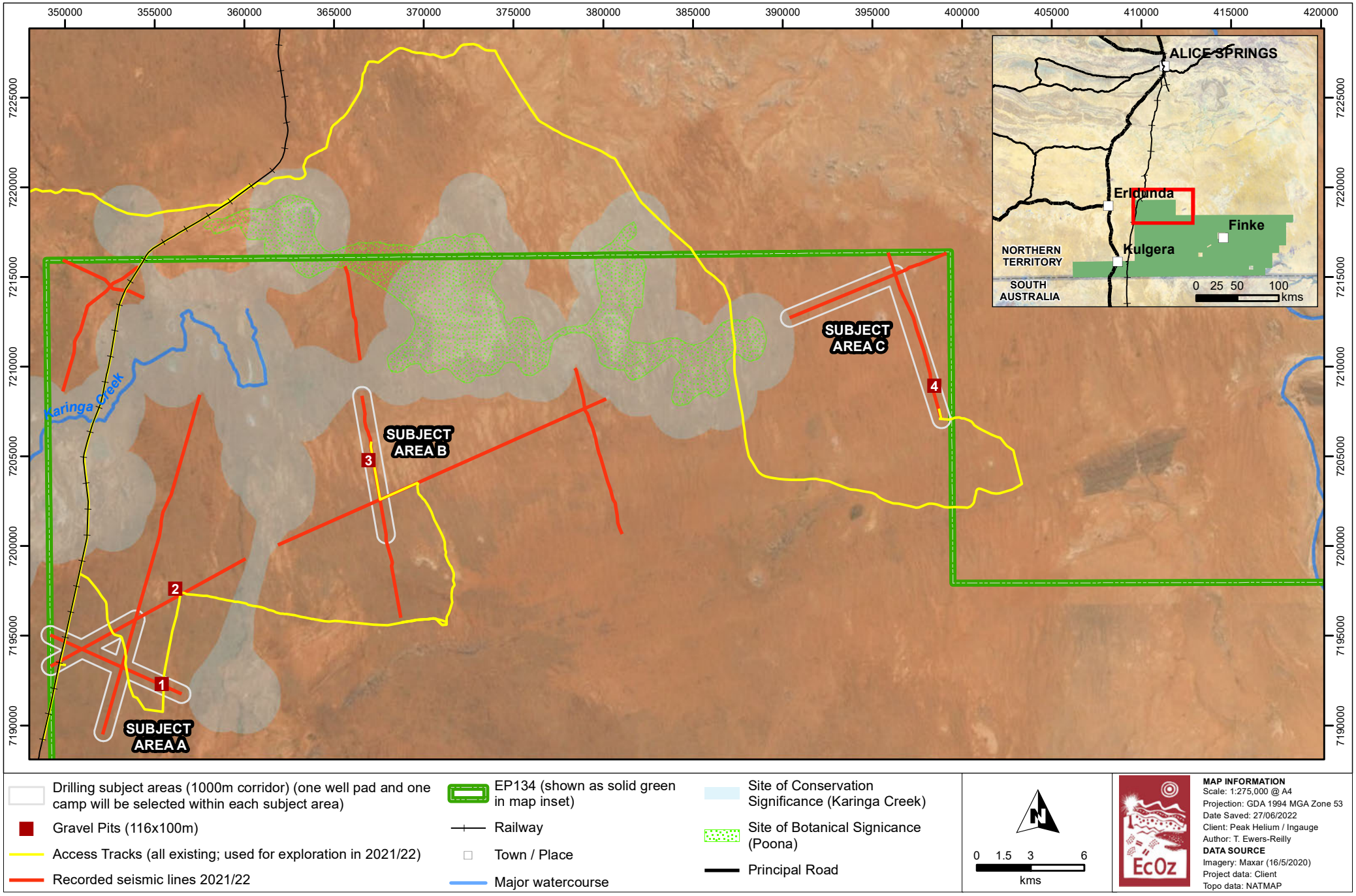

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Figure 2-1. Map of project location and proposed infrastructure

3 LEGISLATION

This following legislation, statutory obligations and guidelines were considered during the preparation of this weed management plan.

3.1.1 Petroleum (Environment) Regulations

The Petroleum (Environment) Regulations, (the regulations), require submission of an EMP prior to any petroleum exploration or production activity. This weed management plan represents a component of the 2022 Peak Helium Drilling Program EMP, as required under the regulations.

3.1.2 Weed Management Act

This NT Act aims to:

> *Protect the Territory's economy, community, industry and environment from the adverse impact of weeds*

It declares undesirable species of plants as weeds, and requires these species to be controlled, eradicated or prevented from entering the Northern Territory (NT) depending on their classification. Under the Act, weeds are classified into one of three classes:

- Class A declared plant – to be eradicated
- Class B declared plant – growth and spread to be controlled
- Class C declared plant – not to be introduced into the NT (all Class A and B weeds are also Class C)

The Act specifies how weeds in each of the classes must be treated. Weed management plans for specific weeds are endorsed under this Act.

The Commonwealth government has also categorised some species as Weeds of National Significance (WoNS). The remaining introduced flora species are referred to as environmental weeds.

3.1.3 Management Plans and guidelines

Statutory Weed Management Plans

These plans are legal documents containing specific information about management requirements for certain high priority weeds. Section 5 lists weeds that are present or have the potential for introduction onto on EP 134 and notes those with an associated statutory weed management plan.

Guidelines and standards

The following guidelines associated with the management of weeds in the NT have also been considered during the preparation of this WMP:

- *Northern Territory Weed Management Handbook* (Weed Management Branch, 2015a)
- *Northern Territory Weed Data Collection Manual* (Weed Management Branch, 2015b)

3.1.4 Peak Helium environmental policy

Peak Helium's Environmental Policy is a public declaration of its understanding of the environmental impacts and risks associated with its operations, as well as a demonstration of its compliance with all relevant environmental, health and safety regulations, legislation and guidelines. A copy is provided as Appendix A.

4 WEED RISK MITIGATION MEASURES

The EMP risk assessment process identified a number of weed introduction and/or spread risks associated with the scope of this project. Table 4-1 documents these risks, as well as the mitigation measures that will be implemented to reduce this risk.

Table 4-1. Weed risk and mitigation measures

Weed risk	Mitigation measures	Measurement criteria	Responsible person
Introduction of new weed species to EP 134 from plant and vehicles.	All vehicles / machinery /equipment entering the EP to be cleaned and free of soil and vegetative matter, and have a valid weed hygiene declaration	A register of vehicle / equipment / machinery inspection is kept.[1] Spot checks on vehicle / equipment / machinery to ensure inspections are completed correctly	Peak Helium Dedicated Weed Officer
	Site environmental inductions for all personnel and contractors to include vehicle weed hygiene requirements	All project staff undertake an environmental induction, to be recorded in the Peak Helium Training Register	Peak Helium Dedicated Weed Officer
Weed spread in on EP 134 resulting from vehicles/plant traversing existing weed infestations	All tracks, campsites and well pads to be inspected prior to use by project equipment	All tracks, campsites and well pads declared 'open' for use prior to anyone utilising them.	Peak Helium Dedicated Weed Officer
	All infestations of declared weeds are mapped; all personnel and contractors made aware of existing infestation locations and trained in the identification of existing weeds	All project staff undertake an environmental induction, to be recorded in the Peak Helium Training Register Weed maps and factsheets included as part of environmental induction All operational staff to attend weed identification training delivered by the NT Weed Management Branch	Peak Helium Dedicated Weed Officer
	All vehicles, machinery and equipment to stay on formed access tracks, except for those involved in clearing	All vehicle movements tracked via in-vehicle management systems	Peak Helium Dedicated Weed Officer
	If infestations are identified during the 2022 program, they will be demarcated and avoided, where possible, via a detour around the infestation	Maintain demarcation during operations and inspect (and rectify if needed) daily	Peak Helium Field Representative
	If infestations cannot be avoided, treat prior to	Work plan to reflect additional tasks required	

[1] Weed hygiene declaration included as Appendix B.

Weed risk	Mitigation measures	Measurement criteria	Responsible person
	traversing using methods set out in Table 6-1.		
	Vehicles/plant to be cleaned and free of soil and vegetative matter prior to moving beyond infestation	Spot checks on vehicle / equipment / machinery to ensure inspections are completed correctly	Peak Helium Field Representative / Peak Helium Dedicated Weed Officer
Existing weed distribution not fully known due to survey conducted outside of prime growth period	Further monitoring to be undertaken, as set out in Section 7 of this document	Annual reporting against this WMP, as per Section 7.	Peak Helium Dedicated Weed Officer

5 WEED SPECIES

5.1 Background

Weed distribution is often related to environmental disturbances caused by the construction of roads and tracks, cattle grazing and feral animals. Weeds are most prevalent on land under pastoral lease, with infestations generally concentrated around infrastructure such as water points, fence lines and tracks, and also along the banks of watercourses where cattle and feral animals tend to congregate.

A review of the NT Weed Branch weed dataset shows that part of the project area, to the east, occurs within the Athel Pine Management Zone. The dataset also shows that the whole project area is also located within the Bellyache Bush, Brazilian Pepper, Gamba grass and Mimosa Eradication Zones (i.e. not priority management zones). Other weeds are present within the project area and indicative of pastoral use, but by far the most frequently reported species is Athel Pine (*Tamarix aphylla*). Its deep, woody root system means it can readily establish within arid regions, particularly around river systems and wetlands.

The project area lies within the *Alice Springs Regional Weeds Strategy 2021-2026* (DEPWS 2021). This strategy focusses on weeds that are most important to the region, categorising them as either:

- *Category 1 – Priority weeds* (present in the region, widely considered feasible to eradicate from the Region, typically evaluated as very high risk and have isolated and restricted distributions)
- *Category 2 – Priority weeds or strategic control – including the eradication of outliers* (species warranting strategic control across the landscape due to the high impact they have on land managers and on broader economic and environmental values)
- *Category 3 – Weeds of concern* (assessed by the weed risk management system as a medium to high risk, or have not been assessed, but have been identified by stakeholders as posing a threat to the values of the Region)
- *Category 4 – Hygiene and biosecurity* weeds (it is important for landholders to implement weed hygiene and other biosecurity measures to prevent the spread of weeds into clean areas, and to control these species where the opportunity arises)
- *Category 5 – Alert weeds* (have the potential to have a high level of impact to the region should it become established, the likelihood of the species naturalising and spreading in the region is perceived to be high).

All such weeds are listed in Table 5-1. The distribution of priority weed species for eradication or strategic control in the Alice Springs Region is mapped in Figure 5-1 and Figure 5-2, respectively.

Table 5-1. Weed species relevant to the project area

Common name	Botanical name	Class	WoNS	Status in management plan
Rope Cactus	*Cylindropuntia spp.* including *C. imbricata, C. fulgida*	A		Category 1, very high
Prickly Pears	*Opuntia spp. including Opuntia stricta*	A		Category 1, very high
Athel Pine	*Tamarix aphylla*	A/B	Yes	Category 2, very high
Parkinsonia	*Parkinsonia aculeata*	B	Yes	Category 2, very high
Buffel Grass	*Cenchrus ciliaris*	Not declared		Category 2, very high
African Lovegrasses	*Eragrostis spp.* including *E. cilianensis, E. barreleri, E.*	Not declared	No	Class 3, *medium

Common name	Botanical name	Class	WoNS	Status in management plan
	cylindriflora, E. minor			
Mexican Poppy	*Argemone ochroleuca*	B	No	Class 3, medium
Kapok	*Aerva javanica*	Not declared	No	Class 3, N/A
Ruby Dock	*Acetosa vesicaria*	Not declared	No	Class 3, low
Saffron Thistle	*Carthamus lanatus*	B	No	Class 3, medium
Mossman River Grass	*Cenchrus echinatus*	B	No	Category 4, medium
#Caltrop	#*Tribulus terrestris*	B		Category 4, low

*Only *Eragrostis cylindriflora* has been assessed for weed risk.

#It is uncertain whether caltrop (*Tribulus terrestris*) is considered native or introduced to the Northern Territory. It is a weed to be controlled around tracks, parks and other infrastructure because their spiny fruit can cause nuisance.

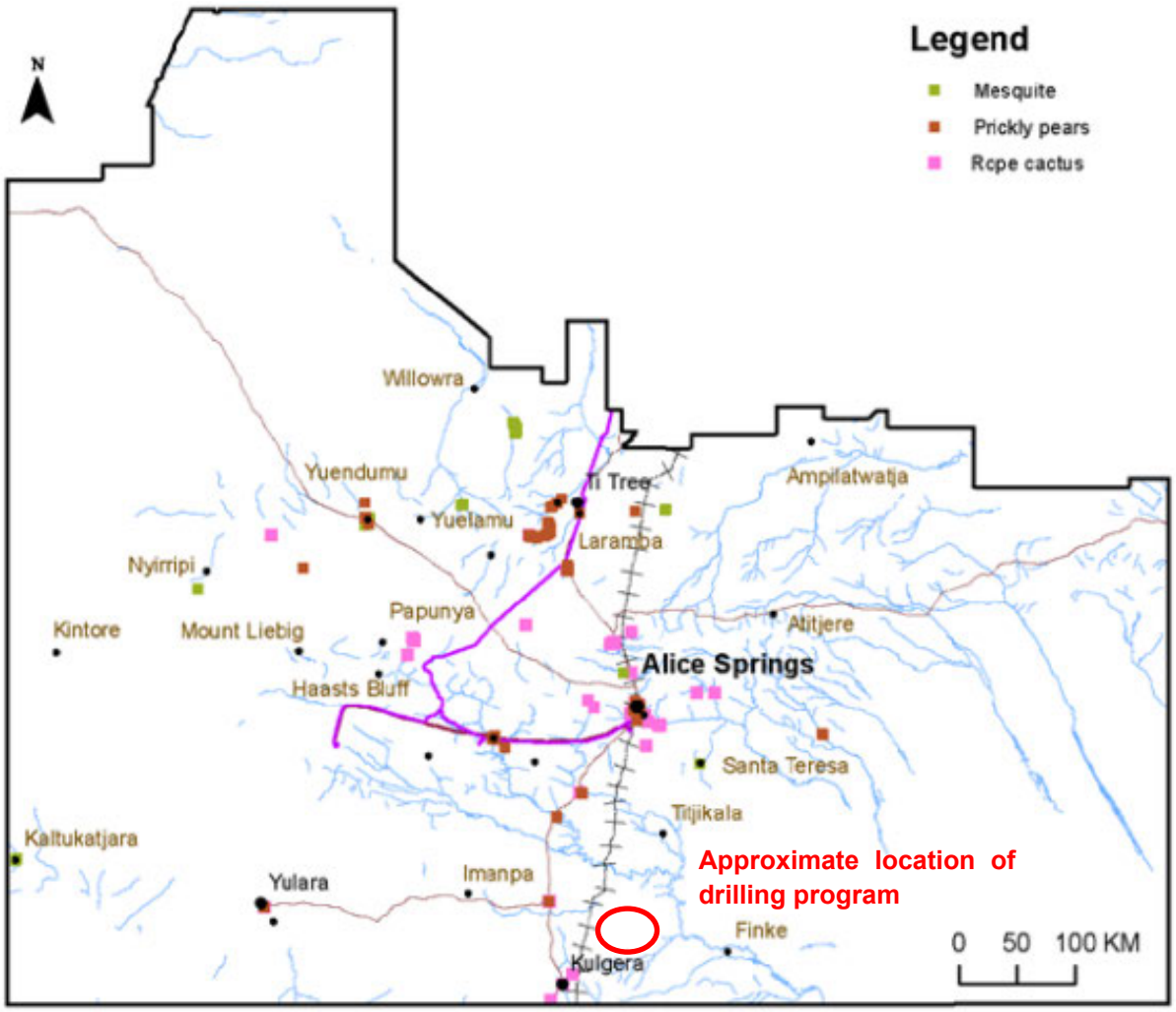

Figure 5-1. Distribution of priority weeds for eradication in the Alice Springs Region (DEPWS 2021)

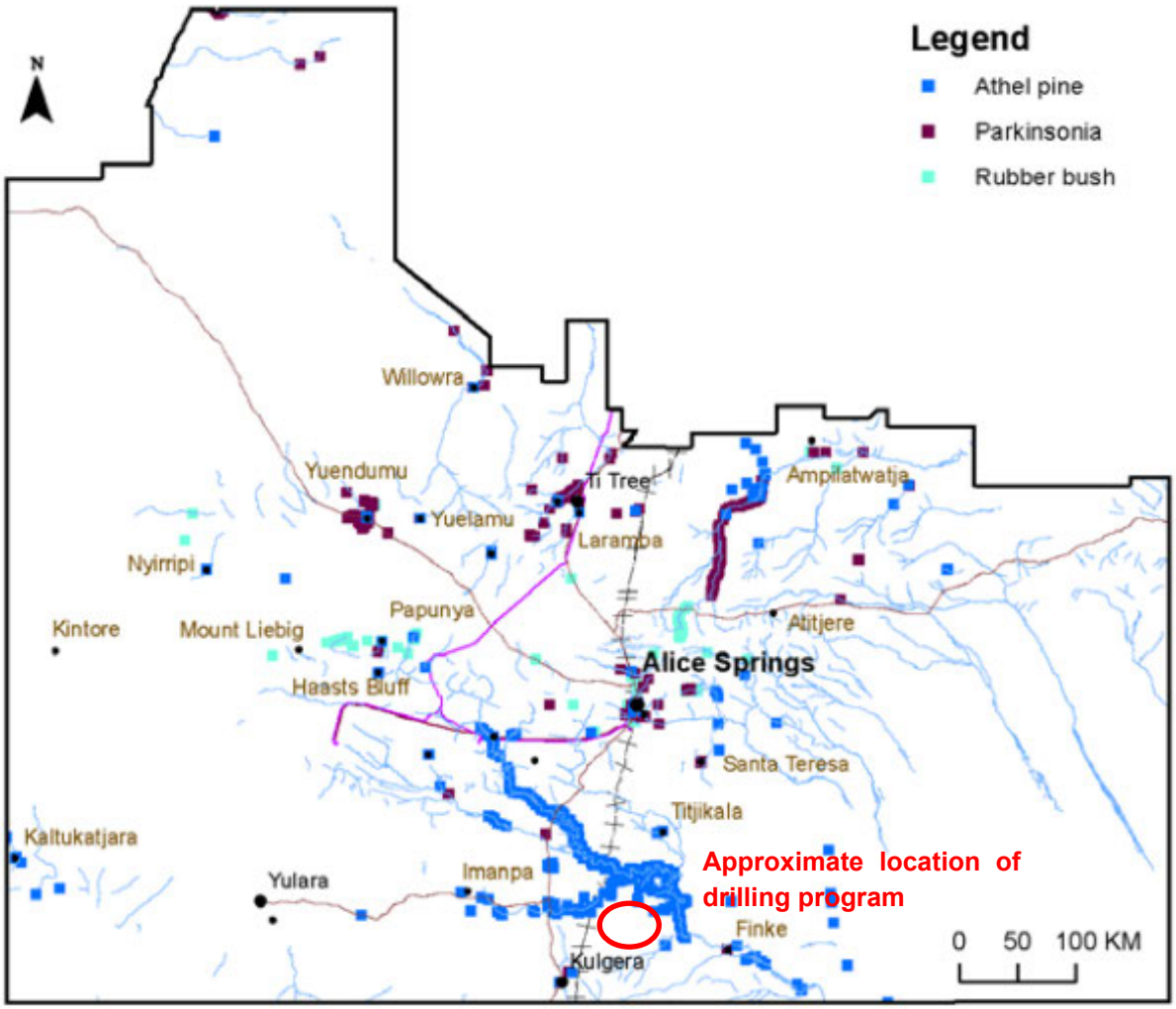

Figure 5-2. Distribution of priority weeds for strategic control in the Alice Springs Region (DEPWS 2021)

5.2 Baseline survey

As part of the 2021/2022 Seismic Program, baseline weed survey was conducted by Tom Reilly (EcOz) on 15 June 2021. Field surveys collected data on landform, vegetation, and surface soil information based on aerial (low level helicopter flight) and ground-based sites. Each ground-based site was surveyed for weeds and low-level aerial transects on a range of environmental investigation aspects, including weeds (for example, Buffel Grass infestations and Athel Pine are easily detectable on aerial transects) (refer to Figure 5-3 for survey effort). Note that the 'survey tracks' are the helicopter GPS track log, surveying was done along the seismic lines, but not in transit between the seismic lines.

Only one weed species was recorded within the subject areas – Buffel Grass (*Cenchrus ciliaris*) – a small patch on the edge of a Coolabah swamp within subject area C (latitude -25.184159 longitude 133.957304) (location shown in Figure 5-3; photograph of infestation in Figure 5-4). Buffel Grass is not declared under the *Weed Management Act* but it is considered as a Category 2 priority species in the *Alice Springs Regional Weeds Strategy 2021-2026* (DEPWS 2021) (refer top Section 5.1). Other weed species noted to occur in the surrounding region are Couch Grass (*Cynodon dactylon*) and Colocynth (*Citrullus colocynthis*).

Athel Pine (*Tamarix aphylla*) was confirmed as present in old borrow pits / dams on the western side of the railway in relatively close proximity to the project area (location shown on Figure 5-3). The species is a Weed of National Significance and can be easily spread by vegetative growth, and must be avoided to avoid spread.

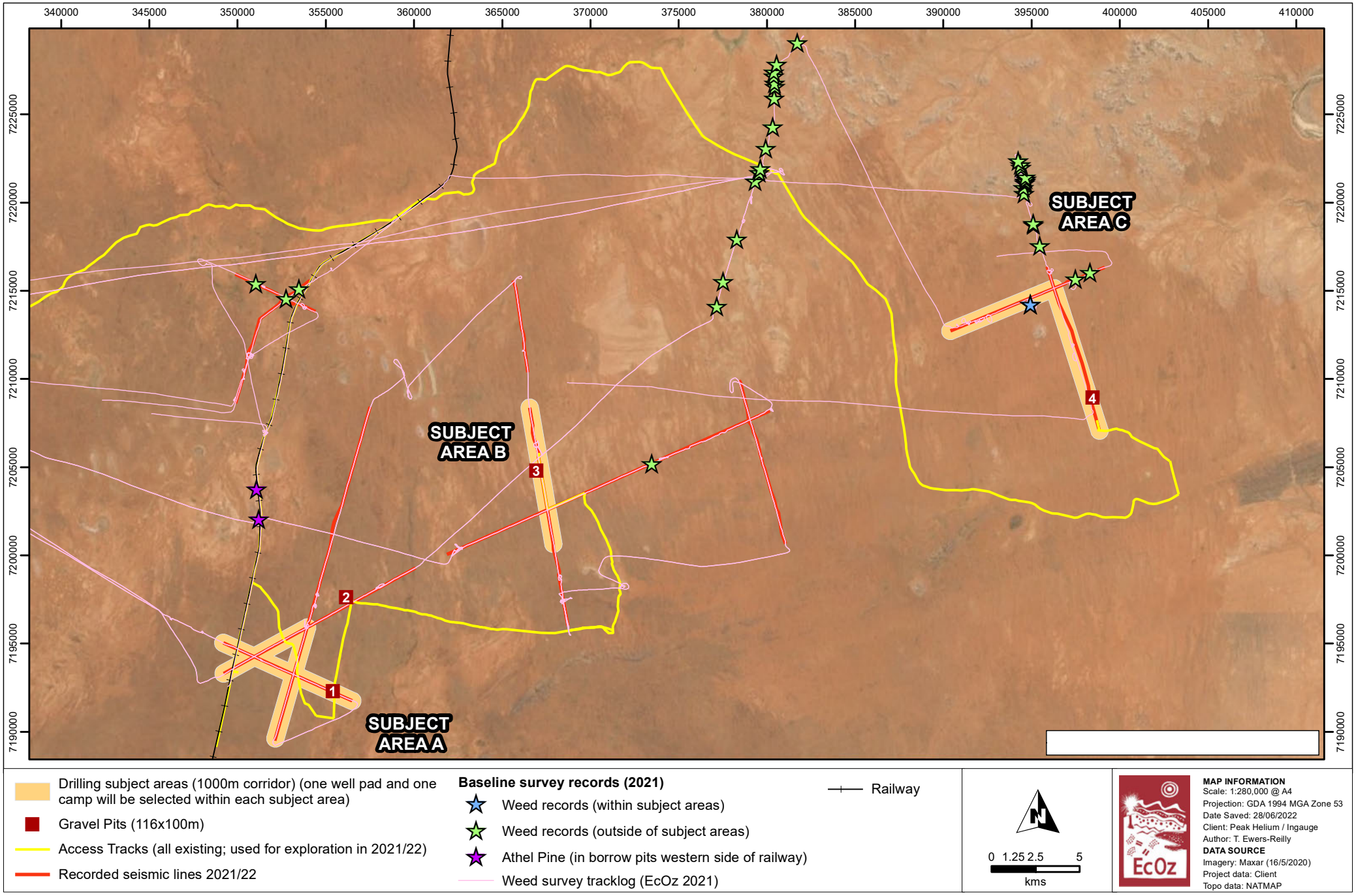

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Figure 5-3. Map of weed survey effort and results (EcOz 2021)

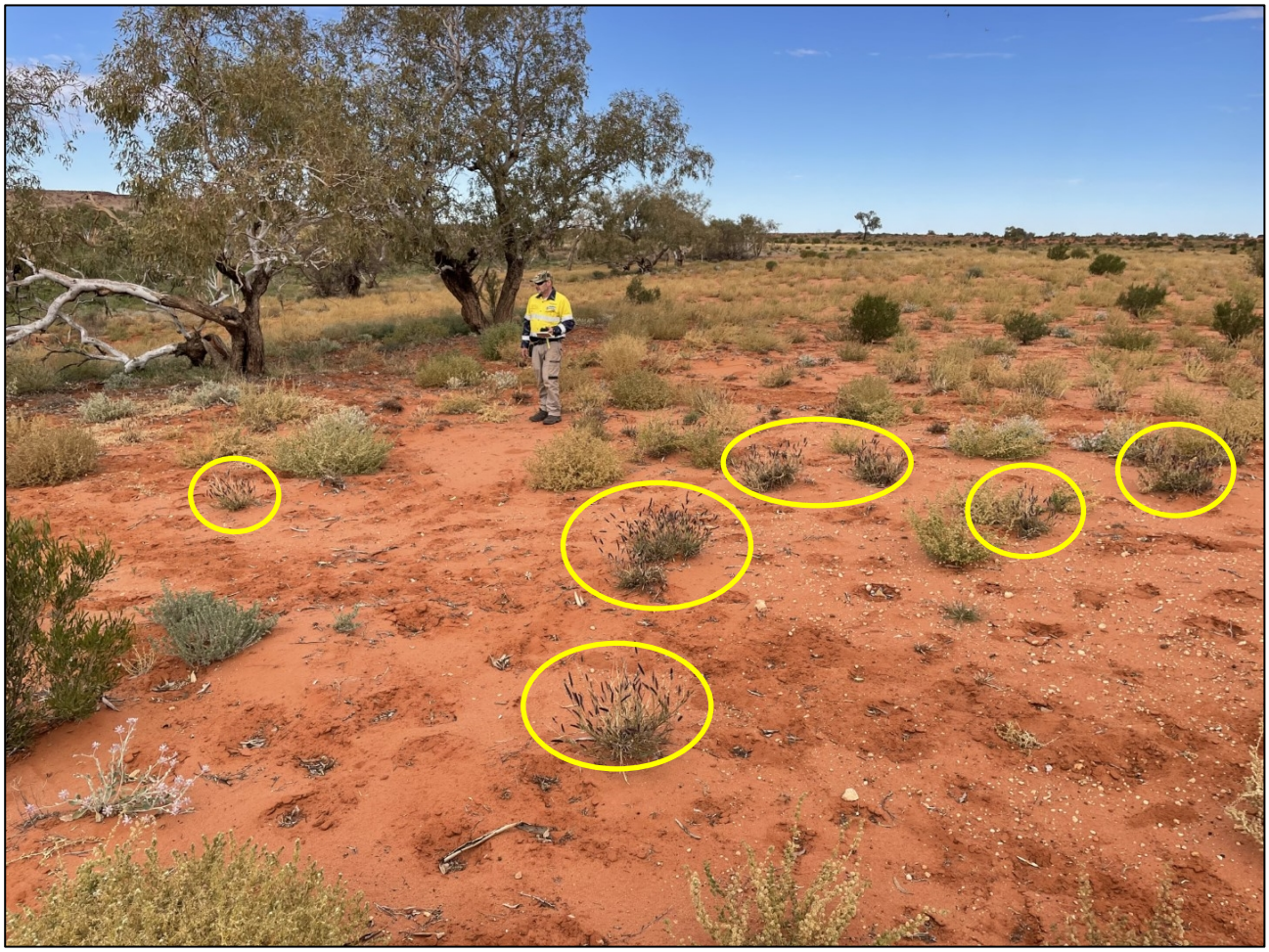


Figure 5-4. Buffel grass infestation located within subject area C

6 ANNUAL ACTION PLAN

The annual action plan in Table 6-1 details the survey and control activities for weeds recorded within the project area.

Table 6-1. Annual action plan

Weed Management Area	Weed species	Management objective	Survey / monitoring time/s	Treatment time/s	Control method/s	Herbicide
Well pads Campsites Borrow pits Access tracks		Prevent the introduction and spread of weeds	Within 4 weeks of the next rainfall event that is sufficient to result in weed growth.	Immediately if weeds are found - ideally when plants are in growth phase	Refer to the *NT Weed Management Handbook*	
Well pads Campsites Borrow pits Access tracks		Prevent the introduction and spread of weeds	At the completion of the project	Immediately if weeds are found - ideally when plants are in growth phase	Refer to the *NT Weed Management Handbook*	

7 WEED MONITORING

The requirements for weed monitoring within each component of the project area are outlined above in Section 6. Additional to the survey / monitoring times listed in Table 6-1, monitoring for weed incursions will be ongoing during operations, as all operational staff will have a responsibility to report new weed incursions to Peak Helium's' dedicated weed officer. Should new weed incursions be identified during monitoring, control will be undertaken during recommended treatment times, and follow-up surveys will be within three months to ensure effective eradication of the incursions.

The potential for weed spread within the project area is mostly within the access tracks, well pads and campsites. To target survey efforts within areas at high risk of weed establishment, annual weed monitoring will focus on the following areas:

- Known weed locations
- Along access tracks
- Well pads
- Campsites
- Borrow pits
- 50 m buffer around stock watering points traversed by access tracks

7.1 Notification procedure

All new weed incursions will be reported to the NT Weed Management Branch by Peak Helium's' dedicated weed officer. Initial notification will be verbal, followed by written notification of preliminary species identification and location within seven working days.

7.2 Recording

All weed monitoring and survey activities will be recorded in accordance with *the NT Weed Data Collection Guidelines* available at: https://nt.gov.au/environment/weeds/weed-mapping-and-data-sharing.

The following attributes of any new weed infestations will be recorded into a GPS-enabled device:

- Site ID
- Weed name
- ID confidence
- Date of record
- Coordinate information
- Recorder / organisation
- Infestation size
    - 5 m diameter
    - 20 m diameter
    - 50 m diameter
    - 100 m diameter
- Infestation density

- 1 = Absent, no weeds of this species in the area
- 2 = < 1%; very few, not many weeds
- 3 = 1 – 10%; more than one or two isolate plants
- 4 = 11 – 50%; Many plants, covering up to half the area
- 5 = > 50%; Weed forms the dominant cover

Weed data will be submitted as an Excel spreadsheet to the Weeds Management Branch (refer Appendix C for an example template).

7.3 Reporting

Peak Helium's weed management officer will submit annual reporting against this WMP as a component of the EMP environmental reporting requirements. This will include

- Details of activities implemented to address weed spread and introduction risks
- Submission of all weed data collected
- Details of survey and monitoring events, including dates, personnel, maps and track data
- An overview of weed control events and success rates.

This annual report will be reviewed by the NT Government's Onshore petroleum weed management officer.

8 REFERENCES

Department of Environment, Parks and Water Security (DEPWS) (2021). Alice Springs Regional Weeds Strategy 2021-2026. *https://depws.nt.gov.au/__data/assets/pdf_file/0003/291513/alice-springs-regional-weed-mgt-plan-2021-2026.pdf*

EcOz (2021). Environmental Assessment EP134 Seismic Program June 2021 PEAK HELIUM. Darwin, Northern Territory.

Weed Management Branch (2015a) Northern Territory Weed Management Handbook, Department of Land Resource Management, Northern Territory Government, Darwin

Weed Management Branch (2015b). Northern Territory Weed Data Collection Manual, Department of Land Resource Management, Northern Territory Government, Darwin

APPENDIX A PEAK HELIUM ENVIRONMENTAL POLICY

Environmental Policy

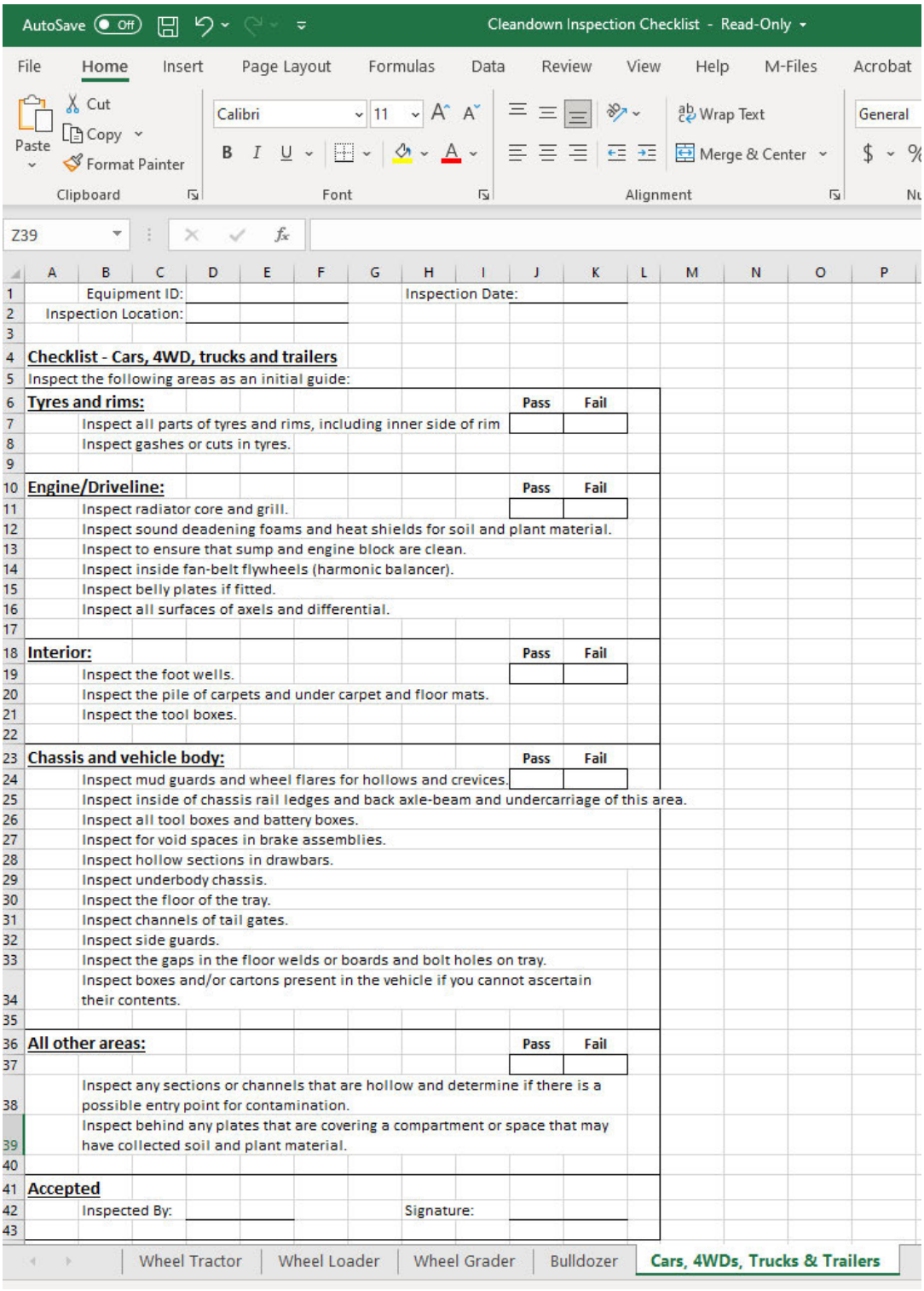
Peak Helium is committed to ensuring that all activities are conducted in a manner that protects and preserves the environment. Peak Helium will ensure that any potential adverse effects on the environment are either avoided or minimised by thorough investigation and planning before the commencement of its activities.

Peak Helium objectives in the fulfilment of this policy are to:

- Ensure all applicable industry and statutory requirements are met, and obligations are fulfilled
- Ensure all employees and contractors are fully aware of their responsibilities concerning relevant environmental matters.
- Develop and document environmental actions and contingency plans to control and minimise all environmental risks with all activities.
- Apply accepted engineering principles in all its operations to reduce and restrict the production of waste products known to be harmful to the environment and dispose of such waste by recycling or other accepted practice.
- Minimise the environmental impact of its operations, including the prevention of pollution
- Promote Peak Helium commitment to continuous improvement of management and protection of the environment, involve the community and stakeholder interests through consultation and address any concerns.

Art Malone
Managing Director
Peak Helium

APPENDIX B WEED HYGIENE DECLARATION



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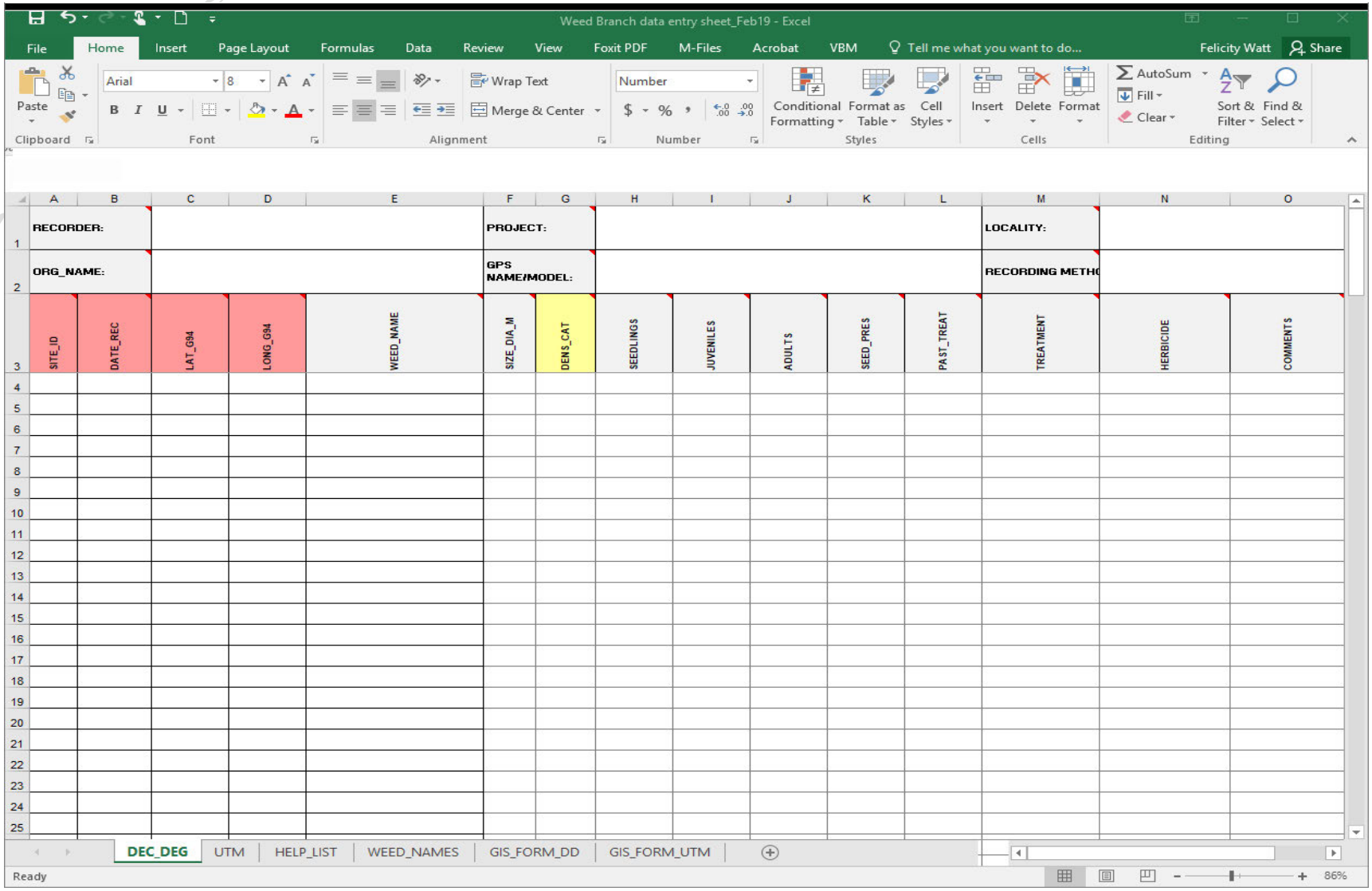
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1		Equipment ID:						Inspection Date:								
2		Inspection Location:														
3																
4	**Checklist - Cars, 4WD, trucks and trailers**															
5	Inspect the following areas as an initial guide:															
6	**Tyres and rims:**									Pass	Fail					
7		Inspect all parts of tyres and rims, including inner side of rim														
8		Inspect gashes or cuts in tyres.														
9																
10	**Engine/Driveline:**									Pass	Fail					
11		Inspect radiator core and grill.														
12		Inspect sound deadening foams and heat shields for soil and plant material.														
13		Inspect to ensure that sump and engine block are clean.														
14		Inspect inside fan-belt flywheels (harmonic balancer).														
15		Inspect belly plates if fitted.														
16		Inspect all surfaces of axels and differential.														
17																
18	**Interior:**									Pass	Fail					
19		Inspect the foot wells.														
20		Inspect the pile of carpets and under carpet and floor mats.														
21		Inspect the tool boxes.														
22																
23	**Chassis and vehicle body:**									Pass	Fail					
24		Inspect mud guards and wheel flares for hollows and crevices.														
25		Inspect inside of chassis rail ledges and back axle-beam and undercarriage of this area.														
26		Inspect all tool boxes and battery boxes.														
27		Inspect for void spaces in brake assemblies.														
28		Inspect hollow sections in drawbars.														
29		Inspect underbody chassis.														
30		Inspect the floor of the tray.														
31		Inspect channels of tail gates.														
32		Inspect side guards.														
33		Inspect the gaps in the floor welds or boards and bolt holes on tray.														
34		Inspect boxes and/or cartons present in the vehicle if you cannot ascertain their contents.														
35																
36	**All other areas:**									Pass	Fail					
37																
38		Inspect any sections or channels that are hollow and determine if there is a possible entry point for contamination.														
39		Inspect behind any plates that are covering a compartment or space that may have collected soil and plant material.														
40																
41	**Accepted**															
42		Inspected By:						Signature:								
43																

Wheel Tractor | Wheel Loader | Wheel Grader | Bulldozer | Cars, 4WDs, Trucks & Trailers

APPENDIX C WEED CONTROL RECORDING TEMPLATE



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10 Appendix 10 – Methane Management Plan

Peak Helium Pty Ltd

EMP PKH2-3

NT Exploration Permit (EP) 134

Appendix 10

Methane Management Plan

Rev	Description	Date	Initiated	Reviewed	Approved
0	Issued for Submission	18/07/2022	Jon Bennett	Trent Smith Katie Robertson Vicky Cartwright	Jon Bennett
1	Issued for Re-Submission	19/08/2022	Trent Smith	Nick Fraser Vicky Cartwright	Jon Bennett
2	Issued for Re-Submission	16/01/2023	Katie Robertson	Nick Fraser Vicky Cartwright	Trent Smith
3	Issued for Re-Submission	01/02/2023	-	-	Trent Smith

Prepared For Peak Helium

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INGAUGE
Well Engineering & Project Management

10 Methane Emissions Management Plan

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10.1 Background

Peak Helium (Peak Helium) proposes exploration activities in the Amadeus Basin from 2022 onwards; this Methane Emissions Management Plan (MEMP) supports EMP PKH02-2 and its revisions.

Under the *Petroleum (Environment) Regulations (the Regulations)* [NT GOVERNMENT, 2016], interest holders in petroleum titles must prepare and submit an EMP. Approval of an EMP is necessary for all activities that have an environmental impact or risk and is one of several approvals required for the activity to proceed. An approved EMP is a statutory document that is enforceable.

The *Code of Practice for Petroleum Activities in the Northern Territory* (*the Code*) sets out the mandatory requirements for management plans for methane emission monitoring, leak management, detection, and reporting. *The Code* states that an EMP for a petroleum activity must include a Methane Emissions Management Plan [DEPWS et al., 2019].

10.2 Scope

This MEMP assesses and manages the risks posed by conducting drilling and well testing as part of **EMP PKH02-2** and its revisions.

10.3 Purpose

Following *the Code*, this MEMP has been designed to outline the measures as to how the risks of methane emissions associated with Peak Helium's exploration activities will be managed.

This MEMP aims to reduce emissions to a level that is As Low As Reasonably Practicable (ALARP) and acceptable via emissions detection and management. The active monitoring and management described in this MEMP aim to reduce fugitive methane emissions from petroleum activities.

10.4 Principles

This MEMP aims to reduce emissions to ALARP and acceptable via emissions detection and management. Active monitoring and management aim to reduce fugitive methane emissions from petroleum activities.

10.5 Activity Description

All activities, including drilling, well testing and the ongoing operation of exploration wells will be conducted as per the requirements of *the Code*. A description of these activities is described in **Table 10.5—1** below. The project activities under this EMP do not include any production, compression, or transportation of hydrocarbons by flowlines.

Table 10.5—1 Activity and Emission Description Summary

Activity	Emission Description	Controls	Emission Monitoring and Frequency
Drilling	• Methane is expected to be encountered, emissions are expected to be small (<1 tonne) and restricted to outgassing of hydrocarbon within intersected geological formations brought to the surface.	• While drilling, the well is kept overbalanced to prevent gas influx from geological formations into the wellbore. • Shale formations have negligible permeability with a limited influx of gas from target formations.	• Due to low emission levels, gas is qualitatively monitored in mud streams as a concentration (not flow rate). • Gas desorption data is collected from the target reservoir, allowing for emission estimates.
Well Testing	• The completed well is unloaded to allow hydrocarbons and fluid to flow to the surface. • All fluids and hydrocarbons will be diverted to a separator and, in turn, to a flare system, releasing a small amount into the atmosphere from produced fluid. Flaring will be used rather than venting, and venting will only be used where flaring is not feasible. • Small volumes (kg's/day) of methane are entrained within liquid the produced fluid and can't be captured or diverted to the flare, these volumes will be released into the atmosphere. • Small emissions (<1 tonne) of methane may be released before the onset of flaring, as the hydrocarbon production rate may not be enough to sustain an initial flare.	• Wellheads are designed per the *NT Code of Practice* [DEPWS et al., 2019] and API standards to minimise loss of methane containment. • All gas is sent to a flare, and a small amount is released to the atmosphere. • Calibrated Personal Gas Detector (PGD) will be used during all operational visits.	• All operational personnel will carry, and monitor, calibrated Personal Gas Detectors (PGD) during every routine operational visit to well sites. • Emission monitoring will be ongoing during well testing.
Ongoing Well Operations / Suspension	• Methane emissions are restricted to unplanned leaks from wellheads, including surface casing vents.	• Operation staff will carry PGDs during every routine operational visit to well sites. • Routine wellhead maintenance, as per well Integrity Management System, will be carried out. • Each well and equipment on a well pad, will be inspected every six months for leaks using a *US EPA Method 21* [US EPA, 2017].	• PGDs will be used during well testing activities. • Six monthly leak detection tests will be conducted until well abandonment.

10.6 Risk Assessment

An assessment of the environmental risks and impacts posed by the regulated activities under this EMP and revisions, has been carried out. This risk assessment includes an assessment of the risks posed by leaks from the operating plant.

Appendix 04 presents the all the environmental risk associated the regulated activities. As demonstrated in the risk assessment, the risk assessment controls, and the information presented in **Table 10.7—1**, emissions are reduced to ALARP and acceptable.

10.7 Equipment Selection

The uncontrolled emissions of natural gas during drilling and well-testing activities represent a potential hazard to works and the environment. All equipment will be selected to minimise the emissions during production activities and have the requirements shown below in **Table 10.7—1**.

Table 10.7—1 ISO/API Standards for Material Selection

Component	Applicable Standards
Casing	• ISO 11960: Steel pipes for use as casing or tubing for wells.
Couplings	• ISO 13679 Procedures for testing casing and tubing connections.
Cement and Additives	• American Petroleum Institute Recommended Practice, (API RP) 10B-2 Recommended Practice for Testing Well Cements.
Drilling Fluids	• ISO 10414-1: Recommended Practice for the Field-Testing Water Based Drilling Fluids. • American Petroleum Institute (API) 13B-1 and 13B-2 Recommended Practices.
Well Control Equipment	• API STD 53: Blow-Out Prevention Equipment Systems for Drilling Wells. • API 16A (ISO 13533): Specification for drill-through equipment. • API 16D: Specification for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment.
Wellheads	• API 6A: Specification for wellhead and Christmas tree equipment. • ISO 10423: Petroleum and Natural Gas Industries – Drilling and Production Equipment – Wellhead and Christmas Tree Equipment.

Detection equipment will be consistent with *the Code*, including standard leak detection instruments (Section D.5.3 of *the Code*) as detailed in **Section 10.8** below. Ongoing well maintenance will be conducted following the Well Operations Management Plan (WOMP).

10.8 Monitoring Methodology and Monitoring Frequency

Mandatory inspections will be completed on all surface infrastructure (vents, flanges, valves, connections, drains, pressure relief vents, etc.) of the exploration well following section D.5.3 standard leak detection instruments and D.5.2 inspection frequency and procedure of *the Code* [DEPWS et al., 2019].

10.8.1 Monitoring Method

Routine inspections will be carried out to detect potential fugitive methane emissions from petroleum activities and mitigate them as soon as practicable. All gas leak surveys will be conducted by suitably qualified personnel using appropriate gas detection instruments calibrated and maintained following the manufacturer's requirements.

Leak testing will be undertaken using *the United States Environmental Protection Agency (US EPA) Method 21* [US EPA, 2017] or optical gas imaging (OGI). Method 21 inspections are used to survey individual pieces of equipment. These types of inspections require access to the equipment's surface and are extremely effective at pinpointing leaks.

The following procedures are to be followed when conducting Method 21 inspections:

1. Ensure gas detector is calibrated and functioning properly.
2. Ensure the appropriate permitting is obtained before entry into a hazardous area.
3. Place the probe inlet at the surface of the component interface where leakage could occur.
4. Move the probe along the interface periphery while observing the instrument readout. If an increased meter reading is observed, slowly sample the interface where the leakage is indicated until the maximum meter reading is obtained.
5. Leave the probe inlet at this maximum reading location for approximately two times the instrument response time (i.e., at least a minute).
6. If the maximum observed meter reading is greater than 500PPM at the surface of a piece of infrastructure, the leak will be measured again at 150mm immediately above (and downwind of) the leak in an open-air environment.
7. The leak will be classified following Section 4.3 of the guideline.
8. The location of the leak will be documented and photographed (if safe to do so).
9. Any liquid petroleum leaks will also be identified, including estimates of leak rate and the volume released.

10.8.2 Inspection and Monitoring Frequency

Training will play a crucial key in detecting emissions; all personnel conducting routine emission inspections will be appropriately trained. Inspections will be carried out at the well sites as per **Table 8.5 – 2 Monitoring Program** of the **EMP**.

10.8.3 Leak Classification, Repair, and Notification

Each leak will be classified, repaired, and reported following **Table 10.8—1**. It should be noted that the classification of leaks is only undertaken using US EPA Method 21, as described in **Table 10.5—1**.

Table 10.8—1 Leak Classification and Remediation Summary

Classification	Threshold	Response	Notification	Comments
Minor Leak	>500ppm measured at the surface of the component per Section D.5.5.1 of *the Code*.	• All minor leaks will be documented and repaired as soon as practicable but within 30 days of identification. • The Minister will be notified where 30 days is unachievable, with the reason for the delay and the target date for completion.	• All minor leaks will be documented within Peak Helium's system and reported where required, including the specifications of the *National Greenhouse and Energy Reporting Act* (NGER) [AUSTRALIAN GOVERNMENT, 2007].	• A minor leak is an unplanned release that does not occur during commissioning or bringing equipment back into service. • These leaks will be corrected immediately as a part of commissioning. • A minor leak originates from an above-ground source.
Significant Leak	>5,000ppm (or 10% of the Lower Explosive Limit) when measured at 150mm above the leak source. Or A Liquid Petroleum (condensate/oil) loss of containment that exceeds 200L. Or The leak is too large or not safe to measure.	1. The activities safety management plan, risk assessment, and emergency response requirements will be followed. 2. Remediation work will only commence after a suitable risk assessment has been undertaken (at a level appropriate to the nature of the leak) and the relevant safety procedures are followed, including the consideration of all the required Personal Protective Equipment (PPE) and emergency response material. 3. If safe to do so, the leak source will be isolated and repaired immediately. The response priority will be to make the site safe above all other actions. 4. The leak will be repaired or made safe as soon as practicable, as follows: a. The leak will be isolated, repaired, if possible, contained or otherwise made safe within 72 hours. b. An exclusion zone will be established around the leak, and appropriate restrictions on access to the exclusion zone imposed where isolation and repair are not possible. c. In the event the 72hour deadline is unachievable, the reason for the delay and the target date for repair will be submitted to *The Department of Industry, Tourism and Trade* (DITT) before the deadline passed. 5. If it is contended that the risk of immediately repairing the leak exceeds the risk posed by the leak, an extension of the 72-hour deadline may be sought provided that other measures to mitigate the risk are undertaken (e.g., ensuring an appropriate exclusion zone has been implemented). 6. For leaks identified on well equipment, higher-order controls such as containment by repair will be implemented wherever possible. 7. For leaks identified on well casings or adjacent to the well casing (where a workover rig is necessary to effect repair), it will be determined whether the leak requires immediate repair, or whether the risk can be adequately managed via other control measures until a workover of the well is scheduled for normal operational reasons. The risk assessment to determine the above will consider the location of the well, likely access to the well from landholders or the general public, and landholder/community concerns in relation to the leak.	• In the case of an emergency, DITT will be notified within 24 hours via the emergency response hotline number 1300 935 250. • Notification will include the date of identification, nature and level of the leak, infrastructure name, number, and location, as well as the initial actions to minimise the risk. • The landowner or occupier of the property in which these leaks are occurring will be notified in the following circumstances: ○ If the leak cannot be repaired immediately; and ○ If the leak is likely to affect any of the landowners or occupiers' facilities or activities. • A written closeout report will be submitted within five business days of the remediation of the leak, specifying the date of identification, nature and level of the leak, location and name of the operating plant, and the rectification actions are taken. • If finalising the remediation is delayed more than seven business days from the identification of the leak, an update will be submitted on that day. • The final closeout report will be provided when all work is complete.	• A significant leak is an unplanned release that does not occur during commissioning or bringing equipment back into service. • These leaks will be corrected immediately as a part of commissioning.

10.8.4 Remediation Work and Leak Response

Remediation works will only commence after a suitable risk assessment has been undertaken and the relevant safety procedures have been followed. This includes consideration of all required Personal Protective Equipment (PPE) and Peak Helium's Emergency Response Plan (**Appendix 14**).

Table 10.8—2 outlines the relevant leak response in relation to a leak location.

Table 10.8—2 Leak Response According to Location

Leak Location	Response
Well Equipment	• Wherever possible, higher order control such as containment by repair will be implemented.
Well Casings (or adjacent to well casings)	• Repairs will be completed as soon as reasonably practicable. • The following points will be taken into account when responding to a leak: o Well location. o Personnel and public safety. o Potential environmental harm. o Likelihood of well access by the public or landholders. o Landholder/community leak related concerns.

10.9 Reporting

10.9.1 Leaking Report

As per *the Code* D.5.6.2(g) [DEPWS et al., 2019], a written closeout report will be submitted within five business days of the leak's remediation. The closeout report will specify the date of identification, nature and level of a leak, location and name of the operating plant, and the rectification actions taken.

If finalising the remediation is delayed by more than seven business days from identifying the leak, an update will be submitted on that day. The final closeout report will be provided when all work is completed as per *the Code* D.5.6.2(h).

10.9.2 Greenhouse Gas Emissions Estimates

Emissions from exploration, well construction, and workovers will be measured. These emissions will be measured using methods consistent with the *National Greenhouse and Energy Reporting (Measurement) Determination 2008* [AUSTRALIAN GOVERNMENT, 2008].

- Peak Helium's reporting will be in accordance with Section D.5.6. leak remediation and notification and 5.9 Venting and Flaring of *the Code*.
- Peak Helium will estimate and report all greenhouse gas emissions as per the requirements of the *Australian Government's Clean Energy Regulator* and the *National Greenhouse Energy Reporting Act* [AUSTRALIAN GOVERNMENT, 2007] as required.
- If Peak Helium's operations are below the reporting threshold specified by the *Commonwealth National Greenhouse and Energy Reporting Act* (2007) [AUSTRALIAN GOVERNMENT, 2007], Scope 1 emissions will still be reported for the approved regulated activities in this EMP to the Northern Territory Government under *the Code*.

10.9.3 Annual Reporting

An annual report will be provided to the Northern Territory Government summarising the following:

- The results of leak detection surveys (in the annual report under *the Code*) outlining:
  - The extent of compliance with the leak management plan.
  - A summary of monitoring undertaken during the period.
  - A summary of minor and significant leaks identified during the reporting period, including:
    - The date of identification and
    - Repair for each leak and those leaks that could not be repaired.
  - An explanation as to why any component could not be repaired and what actions will be taken to either decommission the component or otherwise remedy the problem.

10.10 References

DEPWS, & DITT. (2019). *Code of Practice: Onshore Petroleum Activities in the Northern Territory*. Department of Environment, Parks and Water Security Retrieved from **https://depws.nt.gov.au/__data/assets/pdf_file/0011/705890/code-of-practice-onshore-petroleum-activity-nt.pdf**

US EPA. (2017). *Method 21 - Determination of Voliatile Organic Compound Leaks* United States Environmental Protection Agency. Method 21. Retrieved from **https://www.epa.gov/sites/default/files/2017-08/documents/method_21.pdf** | Changes to standard: **https://www.ecfr.gov/current/title-40**

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