



Government  
of South Australia

Department for  
Energy and Mining

6 May 2025

Dr Chris Giles  
Technical Director  
Havilah Resources Limited  
31 Flemington Street  
GLENSIDE SA 5065

chris.giles@havilah-resources.com.au

Dear Dr Giles,

**Approval Notification - Exploration Program for Environment Protection and Rehabilitation (EPEPR2024-015) EL 5873, EL 6415, EL 6659, EL 6660**

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The program for EL 5873, EL 6415, EL 6659, EL 6660 final version submitted on 11 April 2025 to conduct 102 RC and DD drillholes to a total depth of 21 600 m at the Central Curnamona Prospect, has been approved in accordance with Section 70B(5) of the *Mining Act, 1971 (the Act)*.

In accordance with section 70B(7a)(b) of the Act, the approved program is subject to the conditions listed in the attached notice.

You are reminded that:

1. You must at all times implement and comply with the approved EPEPR.
2. The approved EPEPR will be made publicly available on the Mining Register.
3. Exploration operations on “native title land” (as defined in the *Native Title (South Australia) Act, 1994*) must be conducted in accordance with Part 9B of the Act.
4. In accordance with Section 70C of the Act, the licensee must review the EPEPR on request of the Minister’s Delegate within a time specified in the request and submit the revised EPEPR for approval.
5. As the operator for the approved EPEPR you must take all reasonable and practical measures to avoid undue damage to the environment and meet all the approved outcomes (when measured against the approved criteria) listed within the EPEPR.
6. In accordance with regulation 78 of the *Mining Regulations 2020* and Terms of Reference 012 (TOR 012), the licensee must submit an Exploration Compliance Report to the Mineral Exploration Branch each year, within 60 days after the anniversary of the date the licence was granted, and 60 days after the expiry or surrender of the EL, or in accordance with joint reporting requirements agreed to with the Minister.
7. In accordance with regulation 16(4) of the *Mining Regulations 2020*, drillhole and geological samples must be kept in accordance with guidelines issued by the Department for the term of the relevant tenement and for 7 years after the expiry, surrender, cancellation or forfeiture of the tenement to which the sample relates. Furthermore, samples must be retained by the tenement holder, or provided to the Director, in accordance with those guidelines (unless the Minister has authorised, on application by the tenement holder in a manner and form set out in the guidelines, the destruction or disposal of the samples).
8. The EPEPR is approved for a period of twelve months from the date of this letter.

This approval does not constitute endorsement of the systems that you have in place to manage your exploration operations in compliance with the Act and licence conditions. In granting the approval, the EPEPR and your capacity to undertake the proposed activities have been considered. However, responsibility for compliance with the Act and the licence conditions, remains at all times with the licensee.

This approval relates only to the requirements of the Act. Other legislation relevant to this application includes the *South Australian Work Health and Safety Act, 2012* and Regulations. For example, Chapter 10 of the *Work Health and Safety Regulations, 2012 (SA)* introduced new requirements for mine operators in South Australia. The new requirements include a notification for mining operations and the establishment of a Safety Management System. For further information on your responsibilities, including a guide to Chapter 10 and the Mine Operator Notification Form, contact SafeWork SA on 08 8303 0255 or via its website at [www.safework.sa.gov.au](http://www.safework.sa.gov.au).

The proposed program may be subject to the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Mineral exploration industry-specific information is contained in an appendix in the EPBC Matters of National Environmental Significance – Significant impact guidelines 1.1. This document is available on the Australian Government’s Department for Agriculture, Water and the Environment website at <http://www.environment.gov.au/resource/significant-impact-guidelines-11-matters-national-environmental-significance>. For further information, contact the Department for Agriculture, Water and the Environment, or visit its website at [www.environment.gov.au/](http://www.environment.gov.au/).

Proposed changes to exploration operations stated in the approved EPEPR may require a *PEPR review* to be submitted for assessment. Where a *PEPR review* is required, implementation of the operational changes can only occur after the revised EPEPR is approved. Further information on when an exploration PEPR review is required can be found in Departmental guideline [MG22 Conducting mineral exploration](#).

If you require any further information, please contact Cobus Martins on 0437252134 or Shelley Rasmussen 0409 797 670 or email [DEM.exploration@sa.gov.au](mailto:DEM.exploration@sa.gov.au).

Yours sincerely



Simon Constable  
**GENERAL MANAGER MINERAL EXPLORATION  
REGULATION & COMPLIANCE**

In accordance with delegated  
Ministerial powers and functions  
In accordance with delegated

CC: Amy Jacka Tenement Manager, Havilah Resources Limited [amy.jacka@havilah-resources.com.au](mailto:amy.jacka@havilah-resources.com.au)  
CC: DEW Drilling Inspector [miningwatersciencereferrals@sa.gov.au](mailto:miningwatersciencereferrals@sa.gov.au)  
CC: DEW Hydrogeologist [miningwatersciencereferrals@sa.gov.au](mailto:miningwatersciencereferrals@sa.gov.au)

The Department’s Regulatory Guidelines, Ministerial Determinations and Information Sheets are available at: [http://energymining.sa.gov.au/minerals/knowledge\\_centre](http://energymining.sa.gov.au/minerals/knowledge_centre)

**Notice of Approval Conditions – EPEPR 2024-015**

In accordance with section 70B(7a)(b) of the Act, the approved program is subject to the following conditions:

1. Notify DEM 21 calendar days prior to conducting the Namba Formation Strata Self-Sealing Test Method and Groundwater Quality Sampling Method, as described in EPEPR 2024-015 Appendix 2. Notification must be provided in writing to DEM.Exploration@sa.gov.au.
2. Provide the results and data interpretation of the Namba Formation Strata Self-Sealing Test Method and Groundwater Quality Sampling Method, as described in EPEPR 2024-015 Appendix 2, within 14 calendar days of the completion of the tests. Results must be provided in writing to DEM, by emailing the results to DEM.Exploration@sa.gov.au.

**APPLICATION**

Mining Act 1971 and Mining Regulations 2020

Government of South Australia  
Department for Energy and Mining**EXPLORATION PROGRAM FOR ENVIRONMENT PROTECTION AND REHABILITATION (PEPR)**

USE THIS TEMPLATE TO: Apply to conduct mineral exploration operations not covered by the Generic PEPR (Adopted Program) for a 12 month period of time on one or more exploration licences (ELs), retention leases (RLs) or mineral claims (MCs) in South Australia.

Refer to the Exploration PEPR Terms of Reference and [Minerals Regulatory Guidelines MG22](#) when completing this application. Further information on exploration requirements in South Australia is available on the Department for Energy and Mining (DEM) Minerals website [www.energymining.sa.gov.au](http://www.energymining.sa.gov.au).

**SECTION A – GENERAL DETAILS**

Operational approval period	<b>12-month approval period, with an additional 3 months to complete all rehabilitation</b>		
Tenement details	EL5873, EL6415, EL6659, and EL6660		
Tenement holder(s) (for each tenement)	Havilah Resources Limited		
Operating company	Havilah Resources Limited, PO Box 3, Fullarton SA 5063		
Agency agreement (if applicable)	N/A		
PEPR prepared by	Amy Jacka, Havilah Resources Limited, Senior Geologist, <a href="mailto:amy.jacka@havilah-resources.com.au">amy.jacka@havilah-resources.com.au</a> , 0438 822 771		
Project supervisor/contact person(s)	Traviss Just, Havilah Resources Limited, Chief Geologist <a href="mailto:traviss.just@havilah-resources.com.au">traviss.just@havilah-resources.com.au</a> , 0428 425 789, B.App.Sc, MSc in Geology. Over 30 years' experience in exploration and mining geology.		
Project/prospect name	Central Curnamona		
Location details	The project area is in the northeast of South Australia close to the NSW border. Geologically the project is in the Curnamona province.		
Project description, commodity type and mineralisation model	<p><b>Northern Area – Birksgate and Eurinilla (Maps 1 to 5):</b></p> <ul style="list-style-type: none"> <li>IOCG and skarn style Cu-Au mineralisation at various prospects at the Birksgate Prospect. Kalkaroo / Nth Portia style Cu-Au mineralisation in the prospective sequence (Portia Fm.) around the margin of the Eurinilla Dome.</li> </ul> <p><b>Southern Area – Johnson Dam (Maps 1, and 6 to 7) and Deep Well (Maps 8 and 9):</b></p> <ul style="list-style-type: none"> <li>Kalkaroo replacement &amp; structurally controlled styles of Cu-Au mineralisation at the Johnson Dam Prospect.</li> </ul> <p><b>PROJECT DRILLING</b></p> <p>EL5873 – 50 RC, EL6415/EL6660 – 20 RC, and EL6659 – 30 RC, 2 DD – possible diamond tails at Johnson Dam prospect and Deep Well Prospect (previous holes) – Total 102 holes, ~21,600 m.</p>		
Proposed project schedule	Start date	01/04/2025	End date 01/04/2026

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**DECLARATION**

I, the tenement holder, declare under regulation 84 of the Mining Regulations 2020, that I have taken reasonable steps to review the information in this PEPR/ revised PEPR to ensure its accuracy.

Name	Amy Jacka	Signature (digital allowed)	
Position	Senior Administration Geologist	Date	11 April 2025

Copy and paste the above table if there is more than 1 tenement holder.

Note: An authorised representative from each tenement holder must sign the declaration (eg in accordance with the Corporations Act 2001).

**SECTION B – PROGRAM PREPARATION AND ACCESS TO LAND**

**Work undertaken in preparing the proposal**

Summarise the research and fieldwork undertaken in preparing the proposal including:

- desktop reviews of existing information
- field visits for reconnaissance
- contractor consultation (i.e. equipment scale, type)
- other information used when planning the proposed program.

The drill hole locations were planned following extensive collation and interpretation of existing data (both historical from previous companies and from Havilah's ongoing regional exploration) in combination with the extensive local geological knowledge of the Havilah geologists, who have been working in the area for many years.

Notices of Entry on Land (Form 21B) have been or will be served on the relevant landholders in advance of entry on the land. Havilah have longstanding good relationships with all landholders within the area and maintain continual and open communication regarding any on-ground activity, especially where ground disturbing drilling is involved. Ongoing dialogue (face-to-face as much as possible) both formally and informally with the landowners normally occurs before, during and after all drill programs.

All native title claimants have been served Form 21Bs and requests for native title clearances have or will be submitted to the relevant parties in relation to the drilling on the respective native title claim areas. Reconnaissance visits have been made to each prospect area, in preparation for pegging the drill sites for clearance.

The pastoral lease on which the Kalkaroo deposit is located is owned by Kalkaroo Pastoral Company Pty Ltd., a wholly owned subsidiary of Havilah Resources Limited.

**Consultation (r. 64)**

Using the table below, provide a summary of the individual or group of similarly affected persons and summarise the results of consultation that has been undertaken on the proposed operation. Types of interested or affected parties include residents, council, government agencies etc (exclude native title groups and defence owned or controlled lands – refer to relevant sections below).

Tenement	Stakeholder	Land tenure	Land use	Date and type of NOE served	Type of exempt land	Date waiver obtained	Date consultation/access agreement and/or permits signed/authorised	Stakeholder concerns raised and how addressed
EL5873	Mutooroo Pastoral Co Pty Ltd (Quinyambie Station)	Crown Lease CL 6181/765	Pastoral – grazing of sheep and cattle	Form 21B 28/07/2022	NA	NA	Notice of entry previously served. New notice of entry (Form 21B) served July 2022. Notification and consultation were with Station Manager in Oct/Nov 2023.	Maintain good relations with manager and property owner and no issues ever raised.
EL5873, EL6415, EL6660	Mutooroo Pastoral Co Pty Ltd (Mulyungarie Station)	Crown Lease CL 6181/746 CL 6181/747	Pastoral – grazing of sheep and cattle	Form 21B 27/07/2022	NA	NA	Notification and consultation were undertaken with Station Manager in 2020 and again in Dec 2021, prior to the Heritage Survey (partly completed). Renewed consultation (Form 21B) provided July 2022. Notification and consultation with Station Manager in June/July 2024.	Maintain good relations with manager and property owner and no issues ever raised.
EL6659	Kalkaroo Pastoral Company Pty Ltd (Kalkaroo Station)	Crown Lease CL 6162/839	Grazing	Form 21B 27/07/2022	NA	NA		Owned by Havilah Resources Limited.
EL5873, EL6659,	Ngadjuri Adnyamathanha	Native Title Claim		Form 21B 02/09/2022	NA	NA		WACA in place and a heritage survey is being organised to clear drill sites

**Exploration PEPR application – 12-month period**

Tenement	Stakeholder	Land tenure	Land use	Date and type of NOE served	Type of exempt land	Date waiver obtained	Date consultation/access agreement and/or permits signed/authorised	Stakeholder concerns raised and how addressed
EL6415, EL6660	Wilyakali Native Title AC	SCD2018/002						
EL5873, EL6659,	Adnyamathanha No.1	Native Title Claim SCD2015/001		Form 21B	NA	NA		WACA in place and a heritage survey will be organised to clear any drill sites which lie on this claim area.
EL5873, EL6659, EL6415	Adnyamathanha No.1 – Stage 2	Native Title Claim SCD2014/001		Form 21B	NA	NA		WACA in place and a heritage survey will be organised to clear any drill sites which lie in this claim area.
EL6415, EL6660	Malyangapa Combined Proceedings Native Title Claim Group	Native Title Claim NC2022/002		Form 21B 24/04/2023	NA	NA	A heritage survey undertaken in April 2024.	WACA in place and a heritage survey will be organised to clear any drill sites which lie in this claim area.
All	SANTS			Form 21B 14/07/2022	NA	NA	Involved in Heritage Surveys.	
All	Mining Registrar			Form 21B 16/05/2024	NA	NA		
EL5873	Dog Fence Board				NA	NA	Email to South Australian Dog Fence (04/07/2024): Marty Bower – Dog Fence Program Manager (marty.bower@sa.gov.au) Ash Rees – Dog Fence Inspector (ash.rees@sa.gov.au)	The drilling locations will not be within 20 metres of the Dog Fence track. The Dog Fence track will be used for accessing drill lines. No concerns (Ash Rees).

If any individual or group of similar affected persons were not able to be consulted, what steps were taken to consult with them?

Havilah maintains good relationships with all its neighbouring landholders. It is in regular contact with them and frequently updates them on its exploration plans.

Provide any additional relevant information.

Consultation has or will be carried out as follows:

- Serving of the NOEs to the owners of both the pastoral blocks, the native title claimants, SANTS and the Mining Registrar.
- Liaise with the manager of all listed stations about the timing and location of the planned drilling.
- A request for heritage clearance of the drill sites has been or will be submitted to the relevant native title claimants via their legal representatives and heritage clearance surveys organised to clear nearly all the planned drillholes on the respective claim areas. This includes ATLA, NAWNTAC and Malyangapa native title claimants.
- The South Australian Dog Fence (Marty Bower – Dog Fence Program Manager ([marty.bower@sa.gov.au](mailto:marty.bower@sa.gov.au)) and Ash Rees – Dog Fence Inspector ([ash.rees@sa.gov.au](mailto:ash.rees@sa.gov.au))) were notified of Havilah's proposed activities by email..

**SECTION C – DESCRIPTION OF THE ENVIRONMENT**

Include a description of the features of the environment that are expected to be affected by the proposed operations. Each of the elements of the existing environment listed below must be described only to the extent that they may need to be considered in assessing the impacts that the proposed exploration operations are reasonably expected to have on the environment. If the element is not likely to be impacted by the operation, a statement to that effect must be included.

Where the terms and conditions of an RL include environmental outcomes, include any new baseline environmental data relevant to the control strategies or measurement criteria, and where changes to the environment are identified, provide an updated description of the environment to describe the changes.

**Proximity to infrastructure and housing**

Provide the following information:

- Settlements – indicate the name and distance of the nearest town, and residences within, or near the proposed exploration operations.
- Roads and tracks – indicate existing fence lines, roads and tracks, including those which are to be used in the exploration program.
- Other human infrastructure such as schools, hospitals, commercial or industrial sites, roads, sheds, bores, dams, ruins, pumps, scenic lookouts.
- Railway lines, transmission lines, gas and water pipelines, communication lines – e.g. fibre optic cables etc., if these may be impacted by the exploration operations.

Provide this information on a locality plan/map.

There are no settlements or places of human habitation within any of the areas of proposed drilling. Station roads, tracks, fences, bores, tanks, and dams are the only infrastructure, none of which will be affected by the proposed drilling activities. The nearest inhabited station homesteads are at Strathearn, Mooleulooloo, Yarramba and Mulyungarie, well outside the three areas. The old Benagerie homestead is derelict and abandoned. Havilah's exploration camp is located at the Kalkaroo Homestead, which is the closest to the proposed Johnson Dam prospect drilling and is owned by the Kalkaroo Pastoral Company Pty. Ltd., a wholly owned subsidiary of Havilah Resources Limited. The station homesteads and other infrastructure are too far removed from the areas of proposed drilling for there to be any impact from the proposed activities **Maps 1 to 9**.

## Exploration PEPR application – 12-month period

### Land use and tenure

Using the table below, select the land tenure and land use that the proposed exploration activities will occur in. Include additional information where prompted.

Land tenure/type	Applicable	Land use	Applicable
Freehold	<input type="checkbox"/>	Grazing	<input checked="" type="checkbox"/>
Pastoral lease	<input checked="" type="checkbox"/>	Cultivated land	<input type="checkbox"/>
Perpetual lease	<input type="checkbox"/>	Residential	<input type="checkbox"/>
Crown land	<input checked="" type="checkbox"/>	Township	<input type="checkbox"/>
Mining reserve	<input type="checkbox"/>	Industrial	<input type="checkbox"/>
Aboriginal freehold/leasehold land (e.g. Anangu Pitjantjatjara Yankunytjatjara and Maralinga Tjarutja lands)	<input type="checkbox"/>	Tourism	<input type="checkbox"/>
Forestry reserve	<input type="checkbox"/>	Conservation	<input type="checkbox"/>
Marine parks	<input type="checkbox"/>	Defence activity	<input type="checkbox"/>
National parks, conservation parks, conservation reserves, regional reserves* NA	<input type="checkbox"/>	Road reserve	<input type="checkbox"/>
Adelaide Dolphin Sanctuary	<input type="checkbox"/>	Sites of scientific significance (geological monuments, fossil reserves etc.)	<input type="checkbox"/>
Murray Darling Basin	<input checked="" type="checkbox"/>	Orchard/vineyard	<input type="checkbox"/>
		*Native vegetation heritage agreements	<input type="checkbox"/>
Other*	<input type="checkbox"/>	NA	
		*European heritage sites	<input type="checkbox"/>
		NA	
		*Other (e.g. historic mining)	
		NA	

\* Indicates more information required in field immediately below.

Describe any council policies (or out of council) or development plans that may impact the program area.

NA
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Provide a description of any known plans for future land use changes by other parties.

NA
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Provide any additional relevant information.

NA
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### Woomera Prohibited Area (WPA)

Will activities be conducted within the WPA	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Do you have a resource exploration permit in place?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
In which zone will activities be conducted?					
Does the Exploration Permit allow the operator to conduct exploration operations in the WPA?				Yes <input type="checkbox"/>	No <input type="checkbox"/>
What is the expiry date of the resource exploration permit?					
Identify closure periods that may impact on the exploration program.					

## Exploration PEPR application – 12-month period

### Other land owned or controlled by the Commonwealth Department of Defence

Lands in South Australia that are owned or controlled by the Commonwealth Department of Defence, which they manage either as a training or test area, include the Port Wakefield Proof and Experimental Establishment, Murray Bridge Training Area, and Cultana Training Area.

These lands remain to be mineral land under the Mining Act 1971 (SA) and can be accessed for mineral exploration and mining subject to certain restrictions and conditions under the Defence Act 1903 (Cth) and the Defence Regulation 2016 (Cth).

Will operations be conducted within the Port Wakefield Proof and Experimental Establishment, Murray Bridge Training Area, or Cultana Training Area?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Do you have a Deed of Access with Defence?	Yes <input type="checkbox"/>	No <input type="checkbox"/>
What is the expiry date of the Deed of Access?		
Provide the date the Range Control Officer granted access permission to conduct the proposed exploration operations.		
Describe the results of consultation and how any concerns raised were addressed.		

### Native title

Using the table below, describe how you have complied with the requirements of Part 9B of the Mining Act for each tenement (for further information refer to [Minerals Regulatory Guidelines MG22](#)).

Native title			
Is the proposed area of exploration located on native title land?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> (If no, no further information in this section required.)		
Are there registered native title party/parties in the area of proposed exploration?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	<b>Adnyamathanha No.1</b> SCD2015/001, SAD6001/1998 <b>Adnyamathanha, Ngadjuri, and Wilyakali Overlap Claim (NAWNTAC)</b> SCD2018/002, SAD6001/1998, SAD147/2010, SAD417/2015 <b>Malyangapa Combined Proceedings</b> NC2022/02, NSD525/2021 <b>Map 10.</b>	If no, an Environment, Resources and Development (ERD) Court determination is required.
Have you negotiated a native title mining agreement?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the agreement registered?*	Instrument Number 148: EL5873 Instrument number 286: EL6659, EL6660 Instrument number 286 and 54254: EL6415
Have you accepted an Indigenous land use agreement (ILUA)?	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Is the ILUA registered?*	Yes <input type="checkbox"/> No <input type="checkbox"/>
Have you obtained ERD Court determination?†	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Is the determination registered?*	Yes <input type="checkbox"/> No <input type="checkbox"/>

\* The registration date refers to the date the agreement, determination or ILUA was registered with DEM.

† An ERD Court determination cannot be conjunctive (i.e. cannot apply to subsequent licences).

Provide any additional relevant information.

Each of the drilling areas is on a different native title claim area and each relevant claimant group will be dealt with separately.
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## Exploration PEPR application – 12-month period

### Landform and topography

Describe the topography of the general area affected by the exploration program. Include the susceptibility to erosion and visual attributes (steep or undulating slopes, plains, rocky outcrops, dunes, salt pans, clay pans etc.).

The Central Curnamona Project Area lies within the plains of the Lake Frome Basin. The plains are flat to slightly undulating, with the land surface falling gradually at a gradient of about 1 in 1,000 towards Lake Frome, 100 km to the northwest of the project area. Apart from three isolated basement ridges (Mooleulooloo Hills and Mt. John) near Mooleulooloo Homestead and a rocky knoll at Kalkaroo (Johnny Hill), the nearest areas of elevated topography are the Olary Ranges about 60 km to the south. To the east, the Barrier Range lies beyond the New South Wales border.

The landscape surrounding the project area is characterised by a flat to slightly undulating sandy plain, with low sandy dunes and shallow interdunal areas with scattered small clay pans, trending in a south westerly to north easterly direction. **Photos 1 to 6** attached, show indicative landform, vegetation, and topography.

### Soil and surface cover

Describe soil types and soil surface cover - e.g. gibber, rocky - in the general area affected by the exploration program. Include details on the susceptibility to compaction, erosion, dust, runoff and any other soil characteristics – e.g. acid sulphate – that may require control strategies to reduce environmental impacts during operations or rehabilitation.

The project area is situated within the Benagerie Association of the Southern Frome Basin Region. Soil types and other parameters are described on a schematic profile basis.

The most widespread soil type is found on the principal landform of the area (flat plain with maximum slope 1%) as a brown calcareous earth. Low undulating dunes, the sub-dominant landform type, are characterised by deep reddish sands and some brown calcareous earths. Both are well drained and contain carbonate nodules in the B horizon and below. Occasional pans (small depressions) occur and are distinguished by poorly drained soils: where Gilgai micro-relief is present, the soil is a uniform brown loam, self-mulching with cracking clays, and where a surface crust occurs, the soil is a crusty red duplex type with a strongly structured B horizon. All soils in the Benagerie Association described above have an alkaline reaction trend.

Both the deep reddish sands and the brown calcareous earth are moderately susceptible to powdering and wind erosion, because of disturbance when the ground cover is removed by overgrazing or by vehicle movements.

The susceptibility for significant erosion due to water runoff is very low, because of the low topographic relief and low rainfall of the area. Very localised minor erosion of disturbed areas due to runoff in heavy downpours from rare thunderstorms is the only possibility.

The area has low rainfall, high evaporation rate and resulting sparse vegetation. Previous overgrazing by native and introduced animals has led to soil becoming exposed, often resulting in the generation of large amounts of dust in periods of strong winds, particularly during the warmer months and in times of drought. The amount of dust generated by exploration activities is minor, very localised, and insignificant compared to this source.

The effects of compaction, erosion, dust, and runoff on the integrity of the soils of the area can be mitigated by keeping vehicle movements to a minimum and by prompt rehabilitation involving scarification and revegetation, largely from existing seed stock within the topsoil.

### Surface water

Will the proposed program interfere with surface water bodies and natural drainage (e.g. drainage lines, creeks, floodplains, wetlands)? If yes, describe the potential interference and surface water bodies and natural drainage on maps. If no, indicate why.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Is the program area located within water protection areas defined under the <i>River Murray Act 2003</i> ? If yes, provide the name(s).	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Is the program area located within any prescribed watercourses or prescribed surface water areas under the <i>Landscape South Australia Act 2019</i> ? If yes, provide the name(s).	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

## Exploration PEPR application – 12-month period

### Groundwater

<p>Is groundwater likely to be intersected when conducting the exploration program?</p> <p>If yes, use the table below to describe the expected groundwater (hydrogeological) conditions, and identify groundwater aquifers in the exploration area(s) that may be affected. Indicate the approximate depth of drillholes in each area. Copy and paste a new table for each area where different groundwater conditions are expected.</p> <p>If no, provide evidence or any supporting information demonstrating this.</p>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
<p><b>Appendix 1</b> provides a more detailed discussion of the hydrogeology of the Curnamona prospects that are the subject of this EPEPR.</p> <p>Basement geology comprises metamorphosed Palaeoproterozoic Willyama Supergroup rocks, Mesoproterozoic Benagerie Volcanics, and Ninnerie Suite granitoids of the Curnamona Province and some Neoproterozoic metasediments. Basement rocks are unconformably overlain by Cenozoic cover strata that generally increase in thickness towards the north, excepting over basement topographic highs.</p> <p>The basement rocks typically have a deeply weathered profile of clay rich saprolite to saprock above the fresh unweathered variably fractured bedrock. This varies locally depending on basement topography, the sulphide content of the original basement strata, and the presence of structural features such as shear zones that result in deeper weathering or removal (erosion) of the profile.</p> <p>Cenozoic cover includes Eyre Formation, typically preserved as white to grey soapy clays (Eyre Clay) as localised remnants in basement topographic lows. Eyre Formation sands and gravels are limited to rare, incised channels in the basement such as the Yarramba Palaeochannel that is host to the Honeymoon Uranium Mine. Cenozoic Namba Formation clays and sands unconformably overlie the Eyre Formation and basement and form a blanketing cover over much of the Curnamona North area that is typically capped by Quaternary outwash sediments of the Frome Plains (including frequent hardpan) that in turn are overlain by Holocene aeolian sands that increase in abundance towards the north.</p> <p>These cover strata are variably developed from place to place, and their thickness is controlled by the Benagerie Ridge basement high and local basement topography. In the south basement rocks outcrop (Olary Ranges) or are very near surface (Johnson Dam) and they can also subcrop or have minimal cover many kilometres to the north (Croziers, Birksgate). More generally, there is significant cover of Namba Formation clays (and more rarely Eyre Clay) lying unconformably on the basement over much of the area (Eurinilla).</p> <p>Namba Formation consists predominantly of medium to high plasticity, highly fissured smectitic clay with occasional thin lenses of clayey sand and silt. Eyre Formation may occur locally beneath the Namba Formation and consists of plastic, highly fissured clay and silty clay in this area.</p> <p>Surficial Quaternary sediments and underlying Cenozoic Namba (where present) and Eyre (where present) Formation strata are clay rich with low permeability. Clay rich Cenozoic strata are highly fissured with joints and slickensides providing secondary permeability. Basement rocks are generally of low permeability with joints and fractures providing secondary permeability.</p> <p>Ephemeral perched water tables in the Quaternary cover sediments are not identified in geotechnical studies (Water Technology, 2021 and Mining One, 2017), Portia Tailings Storage Facility compliance monitoring of wells screened in these sediments, or the Portia mine open pit.</p> <p>Groundwater occurs in a single, low permeability, unconfined aquifer with a potentiometric surface (water table) with a low but consistent general hydraulic gradient across the region indicating flow from south (Olary Ranges – recharge area) to north (toward Lake Frome). The water tables are in basement rocks to the south and transitions to the Namba Formation to the north. Saturated formations are transmissive and low permeability (Namba Formation, Eyre Formation – Eyre Clay, and basement – including the highly weathered clay dominated saprolite to saprock to unweathered rock). Groundwater is slow moving with a generally increasing salinity with distance away from recharge zones (Olary Ranges). Water quality is typically saline across the exploration prospects.</p> <p>In previous phases of exploration drilling on Havilah’s exploration prospects the intersection of regional groundwater has typically been evident as wet or mushy RC (reverse circulation) returns and occasional slugs of saline water suggesting intersection with water filled permeable sedimentary lenses, joints, or fractures. Intersection with larger water filled structures tends to produce initial water discharge that decreases over time as drilling progresses beyond the structure.</p> <p>Groundwater quality in this low permeability, regional unconfined aquifer is saline, typically around 13,625 mg/L total dissolved solids, with a pH of around 7.8.</p> <p>Eromanga Basin (and hence Great Artesian Basin) aquifers such as the Cadna-owie Formation do not occur in the areas of proposed drilling based on past exploration drill hole data (See <b>Appendix 1</b>).</p>		

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<b>Description of the locality/area where different groundwater conditions may be encountered</b>					
Callabonna Sub-basin in the Kati Thanda - Lake Eyre Basin, Curnamona Province					
<b>Johnson Dam Prospect</b>					
<b>Formation age and/or stratigraphic unit</b>	<b>Stratigraphic intervals (depth range) (m)</b>	<b>Aquifer formation name</b>	<b>Aquifer interval/thickness (from-to) (m)</b>	<b>Type of aquifer(s) intersected (e.g. unconfined, confined, artesian)</b>	<b>Provide aquifer salinity, depth to water level and any other relevant comments</b>
Quaternary sediments	largely absent, if present, up to 2 m	NA	NA	NA	NA
Willyama Supergroup Curnamona and Strathearn Groups and overlying weathered profile (saprolite) ~1700ma	Surface to beyond limit of drilling	Regional low permeability water bearing zone	From ~45 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)
<b>Birksgate Prospect</b>					
<b>Formation age and/or stratigraphic unit</b>	<b>Stratigraphic intervals (depth range) (m)</b>	<b>Aquifer formation name</b>	<b>Aquifer interval/thickness (from-to) (m)</b>	<b>Type of aquifer(s) intersected (e.g. unconfined, confined, artesian)</b>	<b>Provide aquifer salinity, depth to water level and any other relevant comments</b>
Quaternary sediments	0 - 6	NA	NA	NA	NA
Namba Formation – Early-Mid Miocene	6 - 16	NA	NA	N/A	NA
Willyama Supergroup Curnamona and Strathearn Groups and overlying weathered profile (saprolite) ~1700ma	16 – beyond limit of drilling	Regional low permeability water bearing zone	From ~30 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8)
<b>Eurinilla Prospect</b>					
<b>Formation age and/or stratigraphic unit</b>	<b>Stratigraphic intervals (depth range) (m)</b>	<b>Aquifer formation name</b>	<b>Aquifer interval/thickness (from-to) (m)</b>	<b>Type of aquifer(s) intersected (e.g. unconfined, confined, artesian)</b>	<b>Provide aquifer salinity, depth to water level and any other relevant comments</b>
Quaternary sediments	0 - 14	NA	NA	NA	NA
Namba Formation – Early-Mid Miocene	14 - 56	NA	NA	N/A	NA
Eyre Formation – Eocene	If present 56 - 66	Regional low permeability water bearing zone	From ~30 m to beyond limit of drilling	Unconfined	Saline groundwater (TDS ~13,625 mg/L, pH ~ 7.8).
Willyama Supergroup Curnamona and Strathearn Groups and overlying weathered profile (saprolite) ~1700ma	66 – beyond limit of drilling				

Provide the environmental value of each aquifer present determined according to the current Environment Protection (Water Quality) Policy.

Due to the salinity being generally higher than is usable for longer term stock watering (i.e. >10,000 mg/L for sheep and half for cattle), the groundwater in the area is not presently used for any domestic or commercial purposes.

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Provide a description of the existence, location and value of all Groundwater Dependent Ecosystems (GDEs) within and immediately surrounding the project area.

There are no known permanent GDEs in the area, excepting possibly Lake Yantaweena in the northeast corner of EL5873 (**Map 11 and 12**) which is distant from any drilling sites. This is because all surface water is runoff that is related to infrequent rainstorms and quickly dries up due to evaporation. All vehicle movement during drill programs will be restricted to cleared overland access routes and drilling on selected pad areas.

Is the proposed program located within a prescribed wells area or prescribed water resource area? If yes, provide the name of the area.	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
The planned Birksgate drillholes lie within the Far North Prescribed Wells area, however previous drilling in this area has encountered relatively shallow Willyama Supergroup rocks with no Great Artesian Basin (GAB) aquifer formations present. Therefore, drilling methodologies like that at other prospects to the south will be employed (refer to <b>Appendix 1</b> )		

Provide any additional information, if required.

NA

### Native vegetation

Will you be working within areas of native vegetation? If yes, provide the following information: <ul style="list-style-type: none"> <li>• description of the formation and structure of vegetation in the area (e.g. woodland, shrubland, grassland)</li> <li>• list of the dominant species.</li> </ul> If no, indicate why you will not be working within areas of native vegetation?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
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#### **Northern Area – Benagerie (Birksgate and Eurinilla)**

The regional vegetation is dominated by saltbush, bluebush and bindii, with sparse scattered patches of turpentine bush and sheoaks or black oaks on the sandy dunes.

Given the very close proximity between the proposed drilling areas and the Portia Mine site, flora surveys conducted for the mining PEPR are easily translatable to the current proposed drilling prospects. To complement these surveys, searches of both the State and Australian threatened species databases were made.

This area lies within the Broken Hill Complex Bioregion (Neagle, 2003) and consists mainly of sandy-clay plains with low shrubland vegetation (Playfair and Robinson, 1997). The Benagerie Dome area is located within the North Olary Plains region. Two vegetation surveys covering the Portia gold deposit, which is near the proposed drilling areas, on Mulyungarie Station were conducted under a South Australian Department for Environment and Heritage Permit to Undertake Scientific Research No. G24191 8 held by Dr F.J. Badman. The first survey formed part of an official DEH biological survey, designated “Number 577, Oban – Curnamona Energy”. The second survey also undertaken by Badman Environmental occurred during the second week of October 2007 and is complementary to the earlier survey in June 2007. The two surveys occurred under very different environmental conditions with the first survey after a period of rainfall when conditions were wet and the second when conditions were dry, and all ephemeral species had dried off. Data from the two surveys have been combined.

Vegetation of the Portia survey area fell within five groups. A brief description of the vegetation groups is summarised below.

#### **Group 1**

This is the most common vegetation type in the area. It consists of low open or sparse shrublands dominated by *Maireana astrotricha* on sandy-loam soils. *Maireana aphylla* (Cotton-bush) occurs at most sites in this group and *Atriplex vesicaria* was recorded at a majority of sites. *Gunnioopsis quadrifida* (Sturt’s Pigface) is common at some sites. At the time of the 2007 survey, the understorey was dominated by *Atriplex holocarpa* (Pop Saltbush) and *Sclerolaena ventricosa* (Salt Bindyi).

No other species were dominant in this group and very few tall shrubs and no trees were recorded here. Other species that were often recorded in the understorey include *Austrostipa nitida* (Balcarra Spear-grass), *Dissocarpus biflorus* (Two-horn Saltbush), *Gnephosis arachnoidea* (Spidery Button-flower), *Salsola kali* (Buckbush), *Sclerolaena decurrens* (Green Bindyi), *Sclerolaena intricata* (Tangled Bindyi) and *Tripogon loliiformis* (Five-minute Grass).

Only four introduced species were recorded in this group. The most common of these were *Carrichtera annua* (Ward’s Weed) and *Schismus barbatus* (Arabian Grass). Other alien species recorded here are *Brassica tournefortii* (Wild Turnip) and *Sonchus oleraceus* (Common Sow-thistle), neither of which was very common.

#### **Group 2**

Group 2 vegetation includes sites that are like those in Group 1, but generally support more trees or tall shrubs. This group was found to occur on sandy or sandy-loam soils, with the upper storey including some or all of *Acacia aneura* (Mulga), *Dodonaea viscosa ssp. angustissima* (Narrow-leaf Hop-bush), *Hakea leucoptera* (Silver Needlewood) and *Senna artemisioides ssp. petiolaris* (Senna). The understorey includes the low shrubs *Gunnioopsis quadrifida*, *Maireana astrotricha* and *Rhagodia spinescens* (Spiny Saltbush) and the herbs and forbs *Atriplex holocarpa*, *Atriplex limbata* (Fan Saltbush), *Salsola kali*, *Sclerolaena decurrens* and *Sclerolaena diacantha* (Grey Bindyi). Less common species include *Atriplex velutinella* (Sandhill Saltbush), *Austrostipa nitida*, *Enchylaena tomentosa* (Ruby Saltbush) and *Tripogon loliiformis*. *Schismus barbatus* was the most recorded alien species in this group, with *Brassica tournefortii* also recorded here.

#### **Group 3**

Although only one site was sampled in this group, it is typical of the numerous cane-grass swamps and claypans that occur throughout the survey area. These have a clay base and hold water for varying periods following significant rainfall events.

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The dominant species is the hummock grass *Eragrostis australasica* (Cane-grass). The shrubs *Chenopodium nitrariaceum* (Nitre Goosefoot), *Muehlenbeckia florulenta* (Lignum) and *Rhagodia spinescens* are slightly less common. *Dodonaea viscosa ssp. angustissima* also occurs here in the upper storey.

The understorey is made up mainly of short-lived species with a few biennials, and includes *Atriplex holocarpa*, *Atriplex spongiosa*, *Bulbine sp.* (Bulbine Lily), *Osteocarpum sp.* (Bonefruit), *Sclerolaena brachyptera* (Short-wing Bindyi), *Sclerolaena ventricosa* and *Zygophyllum iodocarpum* (Violet Twinleaf). *Eragrostis setifolia* (Bristly Love-grass) occurs near the margins of swamps. Some swamps are fringed by a narrow band of *Eucalyptus largiflorens* (River Box).

Three introduced species were recorded in this vegetation group, *Brassica tournefortii*, *Schismus barbatus* and *Carrichtera annua*. The first two of these prefer sandy soils and were recorded only on the sandy margins of the swamps.

### Group 4

This group contains areas of *Casuarina pauper* (Black Oak) woodland that occur on clay-loam soils just to the east of the central part of the survey area. *Casuarina pauper* dominates the overstorey, but *Alectryon oleifolius* (Bullock Bush) also occurs here. The understorey commonly includes the low shrubs *Maireana aphylla* and *Maireana pyramidata* (Black Bluebush), with *Gunniopsis quadrifida* and *Atriplex vesicaria* being less common. Other understorey species include *Einadia nutans* (Climbing Saltbush), *Enchylaena tomentosa*, *Eremophila glabra* (Tar Bush), *Rhagodia spinescens*, *Sclerolaena decurrens*, *Sclerolaena obliquispis*, *Tetragonia eremaea* (Desert Spinach), *Tripogon loliiformis* and *Zygophyllum iodocarpum*. No introduced species were recorded at the site that forms the basis for the description of vegetation in this group.

### Group 5

The final group contains sites on very low sand dunes and sandplain just to the west of centre of the survey area. Vegetation comprises low open shrubland or tall shrubland with a low shrubland understorey. Tall shrublands include *Dodonaea viscosa ssp. angustissima* or *Eremophila sturtii* (Turpentine Bush), while low shrublands include *Atriplex vesicaria*, *Gunniopsis quadrifida*, *Maireana astrotricha* and *Sclerolaena decurrens*. Other groundcover species include *Atriplex limbata*, *Erodium sp (p)*(Heron's Bill), *Sclerolaena diacantha/uniflora* and *Tetragonia eremaea*. No introduced species were recorded within this group

### Southern Area – Kalkaroo (Johnson Dam)

The Kalkaroo project has typical low shrubland vegetation consisting of sparse saltbush or bluebush, with very minor patches of acacia scrub and minor sheoak/black oaks. The area is one of disturbed vegetation with a long history of heavy grazing by native and domestic herbivores, combined with past drought conditions. Badman (2008) assessed the Kalkaroo Project area as falling into the category of "Native vegetation with some disturbance" based on the following criteria:

- The vegetation structure has been altered.
- Most seed sources are available to regenerate the original structure
- Obvious signs of disturbance
- Minor clearing of native vegetation (<10 % of the area cleared by grazing)
- Evidence of some grazing

### **Vegetation Group 1 (dominant group): Low Shrubland and Herbland Species include:**

- *Maireana astrotricha*, *Maireana aphylla* (Cotton-bush)
- *Atriplex vesicaria* (Bladder Saltbush)
- *Rhagodia spinescens* (Spiny Saltbush)
- *Atriplex holocarpa* (Pop Saltbush)
- *Dissocarpus biflorus* (Two-horn Saltbush)
- *Pycnosorus pleiocephalus* (Soft Billy-buttons)
- *Sclerolaena ventricosa* (Salt Bindyi)

### **Vegetation Group 2 (less common): Contains less low shrub and has lower species richness Species include:**

- *Atriplex lindleyi* (Lindley's Saltbush)
- *Sclerolaena divaricate* (Tangled Copperburr)
- *Carrichtera annua* (Ward's Weed)
- *Dissocarpus paradoxus* (Ball Bindyi)

### **Vegetation Group 3 (along watercourses): quite diverse because it contains sites along creeks with a larger variety of Species include:**

- *Eucalyptus camaldulensis* (River Red Gum)
- *Acacia victoriae* (Elegant Wattle)
- *Maireana brevifolia* (Short-leaf Bluebush)
- *Atriplex holocarpa* (Pop Saltbush)
- *Dissocarpus paradoxus* (Hard-headed Saltbush)
- *Goodenia glauca* (Pale Goodenia)
- *Pycnosorus pleiocephalus* (Soft Billy-buttons)
- *Sclerolaena diacantha* (Grey Bindyi)
- *Sclerolaena ventricose* (Salt Copperburr)
- *Tetragonia eremaea* (Desert Spinach)

### **Vegetation Group 4 (dominated by *Acacia carneorum* (Purple-wood Wattle)): area of low species richness outside the drilling area Species include:**

- *Acacia carneorum* (Purple-wood Wattle)
- *Acacia carneorum* (Needle Wattle)
- *Enchylaena tomentose* (Barrier Saltbush)
- *Gunniopsis quadrifida* (Sturt's Pigface)

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- *Maireana astrotricha* (Low Bluebush)
- *Rhagodia spinescens* (Spiny Saltbush)
- *Atriplex holocarpa* (Pop Saltbush)
- *Atriplex limbata* (Spreading Saltbush)
- *Sclerolaena decurrens* (Green Bindyi)
- *Sclerolaena ventricose* (Salt Copperburr)
- *Tetragonia tetragonioides* (New Zealand Spinach)

### Significant Flora

A search for information on threatened species indicated that there are no flora species listed as threatened under either the Commonwealth EPBC Act 1999 or the South Australian National Parks and Wildlife Act 1972. The *Acacia carneorum* (Purple-wood Wattle or Needle Wattle) however is listed as vulnerable. There are no known sightings of *Acacia carneorum* (Purple-wood Wattle or Needle Wattle) within the vicinity of any of the proposed drilling prospects. Havilah field personnel are supplied with Fact Sheets to assist with the recognition of Threatened Flora.

### Significant habitats and flora

If you are working within areas of native vegetation, use the table below to list any significant habitats and any rare or endangered flora species located or reported to have been in the area that may be impacted by the proposed program. Include known sightings of listed species on a locality plan/map.

Species/habitat	Common name	NPW Act rating*	EPBC Act rating†
<i>Acacia carneorum</i>	Purple-wood Wattle (Needle Wattle)	Vulnerable	Vulnerable
<i>Swainsona procumbens</i>	Broughton Pea	Vulnerable	Not Rated

\* *National Parks and Wildlife Act 1972* (NPW Act) conservation status includes extinct, endangered, vulnerable, threatened and rare.

† *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) listings include extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent.

### Weeds and pathogens

Provide information of the extent the area is affected or potentially affected by weeds and pathogens (e.g. phytophthora; buffel grass *Cenchrus ciliaris*).

The proposed drill areas are in the Buffel Grass Management Zone 2 (Contain Spread) however there are no known occurrences of Buffel Grass within the project area. Should an area of Buffel Grass infestation be encountered during the drilling program, cleaning procedures will be implemented when leaving the area of infestation and the area avoided.

The vegetation surveys surrounding drilling within the north found a low incidence of alien species which appears to be due to the lack of gullies and creeks flowing through the area. The most common introduced species recorded during the surveys were *Carrichtera annua* (Ward's weed) and *Schismus barbatus* (Arabian Grass). Other declared plants and high priority weeds recorded within the region are: *Marrubium vulgare* (Horehound), *Xanthium spinosum* (Bathurst burr) and *Xanthium strumarium sp. agg* (Noogoora burr), all declared plants under the NRM Act and *Carthamus lanatus* (Saffron thistle), *Cucumis myriocarpus* (Prickly paddy melon) and *Sisymbrium erysimoides* (Smooth mustard), all high priority weeds. Havilah field personnel are supplied with Fact Sheets to assist with the recognition of introduced weeds.

In the south Badman (2008) recognised twenty introduced species of which two *Echium plantagineum* (Salvation Jane) and *Lycium ferocissimum* (African Boxthorn) are Proclaimed Species, as listed by APCC (2004). The introduced species recorded during the October 2007 survey represent 16% of the total species list for this survey.

### Fauna

Describe the native and feral fauna that may be present in the application area, including feral species.

#### **Northern Area – Benagerie (Birksgate and Eurinilla)**

Given the very close proximity between the proposed drilling and the Portia Mine site, fauna surveys conducted for the mining PEPR are easily translatable to the current proposed drilling prospects. To complement these surveys searches of both the State and Australian threatened species databases were made.

The arid zone region (both generally and in this region) is species-poor for most groups and many of the populations of arid zone mammal and bird species have been and are threatened by anthropogenic influences, especially the impacts of pest plants and animals. A few of the larger species, such as kangaroo (two species), euro and emu, and some of the medium sized bird species, have benefited by the introduction of permanent water points.

#### **Birds:**

Seasonal conditions, primarily rainfall and its season of occurrence, have a major influence on the presence of most avifauna species. The KBR survey of 2011, undertaken after exceptional winter and summer rainfall, indicated that avifauna diversity was moderate with a total of 48 bird species recorded at the Portia site and nearby areas during the study period. In general, most of the avifauna recorded was in woodland areas (black oak and mulga) which are not present in the drilling area. However, many birds of prey from the *Accipitridae* (hawks and eagles) and *Falconidae* (falcons) were recorded.

Two species observed at the site and in adjacent areas, *Elanus scriptus* (letter-winged kite) and *Lophoictinia isura* (Square-tailed kite), have a State conservation status of Rare and Endangered respectively. *Falco hypoleucos* (Grey falcon) is also listed as Rare in South Australia (NPW Act). Grey falcon was observed well south of the site. Also recorded were the *Aquila audax* (Wedge-tailed eagle), the *Emblema pictum* (Painted finch) and the *Turnix velox* (Little Button-quail) which are species of interest for the wider region but are not of listed conservation significance.

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*Pedionomus torquatus* (Plains-wanderer) was not recorded at any of the surveyed sites and marginal habitat is present here for it.

**Feral species:** *Passer domesticus* (House sparrow) was observed.

**Mammals:**

There is, apparently, a low frequency and diversity of small terrestrial mammals recorded for the wider region with larger mammals (kangaroo species) and introduced and pest species dominating records. The KBR fauna survey in March 2011 was undertaken after exceptional winter and summer rainfall i.e., under ideal conditions for the occurrence of mammals. *Macropus rufus* (Red kangaroos) were observed on numerous occasions in the general area and were not specific to any site or habitat type. *Macropus fuliginosus* (Western grey kangaroos) were also observed but they were not as abundant as red kangaroos.

Small native mammal species observed included: *Pseudomys bolami* (Bolam's Mouse), *Notomys fuscus* (Dusky Hopping-mouse), *Pseudomys hermannsburgensis* (Sandy Inland mouse), *Sminthopsis macroura* (Stripe-faced dunnart) and *Leggadina forresti* (Forrest's mouse).

**Feral species:** The majority of the commonly observed feral species were the house mouse, which was present in plague numbers. Domestic sheep and cattle are still present within areas adjacent to the drilling prospects, as are introduced species such as European red fox, feral cat, dingo, and dingo-dog hybrid which are known to occur in the wider region. More recently feral pig and goats have been observed.

**Reptiles:**

The KBR survey (2011) indicates that reptile diversity is low given the range of habitat types present at the site and the surrounding areas. Six reptile species had been identified to occur within areas adjacent to the drilling prospects. These include: *Ctenotus schomburgkii* (Sandplain Ctenotus), *Pogona vitticeps* (Central Bearded Dragon), *Ctenophorus nuchalis* (Central Netted Dragon), *Nephurus levis* (Knob-tailed gecko), *Lucasium damaeum* (Beaded gecko) and *Diplodactylus tessellatus* (Tessellated gecko). *Varanus gouldii* (Gould's goanna) tracks and scats were present in all habitat types at the site and one individual was caught in a patch of black oak.

Havilah field personnel are supplied with Fact Sheets to assist with the recognition of Threatened Fauna.

**Southern Area – Kalkaroo (Johnson Dam)**

**Birds:**

A total of 40 bird species were recorded in the region during the survey. Most species were recorded in small numbers only.

**Feral Species:** *Passer domesticus* (House sparrow), and *Sturnus vulgaris* (Common starling).

**Mammals:**

Kellogg Brown & Root (2009) survey of the area noted that the diversity of mammal species was low. The following species were observed:

- *Macropus rufus* (Red Kangaroo) – dominant macropod
- *Macropus fuliginosus* (Western grey kangaroo)
- Dingo and Dingo-dog hybrids (scats observed)
- *Sminthopsis macroura* (Stripe-faced dunnart)
- *Planigale tenuirostris* (Narrow-nosed planigale)
- *Sminthopsis crassicaudata* (Fat-tailed dunnart)

**Feral Species:** European rabbit, *Felis catus* (Feral cat), *Vulpes vulpes* (European red fox), *Mus musculus* (House mouse), and *Sus scrofa* (Feral pig).

**Reptiles:**

A total of 7 reptiles (KBR, 2009) were observed in the proposed drilling area as listed:

- *Tympanocryptis tetraporophora* (Four-pored dragon)
- *Tiliqua rugose* (Sleepy lizard)
- *Tympanocryptis lineata* (Lined dragon)
- *Lucasium byrnie* (Gibber gecko)
- *Lucasium damaeum* (Beaded gecko)
- *Nephurus levis* (Smooth knob-tailed gecko)
- *Ctenotus robustus* (Eastern striped skink) – most recorded lizard.
- *Pseudonaja nuchalis* (Western brown snake) – observed by Havilah personnel.
- *Pseudechis australis* (Mulga snake or King Brown snake) – observed by Havilah personnel.

**Significant fauna**

Where possible, using the table below, list any rare or endangered fauna species located or reported to have been in the area that may be impacted by the proposed program. Include known sightings of listed species on a locality plan/map.

Species	Common name	NPW Act rating	EPBC Act rating
<i>Pedionomus torquatus</i>	Plains-wanderer	Endangered	Critically Endangered
<i>Elanus scriptus</i>	Letter-winged Kite	Rare	Not Listed
<i>Lophoictinia isura</i>	Square-tailed Kite	Endangered	Not Listed
<i>Falco hypoleucus</i>	Grey Falcon	Rare	Near Threatened
<i>Notomys fuscus</i>	Dusky Hopping-mouse	Vulnerable	Vulnerable

Note: NPW Act conservation status includes extinct, endangered, vulnerable, threatened and rare.

EPBC Act listings include extinct, extinct in the wild, critically endangered, endangered, vulnerable and conservation dependent.

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### Environmentally sensitive locations

Are there any environmentally sensitive locations within or close to the proposed exploration area (e.g. areas having particular ecological, cultural, scientific, aesthetic or conservation value)? If yes, provide a description of identified environmentally sensitive location(s). Mark these areas on a locality plan to identify any areas of conflict so that access roads or other activities can be planned and located effectively.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Are you likely to impact on the environmentally sensitive area? If yes, detail the likely effects the proposed program may have.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Include a statement concerning whether or not an Aboriginal heritage survey has been conducted by the proponent and if so, the results of the survey.		
Heritage surveys with the relevant Native Title claimant groups will be completed before drilling occurs.		

### SECTION D – DESCRIPTION OF PROPOSED EXPLORATION OPERATIONS

Each of the elements listed below must be described only to the extent that they apply to the proposed exploration program.

#### Equipment and personnel requirements

Using the table below, describe the equipment, size and composition of field crews, and proposed working hours/days required to conduct the proposed program.

Type of personnel	Number	Name of contractor company (if applicable)	
Geologists	2	Havilah personnel or contractors	
Land access/environmental	1	Havilah Environmental Manager	
Field assistants/technicians	2	Havilah personnel/Contractors	
Drilling crew	3	Havilah personnel/Certified contractor	
Site preparation and rehabilitation	2	Havilah personnel/Contractors	
Shifts worked per day	Hours worked per day	Days worked per week	
1	12	7 days, 2 weeks on/one week off. Ongoing stints if more staff available for rosters	
Equipment type	Owner/operator	Description/capacity	Activity/purpose
Multi-purpose drill rig (RC and DD capable)	Drilling Contractor (TBD)	UDR 1000	Drilling
Compressor/Rod Truck	Drilling Contractor (TBD)	1 x 8-wheel flat bed	Auxiliary Drilling Support
Water Truck	Drilling Contractor (TBD)	1 x 8-wheel 20,000L	Auxiliary Drilling Support
Backhoe	Havilah or Certified Contractor (TBD)	CAT Backhoe	Site prep/sump construction/rehab
2 x 4wd light Vehicles	Havilah and other contractors	Hilux dual cab	Site access for field crew/maintenance
Loader	Havilah or Certified Contractor (TBD)		Site preparation, track maintenance and rehabilitation

Provide any additional information, if required.

#### Low impact exploration activities

Will low impact exploration operations be conducted that are not covered by the <a href="#">Generic program for environment protection and rehabilitation – low impact mineral exploration in South Australia</a> , (generic PEPR)? If yes, describe each type of low impact operations proposed.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

## Exploration PEPR application – 12-month period

### Drilling activities

Will exploration drilling activities be conducted? If yes, fill out the below table Yes  No

Tenement	Drilling type	Maximum number of drillholes	Maximum drillhole depth (m)	Maximum number of sumps required at each site	Maximum size of sumps (length x depth x width) (m <sup>3</sup> )	Average size of each drill pad* (m <sup>2</sup> ) (no excavation required)	Number of sites requiring pad excavation	Average volume (m <sup>3</sup> ) of material to be excavated (excluding sumps)
EL5873	RC	50	400	1 sump	5x3x2m(30m <sup>3</sup> )	30mx30m (900m <sup>2</sup> )	0	0
EL6415, EL6660	RC	20	400	1 sump	5x3x2m(30m <sup>3</sup> )	30mx30m (900m <sup>2</sup> )	0	0
EL6659	RC	30	400	1 sump	5x3x2m(30m <sup>3</sup> )	30mx30m (900m <sup>2</sup> )	0	0
EL6659	DD	2	800	3 sumps	5x3x2m(30m <sup>3</sup> )	40mx40m (1,600m <sup>2</sup> )		
<b>TOTAL</b>		<b>102</b>	<b>41,600</b>	<b>100</b>	<b>3,180m<sup>3</sup></b>	<b>93,200m<sup>2</sup></b>	<b>0</b>	<b>0</b>

Total number of drillholes (add each row to calculate the total).

Total metres proposed (maximum number of holes x average depth for each row, then add each row to calculate the total).

Total number of sumps (maximum number of sumps x drillsites for each row, then add each row to calculate the total).

Total volume of sumps (maximum size of sumps x number of sumps for each row, then add each row to calculate the total).

Total area of disturbance (number of holes x average size for each row, then add each row to calculate the total).

Total number of pads requiring excavation (add each row to calculate the total).

Total volume of material to be excavated (number of sites requiring excavation x average volume for each row, then add each row to calculate the total).

\* The footprint includes all areas of disturbance associated with the drillsite.

### Drillsite preparation

If exploration drilling activities are proposed, describe the methods used to prepare sites, including vegetation clearance requirements, site levelling and digging of sumps.

- Drill sites are located on existing tracks or open areas to minimise ground and vegetation disturbance, wherever possible.
- Vehicles to be restricted to existing/cleared overland access routes and the cleared drill pad, to minimise ground and vegetation disturbance.
- Ground cover clearing or minor levelling is normally done by hand (rakes & shovels)
- Drilling will be restricted to flat areas between dunes (dune swales) to avoid cut and fill pads or drilling on dune crests to the extent possible. Some access may be required across dune crests to reach drill sites, although this will be avoided as far as possible.
- Clearing will always be of a minimal nature to reduce environmental impact and lessen the requirement for extensive rehabilitation.
- All sumps are to have a ramp, to enable animals to escape, should they happen to fall in.
- Sumps will be fenced if stock are at risk, and they may be bunted for safety.
- Topsoil and subsoil dug up is stockpiled separately.
- 30 m x 30 m (900 m<sup>2</sup>) for RC and 40 m x 40 m (1,600 m<sup>2</sup>) for DD drill pad area required.
- 1-3 (DD) – sumps for outside return 5m L x 3m W x 2m D.

**Exploration PEPR application – 12-month period**

**Drillhole construction and decommissioning**

Have the personnel responsible for implementing the proposed program read and understood the Earth Resources Information Sheet M21, <a href="#">Mineral exploration drillholes – general specifications for construction and backfilling?</a>	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
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Describe how drillholes will be constructed, including the casing material to be used, depth of casing, if the casing will be cemented, cementing intervals and the class of driller that will install the casing.

Reverse circulation holes will be pre-collared using either a 9" blade bit or hammer into the plastic Namba clay to a depth of between 24 to 36m (depending on depth of unconsolidated cover) and cased with 6" (150mm) Class 9 PVC. The casing is pushed into the clay, grouted at the base with cement or gypset, then cemented in with polyurethane foam (Sifoam) down the outside of the casing. The hole is then drilled to depth using a ~5 1/2" hammer.  
Diamond holes will be constructed with Reverse Circulation (RC) precollar through Quaternary sands and clay, saprolite and fresh rock to the desired depth. PVC casing through the unconsolidated cover will be required. HQ/NQ size diamond coring from the base of the precollar through the target zone.

When describing drillhole decommissioning requirements, include the materials to be used, stratigraphic intervals where cement plugs will be placed, if the casing will be removed and when decommissioning will occur after drilling is completed.

Havilah's updated groundwater and strata properties interpretation (**Appendix 1**):

- Groundwater in the Namba Formation and underlying basement rocks form one continuous low permeability unconfined aquifer as opposed to groundwater in the basement rocks being confined by Namba Formation sediments where the regional water table is above the basement. This updated understanding of groundwater conditions is based on over 20 years of exploration drilling in the region and review and re-interpretation of detailed groundwater studies completed for Portia Gold Mine and Kalkaroo Copper Gold Mining Lease.
- The physical properties of Namba Formation clay strata (see attached Technical Memorandum) result in unsupported drillholes becoming sealed by swelling clays thus restoring the controlling geological conditions before the hole was drilled. Potential for downward migration of contaminants or water from surface or potential near surface ephemeral water tables to the single low permeability unconfined aquifer is prevented and the regional water table will remain unaffected.

Havilah acknowledges this interpretation is at variance to prevailing characterisation of hydrogeological conditions in this area, but it is supported by Havilah's drilling information to date. To further support this interpretation proposed drillhole decommissioning will include collection of additional data during exploration drilling. Should this additional data suggest differing strata properties and groundwater conditions to those observed to date then alternative decommissioning methods are included to ensure compliance with M21.

<b>Hydrogeological Conditions</b>	<b>Proposed Drillhole Decommissioning</b>	<b>Comments</b>	<b>Additional Control Measures</b>
Basement strata outcrop or subcrop under thin veneer (generally <10 m) of recent unconsolidated soil and sediments with one unconfined fractured rock aquifer (water table > 30 m). Drillholes constructed with PVC collar from surface to competent strata (sealing of unconsolidated strata). No evidence of shallow permanent or potential ephemeral water table.	<p><b>Backfill drillhole with cuttings to the extent practicable.</b></p> <p><b>Leave collar in place to prevent ingress of shallow perched ephemeral groundwater (if it occurs), cut the collar below ground level and cap.</b></p> <p><b>Backfill above the cap to restore surface ground conditions consistent with surroundings.</b></p>	<p>RC cuttings and samples disposed in pit away from the drillholes.</p> <p>Does not require import of additional material to backfill drillholes.</p> <p>Leaving the collar in place and capped prevents formation of a preferential pathway for ingress of ephemeral shallow groundwater entering the drill hole and connecting with the regional unconfined fractured rock aquifer.</p> <p>Capping the collar prevents formation of a void opening to the surface that could result in wildlife to surface contaminants entering the drillhole.</p>	
Basement strata subcrop under Cenozoic low permeability sedimentary strata (Namba Formation, Eyre Clay) with one unconfined low permeability aquifer reporting to the regional water table within or below Cenozoic strata. Drillholes constructed with PVC Collar from surface down into the top	<p><b>Namba Formation sediments will swell and seal the unsupported drillhole, i.e. drill rods and casing removed.</b></p> <p><b>Leave collar in place to prevent ingress of shallow perched ephemeral groundwater (if it occurs), cut</b></p>	<p>The potential for shallow perched ephemeral groundwater accumulating and forming temporary water tables above the Namba Formation are considered unlikely in the exploration prospect areas. Leaving collars in place is proposed as an additional control measure.</p>	<p>Test mythologies for assessing the self-sealing ability of Namba Formation strata and characterising the groundwater chemistry in basement and Namba Formation / Eyre Clay screened wells or drillholes to compare to current interpretation these being a single continuous low</p>

## Exploration PEPR application – 12-month period

of the Namba Formation to seal off surficial soil and Recent unconsolidated sediments.	<b>the collar below ground level and cap.</b>  <b>Backfill above the cap to restore surface ground conditions consistent with surroundings.</b>	permeability water-bearing zone are provided in <b>Appendix 2.</b>
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**Proposed drillhole decommissioning if Additional Control Measures (above) identify different conditions:**

- Namba Formation does not self-seal, but groundwater chemistry confirms the basement and overlying saturated Namba Formation at one continuous low permeability unconfined aquifer:
  - Backfill the drillhole to the extent practicable with drill cuttings.
  - Cut the PVC collar 50 cm below surface and cap, then bury with topsoil and restore surface ground conditions consistent with surroundings.
- Namba Formation and basement groundwater chemistry indicates they are different aquifers, and the Namba Formation does not self-seal:
  - Plug the drillhole at the basement – Namba interface.
  - Grout back to a minimum of 15 m into the Namba Formation as per M21 guidelines.
  - Cut the PVC collar 50 cm below surface and cap, then bury with topsoil and restore surface ground conditions consistent with surroundings.

Where confined or artesian conditions are expected, include a schematic diagram demonstrating how drillholes will be constructed and decommissioned.

### Costeans and bulk sample disposal pits

Will costeans/bulk sample disposal pits be required for the proposed program? If yes, fill out the table below.	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
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Tenement	Number of costeans/pits	Size of costean (length x width) (m <sup>2</sup> )	Average depth (m)	Volume excavated (m <sup>3</sup> )	Total volume excavated (m <sup>3</sup> ) (number of costeans/pits x volume)	Total area of disturbance* (length x width) (m <sup>2</sup> )
<b>TOTAL</b>	100	1m x 3m (3 m <sup>2</sup> )	2	6 m <sup>3</sup>	600 m <sup>3</sup>	300 m <sup>2</sup>

Total number of costeans/pits (add each row to calculate the total).

Total volume of material to be excavated (add each row to calculate the total)

Total area of disturbance (number of costeans/pits x area of disturbance for each row, then add each row to calculate the total).

\*Includes storage of excavated material at the site (e.g. topsoil and subsoil segregation). These are dug at the time of rehabilitation.

### Costeans and bulk sample disposal pit preparation

If costeans/bulk sample disposal pits are required, describe site preparation methods, vegetation clearance, and safety and maintenance requirements.

- |  |
|--|
| <ul style="list-style-type: none"> <li>• Clearing will always be of a minimal nature to reduce environmental impact and lessen the requirement for extensive rehabilitation.</li> <li>• All sumps are to have a ramp, to enable animals to escape, should they happen to fall in.</li> <li>• Sumps will be fenced if stock are at risk, and they will be bunted for safety.</li> <li>• Topsoil and subsoil are stockpiled separately to cap the disturbed area.</li> </ul> |
|--|

### Sample management

Describe the size of samples collected (including drilling samples and bulk sampling), collection methods, materials used when collecting the sample, sample disposal methods (including removal of sample bags), safety management and any other sample management requirements at the exploration site (e.g. tarps or matting used to contain cuttings). Include requirements for on-site geological sample management (splitting of archive samples, bag farms, core processing and storage).

- |   |
|---|
| <ul style="list-style-type: none"> <li>• A small area (5 m x 15 m) within each site will be reserved for samples.</li> <li>• Drill samples are collected through a cyclone/dust suppression unit with attached cone or riffle splitter. Bulk sample reject is collected in 20-30L buckets then laid out in rows on the ground adjacent to the drill rig. Assay samples are collected from the splitter in 10"x 14" calico bags which are put in polyweave sacks (gen 5 per sack), for transport to the assay lab.</li> <li>• Bulk sample reject weights vary between ~15 to 40 kg, and assay samples from ~1 to 3 kg, depending on the nature of the material being drilled and sample quality coming to surface.</li> <li>• Large plastic bags (900 x 600mm) are being phased out for the bulk sample reject where possible, for environmental reasons and the difficulty in handling and disposing of them (Note: photos on page 29 and 31 representative of previous drilling campaigns that used bags).</li> <li>• A geologist will sieve and log each sample and collect representative cuttings in 20 compartment plastic chip trays.</li> <li>• The RC samples will be retained at each site until all assaying and any resampling has been completed, at which time the material will be disposed of into the sumps or pit dug at each site.</li> </ul> |
|---|

## Exploration PEPR application – 12-month period

- If practical RC samples of the cover sequence will be disposed of firstly down the drill hole and then in either a small trench or the sump during the partial rehab of the site, shortly after drilling has been completed.
- There will be no need to store bulk sample or samples in a pit or bag farm. No sample material will remain on the surface. All rubbish will be removed and disposed of appropriately.
- Diamond core will be removed and processed offsite at Havilah's Kalkaroo Camp.
- All drilling, sampling and rehabilitation activities will be conducted under company safety and environmental protocols, to minimise risks to personnel, wildlife and the environment that might be associated with sumps, pits, sampling, and rehabilitation.

### Access routes to work areas

Will existing tracks require upgrading and/or maintenance? If yes, detail the work required to upgrade/maintain existing tracks.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Existing tracks will not require upgrading but they will be maintained and any damage or deterioration due to Havilah's activities will be remedied, using our grader or backhoe.		
Will access be required across adjoining tenements? If yes, detail the method(s) for gaining access, and if an agreement is in place with all stakeholders. Include the total area of disturbance required (i.e. length (km) and width (m) of tracks) and provide on a locality map.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Will access off existing tracks be required? If yes, detail the method(s) for gaining access and if vegetation clearance is required. Include the total area of disturbance (includes drill traverses and seismic lines) required off existing tracks (i.e. length (km) and width (m) of new tracks).	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
<p>Much of the area within the included tenements is flat and sandy and the vegetation consists of bluebush and saltbush, with very minor patches of acacia shrubs and rare sheoak or black oak, allowing for most track access to drilling sites to be across country with no construction or earthworks required. Several strategies to minimise impacts of creating new overland access routes (vehicle movement or equipment used) include:</p> <ul style="list-style-type: none"> <li>• The most direct and clearest route to the site will be taken to minimise impact to the environment.</li> <li>• All larger vegetation and trees will be avoided.</li> <li>• Access route will be checked and marked out (LV or on foot, during heritage surveys).</li> <li>• Backhoe raised bucket (blade ~0.3m above ground) may be used in very rare instances where the terrain is too rough. This method minimises disturbance to rootstock and topsoil.</li> <li>• Natural drainage lines will not be blocked.</li> <li>• Creating windrows avoided.</li> <li>• Use interdune corridors for access as much as possible to avoid traversing over dune crest.</li> <li>• Dune crossing locations will be selected across low-dunes and at right angles, and to minimise impact on soil and vegetation.</li> </ul> <p>Maximum new access/drill line track required for each tenement is shown below*:</p> <ul style="list-style-type: none"> <li>• EL5873: ~9 km x 3 m</li> <li>• EL6415: ~10 km x 3 m</li> <li>• EL6659: ~7.2 km x 3 m</li> <li>• EL6660: ~3.8 km x 3 m</li> </ul> <p>*Note that nearly all this access and drill line track is for one-off or single pass access for the drilling rig and LVs and has no prior backhoe or grader clearance. Disturbance is minimal and normally no backhoe rehabilitation is required (and is avoided except in rare circumstances as it would result in more disturbance than the vehicle access).</p>		

Indicate planned access routes on a locality plan and distinguish between existing and proposed new access tracks and drill lines (including fence lines) – **Maps 1 to 9.**

### Campsites, storage and equipment laydown areas

Using the tables below, provide a description of campsites and/or laydown areas required. Indicate the campsite and laydown area on a locality plan.

Campsite details		
Indicate where staff and contractors will be accommodated during the exploration program.		
Staff and contractors will be accommodated at the existing Portia Mine Site camp or Kalkaroo Station quarters during the exploration program.		
What is the maximum number of personnel requiring accommodation?	10	
Is a campsite required to be established? If no, no further information is required.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Provide a description and justification of the camp location (e.g. previously cleared areas etc.), and any other relevant information.		
What will be the total area (ha) of the campsite(s)?		
What will be the total area (ha) of vegetation clearance for the campsite?		

## Exploration PEPR application – 12-month period

If vegetation clearance is required, describe the methods used to prepare the site.		
Will any excavations be required? If yes, describe the purpose of the excavation and the maximum volume (m <sup>3</sup> ) of material to be excavated.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Are the proposed ablution facilities endorsed/approved for use by the Department of Health or local council, where applicable? If no, indicate why.	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
Proposed infrastructure (includes caravans, tents, offices, hydrocarbon and water storage requirements etc)	Quantity	Description/capacity

Laydown area details		
Will laydown areas be required? If no, no further information is required.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Will the laydown area(s) be located at the same location as the campsite? If no, has the location(s) been discussed with the landowner?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
What will be the maximum area (ha) required for the laydown area(s)?		
What will be the total area (ha) of vegetation clearance for the site?		
If vegetation clearance is required, describe the methods used to prepare the site.		
Will any excavations be required? If yes, describe the purpose of the excavation and volume (m <sup>3</sup> ) of material to be excavated.	Yes <input type="checkbox"/>	No <input type="checkbox"/>
Proposed infrastructure (includes hydrocarbon and water storage requirements)	Quantity	Description/capacity
Provide a description and justification of the location (e.g. previously cleared areas), and any other relevant information if required.		

### Other exploration methods and/or ancillary operations

Are any other proposed exploration methods (e.g. seismic) and/or ancillary exploration operations required? If yes, describe the activity(s), site preparation, vegetation clearance, and safety and maintenance requirements.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>

### Water supply and management

Will camp and/or drilling water be required? If yes, describe how and where water will be sourced for drilling, track maintenance and camping purposes (e.g. groundwater, surface water, mains). Provide details on the volume of water required and how wastewater or runoff water will be managed.	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>
For RC drilling, minor drilling water (<500 L / day) is usually brought in from existing dam water supplies at the Kalkaroo or Portia camp sites. For DD Drilling, water will be obtained from local dams on Kalkaroo station (owned by Havilah). The water will be piped directly to the drill site from the laydown water tanks or transported directly to the drill site via water truck and will be retained in the sumps and circulation by appropriate bunding. There will be no wastewater or runoff from the site.		
Will surface water and/or mineral drillholes be used as a water source/supply? If yes, indicate if a licence for water extraction/usage is required (refer to relevant Natural Resources Management water allocation plan available on the Department for Environment and Water (DEW) website. If a licence is required and has been obtained please attach a copy. Where a licence has not been obtained, include a statement confirming that a licence will be obtained before the extraction and/or usage of water.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
N/A		

**Exploration PEPR application – 12-month period**

**Groundwater and drilling investigation activities**

Will any water bores be required and/or water investigation activities (e.g. pump testing, water monitoring sites, water storage, turkey nests/dams) be conducted? If yes, describe the water drilling and investigation activities, including site preparation, vegetation clearance, and safety and maintenance requirements.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
NA		
Indicate if well permits have been obtained and whether or not a water extraction licence is required in accordance with the Landscape South Australia Act 2019. If yes, attach a copy of the permit(s)/licences. If no, provide a statement confirming that permits/licences will be obtained prior to commencement of water investigation activities.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
NA		

**Water affecting activities**

Will any water affecting activities, other than drilling a water well, be undertaken (refer to s. 127 of the Landscape South Australia Act 2019)? If yes, attach a copy of the permit. If a permit has not been obtained, provide a statement confirming that a water affecting activity permit(s) will be obtained and provide a description of the site preparation, vegetation clearance, and safety and maintenance requirements.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
NA		

**Management of hazardous materials**

Will activities be conducted in areas of known uranium and thorium mineralisation? If yes, attach a Radiation Management Plan and confirmation of endorsement of the plan by the Environment Protection Authority South Australia (EPA).	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
Will any other hazardous material be encountered when exploring in the area? If yes, list the types of hazardous materials and provide a management plan on how these materials will be managed.	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>
NA		

## Exploration PEPR application – 12-month period

### Rehabilitation

Detail all the activities and strategies relating to the remediation of impacts associated with the proposed exploration operations.

Completion of rehabilitation must be achieved within 3 months after the expiry of this PEPR, subject to timely receipt of assays, weather conditions and equipment/personnel availability. Note that rehabilitation will be staged, with a substantial amount of it normally completed shortly after drilling to the extent that is practically possible.

**Staged Rehabilitation** will be undertaken:

- Stage 1 to be completed shortly after drilling is completed:
  - Drill hole decommissioning (as described above)
  - Move drill spoil into sumps
  - Raking or lightly scarify the drill site using a backhoe
  - Remove all external waste material to an appropriate waste facility
  
- Stage 2 (final) rehabilitation will occur once assays are available, and remaining samples can be disposed of into the sump (usually within 2 months after drilling is completed):
  - Sumps will be allowed to dry out before backfilling
  - Sump rehabilitation – deposit remaining samples, backfill, cover with stockpiled topsoil, and rake or lightly scarify (to promote vegetation regeneration) with a backhoe
  - Where no sumps are used, a short trench will be excavated (1m W x 3m L x 2m D) dug at the end of the sample rows and the samples buried and capped with the stockpiled topsoil
  - Overland access routes will be raked or lightly scarified to promote regrowth of vegetation
  
- Rehabilitation will always aim to return areas disturbed by drilling activities to its original land surface profile and in a condition that will promote regrowth of native vegetation.
- **Photo 7** shows an example of a rehabilitated area

State the estimated budget required to rehabilitate impacted sites.

Notes:

- Not all planned drillholes shown on the maps may be drilled as completion of the total program is results dependent.
- Budget estimates are based on the time taken by Havilah to rehabilitate each drill site using its own backhoe and personnel: backhoe rate plus operator \$200 / hour including fuel and light vehicle. Based on experience 10 sites are rehabilitated per day on average for a 10-hour day = 1 site rehabilitated per hour = \$200 / site. Drill sites are close together for each prospect so travel time between drill sites is minimal.

**Stage 1** – drill hole decommissioning and drill site clean-up: 100 drill sites - \$10,000.

**Stage 2 (final)** – Sump, sample, and overland access route rehabilitation: 100 drill sites and associated access routes - \$10,000

### Vegetation Clearance

Will any area of cleared native vegetation be unrehabilitated after the authorised period? Yes  No

If yes, provide a description of the vegetation present in the application area, the extent of the proposed vegetation clearance and the likelihood of the presence of threatened flora. Provide this information on a map.

NA

State the estimated quantum of significant environmental benefit (SEB) to be gained in exchange for the proposed native vegetation clearance and describe how the SEB will be provided.

NA

## SECTION E – LEASE CONDITIONS

### Retention leases

Where the retention lease includes specific conditions that are not environmental outcomes, demonstrate where these have been addressed in the PEPR (if relevant) or demonstrate how otherwise they have or will be complied with.

NA

**SECTION F – MANAGEMENT OF ENVIRONMENTAL IMPACTS**

Use the table below (instructions provided) to identify all of the potential environmental, social and economic impact events that are likely to occur as a result of the proposed exploration operations, how each of the identified impacts will be managed, and the residual risk, i.e. the level of risk remaining after implementing control and management strategies. Identified potential impact events should be developed based on the aspects of the environment that may be impacted on and the proposed operational details. Potential impact events must have corresponding outcomes and measurement criteria.

Where the terms and conditions of an RL include environmental outcomes, list them (where different) in the table below and complete all sections (ie receptor, potential impacts, control strategies, risk assessment and measurement criteria).

**Environmental management – potential impacts/events, outcomes, measurable criteria and monitoring plan**

			Likelihood of consequence (LH)				
			1	2	3	4	5
			Rare	Unlikely	Possible	Likely	Almost certain
Severity of consequence (CQ)	A	Insignificant	Low	Low	Low	Low	Low
	B	Minor	Low	Low	Moderate	Moderate	Moderate
	C	Moderate	Moderate	Moderate	High	High	High
	D	Major	High	High	Extreme	Extreme	Extreme
	E	Catastrophic	High	Extreme	Extreme	Extreme	Extreme

**How to fill out the table**

1. Based on the description of the environment and exploration operations, indicate which potential impacts are applicable to the proposed program. Note that some potential impacts are applicable to all programs.
2. For each applicable potential impact (and corresponding receptor), describe control strategies that will reduce the risk of the potential impact to an acceptable level, and achieve the corresponding environmental outcomes.
3. Conduct an impact assessment to determine if the control strategies address the potential impact (i.e. reduce the risk to an acceptable level). Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level.
4. For each applicable potential impact, the corresponding outcome and outcome measurement criteria are required.
5. Based on the description of the environment and proposed exploration activities, determine if any other potential impacts are applicable. For each new potential impact, describe proposed control and rehabilitation strategies, conduct an impact assessment, and develop corresponding outcomes and outcome measurement criteria.

Use the above matrix to conduct an impact assessment for each potential impact.

Impact assessment							Outcomes	Outcome measurement criteria (inc. monitoring plan)
Receptor	Potential impacts	Is the potential impact applicable (Yes/No)	Control strategies	Risk assessment				
Lists are not exhaustive.	Lists are not exhaustive.	Some potential impacts are applicable to all programs.	Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to <a href="#">Minerals Regulatory Guidelines MG22</a> for more information.	LH	CQ	Risk		
Stakeholders: <ul style="list-style-type: none"> <li>• freehold land owners</li> <li>• perpetual lease holders</li> <li>• pastoral lease holders</li> <li>• Aboriginal land (Anangu Pitjantjatjara Yankunytjatjara and Maralinga Tjarutja lands)</li> <li>• Department of Defence</li> <li>• state government departments.</li> <li>• local government (councils)</li> <li>• federal government</li> <li>• native title parties.</li> </ul>	Interference to: <ul style="list-style-type: none"> <li>• existing or permissible land use (includes loss of income, noise, dust, light and other emissions).</li> <li>• buildings, structures, existing tracks or other infrastructure.</li> <li>• aesthetic values of an area.</li> </ul> Noncompliance with legislative requirements.	Yes (Applicable to all programs.)	<ul style="list-style-type: none"> <li>• Issue Form 21B – Notice of Entry on Land to:                             <ul style="list-style-type: none"> <li>◦ Native Title Claimants</li> <li>◦ SANTS</li> <li>◦ Station owners</li> </ul> </li> <li>• Speed limits will be signposted and adhered to minimise dust disturbance and stock interference.</li> <li>• Station tracks will not be used after rain to ensure no damage is done to tracks.</li> <li>• Mining Native Title Agreements pursuant to Part 9B in place and registered with DEM.</li> <li>• Dog Fence Board.</li> </ul>	2	B	Low	<b>Stakeholders are fully informed and satisfied with the proposed methods used to conduct exploration activities on their land, and all prescribed forms are served and agreements obtained in accordance with the Mining Act.</b>	Provide the information requested within the 'Complaints' section of the annual exploration compliance report demonstrating that all reasonable complaints from stakeholders are resolved to the satisfaction of both parties prior to and ongoing during the course of exploration program, without the involvement of DEM.  Provide the information requested within the 'Landowner details and liaison' section of the annual exploration compliance report demonstrating that prescribed forms were served and agreements obtained in accordance with the Mining Act prior to the commencement of exploration activities.
Stakeholder: DEW	Interference to: <ul style="list-style-type: none"> <li>• existing or permissible land use.</li> <li>• buildings, structures, existing tracks or other infrastructure.</li> <li>• aesthetic values of an area.</li> </ul> Noncompliance with legislative requirements.	No (Applicable to programs located adjacent to or within parks and reserves.)	NA				<b>For activities located within or adjacent to regional reserves, national, conservation and marine parks only:</b> <ul style="list-style-type: none"> <li>• no unauthorised interference with park management activities.</li> </ul>	Provide confirmation that: <ul style="list-style-type: none"> <li>• Park access notification forms were submitted to DEW and DEM at least 10 days prior to entry into regional reserves, national, conservation and marine parks, or</li> <li>• Program notifications for PEPRs approved for an ongoing period of time, were submitted to DEW and the DEM at least 21 days prior to entry into regional reserves, national, conservation and marine parks.</li> </ul>

Exploration PEPR application – 12-month period

Impact assessment							Outcomes	Outcome measurement criteria (inc. monitoring plan)
Receptor	Potential impacts	Is the potential impact applicable (Yes/No)	Control strategies	Risk assessment				
Lists are not exhaustive.	Lists are not exhaustive.	Some potential impacts are applicable to all programs.	Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to <a href="#">Minerals Regulatory Guidelines MG22</a> for more information.	LH = likelihood of consequence CQ = severity of consequence	LH	CQ		
Flora and fauna and their habitats; includes Commonwealth and state scheduled species.	Loss/modification of native vegetation and associated habitats through the clearance of vegetation.	Yes (Applicable to exploration programs located within or impacting on native vegetation.)	<ul style="list-style-type: none"> <li>The placement of drill sites and access routes will be selected to avoid areas of substantial native vegetation.</li> <li>All drill pads will be levelled using a loader with raised blade to stockpile topsoil for post drilling rehabilitation.</li> <li>Drill sites and access routes are rehabilitated in such a way as to promote regrowth of native vegetation.</li> <li>Vehicles are restricted to a single access track to minimise disturbance to native vegetation.</li> <li>No fires are to be deliberately lit on any drill sites.</li> <li>Firefighting equipment/ fire extinguisher will always be available.</li> <li>Compliance with Fire Ban ratings, which is checked daily (CFS website), and a risk assessment of the prevailing conditions is completed and communicated each morning. When CFS Fire rating is Low-Very High – work will continue, and conditions/risks will be monitored. If Fire rating is Severe – work will continue based on risk assessment if winds are low and the prevailing conditions are assessed as acceptable to continue work. Where Fire rating is Extreme-Catastrophic – work will cease, and crew will remain on standby until the fire rating is reduced. All equipment is inspected at the start and end of each day to ensure air filters are clean, and any build-up of grass or other plant matter in the undercarriage is cleared away. This is designed to lower the fire risk and preserve operating equipment.</li> </ul>	3	B	Low	<p><b>No permanent loss/modification of native flora and fauna populations and their habitats through:</b></p> <ul style="list-style-type: none"> <li>clearance</li> <li>fire</li> <li>other</li> </ul> <p><b>unless prior approval under the relevant legislation is obtained.</b></p>	<p>Maintain before, during and after photographic evidence of all exploration sites (e.g. drillsites, new track exit/entry points off existing tracks, costeans, campsites) demonstrating that:</p> <ul style="list-style-type: none"> <li>The area and method of disturbance is consistent with that described in the PEPR.</li> <li>No uncontrolled fires* occurred as a result of exploration activities.</li> </ul> <p>Representative photos to be included within the annual exploration compliance report.</p>
All flora and fauna, especially listed species.	Loss/modification of the environment (biological, social and economic) through the introduction of weeds and pathogens.	Yes (Applicable to all programs.)	<ul style="list-style-type: none"> <li>Vehicles are to be kept clean and free of mud on entering drill sites.</li> <li>Inspection of drill sites on completion and after rehabilitation to check for any introduced species and removal if found.</li> </ul>	3	B	Low	<p><b>No introduction of new species of weeds and plant pathogens, nor increase in abundance of existing weeds species.</b></p>	<p>Provide a statement within the 'Compliance with approved programs' section of the annual exploration compliance report, confirming that:</p> <ul style="list-style-type: none"> <li>Vehicle logs were kept during the exploration program, demonstrating that all vehicles are clean and free of plant and mud material prior to entering properties<sup>†</sup> within the tenement areas, unless otherwise agreed to with the relevant landowners.</li> <li>Photographic evidence before and during exploration operations and after rehabilitation of disturbed sites was captured, demonstrating that no new weeds and plant pathogens were introduced, nor an increase in abundance of existing weeds recorded.</li> </ul>
All fauna	Entrapment of fauna through open drillholes and excavations.	Yes (Applicable to exploration programs that involve drilling and/or require excavations.)	<ul style="list-style-type: none"> <li>All holes will be capped immediately following completion of drilling.</li> <li>Excavations (sumps) will be constructed with a shallow angle ramp to allow egress point.</li> <li>If sump to be left open for any length of time (waiting to dry for rehabilitation), bunding or barricading will be used to prevent access.</li> <li>Sumps will be filled in as soon as possible.</li> </ul>	2	B	Low	<p><b>No fauna traps created as a result of exploration activities.</b></p>	<p>Maintain before, during and after photographic evidence of all drillholes and/or excavations demonstrating that:</p> <ul style="list-style-type: none"> <li>All drillholes were permanently or temporarily capped/plugged immediately upon completion.</li> <li>No fauna and livestock became trapped in drillholes and/or excavations throughout the duration of the program.</li> <li>All rehabilitation was completed within 3 months of expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised.</li> </ul> <p>Representative photos are to be included within the annual exploration compliance report.</p> <p>Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report.</p>
Aboriginal heritage sites	Disturbance to Aboriginal heritage.	Yes (Applicable to all programs.)	<ul style="list-style-type: none"> <li>An Aboriginal Heritage Clearance Survey is to be conducted with the traditional owners to clear the drill sites and access prior to commencement of drilling.</li> <li>Site inductions to be completed and avoidance of any known sites – these will be marked on GPS and on-ground (star-pickets, flagging).</li> <li>If an Aboriginal site (previously unknown) is accidentally disturbed, all work must cease immediately and not recommence.</li> <li>Report any sites as soon as practicable</li> </ul>	2	B	Low	<p><b>No disturbance to Aboriginal artefacts or sites of significance unless prior approval under the relevant legislation is obtained.</b></p>	<p>Maintain a database and provide a statement within the 'Compliance with approved programs' section of the annual exploration compliance report demonstrating that:</p> <ul style="list-style-type: none"> <li>Heritage sites were not impacted during the conduct of the exploration program, unless prior approval was obtained under the appropriate legislation.</li> <li>Work ceased on discovery of a significant site and recommenced only after authorisation.</li> <li>Aboriginal heritage sites identified during the exploration program were appropriately recorded and reported to authorities, if not previously known.</li> </ul>
European heritage sites and sites of scientific and environmental significance	Disturbance to European heritage sites and sites of scientific and environmental significance (e.g.	NA (Applicable to exploration programs)					<p><b>No disturbance to European heritage sites and to sites of scientific and environmental</b></p>	<p>Demonstrate no impact to heritage sites and sites of scientific and environmental significance by:</p>

Exploration PEPR application – 12-month period

Impact assessment						Outcomes	Outcome measurement criteria (inc. monitoring plan)	
Receptor	Potential impacts	Is the potential impact applicable (Yes/No)	Control strategies	Risk assessment				
Lists are not exhaustive.	Lists are not exhaustive.	Some potential impacts are applicable to all programs.	Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to <a href="#">Minerals Regulatory Guidelines MG22</a> for more information.	LH	CQ			Risk
	geological monuments, fossil reserves).	located close to or within European heritage sites and sites of scientific and environmental significance.)					<p><b>significance unless prior approval under the relevant legislation is obtained.</b></p> <ul style="list-style-type: none"> <li>Maintaining evidence, including detailed maps showing sites compared to the location of exploration activities, and photographic evidence of sites before and after the conduct of the exploration program.</li> <li>Providing a statement within the annual exploration compliance report confirming sites were not impacted during the conduct of the exploration program.</li> </ul>	
Soil/vegetation/fauna	Soil/vegetation contamination (e.g. hydrocarbons, rubbish, drill samples/cuttings, ablutions, other sources).	Yes (Applicable to all programs.)	<ul style="list-style-type: none"> <li>All external waste material is removed from site to an approved waste facility.</li> <li>Unwanted drill samples are emptied into sumps/pits, which are back filled, covered with topsoil, and lightly scarified to promote seed germination. The empty plastic bags are removed from site.</li> <li>The drilling rig and ancillary equipment are properly maintained and regularly inspected to ensure there are no diesel or oil leaks.</li> <li>Stored fuel correctly banded, spill kits used, contaminated soil immediately removed off site to an approved waste facility.</li> </ul>	2	B	Low	<p><b>No contamination of soil and vegetation as a result of exploration activities.</b></p> <p>Demonstrate that all domestic or industrial waste (includes general rubbish and hydrocarbons) is disposed of in accordance with the <i>Environment Protection Act 1993</i> within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), and that all fuel and chemicals are stored in accordance with EPA requirements, by providing:</p> <ul style="list-style-type: none"> <li>The name, location and contact details of the authorised waste disposal facility.</li> <li>A statement within the 'Compliance with approved programs' section of the annual exploration compliance report confirming domestic and industrial waste was removed from all exploration sites and disposed of at an authorised waste disposal facility.</li> <li>Photographic evidence within the annual exploration compliance report demonstrating that all fuel and chemical storage facilities were managed in accordance with EPA requirements.</li> </ul> <p>Maintain photographs of all exploration sites and provide representative photos within the annual exploration compliance report demonstrating that drill cuttings are:</p> <ul style="list-style-type: none"> <li>removed from site and disposed of at a licensed facility</li> <li>buried under a minimum of 30 cm of soil, or in accordance with EPA guideline, <a href="#">Radiation protection guidelines on mining in South Australia: mineral exploration</a>, available on the EPA website, or</li> <li>backfilled down the drillhole, within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised.</li> </ul> <p>Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report.</p>	
Soil	Disturbance to the soil profile and topography, and accelerated soil erosion caused by exploration activities (e.g. construction of sumps, new overland access routes and drill pads; ground compaction at laydown areas and camps).	Yes (Applicable to all programs.)	<ul style="list-style-type: none"> <li>A loader with raised blade will be used for preparation of drill sites and any track works to prevent permanent disturbance to topsoil profile or topography.</li> <li>Rehabilitation of each site will be finalised by replacing topsoil and raking or lightly scarifying to promote seed germination and new vegetation growth.</li> <li>Heavy vehicle overland access routes will be scarified.</li> <li>The land surface will be returned to its original profile.</li> <li>All sample material and spoil from the sumps will be backfilled into the sumps.</li> <li>Topsoil from sumps will be stockpiled separately, spread back over the filled in sumps and lightly scarified to minimise wind and water erosion and promote seed germination and plant regrowth.</li> <li>If water does have to be carted for diamond drilling, truck movements will be kept to a minimum and access routes will be rehabilitated as described above. Tracks can be watered down if required.</li> <li>Where possible, water will be carted to tanks located on existing station tracks and piped from there to the drill site, to minimise track powdering and rutting.</li> </ul>	1	B	Low	<p><b>Where soil disturbance occurs as a result of exploration activities, ensure that:</b></p> <ul style="list-style-type: none"> <li><b>topsoil quality and quantity is maintained</b></li> <li><b>the soil profile and topography is reinstated to original conditions</b></li> <li><b>there is no accelerated soil erosion.</b></li> </ul> <p>Maintain before, during and after photographic evidence of all excavations, drillsites, camps, laydown areas and new tracks demonstrating that:</p> <ul style="list-style-type: none"> <li>The soil profile and topography is reinstated to original conditions and is consistent with natural surroundings within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised.</li> <li>Where required, sufficient topsoil is removed (depending on soil profile), stored separately from subsoil and reinstated (in the correct order) within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised.</li> <li>There are no signs of accelerated soil erosion during and post rehabilitation of disturbed sites.</li> </ul> <p>Representative photos to be included within the annual exploration compliance report.</p> <p>Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report.</p>	

Exploration PEPR application – 12-month period

Impact assessment						Outcomes	Outcome measurement criteria (inc. monitoring plan)	
Receptor	Potential impacts	Is the potential impact applicable (Yes/No)	Control strategies	Risk assessment				
Lists are not exhaustive.	Lists are not exhaustive.	Some potential impacts are applicable to all programs.	Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to <a href="#">Minerals Regulatory Guidelines MG22</a> for more information.	LH = likelihood of consequence CQ = severity of consequence	LH			CQ
Surface water	Alteration to surface water – interference to surface drainage.	No (Applicable to exploration programs that are likely to impact on surface drainage channels.)	<ul style="list-style-type: none"> <li>The program is not likely to impact on the surface.</li> </ul>				<p><b>No permanent modification to hydrological features caused by exploration activities without obtaining a water affecting permit from the relevant Landscape Board (under Landscapes Act SA 2019).</b></p> <p>Provide before, during and after photographic evidence within the annual exploration compliance report demonstrating that original drainage contours (watercourses and lakes) are consistent with the natural relief post rehabilitation within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period).</p> <p>Alternatively, provide copies of water affecting permits within the annual exploration compliance report.</p>	
Groundwater/aquifer	Groundwater contamination: <ul style="list-style-type: none"> <li>contamination of aquifers through entry of pollutants from the surface</li> <li>interconnection between aquifers degradation of natural hydrostatic conditions (maintain pre-drilling pressures).</li> </ul>	Yes (Applicable to all exploration programs that may intersect groundwater.)	<ul style="list-style-type: none"> <li>Understanding of the hydrogeology of the prospect areas indicates multiple aquifers and confined aquifers are unlikely in these areas.</li> <li>Drilling experience in the region indicates sapolite and Namba Formation strata are self-sealing and will close the hole soon after drilling ceases.</li> <li>All holes will be abandoned in accordance with M21 Guidelines.</li> </ul>	2	B	Low	<p><b>Drillholes restored to controlling geological conditions that existed before the hole was drilled or, where it is intended to re-enter the hole, the hole must be completed with casing of adequate strength and the casing cemented so that all aquifers are isolated to prevent the movement of any fluids behind the casing.</b></p> <p>Maintain evidence demonstrating that drillholes are decommissioned in accordance with Earth Resources Information Sheet M21, <a href="#">Mineral exploration drillholes – general specifications for construction and backfilling</a>, and/or specific conditions from DEW (Groundwater) within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised.</p> <p>Provide the information requested within the 'Groundwater' section of the annual exploration compliance report.</p>	
Soil/vegetation/fauna	Discharge of groundwater into the surrounding environment.	Yes (Applicable to all exploration programs that may intersect groundwater or where activities require the discharge of groundwater into the surrounding environment.)	<ul style="list-style-type: none"> <li>Groundwater will be contained within the sumps and circulation system to the extent practicable. Any inadvertent spillages of material volume will be immediately cleaned up and returned to the sumps.</li> </ul>	2	A	Low	<p><b>No discharge of groundwater outside of the exploration site (e.g. drillsite) into the surrounding environment and no discharge of water into a watercourse, unless prior approval under the relevant legislation is obtained.</b></p> <p>Maintain photographic evidence of drillsites where significant groundwater is encountered demonstrating that groundwater was not discharged into the surrounding environment, unless water affecting activity permits were obtained allowing the discharge of groundwater into watercourses and/or lakes.</p> <p>Representative photos and water affecting activity permits (where applicable) to be included within the annual exploration compliance report.</p>	
Groundwater users	Interference to existing water users when extracting water from existing dams, water bores or mineral drillholes.	Yes (Applicable to all exploration programs that may require the use of water from existing dams, water bores or mineral drillholes.)	<ul style="list-style-type: none"> <li>Where water is required for drilling, saline groundwater will be sourced from the Portia Mine Pit dewatering or from existing water supplies at Kalkaroo.</li> </ul>	1	A	Low	<p><b>No public nuisance impacts resulting from the extraction of water for exploration purposes, unless prior approval under the relevant legislation is obtained.</b></p> <p>Provide the information requested within the 'Complaints' section of the annual exploration compliance report demonstrating that all reasonable complaints from stakeholders were resolved to the satisfaction of both parties, prior to and ongoing during the course of the exploration program without the involvement of DEM.</p> <p>Where permits are required for the extraction and/or usage of groundwater, provide copies of the licence or permit within the annual exploration compliance report.</p>	
Soil/vegetation/fauna	Degradation of rehabilitated access tracks caused by third party access (includes previously closed and rehabilitated access tracks).	Yes (Applicable to exploration programs that create new access tracks.)	<ul style="list-style-type: none"> <li>No new access tracks to be cleared.</li> <li>Access drill sites by driving vehicles cross country from existing station tracks in most direct route avoiding vegetation where possible.</li> <li>Minimise disturbance by confining heavy equipment to a single access track.</li> <li>Rectify any significant residual compaction along the overland access routes, if necessary, by light scarifying.</li> </ul>	2	B	Low	<p><b>Rehabilitated tracks remain permanently closed, unless prior approval under the relevant legislation is obtained.</b></p> <p>Maintain before and after photographic evidence demonstrating that all tracks are closed and rehabilitated within 3 months of the expiry of the PEPR approval (for PEPRs approved for a period of 12 months), or 3 months after the expiry of a program notification (for PEPRs approved for an ongoing period), unless otherwise authorised.</p> <p>Representative photos are to be included within the annual exploration compliance report.</p> <p>Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report.</p>	
Community/landowners	Damage to infrastructure and loss of income through fire.	Yes (Applicable to all programs.)	<ul style="list-style-type: none"> <li>No fires are lit during the summer months, and only at other times if there is a clear area surrounding and fire danger is minimal (e.g. lack of burnable material and no fire ban period)</li> <li>Fire management procedures in place, including policy for "extreme fire danger rating".</li> <li>Firefighting equipment/ extinguisher are always available.</li> </ul> <p>*Risk is high as with all controls</p>	2	D	High	<p><b>No loss of infrastructure or income through fire as a result of exploration activities.</b></p> <p>Provide a statement within the 'Compliance with approved programs' section of the annual exploration compliance report confirming that no uncontrolled fires* occurred.</p> <p>Alternatively, provide a report on the independent investigation of all uncontrolled fires* demonstrating that the licensee could not have reasonably prevented the fire through the implementation of precautionary measures.</p>	

Exploration PEPR application – 12-month period

Impact assessment						Outcomes	Outcome measurement criteria (inc. monitoring plan)	
Receptor Lists are not exhaustive.	Potential impacts Lists are not exhaustive.	Is the potential impact applicable (Yes/No) Some potential impacts are applicable to all programs.	Control strategies Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to <a href="#">Minerals Regulatory Guidelines MG22</a> for more information.	Risk assessment LH = likelihood of consequence CQ = severity of consequence				
				LH	CQ			Risk
General public	Injury or death to members of the public as a result of exploration activities.	Yes (Applicable to all programs.)	<ul style="list-style-type: none"> <li>Given the remote locality of the program, it is extremely unlikely for members of the public to access the drill site. However, the following mitigation measures will be employed:                             <ul style="list-style-type: none"> <li>Restricting access to only Company personnel as far as possible, and only to others (e.g., Contractors) who have had induction.</li> <li>Enforcing best practice OHS measures.</li> <li>Appropriate danger signs erected.</li> </ul> </li> </ul> *Risk is high as with all controls in place, if an incident was to occur the outcome could be catastrophic.	1	E	High	<p><b>No accidents involving the public that could have been reasonably prevented by the licensee.</b></p> <p>Provide a statement within the 'Compliance with approved programs' section of the annual exploration compliance report confirming no accidents occurred involving the public during and after the exploration program.</p> <p>If an accident involving the public did occur, provide a copy of the independent investigation report within the annual exploration compliance report demonstrating that the licensee could not have reasonably prevented the accident through the implementation of precautionary measures.</p>	
General public, employees, contractors and the environment	Contamination of the environment when exploring for known uranium and thorium deposits.  Public and employee/contractor exposure to low level radiation.	No (Applicable to exploration programs located within known uranium or thorium deposits.)	NA				<p><b>No increase in background radiation levels, and employee/contractor exposure levels during the exploration program are within safe limits.</b></p> <p>Maintain a database and provide a statement within the 'Compliance with approved programs' section of the annual exploration compliance report demonstrating that:</p> <ul style="list-style-type: none"> <li>Radiation levels post exploration and rehabilitation are consistent with pre-existing background levels.</li> <li>Employee and contractors exposure levels were within safe limits during the exploration program.</li> </ul>	
Other (if applicable)								

\* Uncontrolled fires = fires that escape outside of the work area (e.g. drillsite).

† Properties = freehold (cropping and grazing land); perpetual/pastoral lease land; council land; regional reserves; national, conservation and marine parks; Aboriginal land; Commonwealth land etc.

**SECTION G - OPERATOR CAPABILITY**

Provide information demonstrating that the tenement holder and operator (where applicable) has the capability to conduct the program in a manner that consistently ensures ongoing achievement of the environmental outcomes. This may be demonstrated within the PEPR by providing an overview of the following:

- Manuals or standard operating procedures that outline the safe and environmentally sound operation of all critical operations associated with the exploration program that ensure compliance with the PEPR.
- Systems in place to monitor, audit and assess compliance against the criteria approved in the PEPR.
- Systems in place to identify and report any noncompliance with regulatory requirements or relevant environmental outcomes (e.g. measures in place to report incidents in accordance with regulation 79(3)).
- Practices and procedures in place to provide appropriate communication of regulatory requirements to employees and contractors (e.g. induction programs).
- Practices and procedures in place to respond to, and communicate with landowners and external parties on the proposed program and compliance matters (e.g. complaints)

Havilah Resources are an established and competent exploration company with over 20-year history of exploring in this region. The company employs capable geological and exploration staff with an average of more than 25 years exploration industry experience spread over many varied terrains, environments, and jurisdictions. Throughout its history Havilah has maintained best practice industry standards of exploration and rehabilitation compliance in South Australia. It has successfully rehabilitated thousands of drill sites in the area and typically no traces of the historic drilling sites remain after one or two good seasons.

Havilah Resources operates its own equipment including an AC/RC drilling rig and support vehicles, backhoes, and grader. Experienced and trained operators are employed directly by the company and these operators are engaged to conduct the drilling programs and environmental rehabilitation associated with these activities. The company's exploration staff have a long history of working on pastoral country and are also responsible and involved in the management of Kalkaroo Station which is owned by Havilah Resources.

Havilah Resources have a number of operational and procedural documents in place including but not limited to;

- Employee Induction and HSE Booklet.
- Remote Areas Operations – Emergency Response and Hazard Awareness Booklet.
- Guidelines for working on Station Properties.
- Project Specific Inductions including guidelines regarding Heritage Clearance conditions and governmental drilling approval conditions.
- Field Emergency Response Manual.
- Incident Investigation Management Procedure.
- Communication, Consultation, and Involvement.
- Pre-Drilling Safety and Equipment Checklist.
- Drill Rig Safety Inspection Checklist.
- Equipment, Drill Rig and Vehicle Inspection Reports.
- Numerous Hazard, Risk Management, Incident Reporting and JSA documents and records.
- Toolbox Meetings, Training Registers.

In addition to the geological and field exploration staff, Havilah have a Principal Environmental Advisor engaged, Geoff Borg, MSc (Hydrogeology and Groundwater Management): Geoff is an experienced hydrogeologist with over 25 years of experience directing, managing, and advising environment assessment, compliance, risk management, and approvals for industrial operations and resource projects across Australia. Experienced in incorporating technical, legal, and business requirements into effective communications and plans for strategic assessment and implementation of approvals and work plans to achieve environmental compliance. Geoff's experience includes oil refineries and storage terminals, planning and environmental approvals for projects including fuel storage facilities, ranging from service stations to underground coal gasification, carbon capture and storage, and mining projects.

An Environmental Management System specific to the project is being developed which details the environmental management approach adopted for the project to achieve the environmental outcomes as defined in this PEPR. The Environmental Management System will include Environmental Management Plans with procedures and processes to ensure continuous improvement and compliance with legal and other requirements.

The Environmental Management System will also incorporate information for the following:

- environmental governance
- environmental training, awareness, and competence
- audits and inspections
- emergency preparedness, incidents, and response
- monitoring, measurement, and evaluation
- management review
- documentation and records.

All staff and contractors at the current drilling PEPR area will be required to work under the Environmental Management System.

### Exploration PEPR application – 12-month period

Havilah Resources has developed an Environmental Policy, which will be used for the project as follows:

*Havilah Resources is committed to conducting all its operations in an environmentally responsible manner. The Company will plan and manage its activities to minimise disturbance to the environments in which it operates.*

*To fulfil our objectives, the Company will observe all environmental laws and regulations and use all available resources to:*

- *Review, update, and audit this policy and environmental management plans to affect positive environmental outcomes in all the Company's activities.*
- *Discuss and resolve with stakeholders any possible area of environmental conflict.*
- *Integrate environmental considerations into our work planning and operations.*
- *Assess and where possible, reduce the potential impact of our operations on the environment in which we work.*
- *At all times work towards improving our environmental performance.*
- *Rehabilitate the environment affected by our operations, where required by legislation.*
- *Actively promote environmental awareness and provide relevant environmental information, instruction and training for management and personnel.*
- *Where necessary, engage the services of expert external personnel to advise on environmental matters.*
- *Co-operate with government authorities, Traditional Owners, environmental groups, landowners and any other stakeholders in the formulation and application of rational and practical environmental guidelines and legislation.*

*The aim of this Environmental Policy is to provide realistic and achievable guidelines for all personnel involved in the Company's activities.*

#### SECTION H –ADDITIONAL INFORMATION

List any other supporting information and/or documents submitted with the application, including land access approvals/permits required to conduct the proposed exploration program.

NA

**SECTION I – PHOTOS**

Include photographs in this section:

- that have been obtained during site visits
- that help describe relevant environmental and operational aspects in the PEPR.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Northern Area – Birksgate Prospect (EL5873)	28/08/2023	Photo 01 Section C	442040	6537690	54	BKRC001 drill site, shows general area of the Birksgate Prospect, and drill rig set-up onsite.



Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Northern Area – Birksgate Prospect (EL5873)	25/08/2023	Photo 02 Section C	441090	6537690	54	Line 1 Access Track, shows general area of the Birksgate Prospect.



Exploration PEPR application – 12-month period

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Northern Area – Eurinilla Prospect (EL6415)	21/09/2023	Photo 03 Section C	461430	6524970	54	EURC007 drill site, shows general area of the Eurinilla Prospect.



Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Southern Area – Kalkaroo (EL6659)	Nov 2013	Photo 04 Section C	454442	6488573	54	General area of proposed drilling looking east at Kalkaroo East and Kalkaroo Saddle Prospects.



Exploration PEPR application – 12-month period

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Southern Area – Kalkaroo (Deep Well Prospect) (EL6659)	18/03/2023/ 13/08/2023	Photo 05 Section D	456180	6481420	54	KKRC0691 drill site, shows general area of the Kalkaroo Area. The Deep Well Prospect is ~6 km northwest of Johnson Dam, which is characterised by similar country. Before drilling (above), after drilling* (below).



\*Note: Bags used when this photo taken, as mentioned in Section D – Sample Management, green bags are being phased out.

Exploration PEPR application – 12-month period

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Southern Area – Johnson Dam Prospect (EL6659)	12/11/2022	Photo 06 Section D	~449265	~6477184	54	General area of the Johnson Dam Prospect before drilling (both pictures).



Exploration PEPR application – 12-month period

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Southern Area – Kalkaroo (EL6659)	11/06/202 / 27/02/2022	Photo 07 Section D	454758	6488838	54	2020 drillhole KKAC0540 after drilling* (top), after rehabilitation (bottom).



\*Note: Bags used when this photo taken, as mentioned in Section D – Sample Management, green bags are being phased out.



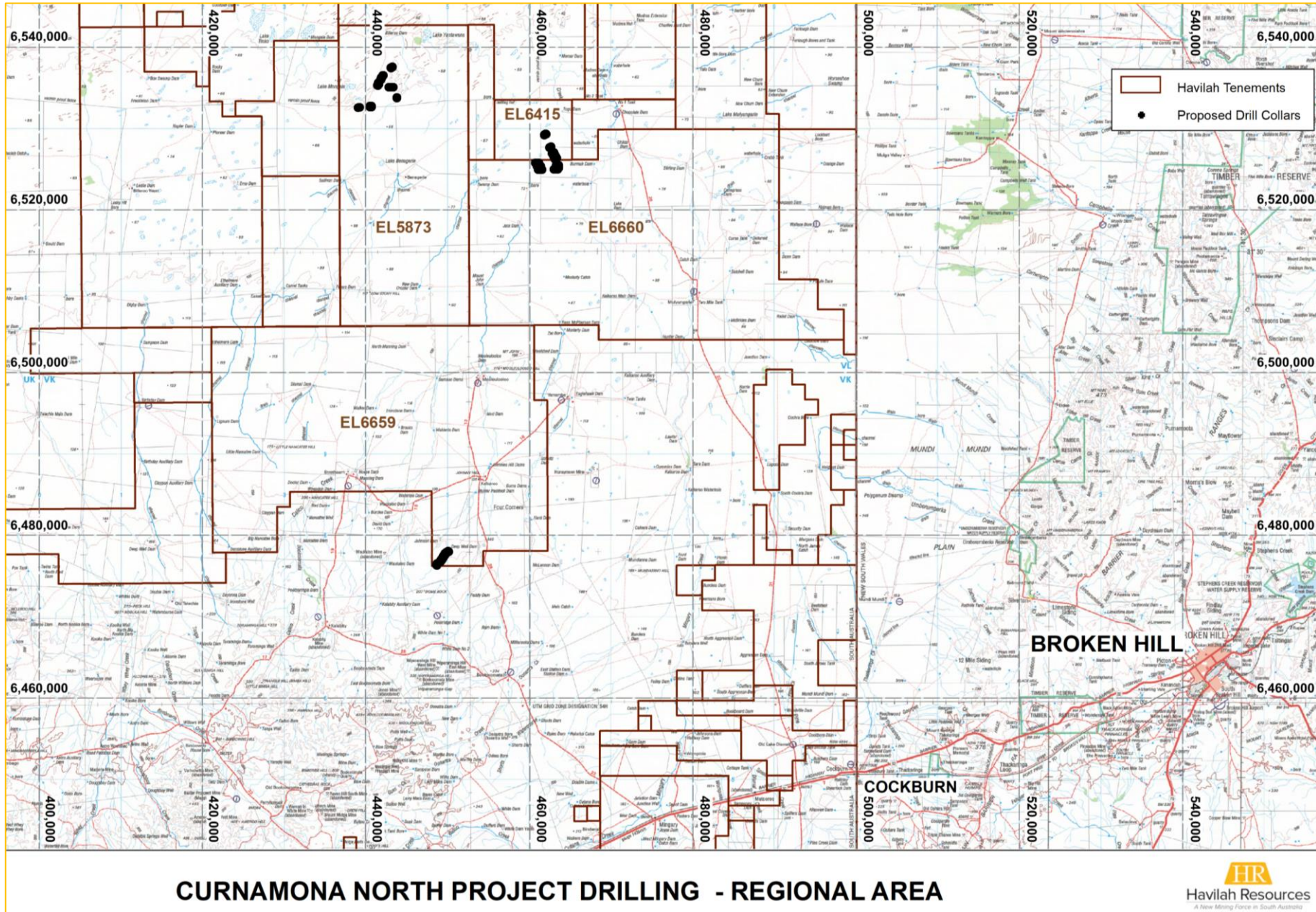
## SECTION J – MAPS

Provide a map(s) showing the following information that is located adjacent to or within the proposed area of operations, where applicable:

- tenement boundaries,
- cadastral information,
- existing surface contours,
- existing vegetation,
- location of the proposed exploration operations (includes drillholes, existing and new tracks, drill traverses, campsites, laydown areas and other applicable information) and/or the target exploration area(s),
- location of existing ephemeral and permanent rivers, creeks, swamps, streams or watercourses and water management structures,
- location of towns, houses and homesteads, existing roads, rails, fences, transmission lines, buildings, dams and pipelines
- known sightings of listed species,
- location and extent of all environmentally sensitive areas,
- any relevant land use types (e.g. parks and reserves, Aboriginal freehold land, Woomera Prohibited Area).

All maps and sections must conform to the standards outlined in the Exploration PEPR Terms of Reference.

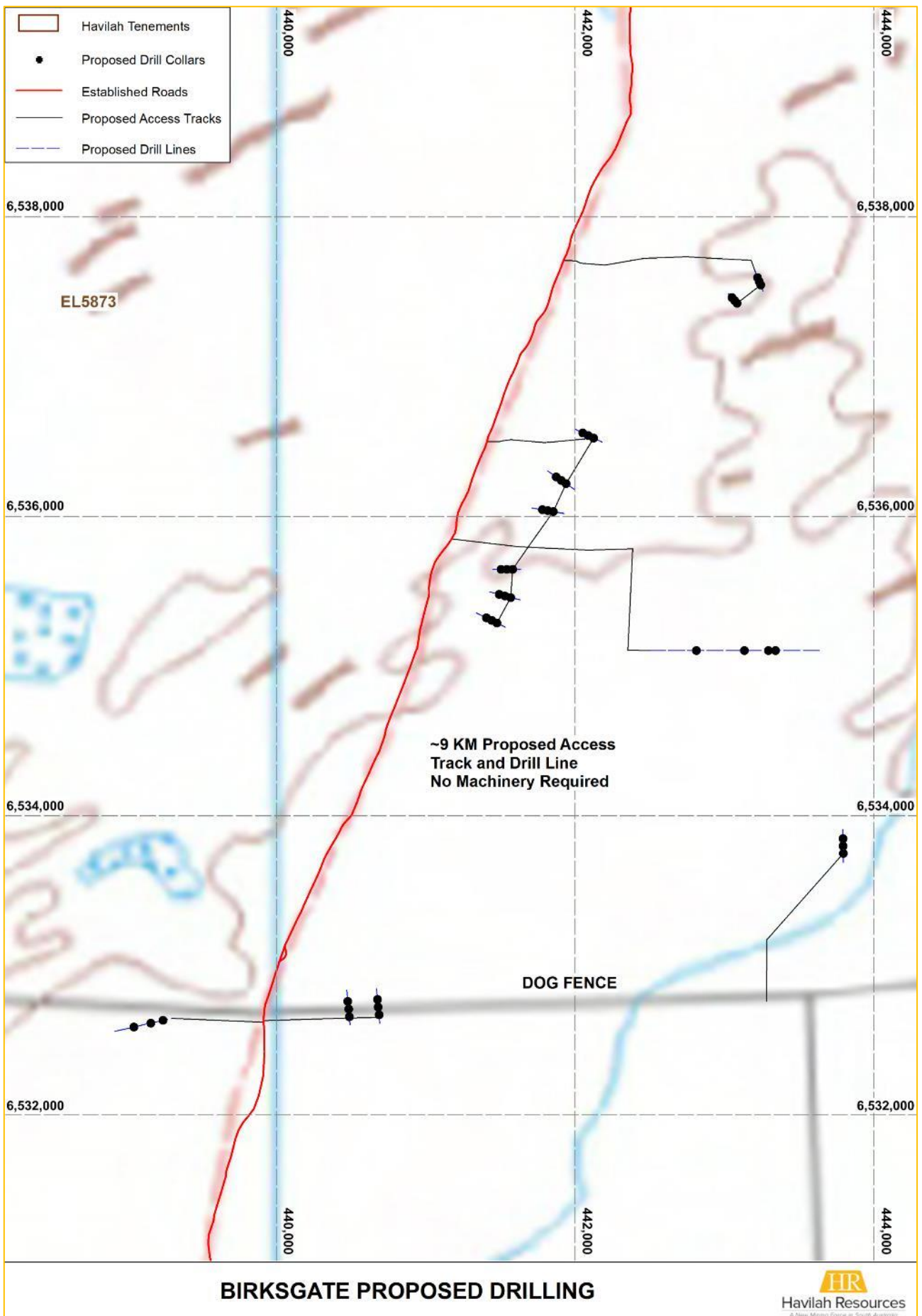
Exploration PEPR application – 12-month period



**CURNAMONA NORTH PROJECT DRILLING - REGIONAL AREA**

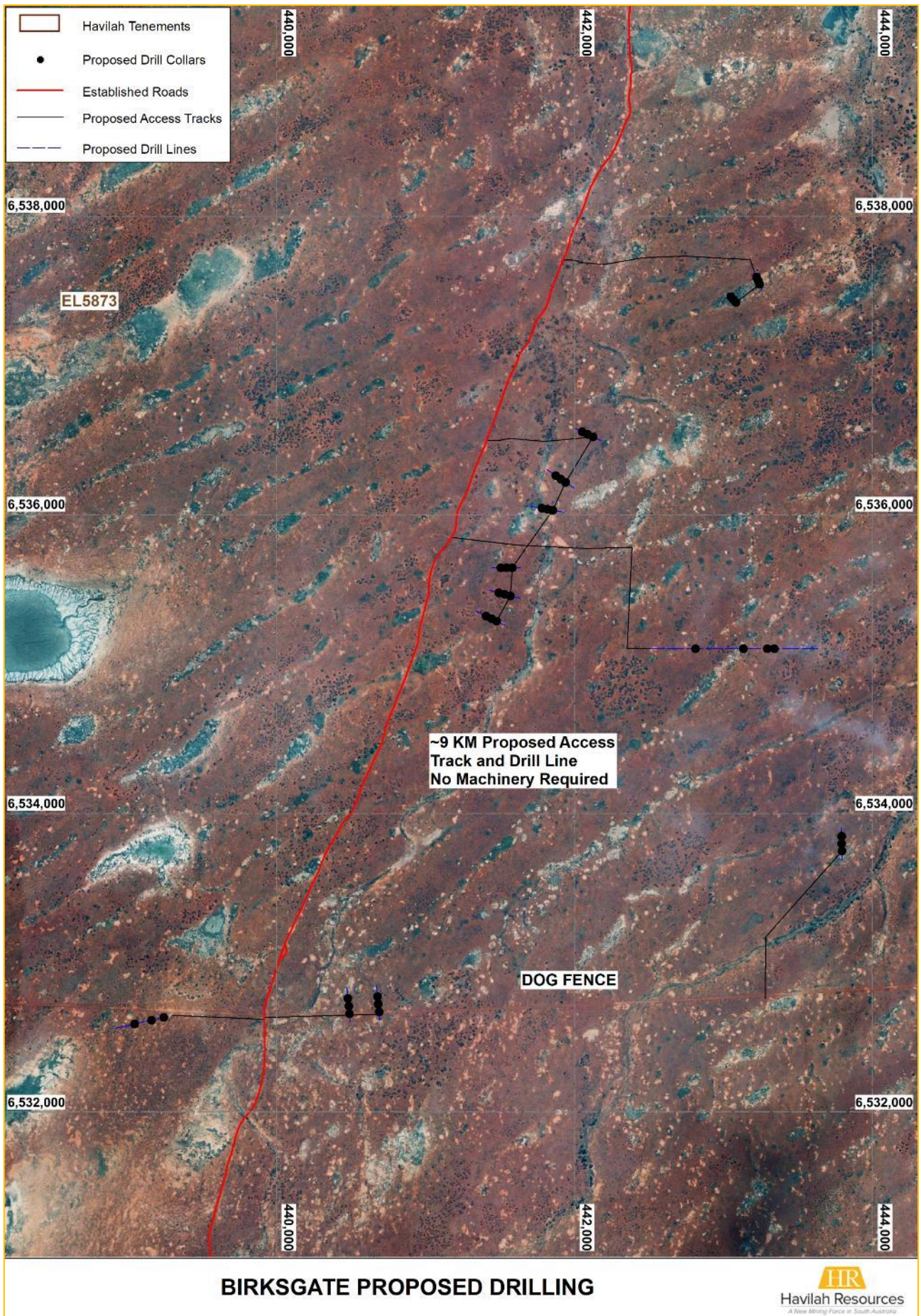


Map 1: Tenement Location – Regional.

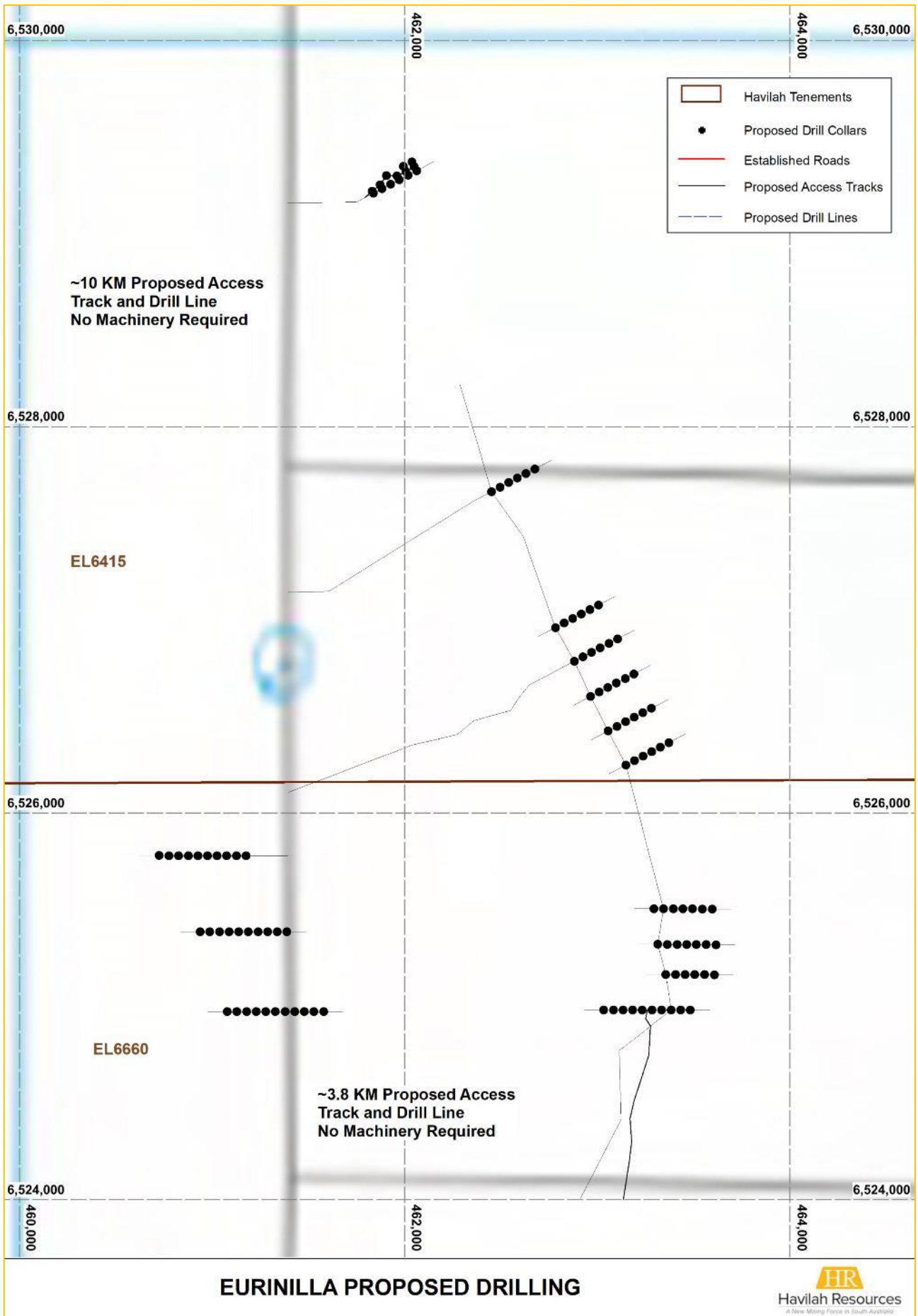


Map 2: Birksgate Proposed Drilling – Topography.

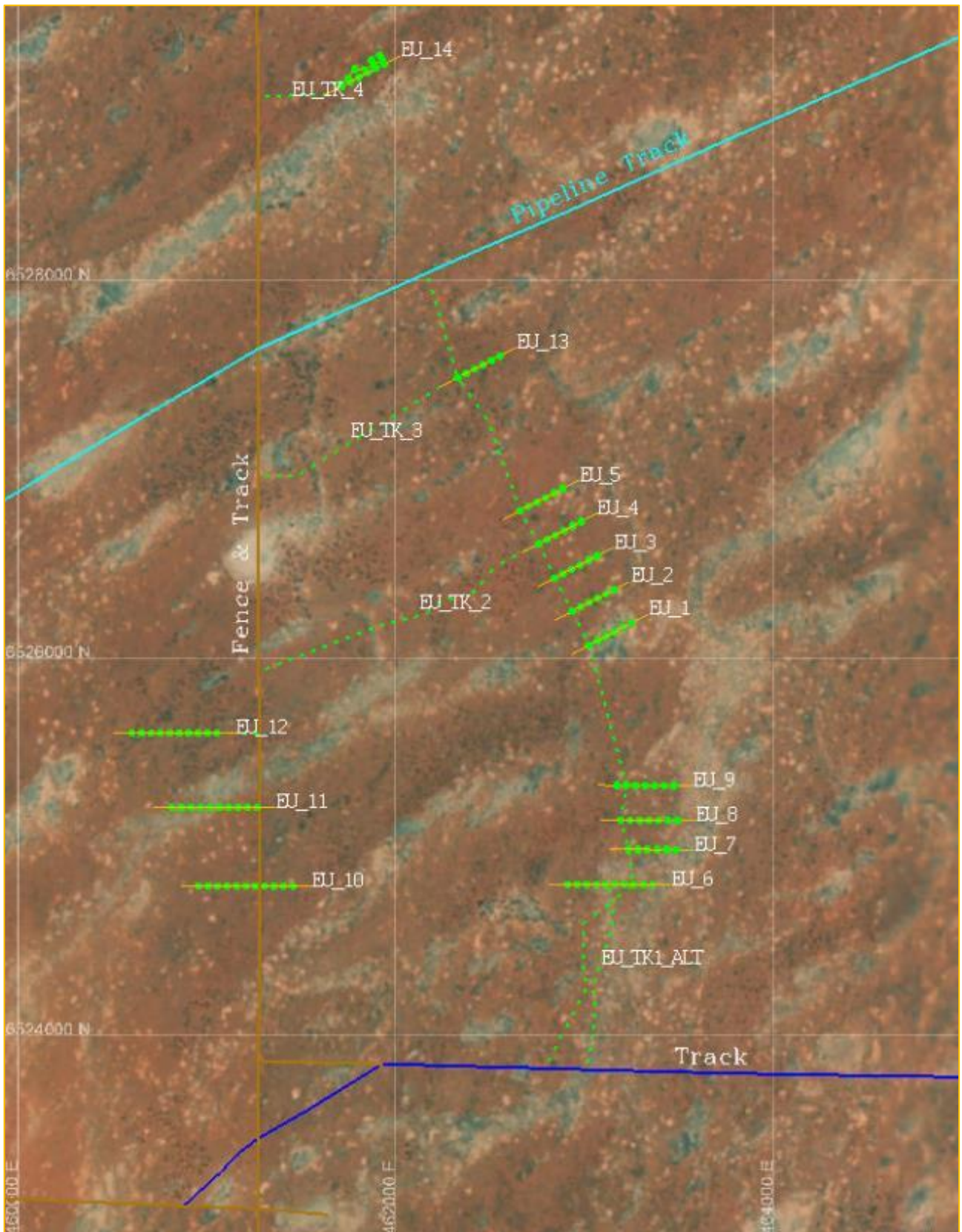
Exploration PEPR application – 12-month period



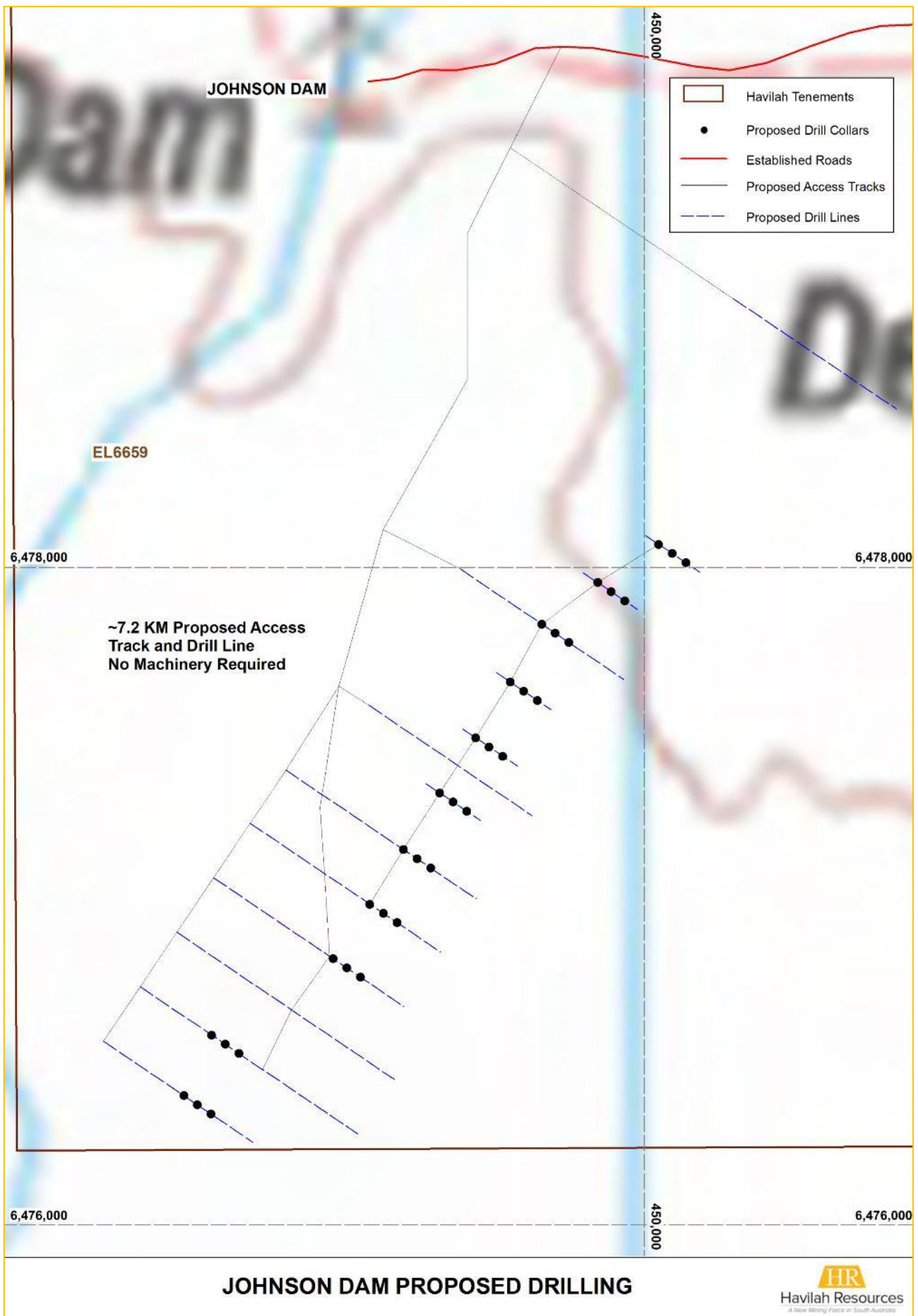
Map 3: Birksgate Proposed Drilling – Satellite Image.



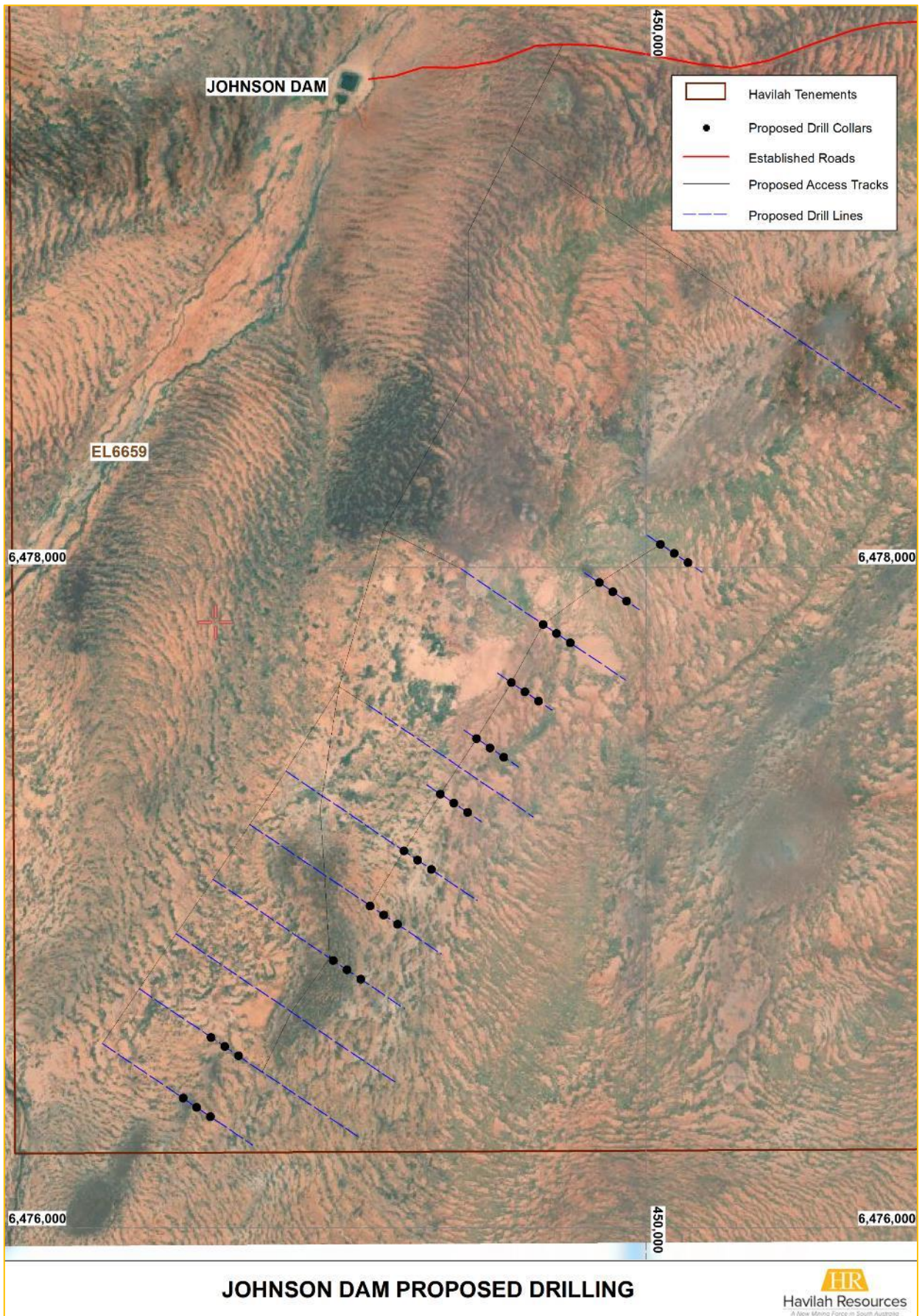
Map 4: Eurinilla Proposed Drilling – Topography.



Map 5: Eurinilla Proposed Drilling – Satellite Image.

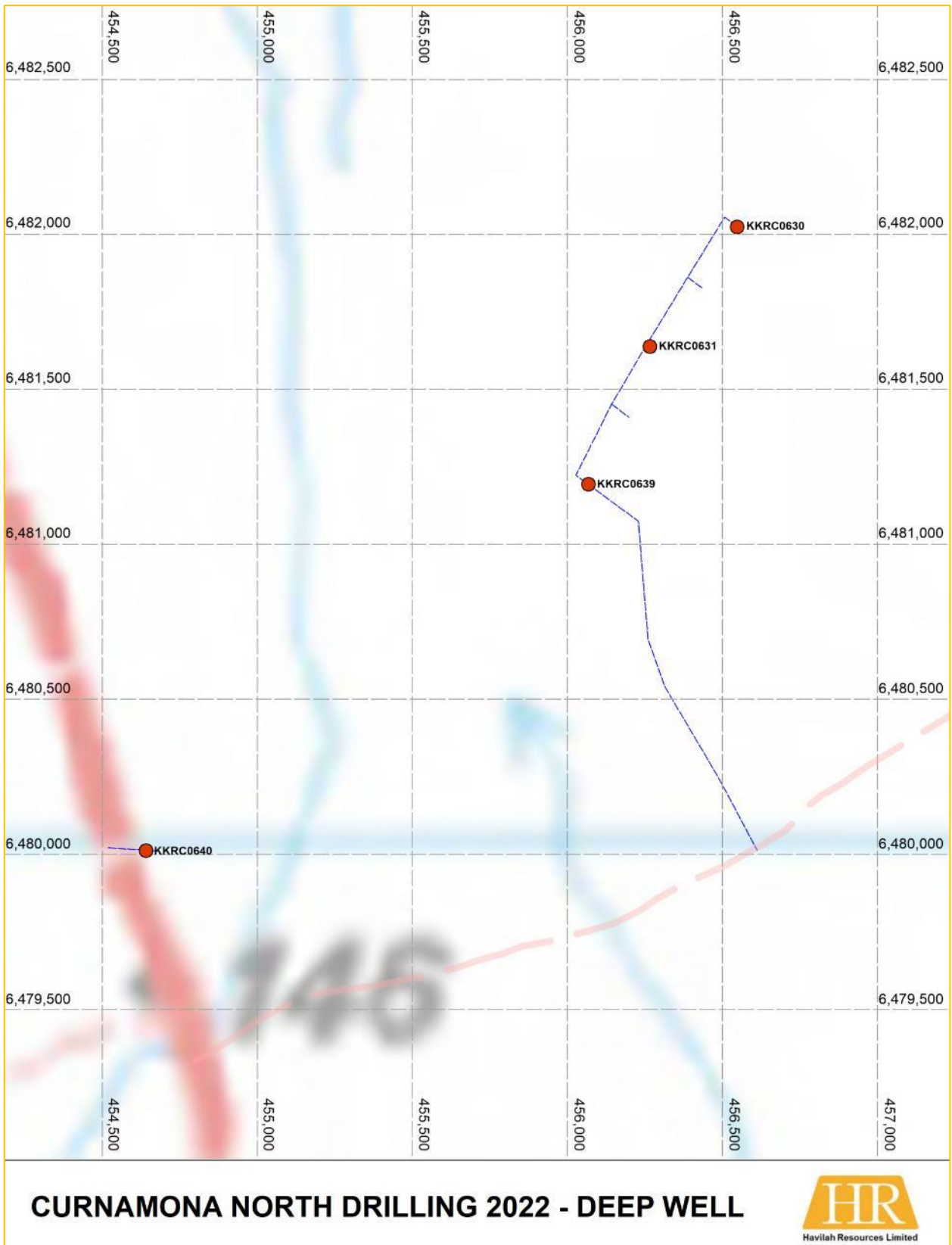


Map 6: Johnson Dam Proposed Drilling – Topography.

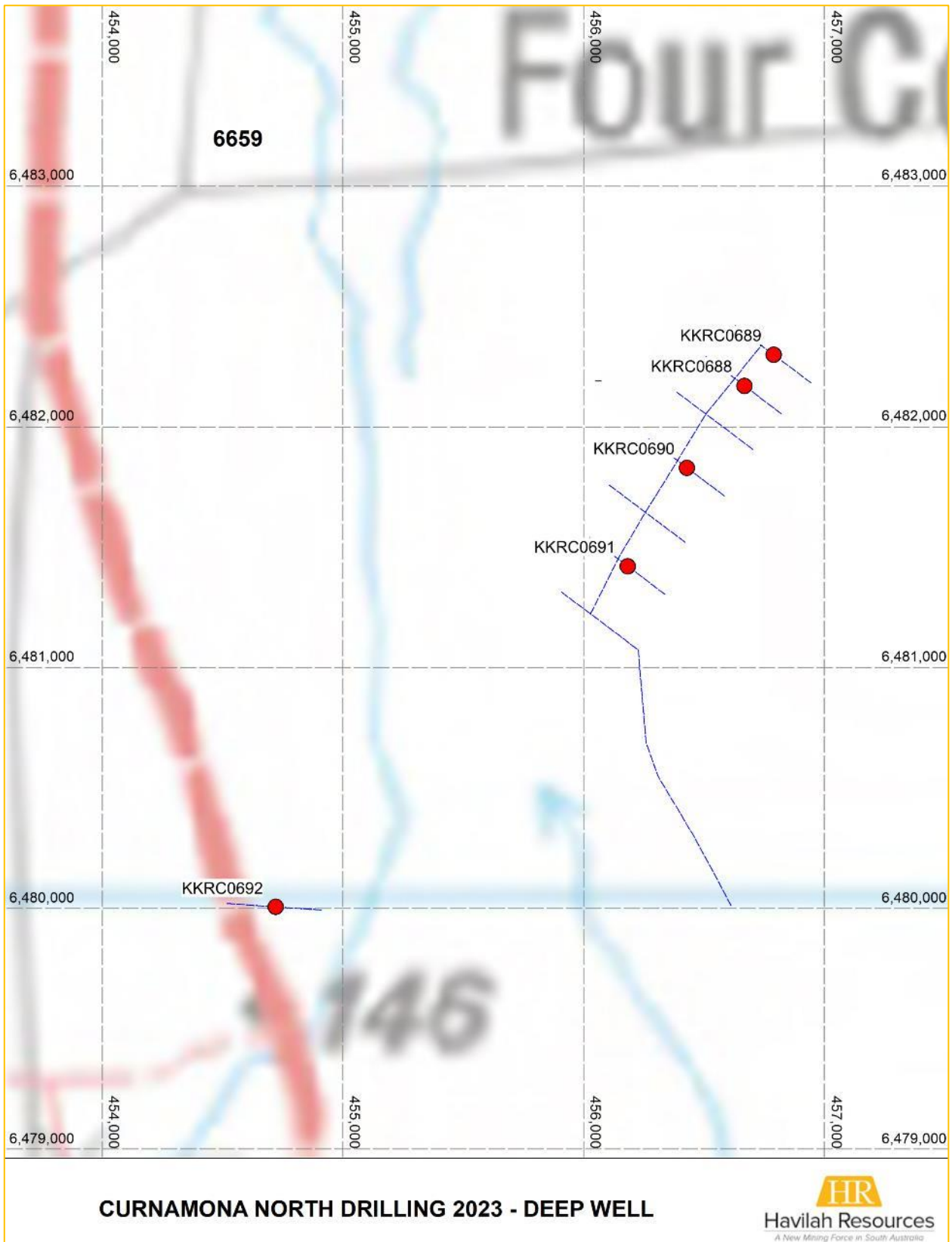


Map 7: Johnson Dam Proposed Drilling – Satellite Image.

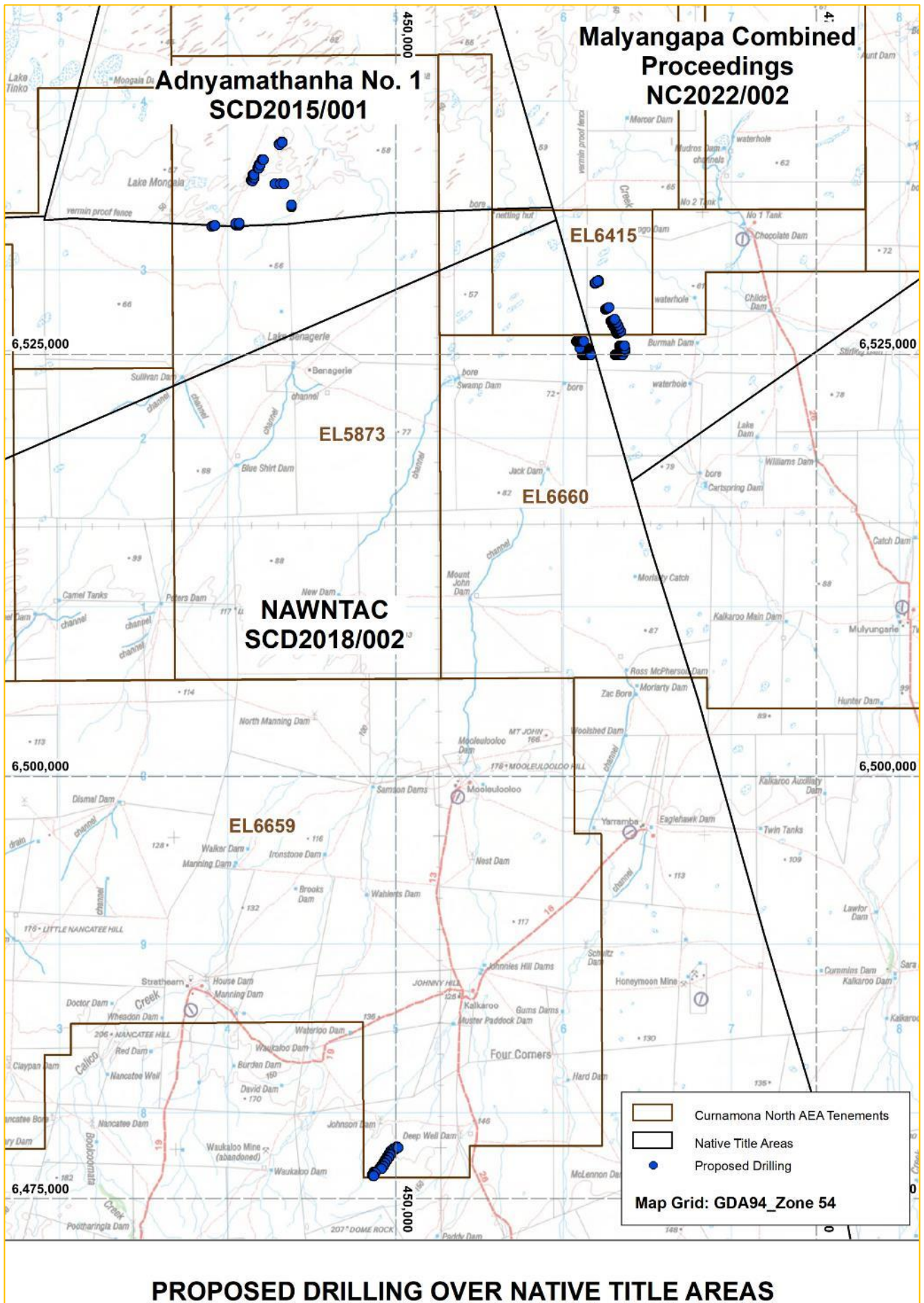
Exploration PEPR application – 12-month period



Map 8: Deep Well Previous Drilling – possible diamond tail location to be decided.

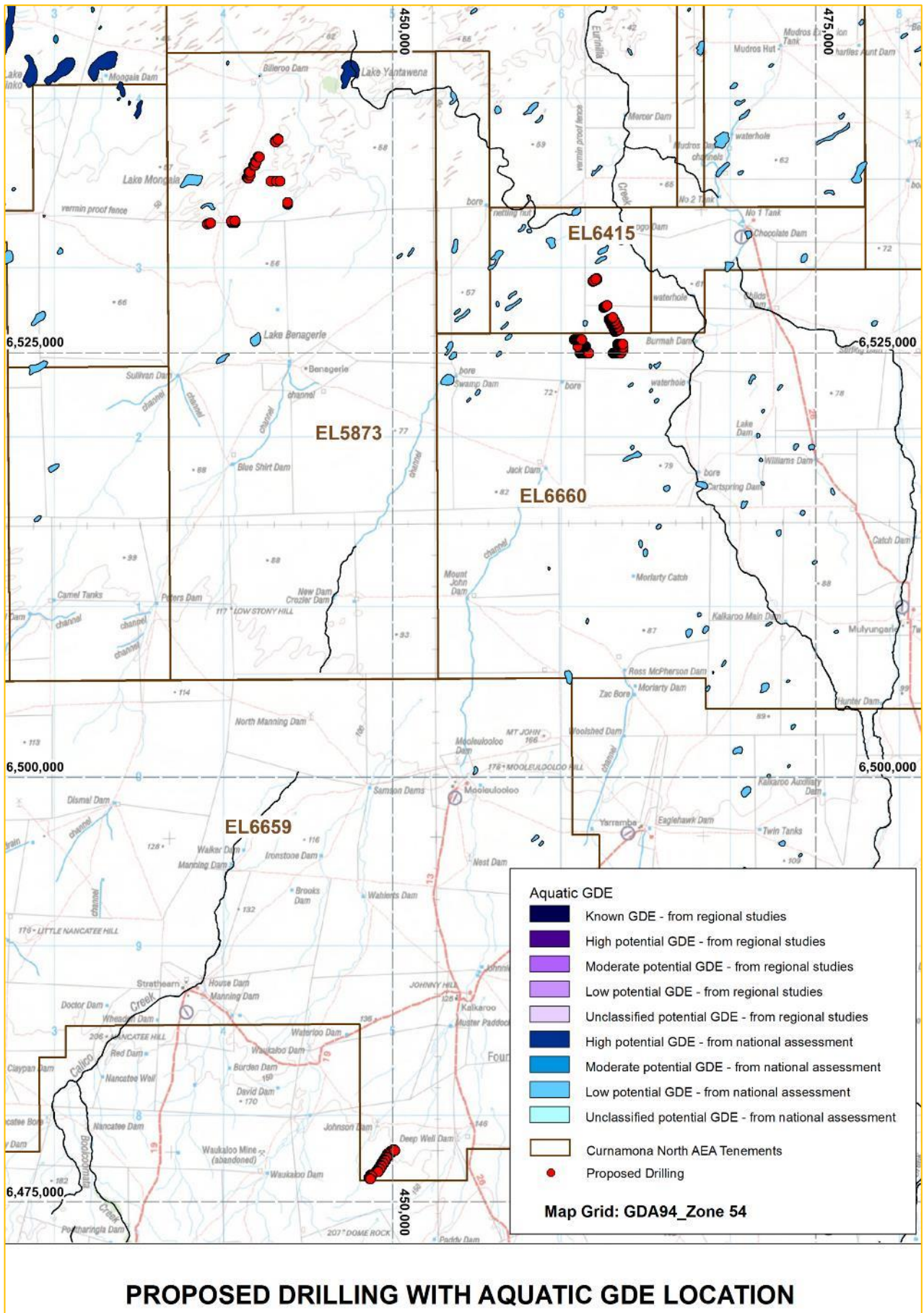


Map 9: Deep Well Previous Drilling – possible diamond tail location to be decided.



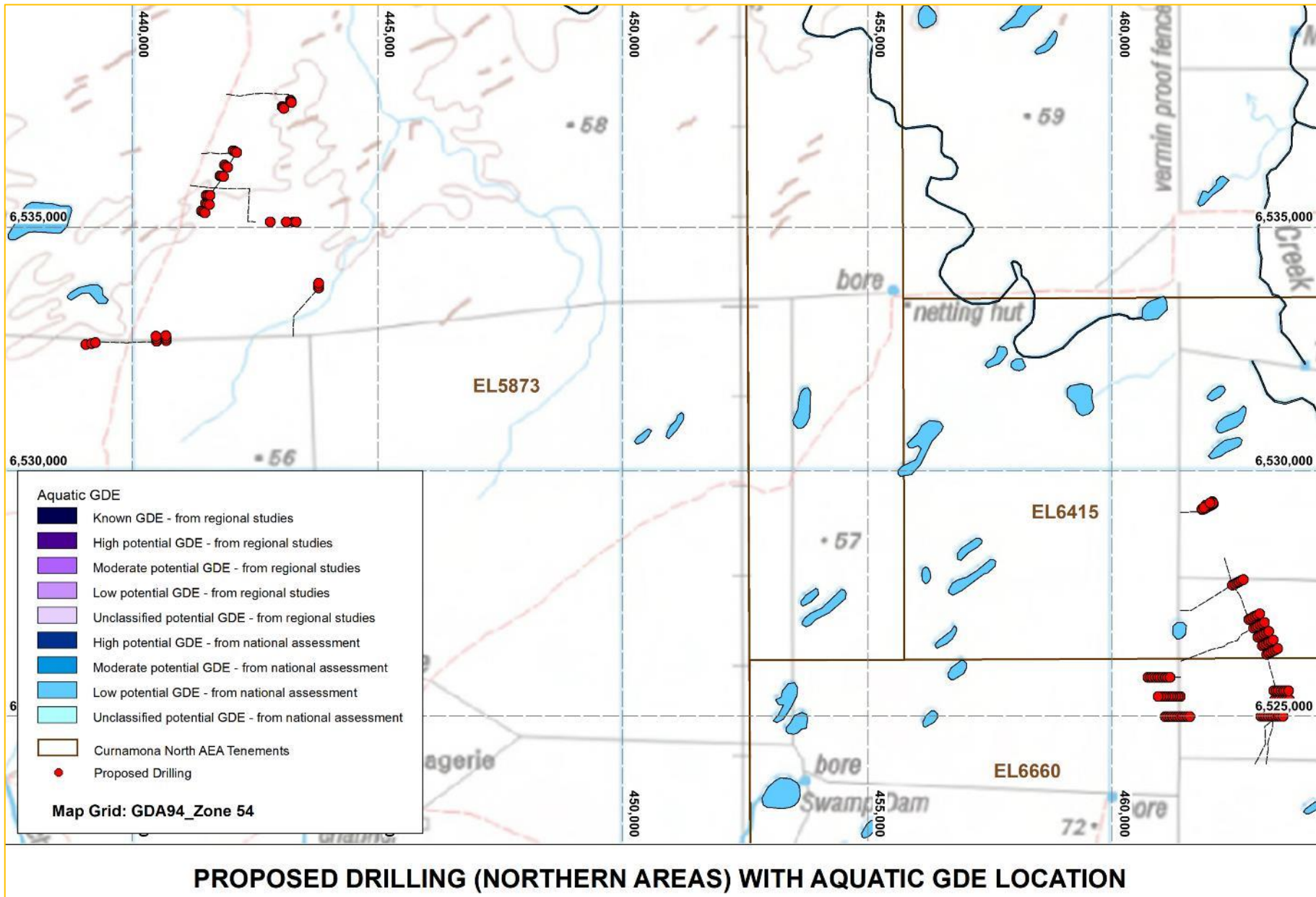
Map 10: EL5873, EL6415, EL6659, and EL6660 proposed drilling with respect to Native Title Claim Areas.

Exploration PEPR application – 12-month period



Map 11: EL5873, EL6415, EL6659, and EL6660 Aquatic GDE location and rating.

Exploration PEPR application – 12-month period



Map 12: EL5873, EL6415, and EL6660 Aquatic GDE location and rating.

## SECTION K – PUBLIC RELEASE

PEPR documents will be registered on the mining register and publicly released in full without the need to request consent from the tenement holder(s). Ultimately, it is the applicant's responsibility to ensure that confidential, or commercially sensitive, information is not included within the PEPR application.

## SECTION L – SUBMISSION OF THE APPLICATION

An application for an Exploration PEPR or PEPR review, must be submitted in the following form, unless otherwise specified by the Director of Mines or an authorised officer:

- an electronic version of the PEPR must be submitted using the exploration PEPR template(s) provided on the DEM Minerals website,
- the electronic version must be submitted online through the DEM Minerals website using the exploration PEPR submission form,
- the electronic version must be submitted in one single Acrobat PDF file, and
- Microsoft Word-compatible files must be submitted if requested by the Director of Mines (or delegate), or other authorised officers.

## **APPENDIX 1**

### **TECHNICAL MEMORANDUM**

#### ***Curnamona North Exploration Area Groundwater Occurrence***

Date:	8 October 2024
From:	Geoff Borg MSc in Hydrogeology and Groundwater Management <i>Principal Environmental Advisor</i>
To:	Chris Giles <i>Technical Director</i>  Amy Jacka <i>Tenement Manager</i>
Subject:	<b>Curnamona North Exploration Area Groundwater Occurrence</b>

This memorandum provides an updated description of the regional groundwater conditions in Havilah’s Curnamona North exploration area based on detailed hydrological studies carried out at the Portia gold mine and the proposed Kalkaroo copper-gold mine area by specialist consults in addition to Havilah’s extensive drilling in the area. The purpose is to inform Havilah’s responses to the Department for Energy and Mining’s (DEM) questions regarding Havilah’s 2024 Curnamona North Exploration (exploration licences EL5873, EL6415, EL6659, and EL6660) Program for Environment Protection and Rehabilitation (EPEPR) dated 4 July 2024. To ensure Havilah’s proposed drillhole decommissioning methods are appropriate for the groundwater conditions encountered in the exploration area.

While this EPEPR relates specifically to planned exploration drilling at the Johnson Dam, Birksgate, and Eurinilla prospects, the geological and groundwater descriptions are relevant to all basement mineral exploration prospects in the Curnamona North area (Figure 1).

The hydrogeology of Cenozoic palaeochannels, subject to extensive local uranium exploration and mining, are outside the scope of this memorandum as they are avoided during hardrock exploration. Hard rock mineral exploration prospects mostly occur in areas of relative basement highs which existed as topographic highs during formation (incision into these basement strata) and filling of the palaeovalleys.

## Regional Geological Setting

Basement geology comprises metamorphosed Palaeoproterozoic Willyama Supergroup rocks, Mesoproterozoic Benagerie Volcanics, and Ninnerie Suite granitoids of the Curnamona Province and some Neoproterozoic metasediments. Basement rocks are unconformably overlain by Cenozoic cover strata that generally increase in thickness towards the north, excepting over basement topographic highs as noted above.

The basement rocks typically have a deeply weathered profile of clay rich saprolite to saprock above the fresh unweathered variably fractured bedrock. This varies locally depending on basement topography, the sulphide content of the original basement strata, and the presence of structural features such as shear zones that result in deeper weathering or removal (erosion) of the profile.

Cenozoic cover includes Eyre Formation, typically preserved as white to grey soapy clays (Eyre Clay) as localised remnants in basement topographic lows. Eyre Formation sands and gravels are limited to rare, incised channels in the basement such as the Yarramba Palaeochannel that is host to the Honeymoon Uranium Mine. Cenozoic Namba Formation clays and sands unconformably overlie the Eyre Formation and basement and form a blanketing cover over much of the Curnamona North area that is typically capped by Quaternary outwash sediments of the Frome Plains (including frequent hardpan) that in turn are overlain by Holocene aeolian sands that increase in abundance towards the north (Table 1, Figure 2).

These cover strata are variably developed from place to place, and their thickness is controlled by the Benagerie Ridge basement high and local basement topography (Figure 2). In the south basement rocks outcrop (Olary Ranges) or are very near surface (Figure 3b, Johnson Dam) and they can also subcrop or have minimal cover many kilometres to the north (Figure 3c Croziers, Figure 3d Birksgate). More generally, there is significant cover of Namba Formation clays (and more rarely Eyre Clay) lying unconformably on the basement over much of the area (Figure 3e Portia, Figure 3f Eurinilla).

The cover sequence exposed in the Portia Mine open pit includes surficial Quaternary sediments, Namba Formation, Eyre Clay, and weathered bedrock (Figures 4).

**Table 1. Generalised Stratigraphy with indicative depths to Cenozoic strata boundaries based on past drilling for Eurinilla and Birksgate.**

South		Central		Northern	
Johnson Dam	Kalkaroo	Croziers	Portia	Eurinilla	Birksgate
	Quaternary outwash sediments	Quaternary outwash sediments	Holocene aeolian sediments		
	Namba Fm	Namba Fm		(14–56m)	(6–16m)
			Eyre Clay (if present 56–66m)		
Palaeoproterozoic Willyama Supergroup metasediments, Mesoproterozoic Benagerie Volcanics, Ninnerie Suite granitoids, and Neoproterozoic metasediments					

## Groundwater Occurrence in Exploration Prospect Areas

Evans et al (2024) identifies the Curnamona North area as being towards the southern limits of the Callabonna Sub-basin within the Kati Thanda – Lake Eyre Basin (Figure 7). Detailed groundwater studies undertaken as part of approvals for the Portia Mine and Kalkaroo mine leases showed that:

- Ephemeral perched water tables in the Quaternary cover sediments are not identified in geotechnical studies (Water Technology, 2021 and Mining One, 2017), Portia Tailings Storage Facility compliance monitoring of wells screened in these sediments, or the Portia mine open pit (Figure 4).

- Groundwater occurs in a single, low permeability, unconfined aquifer (Table 2, Figure 11) with localised confined or semi-confined groundwater zones of limited extent within basement geological structures (e.g. shear zone at Kalkaroo – Figure 11, fractured strata at Portia,). These uncommon higher permeability zones are characterised as local strip aquifers in numerical groundwater models developed to plan mine dewatering (Water Technology, 2021 and Aqueon, 2016).
- The potentiometric surface (water table) is in basement rocks to the south and transitions to the Namba Formation to the north.
- Saturated formations are transmissive and low permeability (Namba Formation, Eyre Formation – Eyre Clay, and basement – including the highly weathered clay dominated saprolite to saprock to unweathered rock) and regionally described as aquitards in the context of the greater Kati-Tander – Lake Eyre Basin (Evans et al, 2024).
- There is a low but consistent general hydraulic gradient across the region indicating flow from south (Olary Ranges – recharge area) to north (toward Lake Frome).
- Unconfined and locally confined or semi-confined groundwater all report to the same regional potentiometric head (Water Technology, 2021 and Aqueon, 2016).
- Groundwater is slow moving with a generally increasing salinity with distance away from recharge zones (Water Technology, 2021).
- Water quality is typically saline across the exploration prospects (Table 3).

In previous phases of exploration drilling on Havilah’s exploration prospects the intersection of regional groundwater has typically been evident as wet or mushy RC (reverse circulation) returns and occasional slugs of saline water suggesting intersection with water filled fractures or minor permeable sedimentary lenses. Intersection with larger structures tends to produce initial water discharge that decreases over time as drilling progresses beyond the structure.

**Table 2. Summary Aquifer Properties**

Strata	Kalkaroo (Water Technology, 2021)		Portia (Aqueon, 2016)	
	Well Yield (L/s)	K (m/d)	Well Yield (L/s)	K (m/d)
Quaternary	Dry (TSF and pit bund design geotechnical studies)		Dry (TSF compliance monitoring well gauging data)	
Namba Formation*	Above water table		No data	0.04 – 0.15
Eyre Clay*	Absent			
Basement	0.1 – 0.8	0.0005 – 0.03	<2	<0.01 – 0.7
Basement <i>local high(er) permeability zone</i>	7 – 15	0.3 – 26 (shear zone)	5 – 7 (fractured hanging wall pelite)	
<b>Note:</b> * Namba and Eyre Formation clays are highly fissured with slickensides with no particular orientation (Mining One, 2017) which is a significant source of groundwater transmissivity as indicated by the slow yield of groundwater into intersecting wells.				

<b>Table 3. Summary Groundwater Quality (Total Dissolved Solids in mg/L)</b>			
<b>Strata</b>	<b>Kalkaroo</b> (Water Technology, 2021)	<b>Portia</b> (Aqueon, 2016)	<b>Regional</b> (SA Water Connect)
Namba Formation			<1,200 (1 well*)
Eyre Clay		13,040	
Basement	9,520 -34,100	15,750	3,000 – 13,000 (20 wells)
Basement <i>local higher permeability zone</i>	15,200 – 30,000	12,913	>13,000 (43 wells)
<b>Notes:</b>			
* Waukalo Bore (Unit No. 639400032) located in the foothills of the Olary Ranges (outcropping basement) on Kalabity Pastoral Station. This is a recharge area where lower salinity groundwater is not unexpected.			

## Summary of Detailed Groundwater Studies

### *Kalkaroo Mining Leases*

Summary of groundwater occurrence (Water Technology, 2021):

- Surficial Quaternary sediments and underlying Cenozoic Namba Formation are clay rich with very low permeability, and unsaturated.
- Regional water table transitions from the basement to the Namba Formation away from the site to the north as the basement topographic level falls.
- Saprolite within the basement-weathered profile are clay rich and are of low permeability.
- Fresh basement rocks are generally of low permeability, except in the vicinity of a shear zone, which is conceptualised as a higher permeability strip aquifer within the surrounding low-permeability basement rock mass (Figure 11, Table 2).
- 

### *Portia Gold Mine*

Summary of groundwater occurrence (Aqueon, 2016):

- The permeability of the fresh basement rocks, saprolite and overlying Eyre and Namba Formations is generally low (Figure 4). Higher groundwater yields are rarely encountered in some particularly fractured, fresh basement rocks.
- Highly fractured basement hanging wall pelite is the most permeable hydrogeological unit and capable of well yields exceeding 5 L/sec for limited periods,
- Pre-mining the potentiometric surface or regional water table was the same for wells completed in the basement as it was in those completed in the Saprolite and Eyre and Namba Formations at approximately 42 to 43 m AHD (Figure 12).
- Groundwater connection between strata is evident in the hydrograph (Figure 13) where wells completed in the Eyre and Namba Formations show definite but delayed or slower responses to mine dewatering indicating hydraulic connection to groundwater in the fractured basement.

Characteristics of the Saprolite and Eyre and Namba Formations (Mining One, 2017 and Aqueon, 2016):

- Eyre and Namba Formation are predominantly medium to high plasticity clays, highly fissured (a sign of over consolidation) with slickensides.

- Saturated below the regional water table with groundwater strongly bound by capillary forces in micro-pore spaces within the clay matrix and water filled fissures and slickensides.
- Little evidence of seepage from the pit wall from any of the geological units above the weathered basement (Figure 4).
- Considered 'dry' due to the apparent lack water influx into drillholes and wells, which do not readily yield water, i.e. it takes considerable time for groundwater to seep into the wells [from intersected water filled fissures].
- Exposed saturated strata becomes increasingly desiccated over time as capillary water is lost to evaporation (to an extinction depth of up to 10 m depth horizontally from the exposed face) (Figures 5 and 6).
- The swelling nature of the clays result in drillholes naturally closing if left unsupported.

## Proposed Drillhole Abandonment

It is apparent from these studies that multiple aquifers do not occur in the Curnamona North area being explored by Havilah. Moreover, there is a clear hydraulic connection of the same saline groundwater from fresh bedrock upwards through saprolite to the Eyre Formation and Namba Formation cover sequences in one continuous column below the water table. Given the absence of multiple aquifers Havilah's exploration drillholes should be abandoned in accordance with the requirements for unconfined aquifers as outlined in DEM's information sheet M21 (Mineral Exploration Drillholes — General specifications for construction and backfilling)

## Far North Prescribed Wells Area – Birksgate

The proposed Birksgate prospect drillholes are located within the Far North Prescribed Wells Area as defined locally by the administrative (i.e. non geological) boundary aligning with the Dog Fence. Based on the known stratigraphy from historic exploration drilling in the Birksgate area, drilling in this area will not intersect strata or aquifers of the Great Artesian Basin. Birksgate prospect is on a local basement high with relatively thin Cenozoic cover (Figure 2, Figure 3d).

Saline groundwater is expected to occur within the regional (low permeability) unconfined aquifer with drillhole abandonment proposed in accordance with DEM information sheet M21 guidance for drillholes in unconfined aquifers.

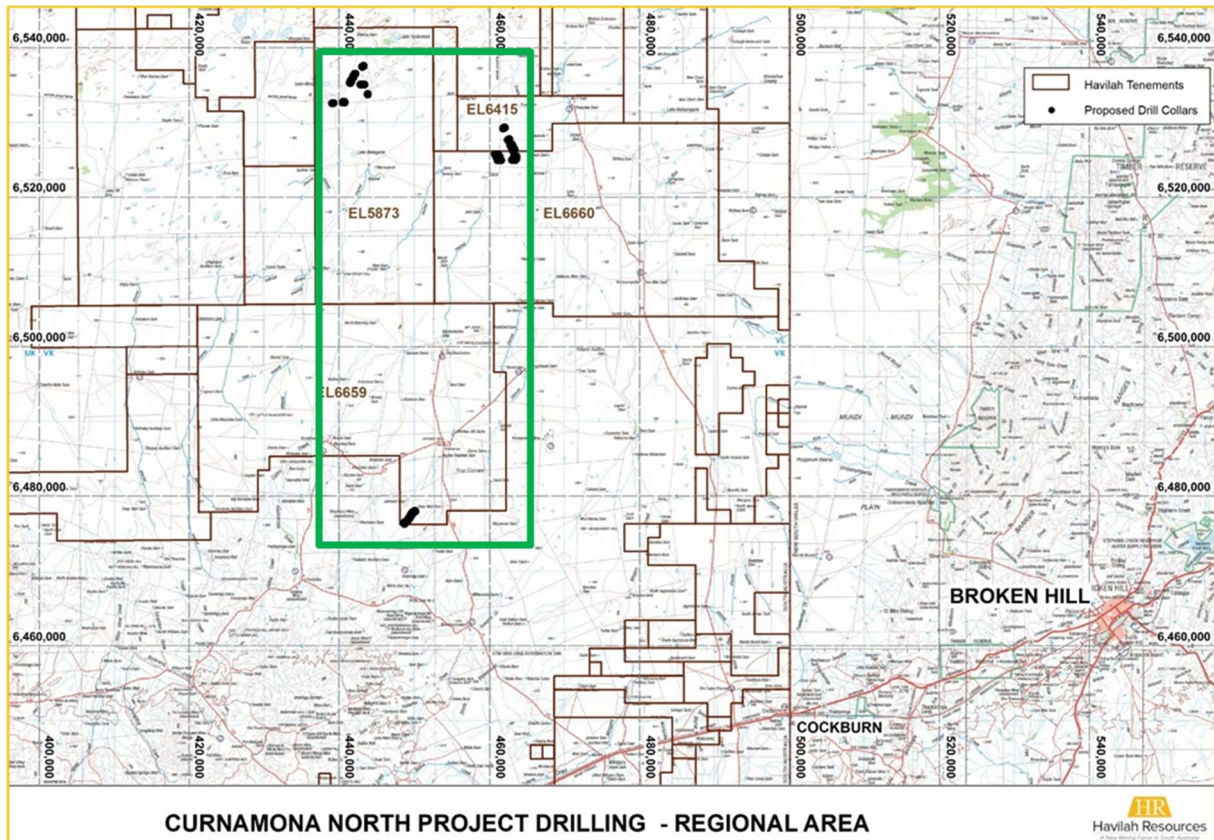
## References

1. Evans TJ, Bishop C, Symington NJ, Halas L, Hansen JWH, Norton CJ, Hannaford C and Lewis SJ (2024) Cenozoic geology, hydrogeology, and groundwater systems: Kati Thanda – Lake Eyre Basin, Record 2024/05, Geoscience Australia, Canberra, <http://dx.doi.org/10.26186/147422>.
2. Water Technology (2021) DRAFT Groundwater Impact Assessment Kalkaroo Copper-Gold Mine. Report prepared for Havilah Resources Limited to accompany the Kalkaroo PEPR.
3. Aqueon (2016) Portia Gold Project – Numerical Model Update and Hydrogeological Review to Support Open Pit Expansion Plans Project Report. Report prepared for Havilah Resources Limited on behalf of Benagerie Gold and Copper Pty Ltd and included in Portia Mine Site ML 6346 Program for Environment Protection and Rehabilitation (PEPR) Version 5.0 Rev1B dated 17 September 2019.

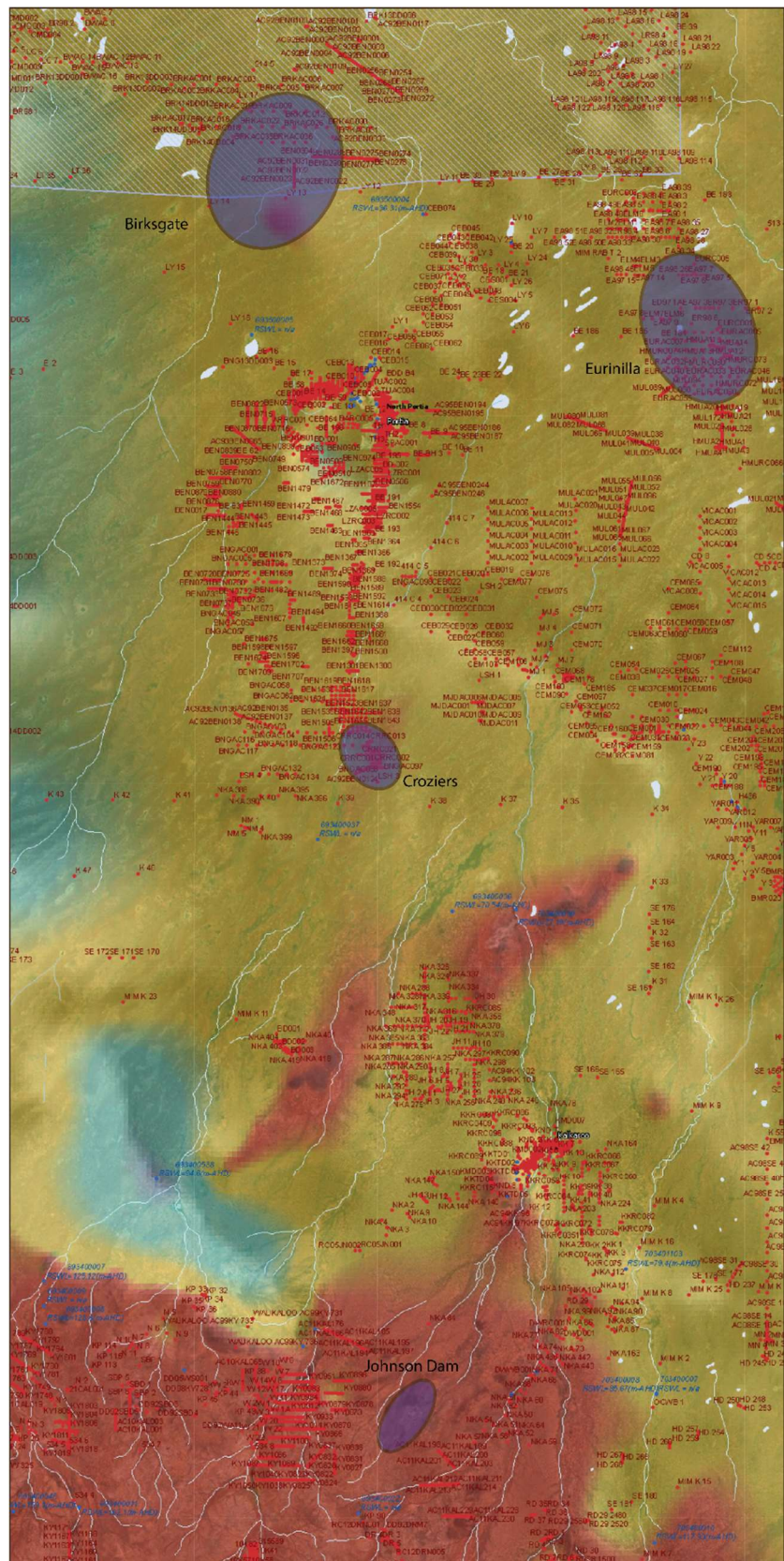
4. Mining One (2017) Portia Mine Review of Geotechnical Model. Report prepared for Havilah Resources Limited on behalf of Benagerie Gold and Copper Pty Ltd and included in Portia Mine Site ML 6346 Program for Environment Protection and Rehabilitation (PEPR) Version 5.0 Rev1B dated 17 September 2019.

## Attachment 1 - Figures

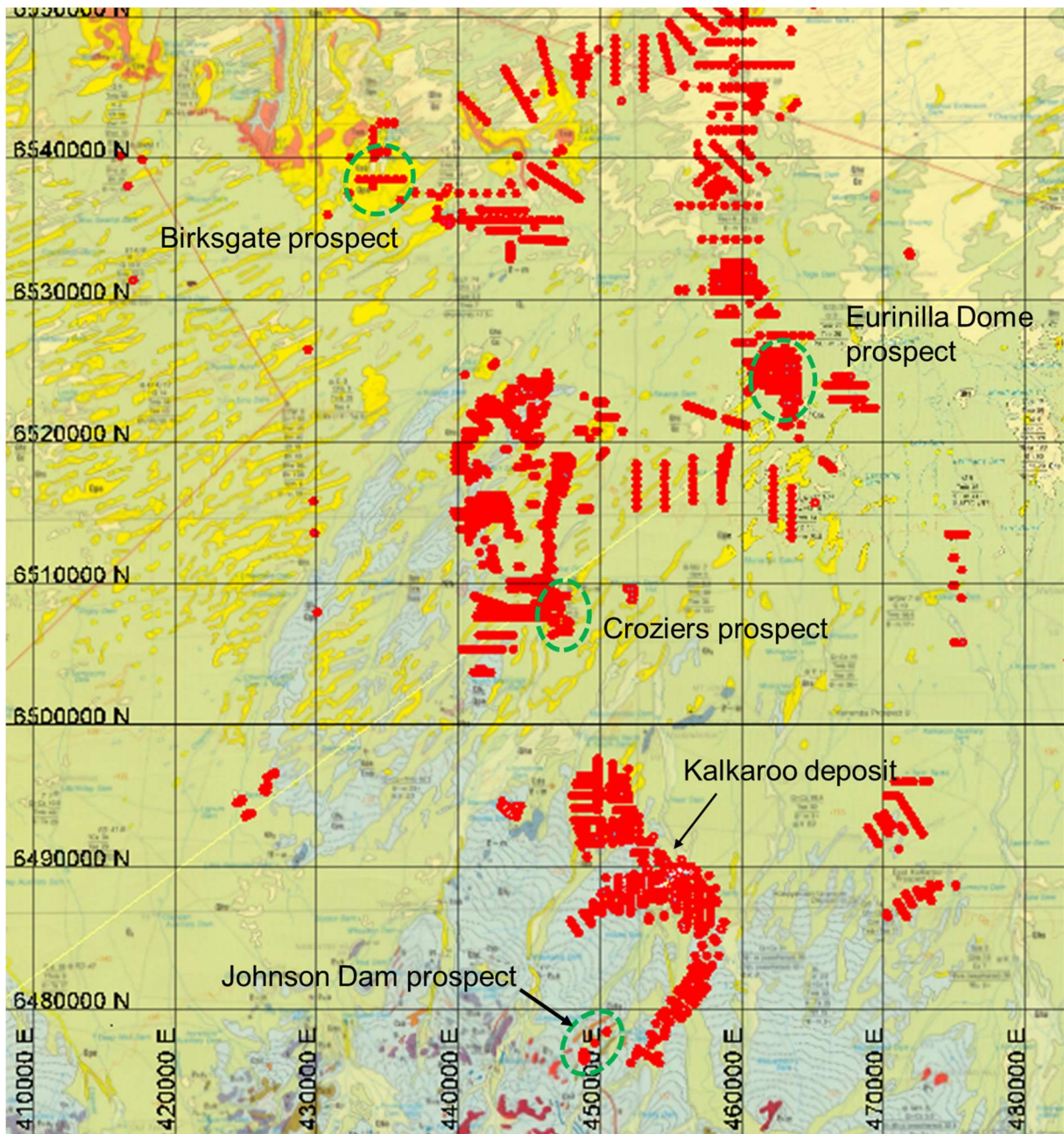
**Figure 1.** Havilah Resources' Curnamona North ELs and mineral exploration prospects - Birksgate (EL5873), Eurinilla (EL6660, EL6415), and Johnsons Dam (EL6659) - with proposed drillhole locations.



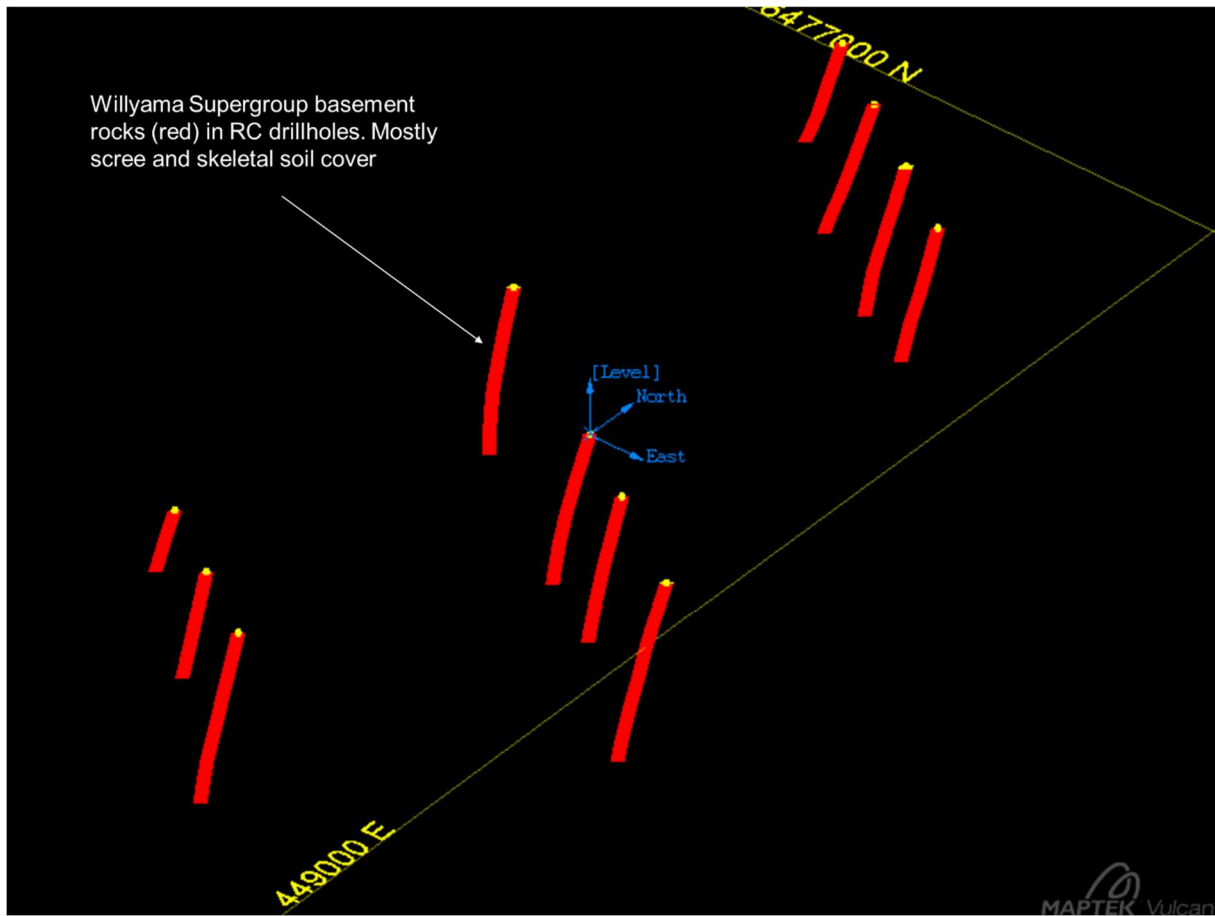
**Figure 2.** SARIG map depicting “SA cover thickness” overlaid on the ESRI satellite image for Curnamona North (including prospect areas, historic mineral exploration drillholes, and groundwater wells). Cover thickness indicated from colour gradations from red (absent cover) through yellow to blue with increasing thickness.



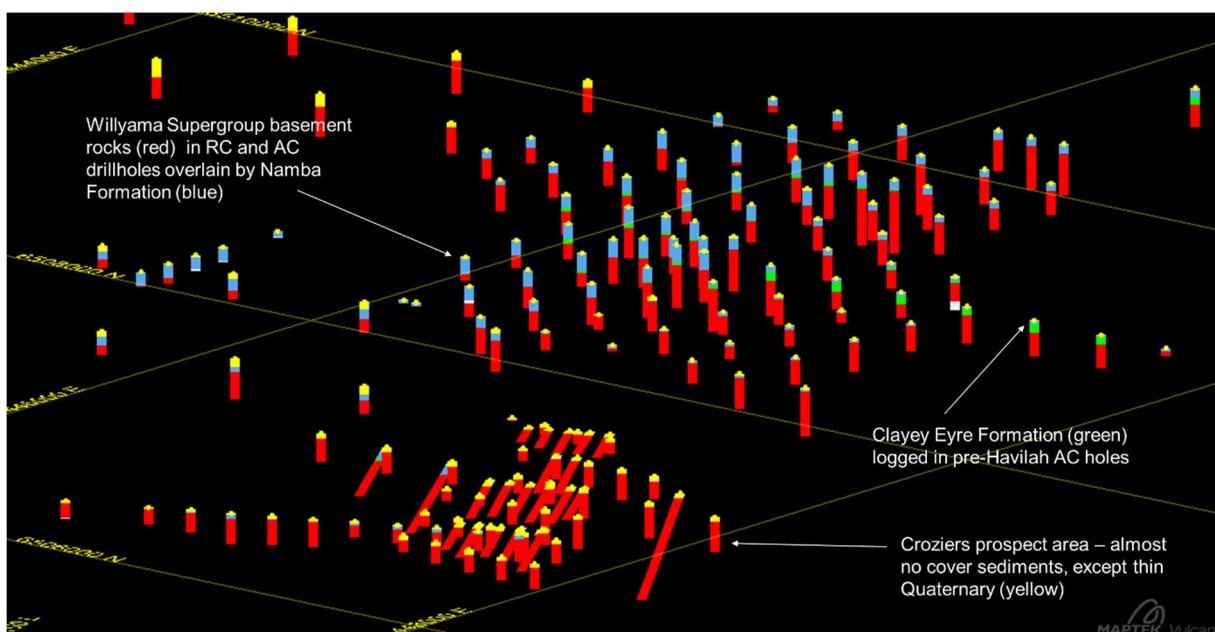
**Figure 3a.** Curnamona North area illustrating historic drillholes and locations of the Havilah prospects with Australian Map Grid overlay for reference.



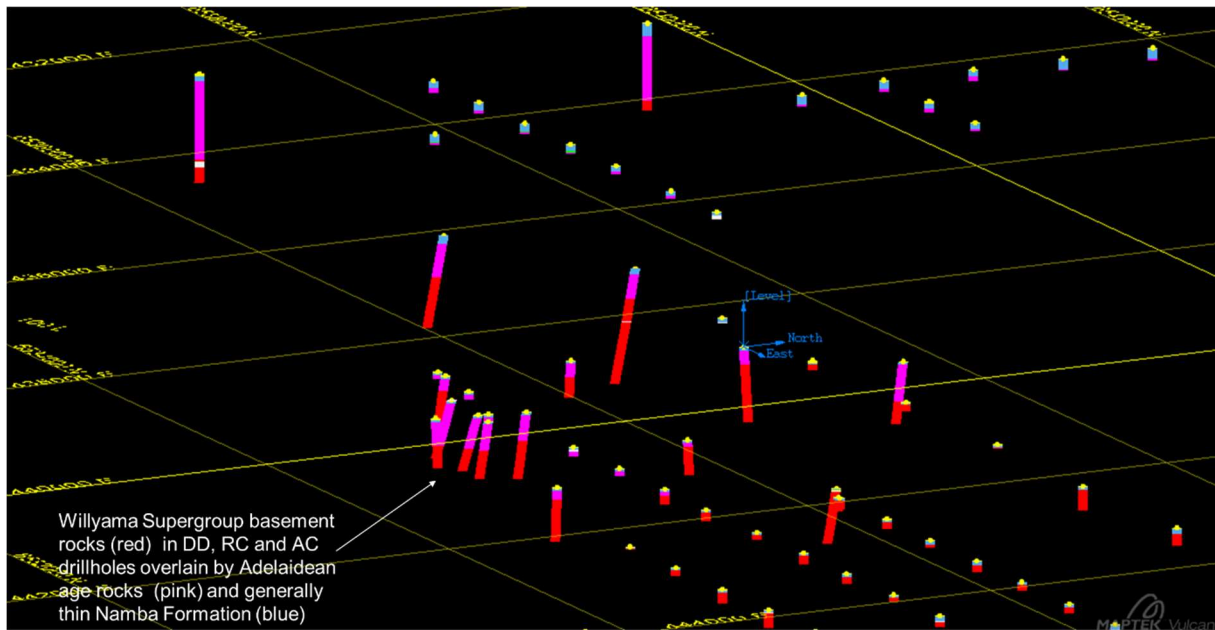
**Figure 3b.** Projection of Johnson Dam drillholes (2022) showing stratigraphy from Havilah’s drilling database.



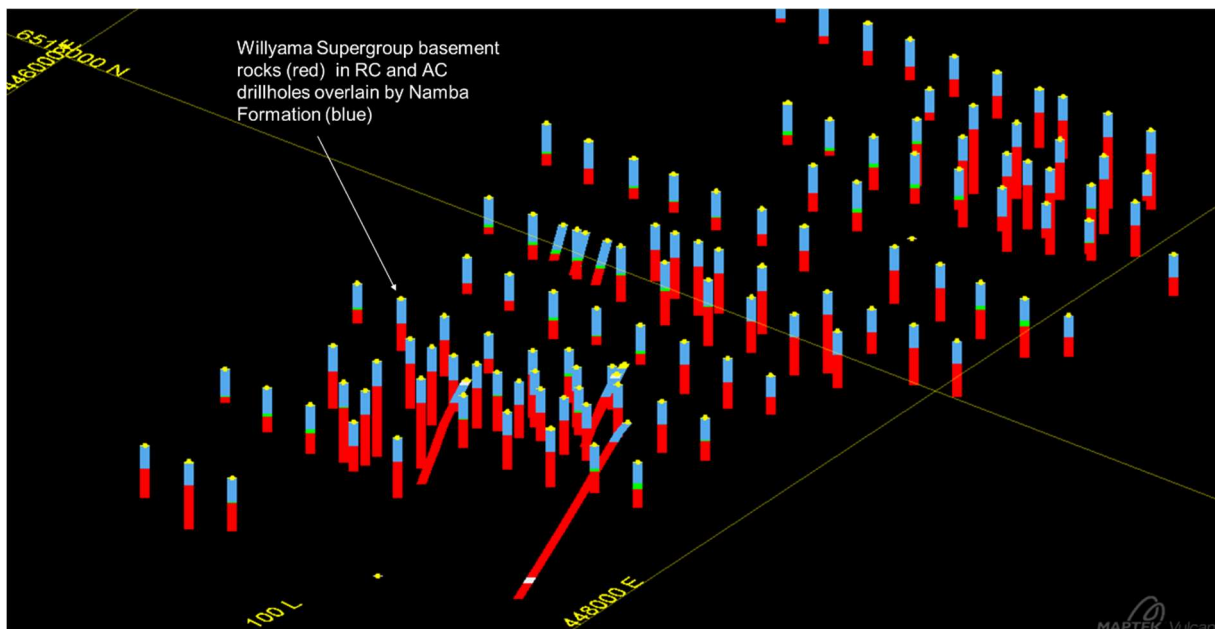
**Figure 3c.** Projection of Croziers drillholes showing stratigraphy from Havilah’s drilling database.



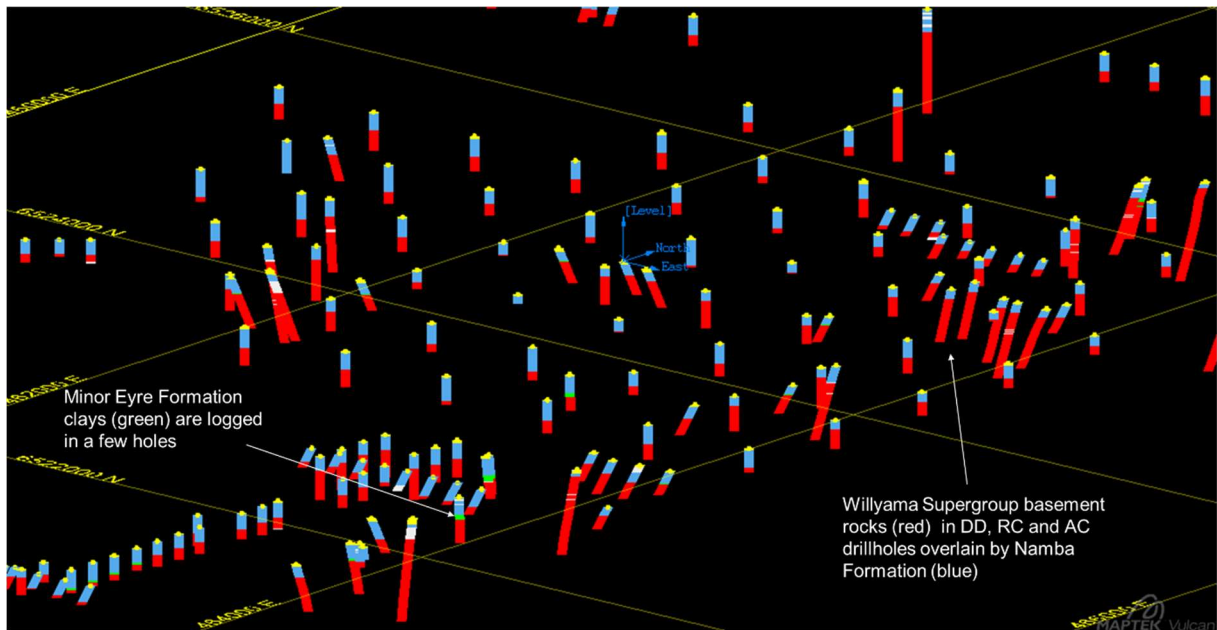
**Figure 3d.** Projection of Birksgate drillholes (including historic and 2023 results) showing stratigraphy from Havilah’s drilling database.



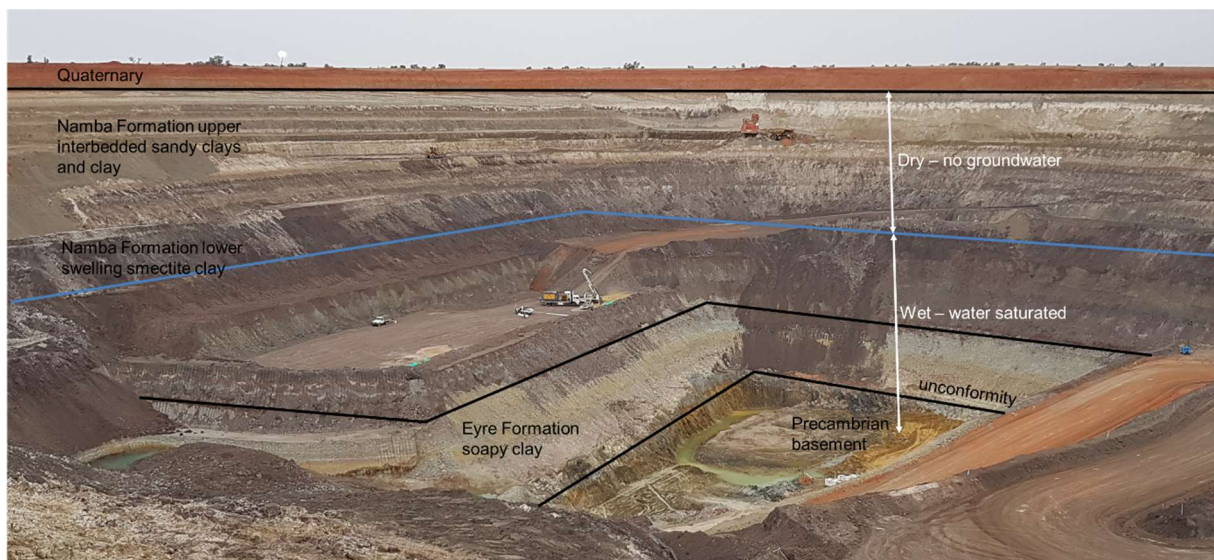
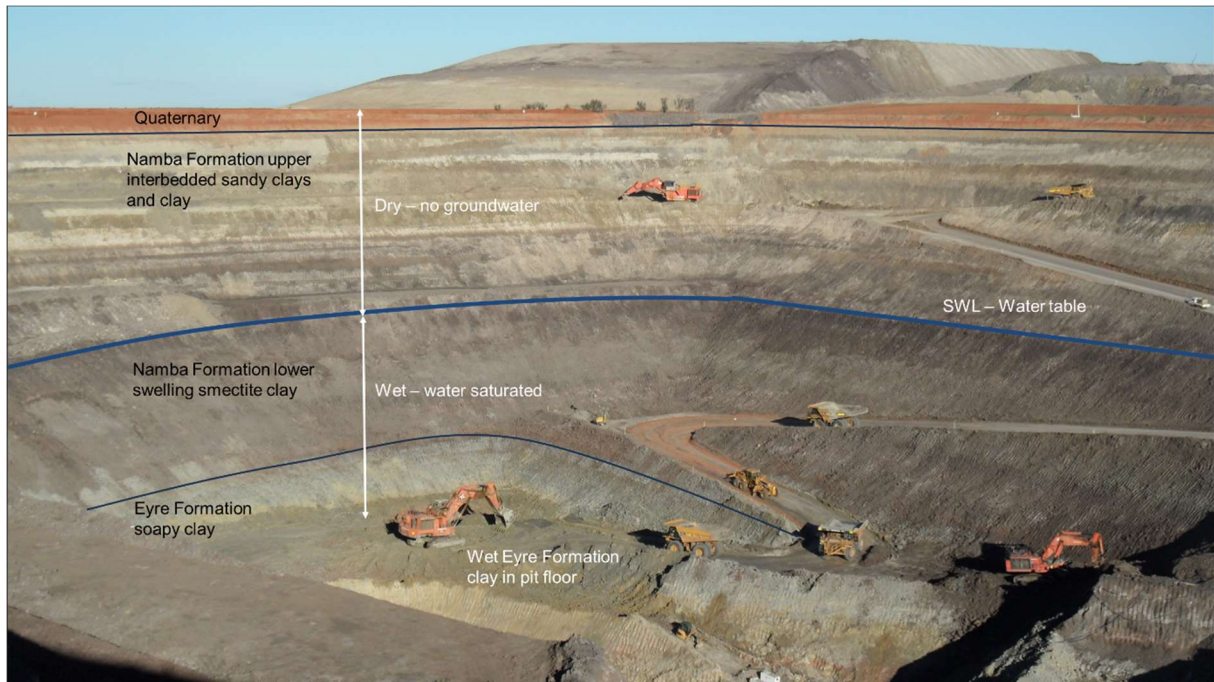
**Figure 3e.** Projection of Portia drillholes (2022) showing stratigraphy from Havilah’s drilling database.



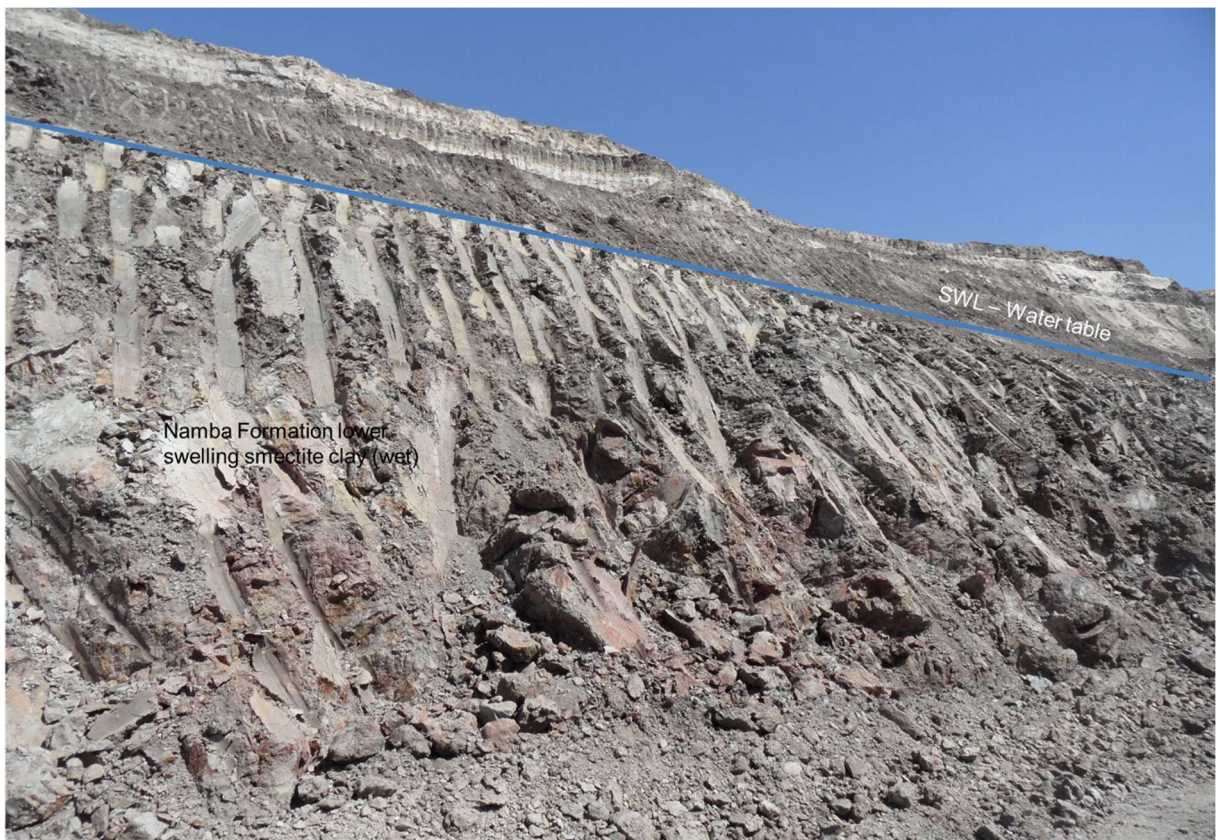
**Figure 3f.** Projection of Eurinilla drillholes (historic and 2023 results) showing stratigraphy from Havilah's drilling database.



**Figure 4.** Views of Portia Mine open pit showing exposed cover strata, and the position of the regional water table as indicated by the standing water level in groundwater wells installed around the pit to monitor aquifer dewatering. Ponding water in the bottom image is from the basement rock “strip aquifer” (Aqueon, 2016). Minimal seepage is observed from the exposed saturated Eyre and Namba Formation strata although they are wet, and water saturated below the water table.



**Figure 5.** Recently exposed Namba Formation strata showing structure (fissuring and slickensides) of the smectite clay before drying.



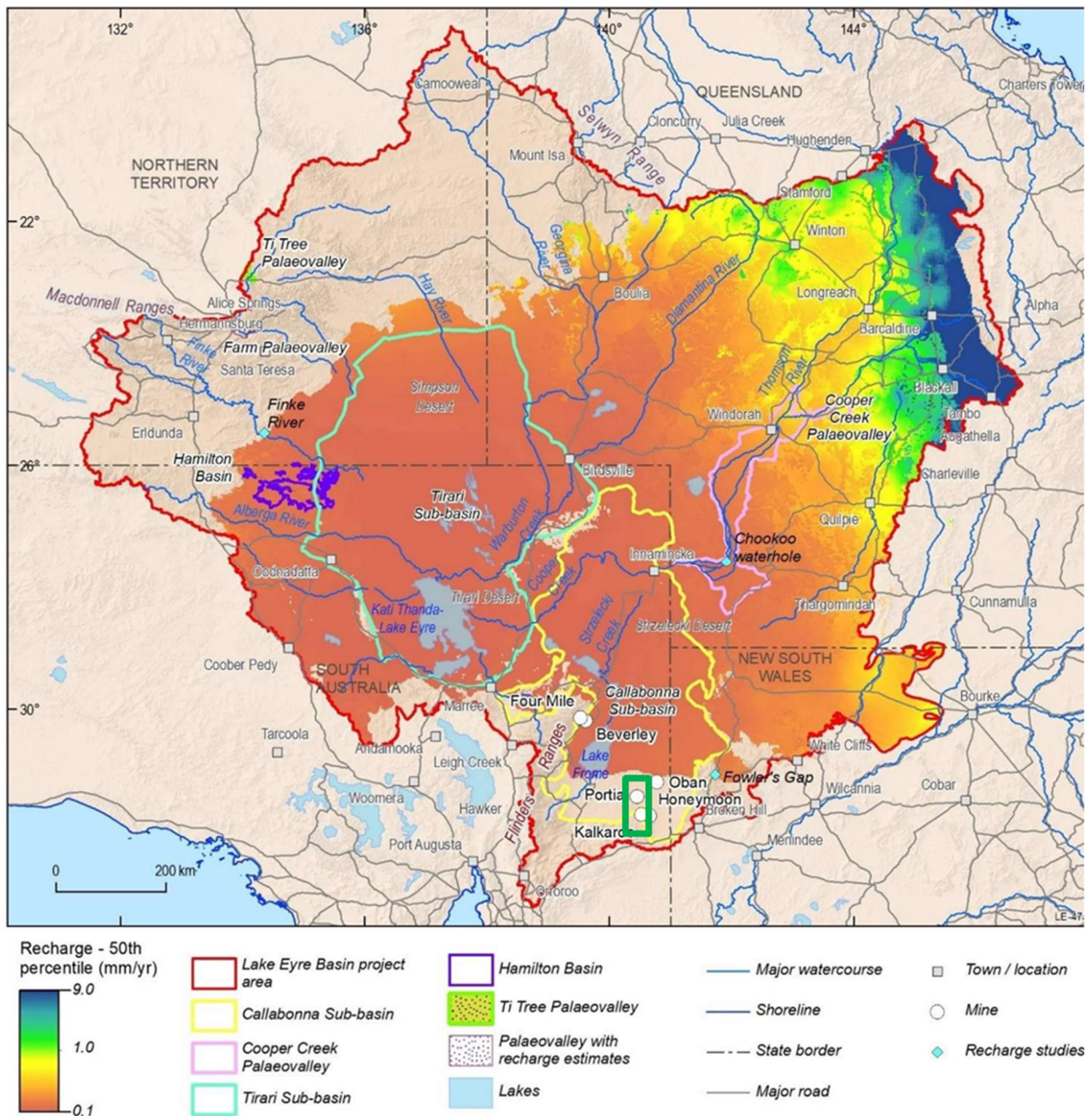
**Figure 6.** Views of Namba Formation smectite clay after extended periods of exposure and resultant drying resulting is significant desiccation (shrinking).



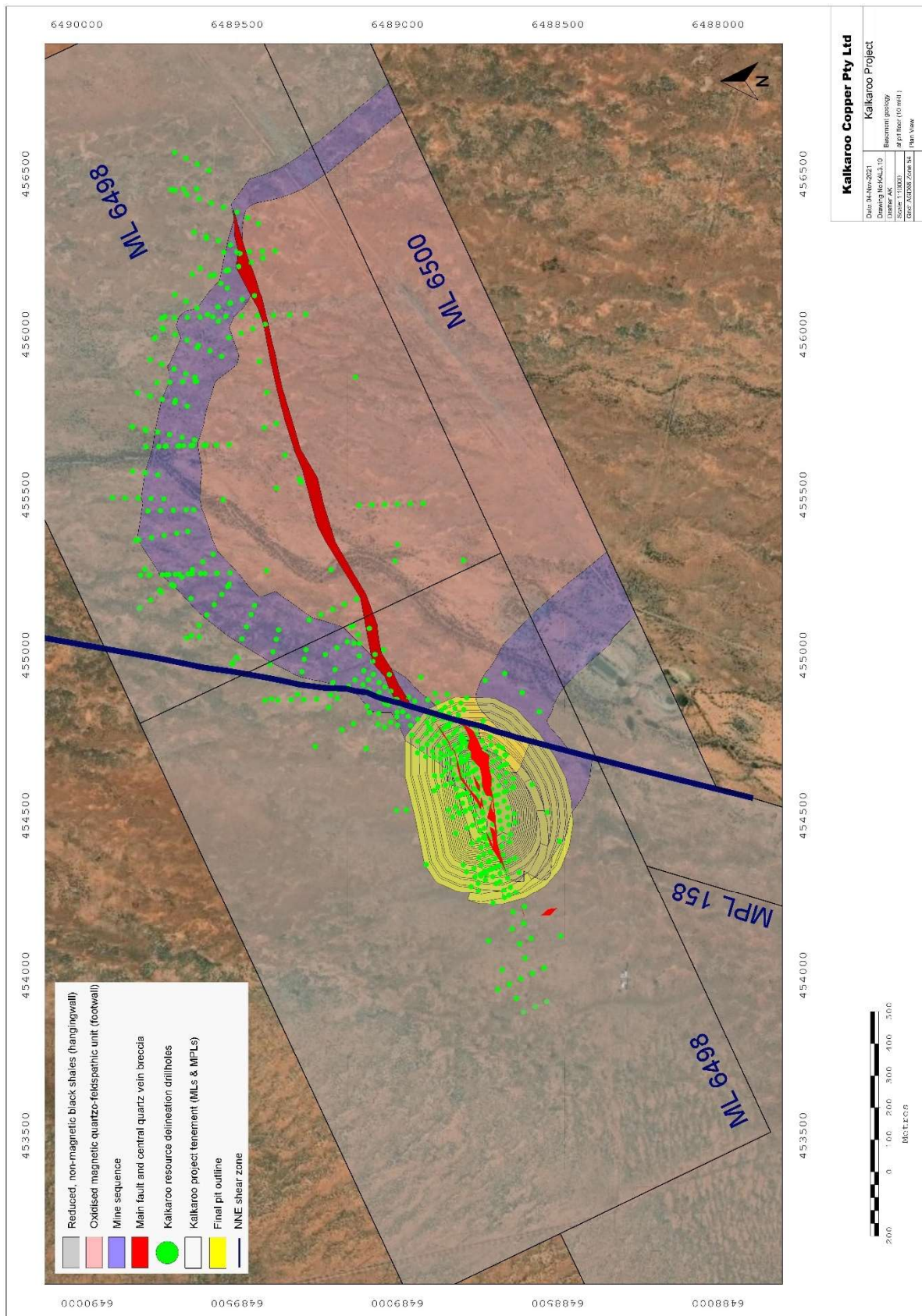
Figure 6. continued



**Figure 7.** Approximate location of Havilah’s Curnamona North province (and nearby mines Portia and Kalkaroo in the Callabonna Sub-basin and Kati Thanda – Lake Eyre Basin (modified from Evans et al (2024).

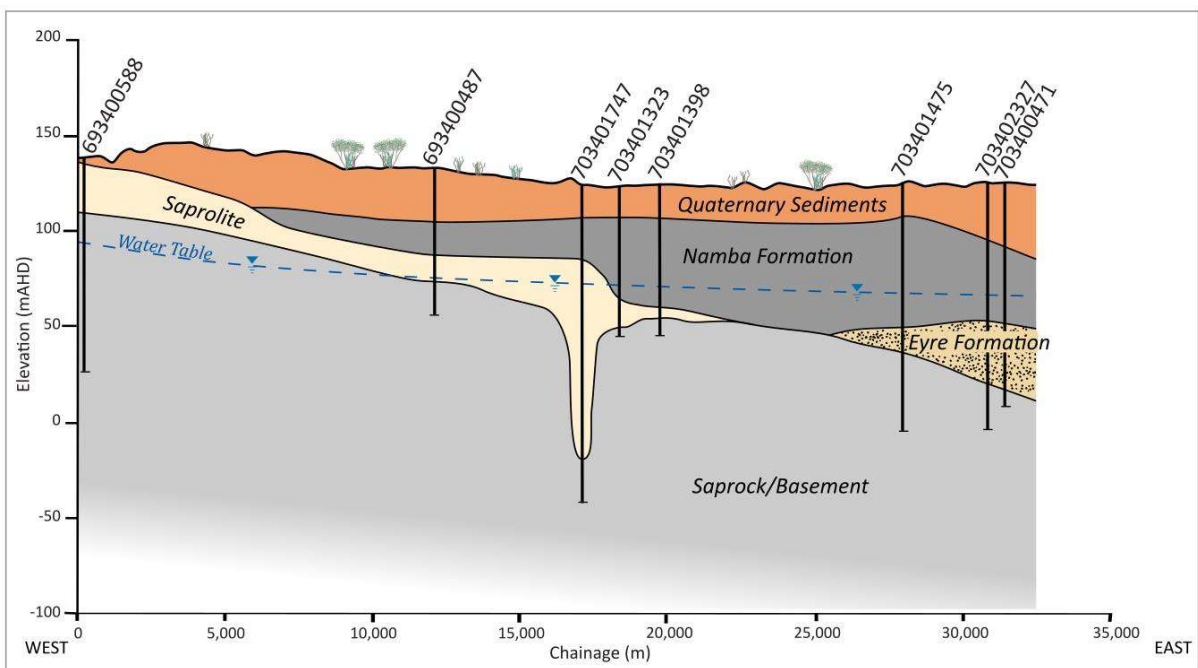
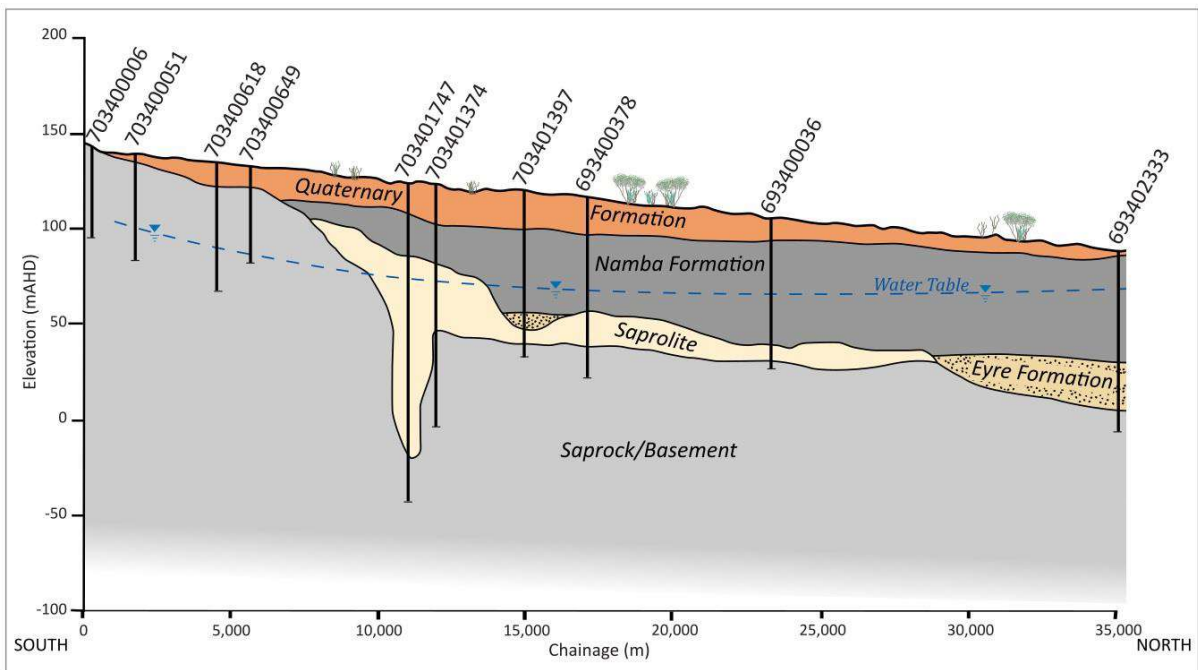
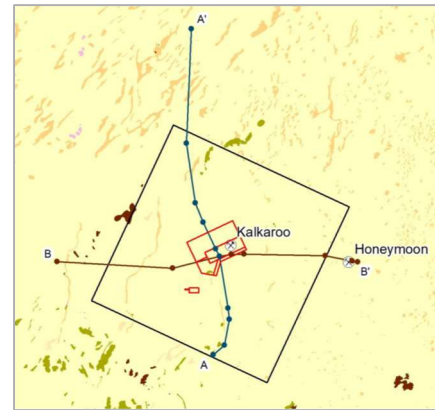


**Figure 8.** Kalkaroo basement geology and major structural features.

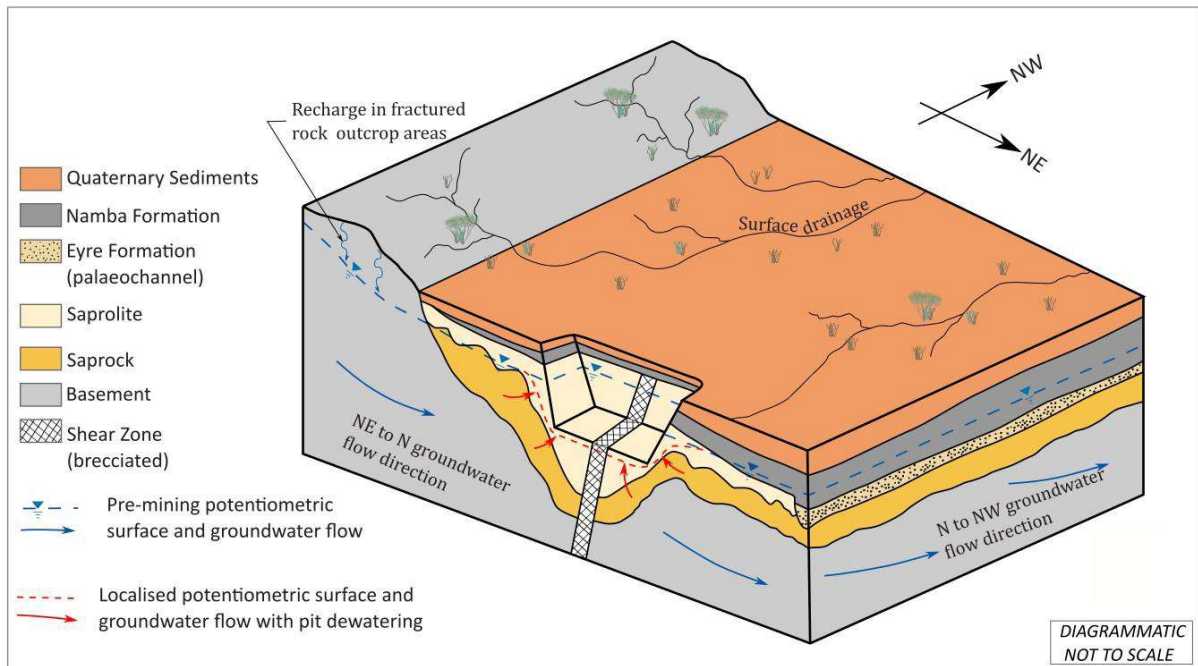




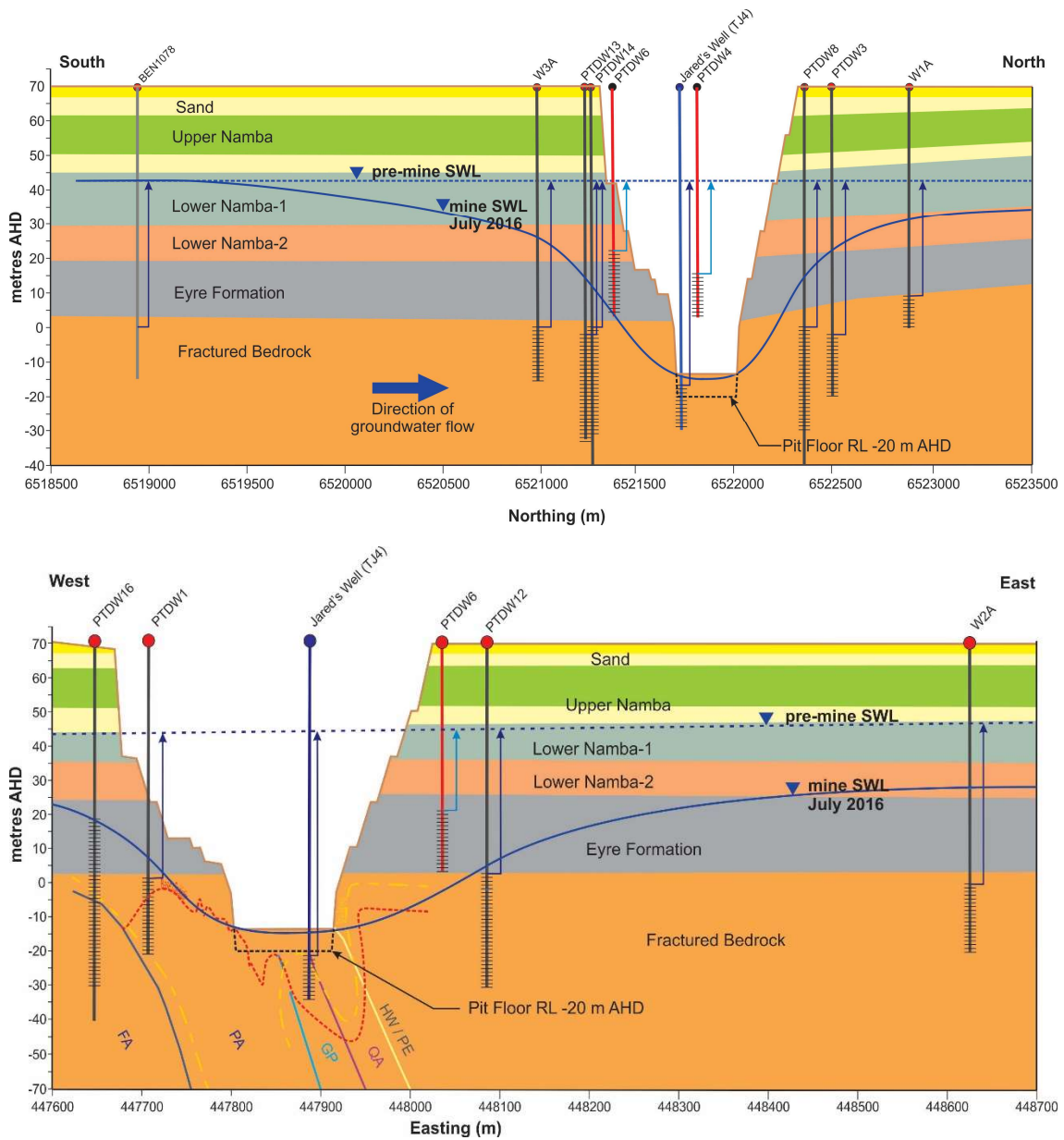
**Figure 10.** Hydrogeological cross sections of Kalkaroo.



**Figure 11.** Kalkaroo hydrogeological conceptual model (Water Technology, 2021)

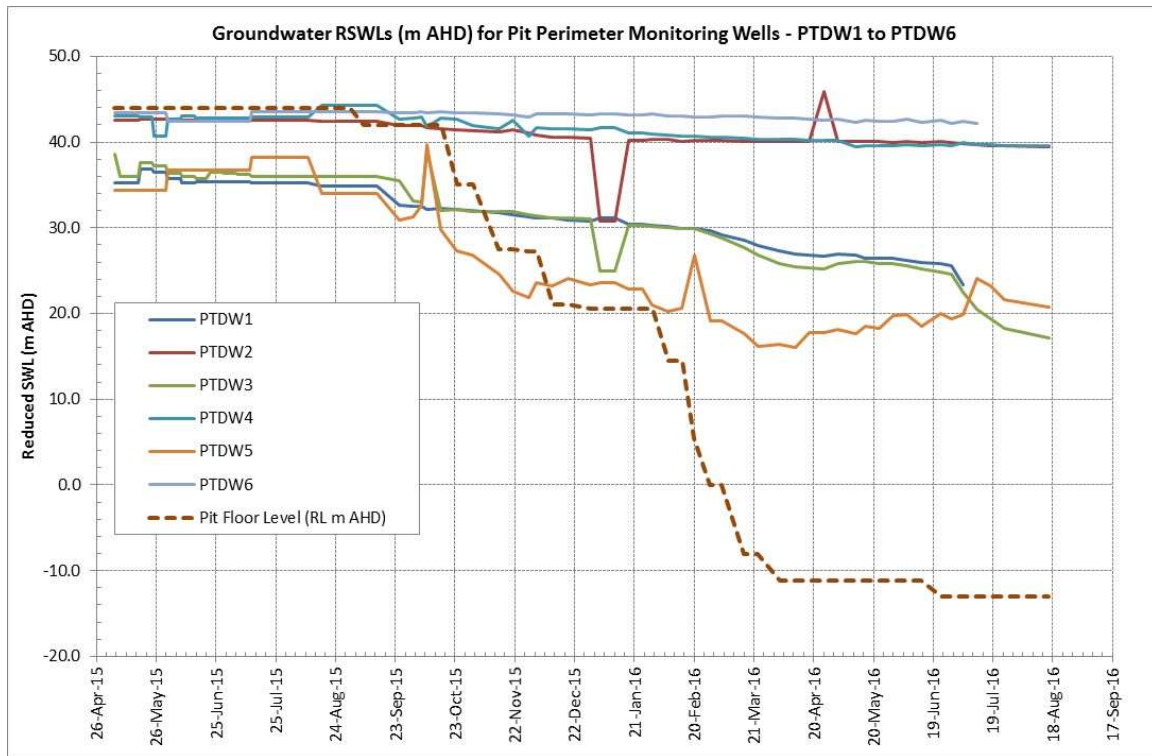


**Figure 12.** Portia pre-mining and July 2016 potentiometric surface for groundwater through pit along south to north and west to east transects (Aqueon, 2016).



**Figure 13.** Portia hydrographs for pit perimeter monitoring wells PTDW1 to PTDW6 from pre-mining through dewatering and open pit development. PTDW4 and PTDW6 are screened in the Eyre and Namba Formation strata, note the delayed and gradual response to dewatering of groundwater.

(NB: RSWL = reduced SWL)



## **APPENDIX 2**

### **TECHNICAL MEMORANDUM**

*Namba Formation Strata Self-Sealing Test Method*

*Groundwater Quality Sampling Method*



Date:	11 April 2025
From:	Geoff Borg MSc in Hydrogeology and Groundwater Management <i>Principal Environmental Advisor</i>
To:	Chris Giles <i>Technical Director</i>  Amy Jacka <i>Tenement Manager</i>
Subject:	<b>Namba Formation Strata Self-Sealing Test Method</b>  <b>Groundwater Quality Sampling Method</b>

## Namba Formation Strata Self Sealing Test Method

### Purpose

Test to collect time series data to provide a semi-quantitative assessment of Namba Formation strata self-sealing (or swelling) properties in unsupported drillholes. Data collected will include drillhole Total Depth (TD) and Standing Water Level (SWL) of a known quantity of water placed into a Reverse Circulation (RC) drillhole completed into Namba Formation strata and terminated above the regional water table.

### Method

- Complete one vertical drillhole penetrating at least 20 m into the top of the Namba sediments with PVC collar to seal off surficial Quaternary soil and sediments (**Figure 1**).
- Measure drillhole TD from top of casing to confirm the stability of unsupported strata.
- If TD remains stabilise after completion of drilling, place a known quantity of water into the drillhole. (Note: water to be sourced from local station dams with permission of the landholder.)
- Periodically measure SWL and TD from top of casing.

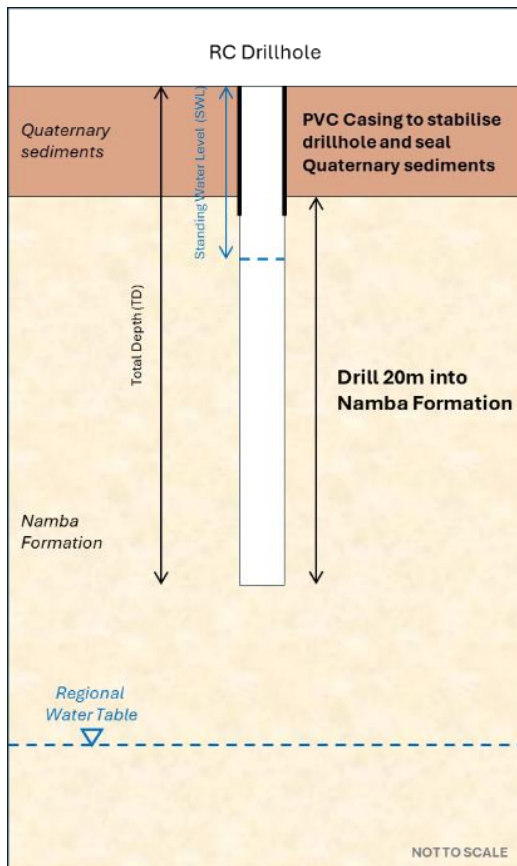


Figure 1 Drillhole details

## Data Interpretation

The primary data for indicating strata is self-sealing is change in TD over time. If unsaturated strata are not self-sealing, this test tests the potential for self-sealing when saturated, i.e. below the regional water table. Table 1 provides a guide to the interpretation of TD and SWL time series data.

Table 1 Data Interpretation guide.

Data	Period of Measurement	Trend	Interpretation
<b>Before water placement in drillhole:</b>			
TD	3 days	TD Reducing (getting shallower)	<b>Self-sealing (unsaturated)</b>
		No change	Proceed with water placement
SWL	3 days	No groundwater	<i>TD results representative of unsaturated zone</i>
		SWL measured (getting shallower)	Localised perched groundwater intersected. <i>TD results indicative of saturated and unsaturated zones</i>
<b>After water placement in drillhole:</b>			
TD	3 days	Reducing	<b>Self-sealing (saturated)</b>
		No change	Not self-sealing
SWL	3 days	Rising (SWL getting shallower)	<b>Self-sealing (saturated)</b>
		No change or Falling (SWL getting deeper)	<i>Changes in TD used to assess self-sealing</i>

## Groundwater Quality Sampling Method

### Purpose

Characterise and compare groundwater chemistry in basement and Namba Formation / Eyre Clay water-bearing zones to determine if they form a single continuous water-bearing zone.

### Method

- Identify existing registered groundwater wells / bores or open exploration drillholes screened or open in either basement or Namba Formation / Eyre Clay water bearing zones.
- Using drilling or well construction data, the downhole interval open to water-bearing strata will be identified using well construction or drilling logs for the hole.
- Measure groundwater SWL with a Water Level Meter before sampling.
- Discrete groundwater samples will be collected using a passive, no-purge methodology (such as HydraSleeve water samplers) from the undisturbed water column within the screened or open hole section of the bore / exploration drill hole.
- Groundwater samples will be transferred from the sample collection device to laboratory prepared containers at the well / drill hole location. Containers will be labelled and stored in a laboratory provided cooler suitable for transport.
- NATA certified laboratory analysis will be by Australian Laboratory Services and include:
  - EC
  - pH
  - Major Anions
  - Major Cations
- Groundwater samples from exploration drillholes during drilling, will be collected directly into laboratory prepared containers directly from water discharge from the drill hole.
- All methods, results, and interpretation will be documented in the compliance report.

### Data Interpretation

Reported analytical results will be interpreted by comparing standing water level, screened strata, EC, pH, and major ion chemistry for different samples.