Government of South Australia
Department for Energy and Mining

26 February 2026

Mr Martin Janes,
Terramin Exploration Pty Ltd
2115 Callington Road
STRATHALBYN, SA 5255

Via email: mjanes@terramin.com.au

Dear Mr Janes

Notification of Approved Exploration Program for Environment Protection and Rehabilitation (EPEPR) Review

In reference to your final submission dated 17 February 2026, the EPEPR has been approved pursuant to section 70C(5) of the *Mining Act 1971* (the Mining Act).

The approved EPEPR will be made publicly available on the Mining Register and the Department for Energy and Mining (DEM) website. Details of the approved EPEPR are listed below.

Approval Granted to	**Terramin Exploration Pty Ltd**
Tenement Type & Number	*Exploration License and number EL 6198*
Program Number	EPR-03936
EPEPR Description	For the drilling of three additional wells and undertake an electrokinetic in ground test at Kapunda, Site A

You are reminded that you must always implement and comply with this approved EPEPR.

This approval does not constitute endorsement of the systems that you have in place to manage the mining operations in compliance with the Mining Act. Whilst your capability to undertake this activity has been considered in this approval, the responsibility for compliance with the Mining Act always remains with the tenement holder.

The legislative requirements associated with the EPEPR are outlined below, and certain requirements must be actioned prior to commencement of operations authorised by the EPEPR.

1	**Public Liability Insurance** Pursuant to Regulation 81 of the *Mining Regulations 2020* (the Mining Regulations), you are required to provide a copy of a certificate evidencing the insurance coverage over the tenement(s).
2	**Compliance Reporting** You are required to submit an annual exploration compliance report. The report is required to be submitted **within 2 months** after the anniversary of the date the licence was granted, or in accordance with joint reporting requirements agreed to with the Minister. Please refer to the DEM website for more information on the reporting requirements.

	You are reminded that a separate compliance report is required **2 months after** the expiry or surrender of the EL.
3	**Work, Health and Safety Compliance** In accordance with Chapter 10 of the *Work Health and Safety Regulations 2012* (SA), you must meet the requirements for mine operators in South Australia, which include a notification for mining operations, the establishment of a Safety Management System, the identification of Principal Mining Hazards and development of a Principal Mining Hazard Management Plan. Further information on your responsibilities, including a guide to Chapter 10, and the Mine Operator Notification Form, is available on the SafeWork SA website.
4	**EPEPR Timeframe** The EPEPR Review is approved for a period of twelve months from the date of this letter. A further 3 months after expiry of the 12-month period is provided to complete all rehabilitation

Please note, proposed changes to exploration operations stated in the approved EPEPR may require a EPEPR review to be submitted for assessment. Where a EPEPR 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.*

In addition to the requirements under the Mining Act, you are reminded that your operation will have other legislative requirements that you will need to comply with.

If you have any further queries, please contact DEM staff as below:

General enquiries	**Jason Perry** Senior Assessment Officer, Exploration Regulation DEM.exploration@sa.gov.au

Yours sincerely

Simon Constable
DIRECTOR, MINERALS REGULATION
In accordance with delegated
powers and functions

The Department's Regulatory Guidelines, Ministerial Determinations and Information Sheets are available at: http://energymining.sa.gov.au/minerals/knowledge_centre

APPLICATION Mining Act 1971 and Mining Regulations 2011

Government of South Australia
Department for Energy and Mining

EXPLORATION PROGRAM FOR ENVIRONMENT PROTECTION AND REHABILITATION (PEPR)

USE THIS FORM TO: Apply to conduct exploration activities for in situ recovery (ISR) operations on an exploration lease (EL) and Mineral Claim (MC) for a 12 month period of time South Australia.

Refer to the determination for exploration PEPRs Ministerial Determination - Minimum information required to be provided in a program for environment protection and rehabilitation (PEPR) for exploration in situ recovery (ISR) operations on an exploration licence (EL) and mineral Claim (MC) 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 .

SECTION A – GENERAL DETAILS

PEPR approval period	**12-month approval period, with an additional 3 months to complete all rehabilitation**
Tenement details	EL 6198 (Kapunda)
Tenement holder(s) (for each tenement)	2115 Callington Road STRATHALBYN, SA 5255 Australia
Operating company	Environmental Copper Recovery (ECR) Pty Ltd Suite 4, Level 1, King William Rd UNLEY SA 5061
Agency agreement (if applicable)	Submitted by Environmental Copper Recovery – Joint Venture Agreement with Terramin Exploration Pty Ltd signed April 2, 2019.
Project supervisor/contact person(s)	Mr Martin Janes, Terramin Exploration Pty Ltd 2115 Callington Road STRATHALBYN, SA 5255 Australia T: 08 8213 1415 Mr Leon Faulkner, Managing Director, Environmental Copper Recovery Pty Ltd M: 0409 612 004 T: 08 7127 1110
Project/prospect name	The Kapunda Copper & Gold ISR Project
Location details	The site (Site A) to be investigated as part of the exploration program is on privately owned land to the south of the Kapunda Historic Mine, located in the Township of Kapunda, some 80km north east of Adelaide. 1:250,000 Map Sheet – Adelaide (SI 5409) 1:100,000 Map Sheet – Kapunda (6629) Specific site location details are shown in Section H – Maps of this application document. The area of the trial is a zone 100m radius around the Push Pull Well KP_PP1.
Project description, commodity type and mineralisation model	ECR is exploring the potential for In-Situ Recovery (ISR) of Copper and Gold. This exploration program is focussed on conducting a Site Environmental Lixiviant Trial (SELT) to assess the extent of the ISR mineral deposit through in-ground test work. The groundwater trial area will be defined as a 100m radius around the operational (Push/Pull) Well KP_PP1.

Proposed project schedule				
	Start date	Jan-2026	End date	April-2026

Note: Where rehabilitation is not completed within 3 months after the expiry of the 12-month approval period, adequate justification must be provided within the annual exploration compliance report. For further information, refer to Minerals Regulatory Guidelines MG22.

DECLARATION

In accordance with regulation 65(8), the information contained in this application is to the best of my knowledge true and accurate.

Name	Martin Janes	Company	Terramin Exploration
Position	Managing Director	Address	2115 Callington Rd Strathalbyn SA 5255
Phone	0419 552 440	Email	mjanes@terramin.com.au

I agree ☒ Date 16/1/2025

For Office Use Only:

E-PEPR		*Date received:*		*Doc Ref:*	
Approved on:		*Approval letter ref:*			

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 and landowner consultation purposes
- contractor consultation (i.e., equipment scale, type)
- other information used when planning the proposed program.

Summary of Previous Work

In preparing the Site Environmental Lixiviant Trial (SELT) concept and this E-PEPR application, the following studies, exploration fieldwork, research and consultation were caried out, which inform the current proposal.

2019 Exploration Program

Earlier exploration work was carried out at Site A in 2019. This work was carried out in the 4th Quarter 2019 and comprised:

- the drilling of a pilot hole (KPFRT01) which was logged and abandoned by grouting, and
- the drilling and installation of two (2) groundwater investigation wells, KPFRT02 and KPFRT03.

The pilot hole (KPFRT01) was logged by Borehole Wireline using a borehole optical scanner. This allowed accurate logging of the fracture number and orientation to feed into a fracture model of the site, which is discussed later in this application. Following well installation, pump testing and tracer testing were carried out as discussed below.

a. Pump Test

Test pumping was carried out to determine the following:

- Achievable production well yields.
- Hydraulic connectivity between test wells
- Groundwater chemical composition profile with depth.
- Aquifer properties of the host rock.

The pump test was undertaken on 10/12/2019. Pumping was undertaken using a 24-volt diaphragm pump. Groundwater was discharged to a 1 m^3 bulk container and the water level rise in the container was used to monitor flow rate. Pumping commenced at 10/12/2019 7:30:00 AM at a rate of 5.53 m^3/day. Pumping continued for 480 minutes. The flow rate was held constant for most of the test. A brief increase in flow rate occurred from 280 to 287 minutes when the voltage supply to the pump was increased by connection to a charging supply. The increase produced marked drawdown in the pumped well. Drawdown was measured manually and by data logger in the pumped well (KPFRT03) and in the observation well (KPFRT02) located 15m distant from the pumped well. The data loggers continued to log complete recovery of both bores. The data is presented in Section H - Maps, Figure 1 “2019 Exploration Pump Test Results”.

b. Tracer Test

A tracer test was undertaken with the aim of determining the connectivity of fractures between the two test production wells KPFRT02 and KPFRT03. The test comprised injection of a sodium bromide tracer into well KPFRT03 and simultaneous extraction of groundwater from KPFRT02. Groundwater was pumped from KPFRT02 and stored in three (3) x 1m^3 containers. Background bromide in the natural groundwater was approximately 10 mg/L Br. Solid sodium bromide was added to the injected water to achieve a target concentration of 4,500 mg/L Br. The tracer was injected into KPFRT03 at a nominal rate of 0.06 L/s, with concomitant extraction from KPFRT02 at the same rate. Flow rate was measured by measuring the rate of water level change in the storage containers. Samples were taken every 15 minutes and a selection of samples were analysed for bromide concentration. The cumulative volumes injected and extracted and the concentration of bromide at the extraction well are presented in Section H - Maps, Figure 2 “Tracer Test Results”. Breakthrough of the bromide tracer occurred, commencing at approximately 150 minutes with the inflection point at approximately 315 minutes. The inflection point equates to injection of 1.4 m^3 tracer and extraction of 1.3 m^3.

The bromide concentration at the extraction well reached a maximum value of 600 mg/L which equates to a 13% concentration of tracer. Upon completion of the exploration program, the two (2) wells, KPFRT02 and KPFRT03 were retained to support background groundwater monitoring and for use in future exploration trials.

Research

In July 2018, ECR was awarded a Commonwealth Government CRC-P Grant for Copper and Gold ISR research to support the Kapunda project. The $2.8 million grant over 3 years is funding research into areas leading to better environmental outcomes, improved economic results and effective community engagement. The following research studies are being caried out by ECR and their research partners, CSIRO and the University of Adelaide.

c. Fracture Modelling

The University of Adelaide has constructed a Fracture/Flow Model over the historic mine area. Reference Attachment

1 “*Modelling of Coupled Hydro-Thermo-Chemical Fluid Flow through Rock Fracture Networks and its Applications (2020), Chaoshui Xu, Shaoqun Dong, Hang Wang, Zhihe Wang, Feng Xiong, Qinghui Jiang, Lianbo Zeng, Leon Faulkner, Zhao Feng Tian and Peter Dowd”.*

This is a model that combines both predictions about groundwater flow and the rate of how much copper goes into solution. It will allow ECR to simulate a range of scenarios and accurately model groundwater flow paths and copper grades, helping to produce more accurate economic estimates for the Kapunda project and future ISR operations.

The work is based on detailed structural analysis of Historic Drill Core, Historic Structural Pit Wall Mapping, detailed 3D drone imagery and incorporates Borehole Wireline downhole optical imaging of KPFRT01. A Discrete Fracture Network (DFN) Model was created, and this was used to generate permeability tensors that allow a model of hydraulic conductivity to be created. The model takes into account the extensive historic underground workings which have an impact on hydraulic parameters for the area. Section H - Maps, Figure 3 “Fracture Modelling Approach” summarises the modelling approach.

d. Monitoring Wells Placement

ECR engaged researcher Hang Wang to compile a smaller scale fracture analysis of the test area, this has been incorporated into a summary document “Structural Review Regarding Monitor Well Placement” (refer Attachment 2). Fracture data from Borehole wireline for hole KPFRT01 was used to create a discrete fracture network model in Fracsim 3D. From this model, permeability tensors were generated for the area, a simulation was carried out and modelled Darcy velocity vectors show a radial spread with a slight elongation in the NW-SE direction due to preferential fracture flow, refer Section H - Maps, Figures 4 - 9. This modelling will guide monitor placement.

e. Magnetotelluric (AMT) Geophysical Survey

The University of Adelaide carried out Magnetotelluric (MT) geophysical surveys that took in approximately 110 sites. The ground survey was undertaken on private farmland south of the exploration area in March 2019. This survey showed a marked difference in both the resistivity and conductivity between rock types in the mine area and those to the south towards the Light River. The boundary between the high apparent conductivity to the north, and the lower conductivity (higher resistivity) to the south, may be due to either a change in porosity to the south due to a more silica cemented rock matrix, or to a change in pore fluid salinity, or combination of both. The mine sits in a regional synclinal structure. This forms a ‘bowl’ like geological structure. Refer Section H - Maps, Map R “MT Geophysics”, Figure 10 “AMT Ground Survey” and Figure 11 “AMT Measurement Sites and Results”.

f. Groundwater Modelling

A probabilistic numerical groundwater flow model of the target area was developed by the University of Adelaide (Li et al 2020). A brief summary is provided here, with further description of the model presented in Attachment 3 “*Kapunda Site Environment Lixiviant Trial (SELT) E-PEPR, Hydrogeological Description of the Environment, Groundwater Science, August 2021*” attached to this application. A copy of the full published report is due to be issued by the University of Adelaide in the 1st quarter of FY2022 and will be made available on request in support of this application. The fractured rock aquifer was simulated using the equivalent porous medium approach. A 3D regional-scale numerical groundwater model was developed for Kapunda using MODFLOW Unstructured Grid (USG) (Panday, Langevin, Niswonger, Ibaraki, & Hughes, 2017). This study demonstrates how multiple geophysical techniques of Audio-frequency Magnetotellurics (AMT), Time Domain Electromagnetics (TEM) and Nuclear Magnetic Resonance (NMR), along with scattered and sparse hydrological measurements, can be coupled with stochastic groundwater modelling. These geophysical techniques provide constraints on hydraulic conductivity, water table depth, hydrostratigraphy and porosity.

The modelling suggests the following:

- A marked difference in hydraulic conductivity between the weathered (Layer 1 top 100m) and unweathered layer (lower portion Layer 2) (Refer Section H - Maps, Figure 12 “Hydraulic Conductivity Layer 1” and Figure 13 “Hydraulic Conductivity Layer 2”)
- A significant difference in hydraulic connectivity (HC) between the mine area (high HC) and the region south to Light River (low HC) (Refer Section H - Maps, Figure14 “Hydraulic Conductivity Between the Mine Area and South Region”)
- Porosity dependant, there is a 95-99% chance of complete capture of particles from field trials. The model achieved a good correlation between the response from AMT survey and the hydraulic conductivity distribution of the calibrated model. Refer Section H - Maps, Figure 15 “AMT HC Correlation (a)” and Figure 16 “AMT HC Correlation (b)”.

g. Groundwater Flow Path Prediction

The groundwater model has been used to predict and model groundwater flow paths and to validate the conceptual model (refer Attachments 4 and 5).

h. Proof of Concept

CSIRO has carried out extensive lab work, to look at the potential for ISR to be a sustainable method for recovering copper. This has included the following studies:

- Mineral Characterisation (QEMSCAN/QXRD)
- Bottle roll testing with a suite of lixiviants
- Small scale column leaching (to test lixiviants and examine gangue mineral leaching)
- Large particle column leaching
- Assessment and selection of biodegradable lixiviants

These studies have shown that copper leaches readily into solution with few problematic gangue (waste material) mineral species. Section H - Maps, Figure 17 “Proof of Concept Bottle Roll Test Results” shows the results of bottle roll testing.

Another important part of this stage of the laboratory work is to examine extent of gangue element leaching and mobilisation (i.e. looks at what other minerals were leached). 49 additional elements were selected for analysis: Ag, Cd, Co, Cu, Li, Ni, Se, Zn, B, Mn, As, In, Sb, Ba, Be, Ce, Dy, Er, Eu, Ga, Gd, Ho, La, Lu, Nd, Pb, Pr, Rb, Sm, Sr, Tb, Th, Tl, Tm, U, Y, Yb, Zr, Al, Cr, Fe, Ti, V, Bi, Cs, Hf, Mo, Sn, Te. The results show the majority of gangue elements have low or trace levels of leachability.

The mini column tests highlight (Section H - Maps, Figure 18 “Mini Column Leach Test Results”) that, in addition to copper, Silver, Cadmium, Cobalt, Lithium, Nickel, Selenium, Zinc, Boron, and Manganese exhibit moderate leachability. Moderate leachability was defined in that study as the percentage of the solid metal that was removed by lixiviant. It is important to note that metals that are very low in abundance can exhibit high leachability because removal of a trace amount results in high percentage depletion. Section H - Maps, Figure 19 “Mini Column Leach Test Results - Average Concentration of Moderately Leachable Elements in Solid Samples” shows the average concentration of the leachable elements in the solid samples subjected to leaching. It is envisaged that Cu levels in solution are required to be 800-1,500ppm to be economic, Section H - Maps, Figure 20 “Cu Grades in Solution” shows that at Kapunda it is expected to achieve up to 2,000ppm into solution.

The groundwater in the mine area is known to be acidic so the research has focussed on finding biodegradable lixiviants that work in low pH environments and target copper and gold. Methane Sulphonic Acid (MSA – a naturally occurring amino acid) has been selected to extract copper.

This specific lixiviant has been selected as it meets the following criteria:

- Works with groundwater chemistry (pH)
- Is not a Persistent Bio accumulative Toxic (PBT) chemical
- Is readily biodegradable (DOC Die away test OECD – 301A/EC)
- Targets value metal species.

Lixiviant selection criteria and assessment outcomes is shown in Section H - Maps, Figure 21 “Lixiviant Selection Criteria and Assessment Outcomes”.

MSA has no established OSHA PEL (Occupational Health & Safety Administration - Permissible Exposure Limit), as aqueous (aq) MSA solutions do not, under normal conditions, evolve any dangerous volatile chemicals. In general, the relatively low toxicity of MSA makes it a suitable choice. MSA is considered readily biodegradable (OECD 303A, OECD 301D closed bottle, OECD 301A DOC Die-Away, BOD), ultimately forming sulphate and carbon dioxide, and MSA is considered to be a natural product, and is part of the natural sulphur cycle (refer Attachment 6).

i. Light River Monitoring

Groundwater-surface water connectivity. In 2018 as part of the CRC-P research program, CSIRO Land and Water carried out a study of groundwater-surface water connectivity in the Light River. Refer to Attachment 7 *‘Groundwater – surface water connectivity in a chain-of-ponds semiarid river’ - A CSIRO Report (draft) for Environmental Copper Recovery, Sebastian Lamontagne and Jason Kirby, 9 April 2019’.* The Light River is a semiarid river, characterised by chains of small ponds connected by riffles and wet meadows. The pools can be maintained by wet season runoff, groundwater discharge or a combination. Conducting synoptic surveys using environmental tracers, an evaluation was carried out of groundwater-surface water connectivity along an eight (8) km section of the Light River in the vicinity of the proposed ISR exploration area. Three (3) surveys were carried out, to represent spring, summer and winter conditions in the river. The survey period was characterised by a period of low rainfall. River pools were connected via small riffles and wet meadows during spring and winter surveys. However, during the summer survey, pools were connected when within approximately two (2) km downstream from a groundwater discharge zone. In all three (3) surveys, river pools were found to be clearly maintained by regional groundwater discharge (although there is no evidence of the low pH, high copper groundwater from the mine area reaching the Light river – probably due to the permeability change identified in the MT geophysical survey – see above section d. AMT Geophysical Surveys and Refer Section H - Maps, Map R “MT Geophysics”) and whilst detrimental to some freshwater organisms, saline groundwater baseflow maintains perennial pools in the Light River during low rainfall periods. Refer Section H - Maps, Figure 22 “Study Area Showing the Location of the Project Area, Ephemeral Stream Line and Pools Along the Light River”.

As part of the CRC-P research program, in 2018 ECR and CSIRO Land and Water, implemented a monitoring program to establish the baseline status of the water quality in the Kapunda Catchment of the Light River. Refer to Attachment 8: *‘Establishment of the baseline water quality data and benchmarks for the Light River, Kapunda SA - A CSIRO Report (draft) for Environmental Copper Recovery, Anu Kumar and Jason Kirby, July 2020’.* The monitoring is being conducted along an eight (8) km section in the vicinity of the ISR exploration area. Twelve (12) river pools are being sampled during each monthly survey. The data is incorporated into an easy-to-understand scorecard. This scorecard will provide accurate, up to date information to appropriately manage river water quality. The score card approach using site-specific benchmarks will help determine if contaminant concentrations being released to the river via groundwater baseflow are exceeding the site-specific guideline/benchmark in the Light River catchment. The initial seasonal monitoring has shown that pH, dissolved oxygen and nutrients in the Light River meet the water quality guidelines, based on key indicators. Section H - Maps, Figure 22 “Study Area” and Figure 23 “Proposed Water Quality Environmental Scorecard” show details of the river monitoring area and water quality environmental scorecard.

j. Social Licence

Under the CRC-P, CSIRO Land & Water social scientists led by Dr Tom Measham were commissioned to undertake Social Licence research into how residents of Kapunda view the mining sector in general and how new mining techniques could fit with town identity. Focus groups and interviews explored the extent to which a potential renewed mining industry would align to community values, considering the possible application of copper ISR from an historic deposit in the town. The methodology involved the Social Licence framework around:

- Trust in Procedural Fairness
- Distributional Fairness
- Confidence in Governance
- Leading to Acceptance.

Refer to Attachment 9 “*Community perceptions of potential renewed Copper mining, Kapunda, SA (CSIRO 30 October 2019) Tom Measham, Simone Carr-Cornish and Andrea Walton”.*

The main results found that most participants were open to the prospect of a new copper ISR operation, provided it is well regulated and environmentally responsible. Participants generally conveyed a high degree of confidence in the technical research process currently being undertaken and, in the assessment, processes conducted by regulators, such that the mine would only go ahead if it met all appropriate safeguards. There was also a sense that mining would go hand in hand with tourism. Kapunda was Australia’s first economic Copper mine, now Kapunda could host Australia’s first Copper ISR mine.

The key recommendations were for ECR to genuinely listen to issues and concerns and to engage early and often. ECR will continue on from the social license research undertaken by CSIRO, and will further develop direct communication through letterbox drops, increased social media usage and community interaction. ECR also established an office in Kapunda in 2019 to support direct access to the general community. This has proven to be a very successful initiative and will be continued to support this E-PEPR application and associated activities and further project development in general. As recently as December 2020, Light Regional Council (Council), conducted community consultation related to the undertaking of In-Situ Recovery exploration in Kapunda. The community related feedback was overwhelmingly positive during the consultation period.

k. Geochemical Modelling Study

Context

ECR engaged Land and Water Consulting (LWC) to establish a conceptual site model (CSM) and undertake a predictive hydrogeochemistry assessment for the SELT being carried out to support development of the Kapunda In-Situ Recovery (ISR) project. Refer to Attachment 10 “*Conceptual Site Model and Predictive Assessment, LWC, August 2021*”, with a summary provided in this section.

The first phase of the project is a SELT to assess the extent of the ISR copper deposit through a Push/Pull Test using the new well, KP_PP1.

The objective of the predictive hydrogeochemical assessment was to establish an environmental CSM for the SELT and environs (including processes) and use this CSM as the basis to predict the fate and transport of associated solutes (copper and other pH sensitive metals/metalloids) using a robust and justified source term.

In Situ Recovery (ISR) of Copper

ECR aims to utilise ISR to extract Copper from underground mineral deposits. ISR involves injecting a specifically selected lixiviant through a well into the desired ore body to leach the copper into a soluble form. This solution is then pumped to the surface where the concentrated Copper can be recovered for processing (USNRC 2021).

Methane Sulphonic Acid (MSA) has been selected by ECR as a suitable lixiviant as it works in acidic conditions, is readily biodegradable, and will target the intended metals.

It is expected that recovered Copper solutions from the Kapunda area will be in the region of 2,000 ppm.

The first phase of the project is a SELT to assess the extent of the ISR copper deposit through a Push/Pull Test using the new well, KP_PP1.

The test will consist of pumping around 5,000 L (5 m^3) of lixiviant into well KP_PP1, allowing it to equilibrate in the copper ore zone for 14 days. Groundwater will then be pumped out at a rate of around 5 m^3 per day.

The groundwater trial area is defined as a 100 m radius around KP_PP1. This will allow for a lixiviant plume of approximately 7 m to form, and then for remediation of the lixiviant within one year. The water table is expected to rise during injection and a cone of depression form during extraction, before returning to equilibrium over time.

The baseline groundwater is acidic with pH in the range of 4. The groundwater exhibits elevated metals (copper, zinc, nickel).

The water is not suited for drinking, stock watering or irrigation and is suited only to industrial use including mining, as the beneficial use of groundwater is constrained by the elevated metals.

Source-Pathway-Receptor Linkage

A source term was derived by applying background (baseline) groundwater concentrations and freshwater ecosystem criteria (ANZG 2018) to the maximum concentrations of column leach test solutions.

The source term comprised the metals Ag, Mo, Cr and V and several rare earth elements (REE) along with low pH.

A total of 1 linkage was identified, being the generation of certain metals (Source term A), low pH / acidity and rare earth elements via addition of MSA to the 8 m thick Cu ore zone, with potential for solute escape along fractures in the rock aquifer, to the Light River, ~585 m south-south east.

The significance of this linkage was tested using Predictive Reactive Geochemical Modelling (PRGM).

Predictive Reactive Geochemical Modelling (PRGM)

1-D modelling of the current baseline system supports the attenuation of solutes (metals) within the Eudunda Arkose via sorption to iron-oxy-hydroxides, which are present in abundance in that system.

The water within the Eudunda Arkose (location of Site A) is likely geochemically different to the sentinel well water down hydraulic gradient, which is representative of the Tapley Hill Formation.

The fractured rock Eudunda Arkose likely has significantly more presence/density of pyrites (e.g. chalcopyrite) which creates the low pH conditions via oxidation of sulfidic minerals (pyrites, itself a simple yet complex process which is not the remit of this assessment). The micro scale cycling of pH around pH 4 will generate amorphous iron oxy hydroxide and infers solutes in groundwater within the Eudunda Arkose are essentially 'trapped' by sorption to colloidal or assemblage amorphous iron oxy hydroxide phases. Modelling of such a scenario using only Fe inherent in the KPFRT02 system and Kd modelling supports this theory.

The specifics of the Push/Pull Test were mimicked using two-dimensional reactive fate and transport modelling.

Key findings

Modelling of the Push/Pull Test fits existing predictions in terms of lateral migration and relevant solutes/low pH are not predicted to reach proposed monitoring wells KP_MON01 – MON03 located 25 m laterally, when using specified gradient (nor the observation well KPFRT02). Refer Section H - Maps, Figure 24 "Predicted Groundwater pH Distribution During Push/Pull Test".

Source Term A-1 solutes are not predicted to migrate laterally to the extent where they are seen at concentrations above laboratory limit of reporting nor relevant water quality screening criteria in the observation well KPFRT02 (5.3 m lateral from the Push/Pull well).

Assessment of copper mineral dissolution in the injection bubble hints at pH rise due to hydroxide alkalinity (when using ferric-cu as representative of copper oxide mineral phases) or carbonate alkalinity (when using malachite as representative of copper carbonate mineral phases). This may cause increased acid consumption over current estimates. Refer Section H - Maps, Figure 25 "Predicted Groundwater Copper Distribution During Push/Pull Test as Function of Copper Mineralogy".

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.

<Include text here.>

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
EL6198	Dale Hampel	Freehold	Agricultural	29 April 2021	Farmland	N/A	29 April 2021 and current as at June 2023.	The landowner (Dale Hampel) reported concerns related to subsidence of drill sumps. This exploration program has been designed to avoid the excavation of sumps, preferring to store all water above ground in purpose designed tanks.
EL6198	Russel Weber	Freehold	Domestic	17 June 2021	House	17 June 2021	17 June 2021 and current as at June 2023.	The resident (Russel Weber) was concerned about noise and dust. ECR has consulted with the resident and will conduct drilling between 07:00am and 18:00pm to minimise disturbance. Dust levels will be kept to the minimum possible.

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

N/A

Provide any additional relevant information.

N/A

Land ownership, 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	Applicable
Freehold Site - Located on privately owned land	☒
Pastoral lease	☐
Perpetual lease	☐
Crown land	☐
Mining reserve	☐
Aboriginal freehold/leasehold land (e.g. Anangu Pitjantjatjara Yankunytjatjara and Maralinga Tjarutja lands)	☐
Forestry reserve	☐
Marine reserve	☐
National parks, conservation parks, conservation reserves, regional reserves*	☐
N/A	
Other*	☒

Land use	Applicable
Grazing	☒
Cultivated land	☒
Residential	☐
Township	☐
Industrial	☐
Tourism	☒
Conservation	☐
Defence activity	☐
Road reserve	☐
Sites of scientific significance (geological monuments, fossil reserves etc.)	☐
Orchard/vineyard	☐
Native vegetation heritage agreements*	☐
N/A	
European heritage sites*	☒
Kapunda Historic Mine Site, Kapunda SA	
Other (e.g. historic mining) *	
Site A is located on privately owned farmland.	

* Indicates more information required in field immediately below.

Provide any additional relevant information.

The proposed exploration activities will take place at Site A, which is located on privately owned farmland, immediately to the south of the Kapunda Historic Mine Site. Site A was selected due to the fact that it was the site of the previous exploration, and a wealth of information is available for the site from pump and tracer testing previously carried out in 2019. Background groundwater monitoring has also been carried out for the area around Site A.

The site was the location for exploration in October 2019, which included approval for six (6) drillholes, of which three (3) were drilled and pump and tracer testing carried out. A push pull test was carried out during 2023/24 and has been re habilitated.

The location of Site A is shown in Section H – Maps (refer Maps A, B, C and D) of this application.

The site shows surface scarring, and other evidence of historic mining activity. The site is located on the edge of farming land. The land is currently used for grazing and cropping. Location views are shown in Section G - Photos (refer Plates 1 - 11).

Woomera Prohibited Area (WPA)

Will activities be conducted within the WPA	Yes ☐	No ☒	Do you have a resource exploration permit in place?	Yes ☐	No ☐
In which zone will activities be conducted?					
Does the Exploration Permit allow the operator to conduct exploration operations in the WPA?				Yes ☐	No ☐
What is the expiry date of the resource exploration permit?					
Identify closure periods that may impact on the exploration program.					
N/A					

Landowner Details and Consultation

This section must provide relevant landowner details, including occupier and land manager details, and summarise the results of consultation that has been undertaken on the proposed operation and development of the PEPR (including submission of statutory forms). The summary should list:

- individual or group of similarly affected persons;
- type of interested or affected party (resident, council, government agency etc.);
- any concerns/issues raised;
- response to any concerns/issues raised;
- if any individual or group of similar affected persons were not able to be consulted, what steps were taken to consult with them;
- any additional land access approvals/permits required to conduct the proposed exploration program.

Where PEPRs for exploration ISR are submitted in accordance with Section 1.2, consultation with all stakeholders at the PEPR submission stage may not be practicable. If so, a plan must be provided demonstrating how the above requirements will be achieved.

Social license research was undertaken in 2019 as part of the CRC-P Research Grant by CSIRO, focusing on community perceptions of renewed Copper mining at Kapunda. In general, the concept of potential Copper ISR mining was well received by the community as long as it was well regulated and considered all environmental risks. Current community communication is via website, Facebook updates, an office in the Main St of Kapunda and letterbox drops.

ECR has had significant on-going consultation with Dale Hampel, the owner of Site A, Dale previously signed Notices of Entry for the exploration at this same site in 2019. Dale was consulted with once again, and a Notice of Entry Form 21 served and signed on 29 April 2021. Russell Weber, a neighbouring resident, as also consulted and Waiver of Exemption Forms 23A and 23B served and signed on 17 June 2021.

Consultation on the project more broadly has been undertaken with the Light Regional Council since October 2016. ECR has presented at Elected Member Meetings on 6 occasions, met with the Council executive team on project updates on a bi-annual basis. ECR liaises as required with the General Manager Strategy & Development (currently Craig Doyle).

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 ☐ No ☒ (If no, no further information in this section required.)	
Are there registered native title party/parties in the area of proposed exploration?	Yes ☐ No ☐		If no, an Environment, Resources and Development (ERD) Court determination is required.
Have you negotiated a native title mining agreement?	Yes ☐ No ☐	Is the agreement registered? * Yes ☐ No ☐	
Have you accepted an Indigenous land use agreement (ILUA)?	Yes ☐ No ☐	Is the ILUA registered? * Yes ☐ No ☐	
Have you obtained ERD Court determination? †	Yes ☐ No ☐	Is the determination registered? * Yes ☐ No ☐	

* 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.

Not applicable to this application.

SECTION C – DESCRIPTION OF THE ENVIRONMENT (r. 65(1)(a))

The following elements of the existing environment need only be described to the extent that they may be considered in assessing the potential impacts of the proposed operations. If an element is unlikely to be affected by the operation, include a statement to that effect.

Where possible, photographs and other relevant information obtained during site visits should be attached to help describe relevant environmental aspects.

Proximity to Infrastructure and housing

Information is required to determine if existing infrastructure (both public and private) may be affected by the program, and to determine the extent of impact on the public from noise, dust etc. The following information is required:

- Settlements – indicate the name and distance of the nearest town, and distance to houses and homesteads from the proposed exploration activity.
- Roads and tracks – indicate existing fence lines, roads and tracks, including those which are to be used in the exploration program.
- Other infrastructure (e.g. 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)) should be considered if these may be impacted by the exploration activity.

Where possible, provide this information on a locality plan.

The proposed exploration site (Site A) is located to the south of the Kapunda Historic Mine Site (Mine Site), located in the Township of Kapunda, some 80km north east of Adelaide (refer Section H - Map A “Proposed Exploration Site and General Infrastructure” for specific location details). The major land uses in the region are grazing and cropping.

All proposed exploration falls within EL6198 Kapunda, on Parcel ID F199322/A92.

The bores to be constructed are located on land that is classified as exempt land used for grazing and cropping.

1:250,000 Map Sheet – Adelaide (SI 5409)
1:100,000 Map Sheet – Kapunda (6629)

The proposed exploration site (Site A) is located adjacent to the intersection of Perry Road and East Terrace to the south of Kapunda. The site is immediately to the south of the intersection. Refer to Section H - Maps (refer Maps A - F). The site is to be directly accessed from East Terrace, via a gate on East Terrace south west of the intersection with Perry Road (refer Plate 10).

The Historic Mine Site buildings are located 750m to the north west of the proposed site. A map showing the location of historically significant buildings relative to the proposed exploration location is shown in Section H – Maps (refer Map B “Property Boundaries and House Locations” and Map C “Relevant Land Uses”).

Exploration Site

The centre of the Township of Kapunda is located 1.3km to the north of the site. The nearest property is located 130m to the north east, this property is owned by Russell Webber. These are rural farming properties with homestead and associated sheds and other agricultural buildings. Another property lies 300m to the north west. This is an unoccupied residential property on the outskirts of the township. See Section H – Maps, Map B “Property Boundaries and House Locations”). Perry Road and East Terrace run along the northern and western edge of the property. A section of the Heysen Trail runs along the northern edge of the site. The Mary McKillop Walk runs from north to south approximately 250m to the north of the site. See Section H – Maps, Map C “Relevant Land Uses”). Refer Section H - Maps, Map D “Exploration Operations Site” for location of exploration location and Section H - Maps, Map E “Sensitive Receptors” for location of exploration site in relation to sensitive receptors.

Other Infrastructure

There is an industrial estate 500m to the north west of the northern extent of the exploration area, on the western side of Perry Road. There is also a stock feed mill 1.2km to the north west.

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 topography of the area is slightly sloping, with the slope running generally from north to south across the exploration area. There are higher elevations to the north east (245m) and north (235m) of the exploration area. The land slopes down towards the site, at an elevation of 220m, and then slopes gradually towards the Light River to the south east of site at 215m. Contours for the site are shown in Section H - Maps, Map F “Water Courses and Surface Water Flow Management”. Note: Heights quoted are from SRTM above sea level digital elevation data.

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 aspects that may be an issue for disturbance and rehabilitation.

The site is on the fringes of marginal agricultural land. Like most of the Kapunda area the surface soils are of the sandy variety of red-brown earth which has a sandy loam topsoil and a yellow-brown clay sub-soil. This soil type is used for cropping and grazing. This soil type is potentially erodible and can be prone to waterlogging.

The site has been disturbed by historic mining and farming activity. The site also has the potential to have elevated levels of copper and other contaminants in surface soils and surrounding surface water drainage lines, because of historic mining activity. The soil structure may be susceptible to water logging, erosion from stormwater flows and compaction from wheel traffic as a result of exploration activities.

Topsoil disturbance will be reduced by limiting track construction work and limiting the size of drill pads. The program will also utilise surface truck mounted tanks rather than construction of sumps on site to limit soil disturbance. All areas of earthworks such as drill pad preparation undertaken will have temporary sediment traps (silt fencing or hay bales) installed down slope to reduce any sediment travel in heavy rainfall events.

Rehabilitation of drill pads and access roads will be discussed with the landowner. Following consultation and agreement, rehabilitation will generally be through seeding, and any identified areas of compaction will be scarified. Top soil will be stored for redistribution during rehabilitation.

Hydrology

Will the proposed program interfere with natural drainage (e.g., drainage lines, creeks, floodplains)? If yes, describe the potential interference and show natural drainage on maps. If no, indicate why. Provide a description and map of the surface water hydrology of the exploration program area, and description in context of the surface water catchment area, including: • rainfall – long-term annual and monthly rainfall patterns, high-intensity rainfall events (1 in 100, for example) to address flooding risks; • surface water features, including drainage lines, watercourses, and dams; • potential runoff from site and/or flow in drainage lines; • where the site is located on a drainage line/watercourse or hydrologically connected (or directly draining) to a drainage line/watercourse, describe the flow regime (i.e., frequency, duration and timing of flow events in the drainage line/watercourse). • surface water – groundwater interactions (e.g., permanent/semi-permanent pools across the drainage lines/watercourses); and • identify whether the area is within any water protection areas defined under the River Murray Act 2003, or any prescribed watercourse, or surface water areas under the Landscape South Australia Act 2019.	Yes ☐	No ☒

The target exploration area is located to the south of the township of Kapunda, immediately to the south of Historic Mine Site (Mine Site). The Mine Site is located near the top of a local topographic high and forms the headwaters of a small surface water catchment leading to the Light River via an ephemeral stream channel. Stormwater originates on higher ground and flows along the ephemeral stream line from north to south towards the Light River. A map showing the overall exploration area catchment and drainage lines is shown in Section H – Maps, Map F "Water Courses and Surface Water Management"). Photographs of drainage lines can be referenced in Section G – Photos (refer Plates 6, 8 and 9).

The Light River catchment is in the mid-north region of South Australia and covers approximately 182 km^2. The climate is semiarid with distinct hot, dry summers (mean maximum daily temperatures December to February = 29.0°C and mean minimum daily temperatures December to February = 14.1°C) and cool, wet winters (mean maximum daily temperatures June to July = 13.9°C and mean minimum daily temperatures June to July = 5.8°C. Climate data has been sourced from the Kapunda Bureau of Meteorology (BOM) Station (No. 023307). Refer Section H - Maps, Figure 26 "Climate Information" for climate statistics.

Climate data shows that the wettest months are between the months of May and October (wettest in August). Annual average rainfall at this location is 491.8 millimetres (mm). The mean number of days of rain ≥ 1mm is 2.8 between December and February and 8.0 between May and October.

The site is located on the southern side of East Terrace, on lower lying land. There is a culvert located under East Terrace moving stormwater from north to south. This results in stormwater moving through the culvert from the Historic Mine Site and other areas to the north of the exploration site. Stormwater runs in a southerly direction through the culvert and enters an ephemeral stream located on site. Stormwater then moves south east along the stream line towards the Light River located approximately 700m to the south east of the site. There is also a second ephemeral stream running off higher ground to the north west of the site which joins the main stream south of the exploration site. No water courses or drainage lines will be crossed during the establishment or operation of the exploration site. The ephemeral stream will retain some water during winter, but not during summer. Thus, the ephemeral stream is considered a minor (seasonal) groundwater recharge feature.

Historical contamination from the Mine Site may have been distributed by run-off along the ephemeral stream. The stream channels located near the exploration sites therefore may have elevated levels of Copper and other contaminants and are potentially showing stress from the presence of low pH acid mine drainage. See Section G – Photos (refer Plate 8).

To account for the presence of potential contamination in the exploration area, site(s) track development and contouring will be kept to a minimum to avoid disturbance and erosion. Surface water tanks are preferred to in-ground sumps to avoid disturbance and all waste generated will be taken off site for disposal. All produced water will be stored in above-ground tanks and either taken off site for disposal or re-injected into the groundwater well (refer Drainage Discharge Licence) to avoid water flowing off site into drainage lines. All areas of earthworks such as drill pad preparation will have temporary sediment traps (silt fencing or hay bales) installed down slope to reduce any sediment travel in heavy rainfall events.

Is the program area located within water protection areas defined under the *River Murray Act 2003*? If yes, provide the name(s).	Yes ☐	No ☒
N/A		
Is the program area located within any prescribed watercourses or prescribed surface water areas under the *Natural Resources Management Act 2004* (NRM Act)? If yes, provide the name(s).	Yes ☐	No ☒
N/A		

Groundwater

Is groundwater likely to be intersected when conducting the exploration program? 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. Copy and paste a new table for each area where different groundwater conditions may be encountered. If no, indicate why.	Yes ☒	No ☐

Description of the locality/area where different groundwater conditions may be encountered

Baseline groundwater conditions for Site A have been studied since 2017. Groundwater conditions are summarised in two (2) reference reports: *"Kapunda Copper Project – Baseline Hydrogeological Assessment, Groundwater Science, 29 September 2017*" (Attachment 11) and *"Hydrogeological Description of the Environment (DoE), Groundwater Science, August 2021"* (Attachment 3). The following hydrogeological description is sourced from these two reference documents, which are attachments to this application.

The project lies within the Adelaide Rift Geological Domain with the region dominated by Neoproterozoic Aged rocks. The 100K geology map indicates the main geological units as Tapley Hill Formation and Eudunda Arkose Member, with the southern portion of the historical mining area comprising Brighton Limestone and Tarcowie Siltstone.

The groundwater system comprises an unconfined fractured rock aquifer. Groundwater will move through fractures in the host rock. Fracturing will be controlled by structures in the host rock. The structure comprises beds steeply dipping to the west in this area. In general, the structure indicates that groundwater can expected to move preferentially from northwest to south east toward the Light River and this interpretation is supported by the potentiometric surface.

Formation age and/or stratigraphic unit	Stratigraphic intervals (depth range) (m)	Aquifer formation name	Aquifer interval/thickness (from–to) (m)	Type of aquifer(s) intersected (e.g. unconfined, confined, artesian)	Provide aquifer salinity, depth to water level and any other relevant comments
Neoproterozoic Tapley Hill Formation			NA	Unconfined	Well: KPFRT002 — Depth to water (m): 11.8 — Salinity (mg/L): 9500 Well: KPFRT003 — Depth to water (m): 11.7 — Salinity (mg/L): 7330

Is the proposed program located within a prescribed wells area or prescribed water resource area? If yes, provide the name of the area.	Yes ☐	No ☒
N/A		

Provide the following additional information:
- a description of the local and regional hydrogeology, detailing both the stratigraphy and hydrostratigraphy;
- a detailed baseline description of the groundwater characteristics and flow dynamics which includes:
- baseline groundwater hydrochemistry, including any seasonal fluctuations and spatial variability
- aquifer properties for each aquifer that may be affected by the proposed operations, including waste disposal and water supply, that includes hydraulic conductivity, transmissivity, storage coefficient, total porosity, effective porosity, aquifer thickness, piezometric pressures, mineralogy, and chemical composition range for natural groundwaters.
- static water levels for each aquifer including seasonal fluctuations
- hydrogeological characteristics of confining strata, including hydraulic conductivity and thickness
- connectivity between the proposed exploration ISR test aquifer and lateral overlying, or underlying aquifers and surface water
- conceptualisation of groundwater flow regime
- a numerical model of groundwater flow dynamics, including recharge, discharge areas and processes.
- the environmental value of each aquifer present determined according to the current Environment Protection (Water Quality) Policy;

- a description of the existence, location and value of all Groundwater Dependent Ecosystems (GDEs) within the application area and within and immediately surrounding the extent of predicted hydrogeological impact of the proposed operations;
- an assessment of any current or historical use of local groundwater by the landowner(s) and other users which includes a baseline survey of bores, including water level, groundwater quality, bore construction details, status and purpose and collar/ground elevations;
- a statement describing if the application area is within an area where the water resources are prescribed under the Landscape South Australia Act 2019, and provide details on the current availability of water resources within the prescribed area;
- a plan, to scale, identifying the application area, all drillholes and boreholes relevant to the identification of hydrogeology, GDEs, direction of groundwater flow, any potential paleochannels and recharge zones;
- a diagram of the potentiometric groundwater elevation contours for each aquifer system that occurs within the application area and include the location of all drillholes and boreholes and supporting tabulated data used in developing the contours;
- a diagram of the location of all drillholes and boreholes used to determine the baseline groundwater quality, and supporting tabulated data and calculations used to define baseline groundwater quality and/or ranges; and
- cross-section(s) of the interpreted hydrostratigraphy showing the known and inferred groundwater levels, and groundwater flow direction, recharge, and discharge mechanisms (if applicable), application area, proposed mining operations, and relevant drillholes and boreholes used in developing the cross-section(s).

A description of the hydrogeological environment has been prepared by Groundwater Science (refer Attachment 3 "*Hydrogeological Description of the Environment, Groundwater Science, August 2021*"). A summary of the report is provided below. Further groundwater studies were carried out and reported in 'Groundwater Monitoring & Management Plan (GMMP) Version FR004A', prepared by LWC Consulting in June 2023 (referred to hereafter as GMMP (Version FR004A, June 2023)), with contributions from EMM Consulting. Refer Section 2.3 Hydrogeology of the GMMP (Version FR004A, June 2023) for further information. The GMMP (Version FR004A, June 2023) has been submitted (as Attachment 21) along with this revised EPEPR and should be referenced along with the following description.

Overview

The following provides a specific, brief, tangible description of the subsurface in the immediate trial area. Further detail is provided in the sections that follow.

At the immediate trial area (refer Section H - Maps, Figure 27 "Site Specific Hydrogeological Setting"):

- There are skeletal soils of less than 0.5m thickness.
- The rock comprises siltstone of the Tapley Hill formation.
- The rock is weathered and oxidized to 16 m depth, neutral to approximately 50 m depth and reduced below that depth.
- The rock is bedded with dip direction/dip of 240/35. There are three main fracture sets: 270/70, 050/55, 310/65-80. Fractures are almost entirely infilled. Fracture Frequency is high, averaging 2.6 fractures per meter of rock (refer Section H - Maps, Figure 28 "Visual Representation of Fracture Network Based on Fracture Statistics").
- The groundwater table is at 11.7 – 11.8 mBGL. Groundwater is saline (7,7700 – 9,500 mg/L TDS) and acidic (pH 3.9-4.2).
- Total (matrix) porosity of the rock ranges from ~35% near surface declining to 25% as measured by downhole neutron log. Effective (Fracture) porosity is estimated to be approximately 0.5% based on fracture count and aperture from downhole optical logs.
- Transmissivity at the site was estimated at 0.36 - 0.93 from CRT tests of investigation holes. There will be anisotropy along the orientation of fractures.
- Inferred hydraulic gradient across the site is approximately 0.004 declining from north to south.

Local and Regional Hydrogeology Including Stratigraphy, Hydro-stratigraphy and Structure

Kapunda is located within the Adelaide Geosyncline, a major geological province in central South Australia. The local geology is dominated by Neoproterozoic aged formations (Lambert, Donnelly, & Rowlands, 1980). The main geological formations in the study area include the Tapley Hill Formation which covers the SELT site, and the Brighton Limestone to the east. The Tapley Hill Formation primarily consists of blue-grey laminated siltstone and slate.

The site is positioned within a regional synform with northwest-southeast axis folded into the Tapley hill formation. There is a sequence of parallel antiforms and synforms from west to east across the site, refer to Section H - Maps, Figure 29 "Geology and Inferred Groundwater Flow". The Eudunda Arkose member of the Tapley Hill formation is present on both sides of the antiform. The formation dips steeply to the west at the project site, and steeply to the east at the location of Mantina quarry some 1000 m to the east on the other side of the fold axis.

Table C1: Stratigraphy and Hydro-stratigraphy

Stratigraphy	Hydro-stratigraphy
Tapley Hill Formation. Laminated Siltstone	Unconfined Fractured Rock Aquifer
Eudunda Arkose Member of Tapley Hill Formation	Unconfined Fractured Rock Aquifer

The groundwater system comprises an unconfined fractured rock aquifer, where groundwater will move through fractures in the host rock. Where saturated, a thin weathered zone near the surface will comprise a zone of decreased permeability. Fracturing will be controlled by structures in the host rock. The structure comprises beds steeply dipping to the west on the western side of the axis of an antiform. In this area, the weathered Eudunda Arkose member may be slightly more permeable than the equivalently weathered Tapley's Hill Formation, due to the coarser matrix grainsize.

In general, the structure indicates that regionally groundwater can be expected to move preferentially from north-west to south-east, toward the Light River, and this interpretation is supported by the potentiometric surface. Local variability indicates a south-west to south-east inferred groundwater flow direction, with a south-southwest to south-southeast flow direction in the vicinity of Site A.

The structure is shown in block diagram in Section H - Maps, Figure 30 "Block Diagram", and in a north-south cross section in Section H - Maps, Figure 31 "North-South Cross Section".

Section H - Maps, Figure 29 "Geology and Inferred Groundwater Flow" presents geology and groundwater flow. The axes of the synforms and antiforms are oriented NNW-SSE. The potentiometric surface follows that structure and groundwater flow is inferred to move preferentially from NNW to SSE along the axes of these main structures.

Detailed Baseline Description of Groundwater Characteristics and Flow Dynamics

Background Hydro Geochemistry

Hydro chemical data is presented in Table C2 "Baseline groundwater geochemistry" and C3 "Groundwater Samples from KPFRT02 taken during tracer test". Bores KP001, KP060 and KP009 represent background groundwater quality. The location of wells sampled is shown in Section H - Maps, Map G "Groundwater Monitoring Sites" and placement of well infrastructure is shown in Section H - Maps, Map H "Site Detail".

WaterConnect is an online database of registered groundwater bores within South Australia and is maintained by the Department for Environment and Water (DEW). It contains information on the age, construction and, in some cases, water quality data (i.e. pH, salinity). It is considered a useful tool in understanding how groundwater is being used by the community (i.e. bore purpose at time of installation). This provides further information to consultants and auditors that may be relevant in determining the EV of groundwater at a site.

Based on the available DEW (June 2023) WaterConnect data, there are 224 registered groundwater wells in a 2 km radius using on site well 6629-2306 as the centre of the search area – please refer Appendix B.

Based on the available DEW (2023) WaterConnect data the salinity of the broader catchment ranges (as Total Dissolved Solids (TDS)):

- Lowest recorded TDS = 560 mg/L (6629-574 – up-hydraulic gradient of Site A)
- Highest recorded TDS = 8269 mg/ (6629-1645 – cross/ down hydraulic gradient)

Four of these registered wells are registered as irrigation/ stock or stock. However, two of these are listed as 'abandoned'. There are 182 wells that are not registered for a specific use - i.e. potentially could be used for stock watering.

The two *operational* wells that are listed as being used for irrigation/stock are:

- 6629-2372 – located up-hydraulic gradient of Site A – listed as being drilled to 50.2 m with a listed TDS of 6,100 mg/L; and
- 6629-2373 – located northeast, cross hydraulic gradient from Site A - drilled to 34 m, with listed TDS of 1,750 mg/L.

Table 3-2 of the GMMP (Version FR004A, June 2023) lists the registered wells that are down hydraulic gradient of Site A (June 2023) within a 2km radius. Only one well is listed as irrigation but is also listed as abandoned. Most wells do not have a listed use – most wells are relatively deep and are associated with the Mantina Quarry area east/ southeast of the Site.

Where not listed for a specific use, we consider that a well may be used for a certain purpose assuming the TDS is correct and suitable for such use. The lowest TDS is 2409 mg/L – 6629-382, This would be suitable for irrigation and stock watering purposes.

A summary of the potential Environmental Values of groundwater beneath the Site and in a 2 km radius of the Site is presented below.

Environmental Values	Likelihood of Realising Environmental Values (Current & Realistic Future Potential)	
	On-Site	Off-Site (Down Hydraulic Gradient – DHG)
Drinking Water - Human	**UNLIKELY** The quality of groundwater beneath the Site is not suitable for potable use based on salinity as well as the elevated heavy metal concentrations.	**UNLIKELY** The quality of groundwater DHG is not suitable for potable use. Since a reticulated water supply is available and there are no registered domestic or town water supply bores within the 2 km buffer zone, the potential use of groundwater for potable purposes is considered unlikely.
Recreation and aesthetics	**UNLIKELY** Since the Site will not be used for recreational purposes (e.g., swimming pools, spas), the domestic recreational use of groundwater is not considered relevant. The absence of surface water bodies on the Site means that non-domestic recreation is also not considered relevant.	**POTENTIAL** As no registered abstraction point used for recreational purposes (e.g., the filling of swimming pools or spas) has been identified within the 2 km buffer zone domestic recreation is not considered relevant. However, non-domestic recreation (i.e. swimming, fishing) does occur within the Light River within the vicinity of Kapunda – the river is located approximately 650 m to the south-east of the Site (at its closest point) and is known to receive groundwater baseflow input. The aesthetics of the river are also potentially relevant.
Maintenance of Aquatic Ecosystems (Freshwater)	**UNLIKELY** There are no freshwater ecosystems on the Site.	**HIGH** The Light River is a freshwater ecosystem located approximately 650 m to the south-east of the Site (at its closest point) which is known to receive groundwater baseflow input. According to SA EPA (2016), the river (which is saline and enriched with nutrients) hosts a moderately diverse saline-tolerant macroinvertebrate community with only one flow-dependent species but no recorded rare or sensitive species.

Maintenance of Aquatic Ecosystems (Marine)	**UNLIKELY** There are no marine ecosystems on the Site.	**UNLIKELY** No marine ecosystems are located within the 2 km buffer zone.
Primary Industries - Irrigation and General Water Uses	**UNLIKELY** The quality of groundwater beneath the Site is not suitable for this use based on salinity as well as the elevated heavy metal concentrations.	**POSSIBLE** Although this is a rural area with extensive agricultural properties, no ACTIVE registered irrigation bores are located within the 2 km buffer zone. There are several bores with no listed use, that could be used for such purpose.
Primary Industries - Livestock Drinking Water	**UNLIKELY** The quality of groundwater **beneath** the Site is not suitable for this use based on salinity as well as the elevated heavy metal concentrations – in addition, no livestock are kept on the Site.	**POSSIBLE** Although this is a rural area with extensive agricultural properties, no ACTIVE registered irrigation bores are located within the 2 km buffer zone. There are several bores with no listed use, that could be used for such purpose.
Primary Industries - Aquaculture and Human Consumption of Aquatic Foods	**UNLIKELY** There are no surface water bodies at the Site and groundwater is not abstracted for this purpose.	**UNLIKELY** There is no evidence to suggest that commercial aquaculture, based on the use of either surface water or groundwater, is undertaken within the 2 km buffer zone.
Environmental Values not prescribed in WQEPP but included for completeness of assessment		
Human Health in Non-Use of Groundwater Scenarios (i.e. Vapour Flux) if volatiles present	**UNLIKELY** There are no sensitive receptors, likely to be affected by vapour intrusion, located on the Site.	**UNLIKELY** There are no sensitive receptors, likely to be affected by vapour intrusion, located DHG between the Site and the Light River.

Seasonal variability of site groundwater levels is low, with a maximum range of 0.76 m. This data has been collected over a period of up to two years (2020-21 or 2021-22).

Historical data assessed from monitoring bores at the Mobil service station, corner of Adelaide Road/Thiele Highway and Perry Street, approximately 1 km north-west of site, show similarly low groundwater level variability of up to 1.02 m over a data collection period of up to five years (2003-08).

Site A Baseline Hydro Geochemistry

Baseline groundwater hydro geochemistry data for Site A, that includes Bromide for KP_PPH001 KP_MON01, KP_MON02, KP_MON03, will be provided after construction and prior to groundwater connectivity testing as outlined in Section D Detailed Description of Exploration Operations, Table D1: Project Scope and Schedule – Baseline Sampling.

Groundwater at Site A is saline and acidic and markedly different to the background groundwater quality due to the low pH and elevated metals that are naturally occurring. Salinity ranges from 5,300 to 9,500 mg/L TDS. The groundwater, in part, is acidic with pH of approximately 4 and elevated sulphate. The groundwater exhibits elevated metals with 48 mg/L copper, 85 mg/L zinc, 9 mg/L nickel and 1,200 mg/L iron. The beneficial use of groundwater beneath the Site is constrained by the elevated metals. Seasonal variability is not yet measured but is expected to be minimal give the low rates of recharge in the semi-arid low recharge environment.

Refer to Table C2 and C3 for groundwater composition at Site A. More detailed and technical information can be found in the GMMP (Version FR004A, June 2023).

Table C2: Baseline Groundwater Geochemistry (mg/L)

	Background				Site A						
Well ID	**KP001**	**KP060**	**KP060**	**KP009**	**KPFRT02**	**KPFRT02**	**KPFRT02**	**KPFRT03**	**KPFRT03**	**KPFRT02**	**KPFRT02**
Sample Date	12 Dec 2017	8 Apr 2019	1 Dec 2020	3 Oct 2019	4 Feb 2020	4 Feb 2020	4 Feb 2020	28 Nov 2019	1 Dec 2020	9 Dec 2019	1 Dec 2020
Lab Report	578446-W	651012-W	CSIRO Spreadsheet	977206	Metals: 703174-W Br: 708682-W pH and Salinity from field results			977206	CSIRO Spreadsheet	Field Results	CSIRO Spreadsheet
pH	8.7	7.8			4.22	4.22	3.9			3.9	
Salinity (TDS)	6300	4500		11738	9555	9555	9458	7730		9500	
Na	2600	1600	1360	3300				1600	1750		1590
Ca	36	44	42.5	210				320	334		627
Mg	330	230	221	510				330	268		393
K	55	34	14.3	70				52	19.9		33
Cl	4000	2600									
Br					10	11	11				
SO4	990	370	351						3180		5460
Carbonate Alkalinity	28	< 10									
Bicarbonate Alkalinity	140	92									
Hydroxide Alkalinity	< 10	< 20									
Total Alkalinity	160	92									
Ammonia			0.114						0.553		1.05
Nitrate + Nitrite			<0.1						<0.1		<0.1
Aluminium	< 0.05	< 0.05	0.00987	0.2	18	16	16	2	1.05		1.63
Arsenic	< 0.001	< 0.001	<0.0004		0.06	0.048	0.046		0.002		0.007
Boron	1.4	0.81	0.659	3	2.7	2.6	2.6	1	1.08		1.67
Barium	< 0.02	< 0.02		<0.1	< 0.05	< 0.05	< 0.05	<0.1			
Beryllium	< 0.001	< 0.001			< 0.01	< 0.01	< 0.01				
Cadmium	< 0.0002	< 0.0002	<0.0002	<0.1	0.069	0.064	0.063	<0.1	0.014		0.04
Chromium	< 0.001	0.001	<0.0004	<0.1	< 0.01	< 0.01	< 0.01	0.7	0.0007		0.0009
Cobalt	< 0.001	< 0.001	0.002		6.1	5.8	5.8		1.92		4.79
Copper	< 0.001	< 0.001	0.002	0.2	70	49	46	0.4	1.05		15.2
Gold					< 1	< 1	< 1				
Iron	< 0.05	11	0.377	<0.1	1600	1300	1200	570	459		1110
Lead	< 0.001	< 0.001	<0.0002	<0.1	0.047	0.043	0.042	<0.1	0.001		0.0004
Mercury	< 0.0001	< 0.0001			< 0.001	< 0.001	< 0.001				
Manganese	0.28	0.72	0.38	<0.1	2.6	2.5	2.5	0.1	0.865		2.2
Molybdenum	< 0.005	< 0.005	<0.0003	<0.1	< 0.05	< 0.05	< 0.05	<0.1	0.004		0.00062
Selenium	< 0.001	0.002	<0.0004		0.025	0.02	0.018		0.002		0.0068
Strontium			0.292						2.84		4.85
Uranium	< 0.005	< 0.005			0.2	0.18	0.17				
Vanadium	< 0.005	< 0.005		<0.1	< 0.05	< 0.05	< 0.05	<0.1			
Nickel			0.003	0.2	9.8	9.3	9.3	4	2.85		7.22
Zinc	< 0.005	< 0.005	0.016	<0.1	110	87	82	39	31.8		65.2
Silicon			<0.2	12	67	64	63	35	21.8		28.8
Antimony			<0.0004						<0.0004		<0.0004

Table C3: Groundwater Samples from KPFRT02 Taken During Tracer Test 4/2/2020

Minutes of pumping	**45**	**105**	**165**	**210**	**255**	**300**	**360**	**405**	**450**	**510**	**Beneficial Use Limits**		
Lab Report	Metals: 703174-W; Br: 708682-W; pH and Salinity from field results										ADWG	Irrigation	Livestock
Silicon	67	64	63	63	63	54	64	61	69	65			
Heavy Metals													
Aluminium	18	16	16	17	16	17	16	16	15	17	7	20	5
Arsenic	0.06	0.048	0.046	0.051	0.044	0.03	0.04	0.053	0.024	0.027	0.01	2.0	0.05
Barium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	2		
Beryllium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		0.05	
Boron	2.7	2.6	2.6	2.9	2.7	2.8	2.7	2.7	2.7	3	4	0.5	5
Cadmium	0.069	0.064	0.063	0.065	0.062	0.063	0.058	0.06	0.058	0.064	0.002	0.05	0.01
Chromium	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01		1	

Cobalt	6.1	5.8	5.8	6.1	5.8	5.9	5.5	5.7	5.6	6.2		0.1	1
Copper	70	49	46	52	48	49	47	46	43	50	2	5	0.4
Gold	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1			
Iron	1600	1300	1200	1300	1300	1200	1200	1100	1200	1300		10	
Lead	0.047	0.043	0.042	0.045	0.042	0.042	0.04	0.041	0.039	0.044	0.01	5	0.1
Manganese	2.6	2.5	2.5	2.6	2.5	2.5	2.4	2.4	2.4	2.7	0.5	10	
Mercury	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001		0.002	
Molybdenum	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		0.05	
Nickel	9.8	9.3	9.3	9.8	9.3	9.5	9	9.1	9	10	0.5	2	1
Selenium	0.025	0.02	0.018	0.019	0.015	0.019	0.016	0.017	0.015	0.017	0.1	0.05	0.02
Silver	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05			
Uranium	0.2	0.18	0.17	0.18	0.17	0.17	0.16	0.17	0.16	0.18	0.02	0.1	0.2
Vanadium	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05		0.5	
Zinc	110	87	82	91	86	86	81	78	80	92		5	20
Bromide	10	11	11	110#	160	350	590	510	580	600			
pH	4.22	4.22	3.9	3.94	3.9	3.93	3.77	3.76	3.82	3.82			
Salinity	9555	9555	9458	9575	9555	9679	9594	9711	9666	9633	1000		7,000*

- For sheep on dry feed
- # Arrival of tracer

Aquifer Properties for Each Aquifer That May be Affected by the Proposed Operations

Hydraulic conductivity, Transmissivity, Storativity and Specific Yield

Aquifer testing at Site A has comprised the following:

- Opportunistic low-rate testing at KP001 during borehole sampling
- Eight-hour constant rate pumping test at Site A
- Hydraulic conductivity inferred from NMR logs of drillhole KPFRT002 at Site A
- Analysis of water yield reported during historic exploration drilling
- Analysis of reported historic mine dewatering rates.

An overview is provided in Table C4: Summary of hydraulic testing and aquifer properties.

Table C4: Summary of Hydraulic Testing and Aquifer Properties

Tests	Test Bore	Observation Bore	Transmissivity (m^2/day)	Storativity[3]	Specific Yield	Aquifer Thickness (m)	Bulk Average Hydraulic Conductivity (m/day)	Solution
Constant Rate Pumping Test	KPFRT03	KPFRT02	0.36	0.00035	0.01	7.5	0.048	Neuman
	KPFRT03	Pumped	0.93		0.02	7.5	0.12	Moench
NMR Log	KPFRT02		0.66			15	0.04	NMR
Low-Rate Pumping Test	KP001	KP001	40	-	-	Unknown		Logan[1]
Historic Exploration Drilling Yields	Mean (min and max)	27 data points	10 (0.3-36)	-	-	Variable		Logan[1]
Historic Mine Dewatering Sites	Historic workings	N/A	26	-	-	146	0.18	Logan[2]

Notes:

1) The Logan Approximation was applied to water yield recorded during exploration drilling. This is typically very short duration pumping at significant depth, and the aquifer response will be due to depressurisation of confined fractures rather than slow drainage of unconfined (specific yield) storage, hence the confined form of the equation was used.

2) The Logan Approximation was also applied to reported historic rates of dewatering from the mine workings. This long duration pumping will represent slow drainage of unconfined storage in this setting, so the unconfined form of the Logan Approximation was used. The unconfined form returns the bulk average hydraulic conductivity estimate of 0.18 m/day.

3) Storativity is the elastic (confined) storage released during early times of the pumping tests before slow drainage of the unconfined storage occurs. This is derived from the early time response at the observation bore.

4) All of the analyses produce estimates of aquifer properties that are not precise.

Testing the transmissivity of fractured rock aquifers is problematic because of the variability in fracture occurrence. Typically, small-scale tests such as single borehole tests or pumping tests will determine the transmissivity of the specific joint sets intersected by the drillhole. Regional scale transmissivity is controlled by the frequency and connectivity between joint sets. Larger scale test methods are better suited to determining transmissivity per Cook (2003)[1]:

> *At the scale of hundreds of metres or more, hydrogeologic simulation models calibrated to estimates of recharge rates, watertable positions and/or potentiometric head data may be the most suitable and reliable way of estimating the large-scale hydraulic conductivity of the fractured rock aquifer.*

The analysis of reported dewatering from the historic workings is likely the most useful regional scale evaluation of transmissivity for the current study. The transmissivity of the fractured rock aquifer is likely to range around 10 to 14 m^2/day, whilst the concomitant bulk average hydraulic conductivity will be around 0.05 to 0.1 m/day.

At Site A within the surrounding 50 m radius of KP_PP1, and between approximately 20 and 30m depth, the bulk hydraulic conductivity will be in the range of test results from KPFRT02 and KPFRT03; i.e. between 0.048 and 0.12 m/day.

ECR will provide updated Site A conductivity, transmissivity, storativity and specific yield data that is inclusive of wells for KP_PP1, KP_MON01, KP_MON02, KP_MON03 following the groundwater connectivity testing stage of works.

Hydraulic conductivity and Transmissivity are likely to be anisotropic with higher conductivity along the planes of bedding and also along the planes of fracturing.

Fracture and Bedding Orientation

The structure of the deposit was reviewed in detail on the basis of optical imaging of the KPFRT001 pilot hole. This data is supported by logging cored drillholes, historic geotechnical reports, aerial scanning of the historic pits and automated structural analysis, and (refer to Attachment 4 “Estimation of the Kapunda Fracture Model and Hydraulic Conductivity Model, Hang Wang, March 2021). The orientation of the main structures at the site is summarised in Table C5 “Fracture and Bedding Orientation” and Section H - Maps, Figure 4 “Fracture and Bedding Orientation”.

The estimated fracture density averages 2.6 fractures per m of rock. Analysis of the fracture logs at KPFRT001 was undertaken and a fracture model was developed. This work is presented in Attachment 5 “Fracture Flow Modelling Overview, Hang Wang, August 2021”, and a figure showing that the fracture model is displaced is provided in Section H - Maps, Figure 6 “FRACSIM Output for Kapunda Site A”. Fractures were simulated in Frac-sim 3D and permeability tensors calculated for the site area.

Table C5: Fracture and Bedding Orientation

Feature	Dip Direction (Degrees)	Dip (Degrees from Vertical)
Bedding	240	35
Fracture Set #1	270	70
Fracture Set #2	050	55
Fracture Set #3	310	65-80

Porosity

Total porosity of a sedimentary rock typically ranges around 0.2 – 0.45. This reduces with cementation and lithification. Calibrated neutron logs were run on Pilot Hole KPFRT001. The total porosity measured by neutron log ranges around 0.35 from 10 to 30 m depth. Porosity decreases with depth to approximately 0.25 at the end of hole at 65 m depth.

Effective porosity was estimated based on structural analysis undertaken using downhole optical images. In total 82 structures were identified to 60 m depth. Cumulative fracture aperture was 1.08 m which equates to an average porosity of 1.7%. There is no data regarding cementation or filling of the fractures. The percentages presented here are an upper limit for effective (fracture) porosity assuming that the fractures are clean and open. Visual inspection of larger fractures confirmed that these are mostly infilled. Refer to Section H - Maps, Figure 5 “Fracture (Effective) Porosity”. Hence the effective porosity is expected to be significantly less than 1.7%, and an estimate of 0.5% to 1% has been used for planning purposes.

Piezometric Pressures (Groundwater Level)

Groundwater elevation data were obtained from the WaterConnect Database, industrial site investigations at Kapunda BP site (JBS&G 2019) and the drillholes drilled and sampled by ECR. The data points, the inferred water table elevation and inferred groundwater flow is presented in Section H - Maps, Map I “Groundwater Elevation and Inferred Flow”. The data is provided in Table 4.1 of Attachment 3 “Hydrogeological Description of the Environment”. The groundwater elevation at Site A is 206 m AHD which equates to 11.7 m below ground surface. Groundwater flow is inferred from the NNW to SSE along the axis of the syncline axis and bedding, and perpendicular to the Light River.

[1] Cook, P. G. (Peter G.). A guide to regional groundwater flow in fractured rock aquifers. CSIRO 2003

Mineralogy

The Kapunda Mineral Resource is a structurally controlled copper deposit with primary copper mineralisation consisting of an en-echelon series of lodes striking at ~020 degrees magnetic and dipping ~70 degrees west. Secondary supergene enrichment has taken place leading to the development of a significant copper enriched zone with kaolinized metasediments. Mineral species include copper oxides (azurite, malachite and cuprite) and secondary copper sulphide minerals (chalcocite and covellite) within 100m of surface.

Quantitative Evaluation of Materials by Scanning Electron Microscopy (QEMScan) results from the Pilot Hole KPFRT001 at Site A are presented in Table 6 “QEMScan Assay of Samples from Pilot Hole KPRFT01”. The rock is predominately Kaolinite (Clay), Feldspars, and Quartz. Pyrite becomes more abundant at depth exceeding 20 m below the redox boundary. Copper is present as Malachite/Azurite in the oxide zone and as chalcopyrite and Chalcocite in the reduced zone below 20 m depth.

Table C6: QEMScan assay of samples from pilot hole KPFRT01

Mineral	3 - 8 metres	8 - 18 metres	20 - 25 metres	26 - 29 metres
Kaolinite (clay)	31.63%	24.69%	3.72%	4.36%
Feldspars	26.66%	5.62%	45.75%	45.74%
Quartz	25.42%	40.79%	33.03%	33.51%
Micas	8.79%	1.21%	3.63%	2.83%
Fe-oxide/hydroxide	3.64%	16.08%	0.46%	0.08%
Rutile/Anatase	2.84%	3.17%	1.99%	2.04%
Others	0.37%	0.95%	0.57%	0.34%
Sulphates	0.25%	1.50%	1.03%	0.93%
Cu trap	0.11%	3.85%	0.11%	0.06%
Zircon	0.08%	0.11%	0.22%	0.37%
Amphibole	0.06%	0.02%	0.00%	0.02%
Cu-Kaolinite	0.05%	0.41%	0.00%	0.00%
Pyrite	0.04%	0.03%	9.06%	8.75%
Carbonates	0.03%	0.30%	0.01%	0.01%
Malachite/Azurite	0.01%	0.79%	0.00%	0.00%
Chrysocolla	0.00%	0.22%	0.01%	0.00%
Chalcopyrite	0.00%	0.00%	0.11%	0.34%
Chalcocite/digenite	0.00%	0.02%	0.17%	0.39%
Covellite	0.00%	0.00%	0.12%	0.22%
Curprite	0.00%	0.00%	0.00%	0.00%
Cu-Limonite	0.00%	0.24%	0.00%	0.00%

Chemical Composition Range for Natural Groundwaters

Refer description provided in sections above “Broader catchment baseline hydro-geochemistry” and “Site A baseline hydro-geochemistry”, and further detail in attached report from Groundwater Science.

Static Water Levels for Each Aquifer Including Seasonal Fluctuations

Refer to description provided in section above “Piezometric pressures”.

Seasonal fluctuation

The only available record of seasonal water level fluctuation is a set of 15 monitoring wells installed around the former Mobil Petrol Station at the corner of Perry Street and Main Street. The depth to water ranges from 13 to 18 mBGL. 6 water level monitoring events occurred between 2003 and 2008. The maximum fluctuation in any one well from 2003 to 2008 was 1.1 m change from April 2003 to November 2005 in monitoring well MW3. In general, seasonal fluctuation was around 0.3 m. This data set is sparse and will likely not capture the full range of seasonal variation.

Hydrogeological Characteristics of Confining Strata

The fractured rock aquifer at the site is unconfined. There are no confining strata.

Connectivity Between Aquifers

The fractured rock aquifer at the site is unconfined, there is no overlying aquifer or underlying aquifer.

The fractured rock aquifer discharges to the Light River, which at its closest is a distance of some 650 m to the south east of the project site. The groundwater discharge maintains saline perennial pools in the river (CSIRO 2020).

Conceptual Model of Groundwater Flow Regime

The site is conceptualised as a localised and structurally controlled groundwater flow system. The site sits within a regional syncline structure oriented North West to South east with a number of parasitic synform and antiform structures throughout the area. Groundwater flow is parallel to the fold axes and discharges to the Light River.

Recharge

Groundwater recharge will be via diffuse rainfall recharge and some localised higher rates at outcropping or thinly covered basement rock. The Clare valley is a nearby analogous fractured rock aquifer system. Estimated recharge reported in the Clare Valley Water Allocation Plan (WAP) (NYMRMB, 2009)[2] is 30 mm/year, though it is reported that the rate is variable and in many areas of the WAP, less than that estimate.

Chloride mass balance analysis of the groundwater at the Kapunda site (Li et al 2020) produced an estimate of 4 mm/year. This value seems appropriate for the more saline system at Kapunda.

Discharge

Discharge from the system is via baseflow to the Light River. The Light River at the site has been investigated by CSIRO (2020). The report concluded that the River receives groundwater discharge and that the discharge maintains flow and pools over summer.

Groundwater flows through the fractured rock aquifer toward the discharge zone of the Light River. Flow will be preferential via fractures. Flow velocity estimates from 0.3 m per year up to a maximum of 15 m per year have been derived. The lower range estimates around 0.3 are considered more realistic since these are based on individual fracture flow for a fractured rock aquifer.

Groundwater Flow

An estimated flow velocity of around 15 m/year is derived via the Darcy equation from the measured hydraulic gradient of 0.004, the average bulk hydraulic conductivity estimate of 0.1 m/day (average of four different tests) and an effective porosity estimate of 1% (assuming a partially filled fracture porosity of 1.7%). This analysis treats the aquifer as a porous media equivalent.

It is noted that studies in a similar fractured rock environment (Clare Valley) reported a trend of decreasing hydraulic conductivity with depth (Love et al 2001). Love et al (2001) also identified that borehole hydraulic conductivity varied by up to five orders of magnitude.

Effective porosity was estimated based on structural analysis undertaken using downhole optical images. An average porosity of 1.7% was reported to 60 m depth. From 20-60 m the fracture porosity ranged from 1- 3.5% and averaged 2.5%. There is no data regarding cementation or filling of the fractures. The percentages listed here are an upper limit for effective (fracture) porosity, assuming that the fractures are clean and open. Visual inspection of two larger fractures confirmed that these are mostly infilled.

In addition, the hydraulic gradient may vary over time. Thus, groundwater flow velocities may be lower or higher than that estimated above.

Additional test-scale hydrogeological data (e.g., via tracer tests) can provide refined estimates of hydrogeological parameters such as effective porosity, dispersivity and groundwater flow velocity.

This analysis treats the aquifer as a porous media equivalent. Flow in discrete fractures will be both higher and lower than this estimate.

Mine and quarry workings

The historic mine pits retain water during winter but not during summer. The water is understood to be rainfall run-off. The historic mine is considered neither a marked groundwater discharge nor a groundwater recharge feature. Some enhanced recharge from the ponded water at the base of the pits is possible, but this is likely to be minor as there is no groundwater level mounding evident around the pits.

The historic mine workings do not express to surface. The mine workings are believed to act as a higher transmissivity feature. This may contribute to the flattening of the potentiometric surface shown on Map I (refer Section H - Maps, Map I “Groundwater Elevation and Inferred Flow”.

The net impact of the nearby Mantina quarry on the water table is not known but likely to be minor. The quarry has two unlicensed bores that are used for water supply at an unknown rate, and this would lower the water table. However, rainfall run-off to the base of a quarry pit can act as a source of enhanced recharge which would act to counter the pumping of groundwater and raise the water table.

Numerical Groundwater Flow Model

A numerical groundwater flow model of the Site was developed by the University of Adelaide (Li et al 2020). A brief summary is provided here.

[2] Northern and Yorke Natural Resources Management Board, 2009, Water Allocation Plan for the Clare Valley Prescribed Water Resources Area. Government of South Australia, through the Northern and Yorke Natural Resources Management Board, Crystal Brook, South Australia

The fracture rock aquifer was simulated using the equivalent porous medium approach. A 3D regional-scale numerical groundwater model was developed for Kapunda using MODFLOW Unstructured Grid (USG)(Panday, Langevin, Niswonger, Ibaraki, & Hughes, 2017).

Model Grid

The model domain is 5.5 km × 5.2 km in area and the model edges were set ~2 km away from the study area to avoid boundary effects. The Voronoi grid was generated using AlgoMesh (Merrick, 2016) with a nominal cell size of 10 m² in the study area and up to ~25,000 m² in the regional area. The same grid was applied to two layers, resulting in a total of 294,356 cells.

The groundwater model was discretised into two layers, with the top layer representing the more permeable, weathered part of the fractured rock aquifer and the bottom layer representing the less permeable, unweathered part of the aquifer.

Layer Properties

Layer properties were applied in the range presented in Table C7 “Model Layer Properties”.

Table C7: Model Layer Properties

Parameter Group	Layer	Unit	Initial Value	Lower Bound	Upper Bound	Source
Hydraulic conductivity	1	m/d	0.1	$1e^{-5}$	1	Aquifer Test Logan Approximation
Hydraulic conductivity	2	m/d	$1e^{-4}$	$1e^{-5}$	$1e^{-3}$	Aquifer Test Logan Approximation
Specific storage[1]	1, 2	m^{-1}	$1e^{-6}$	$1e^{-7}$	$1e^{-5}$	Li and Cranswick (2016)
Specific yield[1]	1, 2	-	0.01	0.001	0.05	Li and Cranswick (2016)
Rainfall-Recharge Ratio	1	-	0.008	$1e^{-4}$	0.05	Chloride mass balance

Notes:

1) Specific Storage is the elastic storage that is released during depressurisation. The aquifer is unconfined, and the aquifer response to changes in flow will be dominated by unconfined storage (specific yield) however modelling software requires an estimate of Specific storage to calculate the short-term changes in elastic storage that occur due to depressurisation.

Boundary Conditions

The AMT survey was used as one of the datasets that constrained hydraulic conductivity during model calibration. The comparison between AMT survey results and the hydraulic conductivity distribution of the model calibration is shown in Section H - Maps, Figure 15 “AMT HC Correlation (a)” and Figure 16 “AMT HC Correlation (b)”. Figure 15 presents the results AMT survey. Figure 16 presents the hydraulic conductivity distribution of layer one of the calibrated groundwater flow model. The two figures show that inferred hydraulic conductivity and inferred electrical conductivity are somewhat coincident. The inference is that the areas of high electrical conductivity may also be areas of higher hydraulic conductivity.

The south east red band is a band of higher inferred hydraulic conductivity and inferred electrical conductivity.

Figures 15 and 16 show a coincident low AMT EC and low hydraulic conductivity zone to the south of the site and running along the Light River.

River

The Light River and other ephemeral creeks were simulated using MODFLOW’s RIV package (Panday et al., 2017). Time-varying river depths were used for the Light River based on data from the nearest gauging station.

Model Perimeter

The regional lateral groundwater inflows from the northern and southern sides were modelled in both layers using MODFLOW’s GHB package (Panday et al., 2017). The head values were derived from groundwater level observations and the conductance was set to 0.1 m²/d.

Recharge

Net groundwater recharge was simulated using MODFLOW’s RCH package (Panday et al., 2017). Annually varying rainfall data were incorporated into the model as recharge multipliers, which were multiplied with the spatially varying rainfall-to-recharge ratios (a calibration parameter) to derive net recharge.

Historic Pits

The historical mine and quarry were represented as groundwater discharge features using MODFLOW’s DRN package (Panday et al., 2017). The drain elevation was sourced from the DEM and the drain conductance was set to 0.1 m²/d.

Time Steps

The model consists of 53 stress periods. The first period is steady-state and represents the pre-1970 period, which was selected based on the observation data availability. This stress period provides the initial conditions for the subsequent 50 transient annual stress periods, which represent the time period between 1970 and 2019 and were used for history-matching.

Calibration

Model calibration entailed varying the 5 parameter sets in the table above “Model layer properties”. The calibration approach was an ensembler-smoother method via PESTPP-IES. This does not produce one calibrated model, but rather an ensemble models that represent the uncertainty of the study site. This ensemble of models is run to provide a range of possible outcomes.

Environmental Value of Aquifers

Environmental value of the groundwater at Site is constrained by elevated metals. The water is not suitable for drinking, stock watering or irrigation. Refer to section “Site A Baseline Hydro Geochemistry” on page 15.

Groundwater Dependent Ecosystems (GDEs)

Groundwater Dependent Ecosystems (GDEs) in the study area were evaluated by firstly plotting the GDE Atlas maintained by BOM[3]. The data are shown in Section H - Maps, Map J “Groundwater Dependent Ecosystems”.

In proximity to the project site, the data set identifies:

- The stand of vegetation to the south and west of the historic workings is identified as a potential terrestrial ecosystem that relies on the subsurface presence of groundwater–this includes all vegetation ecosystems. The area is classified as having a low potential for groundwater interaction. Given the groundwater depth is greater than 10 m below surface and the groundwater salinity is moderately high, and the dominant species is Blue Gum, this stand of vegetation can be excluded as a groundwater dependent ecosystem.
- The Light River is identified as an aquatic ecosystem that relies on the surface expression of groundwater–this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs.

The Light River at the site has been investigated by CSIRO (2020). The report concluded that the River receives groundwater discharge and that the discharge maintains flow and pools over summer. Whilst a groundwater baseflow to streams and rivers is common, an interesting feature in the case of the Light River is that this baseflow is quite saline. Accordingly, the Light River is often considered by local management agencies to be ‘degraded’ owing to ecological classification systems for Australian waterways that use comparison with pristine (usually freshwater) reference environments. This approach is appropriate when formerly freshwater environments have become more saline due to land-use change or other processes. However, it is less so in cases when the environment is naturally saline.

Current and Historical Local Groundwater Users

A review of all third-party bores in proximity to the site was undertaken (refer Table C8 “Third Party Bore Audit”. Bore records were downloaded from WaterConnect and filtered to exclude records described as; mineral exploration holes (MW), or water points (WP), and to exclude records where the status was described as; backfilled or abandoned. The remaining records are presented in Section H - Maps, Map K “Third Party Bores” and Table C8 below. The status of these bores was followed up by site inspection and enquiry.

The only bores in use for water supply are located in Mantina Quarry approximately 1 km to the south east of the site.

The remaining bore records are monitoring bores associated with a service station in Kapunda, a single shallow monitoring bore within Kapunda and two bores that no longer exist.

Table C8: Third Party Bore Audit

DHNO	Unit_No	East	North	Date	Depth (m)	Purpose	Status	Audit Comment
63534	6629-381	309139	6196389					No Longer Exists
63551	6629-398	309893	6197614		22.86		NL	No Longer Exists
64602	6629-1459	309713	6196322	14/11/90	200	IND	OPR	Mantina Quarry Bore (in use)
164823	6629-1645	310023	6196450	8/04/97	71	IND	OPR	Mantina Quarry Bore (in use)
200105	6629-1847	307765	6197663	4/05/04	16	MON		Service Station Monitoring
214274	6629-2065	307945	6197536	17/10/05	19	MON		Service Station Monitoring
214275	6629-2066	307911	6197584	18/10/05	18	MON		Service Station Monitoring
214277	6629-2067	307894	6197563	18/10/05	18	MON		Service Station Monitoring
214278	6629-2068	307960	6197486	19/10/05	23.8	MON		Service Station Monitoring
214279	6629-2069	307954	6197584	19/10/05	24	MON		Service Station Monitoring
214370	6629-2074	307934	6197503	24/01/05	24	MON		Service Station Monitoring
214371	6629-2075	307951	6197533	24/01/05	24			Service Station Monitoring
214372	6629-2076	307971	6197550	25/01/05	24			Service Station Monitoring
214373	6629-2077	307948	6197569	27/01/05	24			Service Station Monitoring

[3] http://www.bom.gov.au/water/about/publications/document/BOM_GDE_Atlas_info_sheet_WEB.pdf

214374	6629-2078	307907	6197553	27/01/05	22			Service Station Monitoring
214375	6629-2079	307922	6197577	28/01/05	18			Service Station Monitoring
271988	6629-2255	307732	6197657	29/10/12	12	INV		Service Station Monitoring
272010	6629-2256	307753	6197698	29/10/12	12	INV		Service Station Monitoring
289421	6629-2277	307792	6197410	29/01/16	15	INV		50 mm monitoring bore cased to 6m

Prescribed water resources

Site A is not in a Prescribed Wells Area or Prescribed Water Resources Area.

Native vegetation

Will you be working within areas of native vegetation? If yes, provide the following information: • description of the formation and structure of vegetation in the area (e.g., woodland, shrubland, grassland) • list of the dominant species. • the presence of significant habitats and any rare, or endangered species located, or reported to have been identified in the area; include any known sightings of rare and endangered species on a locality plan/map where possible. If no, indicate why you will not be working within areas of native vegetation?	Yes ☐	No ☒

The proposed exploration site is located within the Broughton sub region of the Northern and Yorke Regional Species Conservation Assessment Project Area. The exploration site is located on an area that does not have areas of native vegetation as the site is located on land currently used for cropping and grazing.

A search of the Atlas of Living Australia (ALA) Species Occurrence was carried out within a 100m (0.1km) and 1km radius of the exploration sites, as shown in Section H - Maps, Map E "Sensitive Receptors".

Search 1 - ALA Species Checklist (Flora) within 0.1km radius of the site Latitude -34,353 and Longitude 138,919

Species	Common Name	Native Species/Conservation Status
Salvia verbenaca	Wild Sage	N/N
Acacia pycnantha	Golden Wattle	Y/N
Eucalyptus leucoxylon	South Australian Blue Gum	Y/N
Austrostipa	Spear Grass	Y/N

Search 2 – ALA Species Checklist (Flora) with 1km radius of Latitude -34,353 and Longitude 138,919

Species	Common Name	Native / Conservation Status	Species	Common Name	Native / Conservation Status
Cynodon dactylon	Couch Grass	N/N	*Acacia spilleriana*	Spillers Wattle	Y/Y
Rosa canina	Common Brier/Dog Rose	N/N	*Choretrum glomeratum*	Berry Broombush	Y/N
Eucalyptus dumosa	Waikerie/White Mallee	Y/N	*Kennedia prostrata*	Scarlet Coral Pea	Y/N
Olea europaea	Olive	N/N	*Pimelea humilis*	Common Rice Flower	Y/N
Eucalyptus leucoxylon	Red-Flowered Yellow Gum	Y/N	*Hypericum perforatum*	St John's-Wort	N/N
Acacia pycnantha	Golden Wattle	Y/N	*Heliotropium europaeum*	Caterpillar Weed	N/N
Schinus molle	Chilean Pepper Tree	N/N	*Goodenia pusilliflora*	Mallee Bonza	Y/N
Salvia verbenaca	Wild Sage	N/N	*Piptatherum miliaceum*	Smilograss	N/N
Acacia acinacea	Wreath/Gold Dust Wattle	Y/N	*Pinus radiata*	Monterey Pine	N/N
Scabiosa atropurpurea	Egyptian Rose/Scabiosa	N/N	*Euphrasia collina*	Purple Eye-Bright	Y/N
Eucalyptus odorata	Box Gum	Y/N	*Ranunculus muricatus*	Sharp Buttercup	N/N
Trifolium campestre	Hop Trefoil/Field Clover	N/N	*Juncus subsecundus*	Fingered Rush	Y/N
Atriplex semibaccata	Berry/Creeping Salt Bush	Y/N	*Boerhavia dominii*	Tarvine	Y/N
Echium plantagineum	Paterson's Curse	N/N	*Lomandra micrantha*	Mat Rushes	Y/N
Callitris gracilis	Southern Cypress Pine	Y/N	*Centipeda crateriformis*	Compact Sneezeweed	Y/N
Hordeum glaucum	Barley Grass	N/N	*Brachyscome dentata*	Lobe-Seed Daisy	Y/N
Juncus kraussii	Sea/Salt Marsh Rush	N/N	*Rostraria pumila*	Tiny Bristle Grass	N/N
Phragmites australis	Bamboo Reed/Cane Grass	Y/N	*Cassytha melantha*	Mallee Strangle Vine	Y/N
Asperula conferta	Common Woodruff	Y/N	*Adonis microcarpa*	Pheasant's Eye	N/N
Stackhousia monogyna	Creamy Stakhousia/Candles	Y/N	*Acacia iteaphylla*	Flinders Range Wattle	Y/Y
Eucalyptus behriana	Broad Leaved Box	Y/Y	*Verbascum virgatum*	Moth Mullein	N/N
Schoenus nanus	Tiny Bog-Sedge	Y/N	*Acacia paradoxa*	Kangaroo Acacia	Y/N
Eucalyptus phenax	Jeparit Mallee	Y/N	*Chrysocephalum semipapposum*	Clustered Everlasting	N/N
Austrostipa blackii	Spear Grass	Y/N	*Chenopodium desertorum*	Frosted Goosefruit	Y/N
Hordeum murinum	False Barley	N/N	*Euphorbia multifaria*	*None Recorded*	Y/N
Prunus dulcis	Almond	N/N	*Teucrium racemosum*	Forest Germander	Y/N
Austrostipa nodosa	Needle Grass	Y/N	*Bursaria spinosa*	Native Blackthorn	Y/N
Solanum elaeagnifolium	Bull Nettle	N/N			

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.

Searches of a 1km radius found single occurrences of *Acacia spilleriana* and *Acacia iteaphylla* and two (2) occurrences of *Eucalyptus behriana*. These are found outside the exploration area and will not be disturbed or impacted by access to the exploration site (s) or by exploration activities. These are shown in Section - H Maps, Map E "Sensitive Receptors".

Species	Common name	NPW Act rating*	EPBC Act rating†
Acacia spilleriana	Spillers Wattle	Endangered	Endangered
Acacia iteaphylla	Flinders Range Wattle	Near Threatened	Near Threatened
Eucalyptus behriana	Broad Leaved Box	Near Threatened	Near Threatened

* *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*).

Weeds recorded as being present within 1km of the exploration site (-34,353 and Longitude 138,919) include:

- *Adonis microcarpa* (Pheasant's Eye)
- *Cynodon dactylon* (Couch)
- *Echium plantagineum* (Paterson's Curse)
- *Heliotropium europaeum*
- *Hordeum murinum*
- *Hypericum perforatum* (St John's Wort/Klamath Weed)
- *Olea europaea* (Olive)
- *Pinus radiata* (Monterey Pine)
- *Piptatherum miliaceum*
- *Prunus dulcis* (Almond)
- *Rosa canina* (Common Brier)
- *Rostraria pumila*
- *Salvia verbenaca* (Vervain)
- *Scabiosa atropurpurea* (Annual Scabious/Egyptian Rose)
- *Schinus molle* (Chilean Pepper Tree)
- Solanum elaeagnifolium (Bull Nettle)
- *Trifolium campestre* (Hop Trefoil)
- *Verbascum virgatum* (Moth Mullein)

Fauna

Describe the native and feral fauna that may be present in the exploration program area, noting the conservation status, in particular endangered, threatened, or feral species. Include known sightings of rare and endangered species on a locality plan/map, where possible.

The proposed exploration site is located within the Broughton sub region of the Northern and Yorke Regional Species Conservation Assessment Project Area. The proposed exploration site will not work in areas of native vegetation as the site is located on land currently used for cropping and grazing. Soil disturbance will be kept to a minimum and surface tanks will be used for the storage of water and fluids, removing any requirement to construct or use sumps.

A search of the Atlas of Living Australia (ALA) Species Occurrence was carried out within a 100m (0.1km) and 1km radius of the exploration site (refer Section H - Maps, Map E "Sensitive Receptors"). There were no occurrences of fauna species found with 100m of the exploration site.

Search 1 – ALA Species Checklist (Fauna) with 1km radius of Latitude -34,353 and Longitude 138,919

Species	Common Name	Native / Conservation Status	Species	Common Name	Native / Conservation Status
Platycercus (Platycercus) elegans	Crimson Rosella	Y/N	*Rhipidura (Rhipidura) albiscapa*	Grey Fantail	Y/N
Cracticus tibicen	Australian Magpie	Y/N	*Manorina (Myzantha) melanocephala*	Noisy Miner	Y/N
Ptilotula penicillata	White-Plumed Honeyeater	Y/N	*Anthochaera (Anthochaera) carunculata*	Red Wattlebird	Y/N
Ocyphaps lophotes	Crested Pigeon	Y/N	*Artamus (Angroyan) cyanopterus*	Dusky Woodswallow	Y/N
Turdus merula	Blackbird	N/N	*Chenonetta jubata*	Australian Wood Duck	Y/N
Columba (Columba) livia	Rock Pigeon	N/N	*Accipiter (Leucospiza) fasciatus*	Brown Goshawk	Y/N
Anthochaera carunculata	Red Wattlebird	Y/N	*Pachycephala (Alisterornis) rufiventris*	Rufous Whistler	Y/N
Rhipidura (Sauloprocta) leucophrys	Willie Wagtail	Y/N	*Aquila (Uroaetus) audax*	Wedge-Tailed Eagle	Y/N
Eolophus roseicapillus	Galah	Y/N	*Lalage (Lalage) sueurii*	White-Winged Triller	Y/N
Corvus mellori	Little Raven	Y/N	*Cacatua (Licmetis) sanguinea*	Little Corella	Y/N
Passer (Passer) domesticus	House Sparrow	N/N	*Geopelia striata*	Peaceful Dove	Y/N
Psephotus (Psephotus) haematonotus	Red-Rumped Parrot	Y/N	*Gallinula (Gallinula) tenebrosa*	Dusky Moorhen	Y/N
Phylidonyris (Meliornis) novaehollandiae	New Holland Honeyeater	Y/N	*Tachybaptus novaehollandiae*	Australasian Grebe	Y/N
Grallina cyanoleuca	Magpie-Lark	Y/N	*Caligavis chrysops*	Yellow-Faced Honeyeater	Y/N
Acanthiza (Geobasileus) chrysorrhoa	Yellow-Rumped Thornbill	Y/N	*Anas (Nettion) gracilis*	Grey Teal	Y/N
Hirundo neoxena	Welcome Swallow	Y/N	*Alauda arvensis*	Eurasian Skylark	N/N
Glossopsitta concinna	Musk Lorikeet	Y/N	*Anas (Anas) superciliosa*	Pacific Black Duck	Y/N
Sturnus (Sturnus) vulgaris	Common Starling	N/N	*Colluricincla (Colluricincla) harmonica*	Grey Shrike-Thrush	Y/N
Falco (Tinnunculus) cenchroides	Nankeen Kestrel	Y/N	*Haliastur sphenurus*	Whistling Kite	Y/N
Zosterops lateralis	Silvereye	Y/N	*Parvipsitta porphyrocephala*	Purple-Crowned Lorikeet	Y/N
Falco (Ieracidea) berigora	Brown Falcon	Y/N	*Trichosurus vulpecula*	Australian Brushtail Possum	Y/Y
Coracina (Coracina) novaehollandiae	Black-Faced Cuckoo-Shrike	Y/N	*Anilios bicolor*	Dark-Spined Blind Snake	Y/N
Corcorax melanorhamphos	White-Winged Chough	Y/Y	*Anilios bituberculatus*	Prong-Snouted Blind Snake	Y/N
Vanellus (Lobipluvia) miles	Masked Plover	Y/N	*Morelia spilota*	Carpet Python	Y/Y
Merops (Merops) ornatus	Rainbow Bee-Eater	Y/N			
Acanthiza (Subacanthiza) nana	Yellow Thornbill	Y/N			
Melopsittacus undulatus	Budgerigar	N/N			
Streptopelia (Spilopelia) chinensis	Spotted Dove	N/N			

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.

Searches of a 1km radius found two (2) occurrences of *Corcorax melanorhamphos* and single occurrences of *Morelia spilota* and *Trichosurus vulpecula*. These are found outside the exploration area and will not be disturbed or impacted by access to the exploration site or by exploration activities. These are shown in Section H - Maps, Map E "Sensitive Receptors").

Species	Common name	NPW Act rating	EPBC Act rating
Corcorax melanorhamphos	White-Winged Chough	Near Threatened	N/A
Morelia spilota	Carpet Python	Near Threatened	N/A
Trichosurus vulpecula	Australian Brushtail Possum	Near Threatened	N/A

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.

Environmentally sensitive areas

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 ☒	No ☐

Historic Mine Site

The Historic Mine Site located to the north of the proposed exploration site is a significant European Heritage site, dedicated to demonstrating the cultural heritage of mining in the landscape. The Historic Mine Site is managed by Light Regional Council and is subject to a Mine Site Conservation Plan and Tourism Development Plan. Access to Site A does not require access to the Historic Mine Site. Access to Site A has been planned to allow all exploration vehicles access via Perry Road and East Terrace, which are heavy vehicle access public roads, and a traffic management plan will be prepared to avoid any areas of conflict. Refer Section H - Maps, Map C "Relevant Land Use Areas" and Section G – Photos (refer Plate 11).

Light River

The Light River is located approximately 600m-700m south of the proposed exploration site (Site A). The Light River was noted in 2016 as a permanently flowing stream in autumn and spring with no rare or sensitive species recorded. Water was noted as saline, clear and enriched with nutrients. Riparian vegetation consisted of native trees over weedy understory of *("Light River Aquatic Ecosystem Condition Reports, Panel Assessment of Creeks and Rivers in the Adelaide and Mount Lofty Ranges NRM Region, Environment Protection Agency")*. There will be no traffic interaction or other activity to the south of the exploration site in the direction of the Light River.

Studies have been carried out as part of the Kapunda project into groundwater-surface water interactions. The following is a summary information taken from Attachment 7 "*Groundwater – surface water connectivity in a chain-of-ponds semiarid river"*. The Light River can be classified as a semiarid river. Semiarid streams and rivers become a series of pools during the dry season with minimal or no surface water flow between them. These pools are refuges for organisms which provide seed populations to recolonise rivers once surface flow resumes during wetter periods. In semiarid rivers, pools can be perennial when they are periodically filled by rainfall runoff or when they receive enough groundwater discharge to balance evaporative losses. The Light River in this region, consists of well-defined pools separated by wet meadows of aquatic plants. The ephemeral stream originating on the exploration area catchment drains into the Light River at Pool 16, with run-off contributing to river flows during storm events. A map showing the study area, the location of the Mine Site and pools along the Light River is shown in Section H – Maps, Figure 22 "Study Area Showing the Location of the Project Area, Ephemeral Stream Line and Pools Along the Light River" and Section H - Maps, Map L "Exploration Area Surface Water Catchment".

The Light River is influenced by surface water flows in the wet season and groundwater flows in the dry season. The baseline water quality of the Light River has been the subject of an extensive monitoring program. This has allowed the project to develop an environmental scorecard to evaluate any potential impact on water quality through surface water or groundwater flows. This water quality monitoring program will be continued for the duration of the exploration program and in anticipation of a future mining application.

Water quality is tested at a number of locations along the river and monitors for the following indicators:

- Electrical Conductivity (EC)
- pH
- Dissolved Oxygen
- Copper (Cu)
- Zinc
- Other nutrients, metals and metalloids

Water quality data will be used to detect any changes in water quality as a result of activities. However, no changes are considered likely with the small-scale exploration activity anticipated in this proposal. However the water quality monitoring program, developed to support a future mining operation, will, identify water quality changes , which will be categorised and into "Minor, 'Moderate' or 'Major' and resulting management actions taken. The scorecard showing the proposed water quality indicators, identified change criteria and proposed management actions is shown in Section H - Maps, Figure 23 "Proposed Water Quality Environmental Scorecard".

Are you likely to impact on the environmentally sensitive area? If yes, detail the likely effects the proposed program may have.	Yes ☐	No ☒

Not applicable to this application.

SECTION D – DESCRIPTION OF PROPOSED EXPLORATION ISR OPERATIONS

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)
Geologist/Hydrogeologist	2	ECR Geologist (1), Groundwater Science Hydrogeologist (1)
Land access/environmental	1	ECR Environmental Scientist (1)
Field assistants/technicians	1	ECR Field Technician (1)
Drilling crew	3	Drilling Crew (3): Driller/Offsider and Fitter
Site preparation and rehabilitation	1	ECR Field Technician (1)
Other (provide details)		N/A

Shifts worked per day	Hours worked per day	Days worked per week
1	07:30am to 18:30pm	6

Equipment type	Owner/operator	Description/capacity	Activity/purpose
Rig	Leon Dickenson Drilling	Track mounted, walk behind rig	Drilling Rig (refer Section G - Photos, Plates 12 and 13)
Small ATV support vehicle	Leon Dickenson Drilling	Support Vehicle	Generator and support equipment (refer Section G - Photos, Plates 12 and 13)
Medium Sized Vehicle with Tandem Trailer	Leon Dickenson Drilling	Land Cruiser with tandem trailer	Equipment supply and maintenance
1 X 4WD Light Vehicle	Leon Dickenson Drilling	Land Cruiser or equivalent	Support Vehicle
2 X 4WD Light Vehicle	ECR	Land Cruiser or equivalent	Support Vehicle
1 x Above ground solid handling system	Leon Dickenson Drilling	Solids handling system	Replaces in ground settling pits
Small Mixing and Distribution Equipment	ECR	Shipping container sized	Preparation and mixing of lixiviant solutions
Bleed Stream Storage Tank	ECR	5000L poly tank or 5 *1000L IBC containers	Storage of excess production solutions
Site Generator	Leon Dickenson Drilling	Diesel generator	Power for mixing and distribution equipment
Reagent Storage Area	ECR	Bunded poly lined	Storage of concentrated lixiviant solutions
Fuel Storage Tank	Leon Dickenson Drilling	Bunded area for 44-gallon storage	Fuel for generator

Provide any additional information, if required.

The infrastructure for the proposed activity covers the Push/Pull Test and will comprise:

- Small mixing and distribution equipment;
- Test well pattern consisting of 4 wells and electrode – section H figure for well layout;
- Bleed stream storage tank;
- Monitoring wells (groundwater wells installed during the recent pump testing will be used to monitor groundwater quality during the Test);
- Site generator;
- Fuel storage tank; and
- Bunded reagent storage area.

Minimal infrastructure is needed for the Site A Test as there will be no on-site office or laboratory.

Drilling solids will be captured in a portable plastic pit surrounding the drill collar, the solids will then be sampled and stored in green plastic bags. The remaining solids will be shovelled out into a trailer for disposal into a larger truck stored off site.
Water and liquid solids will be removed via sludge pump and pumped to a storage tank in the laydown area to be removed and disposed of in a licensed facility.

Detailed description of Exploration ISR operations

Provide information on the proposed operations, including:

- detailed description of each stage involved in the process;
- general description of the planned sequence and timing of test sites/stages (e.g. groundwater pre-treatment, lixiviant test, recovery);
- lixiviants used (acidic or alkali) and the recovery process;
- injection and extraction process used;
- any required initial groundwater flush or groundwater treatment; and

estimated project commencement and completion schedules, including monitoring requirements.

Detail of the completed push/pull operation has been removed for ease of reading of this document*

Scope Overview and Schedule - Electrokinetic in ground test

3 additional wells adjacent to KPFRT06 will be drilled and established, KPFRT06 and the new holes will have electrodes placed within them and a small electric field generated to move copper ions from one electrode to the other through the intervening rock mass. The time taken and amount of copper deposition will be monitored as a result of the experiment. An overview of the project scope and the schedule is presented in Table D1 “Project Scope and Schedule”.

The circuit containing the electrolyte solution, whether NaCl or an alternative such as Na2SO4, is isolated from the outer well through ion exchange membranes and therefore the fluids in this circuit are not in any direct contact with the groundwater environment. The sole purpose of this circuit is to provide near neutral pH conditions for the electrodes that are hosted within this circuit and to prevent rapid degradation of those electrodes. The neutral conditions are achieved by constant mixing of the cathode and anode circuit fluids and by occasional dosing. The electrolyte solution does not contain any metals or other elements that could represent any environmental risks.

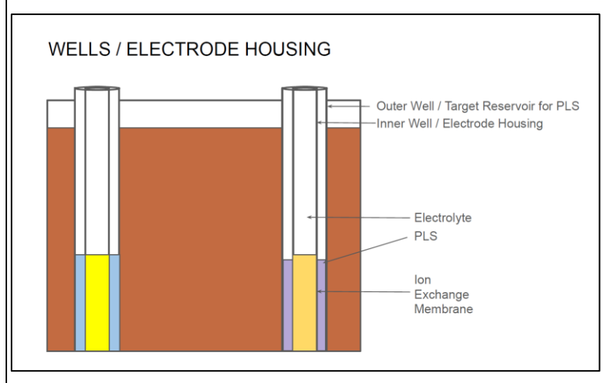


Figure 1: Diagram showing That the NaCl solution circulation within the electrode housing (ie. not circulating NaCl in the aquifer).

The outer well section contains the pregnant liquor solution (PLS) in which dissolved Cu and other cations will accumulate. Fluid extraction from the outer well will be undertaken by pumping it to the above ground infrastructure at regular intervals. Note, that the volumes to be pumped are very small compared to the volumes handled by conventional ISR.

The test will be undertaken in ore sections where fluid movement is effectively absent and conventional, hydraulically driven fluid movement can’t be induced. During the EK-ISR test, solute migration will occur along the voltage gradient that is induced by electrodes of opposite polarity. All positively charged ions, including copper, will move towards the cathode, where they will accumulate in the “outer well” section of an emplaced well. From there, the solution can be pumped to the surface to harvest the copper and no toxic elements will be left behind in the well housing.

Copper movement will be solely from its accumulation in the “outer well” reservoirs surrounding the “inner wells” that house the electrodes. In the ore section selected for the EK test, the movement of copper will solely occur through the electromigration, which is induced by the electric filed that is established between two electrodes of opposite direction. Any migration of ions, including copper, will stop instantly when the electric field is no longer applied.

Table D1: Project Scope and Schedule

Stage	Description	Duration (Days)	Monitoring
Preparation	Well drilling, equipment procurement	14	
Trial set up	Mobilisation to site, installation of equipment	7	
Trial	Electric field applied and effects monitored	6-12 months	Weekly sampling
Trial Completion	The trial is complete when water quality at all bores returns to baseline conditions	21 days post trial	Weekly sampling
Post Test Monitoring	Monitoring post trial changes to groundwater quality.	Up to 3 months	Monthly sampling

Drilling/Wells

Construction is described under the heading "*Drilling, test well construction and operation*". Refer to Section H - Maps, Figure 9 "Push/Pull Test Array" and Figure 32A "Diagram Showing Push-Pull Well Construction"

Drilling activities

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

Drilling is to establish 3 additional test well, 2 contingency wells allowed for.

Tenement	Drilling type	Maximum number of drillholes	Maximum drillhole depth (m)	Maximum number of Tanks required at each site	Maximum size of sumps (length x depth x width) (m^3)	Average size of each drill pad* (m^2) (no excavation required)	Number of sites requiring pad excavation	Average volume (m^3) of material to be excavated (excluding sumps)
EL6191	Rotary Air Blast (RAB) and Rotary Mud	5	40m	3 (5,000L per tank)	N/A (above-ground water tanks)	50	5 (drilling locations only)	0
TOTAL		5	200m	5	N/A	50	5	0
		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.

Drill site preparation

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

Site preparation is to include:

- Access to the sites will be directly from East Terrace, to minimise the length of access track and reduce disturbance to other tracks, trails and drainage networks;
- The site is generally flat, with access track clear of vegetation, due to previous farming activities.
- Surface tracking of vehicles will be the norm with little surface disturbance apart from the preparation of drill pads, which will be cleared of grass and levelled prior to entry of the drilling rig. There will be no ripping or blading of access tracks;
- The use of above-ground tanks is preferred to the digging of sumps. All produced water, drilling fluids and cuttings will be stored in containers/tanks;
- Any surface topsoil excavated for drill pads will be stockpiled for respreading on completion of drilling program;
- There are no camp facilities required for this project;
- ECR has access to a nearby industrial storage and maintenance area. Bulk chemicals, including oils and fuels will be stored here when not in use. All 'hot' work and other maintenance activities will also be carried out at this location. Only operational quantities of fuel e.g. bunded generator and fuel tank will be located on site. Similarly, operational quantities of reagents (lixiviants) will be stored on site, up to a maximum of 5,000L.

Drilling, test well construction and operation

Provide standard design and construction details (including screened intervals) in both text and schematic form where applicable for:

- injection wells;
- extraction wells;
- liquid disposal wells;
- water supply wells;
- observation wells
- compliance (monitoring) wells.

Describe any additional well construction considerations required to ensure that all wells remain inert to the leaching solution.

Describe decommissioning requirements, including 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.

Indicate if water affecting activity permits required for the construction of wells, have been obtained in accordance with the *Landscape South Australia Act 2019*. If not provide a statement confirming that permits/licences will be obtained prior to commencement of operations.

Notes:

- Construction and abandonment requirements for mineral drillholes must be compliant with Mineral exploration drillholes — general specifications for construction and backfilling, Earth Resources Information Sheet M21, available on the DEM Minerals website.
- Water affecting activity permits (well construction permits) must be in place prior to commencement of drilling operations.
- Drilling, construction and decommissioning of any water wells must be in accordance with the General Specification for Well Construction, Modification and Abandonment in South Australia (or any subsequent or related policy), as provided by the relevant authority.

Well Construction

Drilling will be undertaken using rotary air or rotary mud methods and well design is specified to comply with the 'Minimum Construction Requirements for Water Bores in Australia' (National Uniform Drillers Licensing Committee, 2012, Minimum Standards for Water Bore Construction in Australia, Third Edition, 2012).

The proposed well construction design and the ongoing management is compliant with Mineral Exploration Drillholes — General Specifications for Construction and Backfilling, Earth Resources Information Sheet M21.

The inert casing material and grout sealed annulus is also specified to be consistent with guidelines for ISR mining developed for Australia (Commonwealth of Australia (2010) Australia's in situ recovery uranium mining best practice guide), that specifies *"casing and grouting all of the injection, recovery and monitoring wells with materials that are inert to the leaching solution and strong enough to withstand injection pressures as demonstrated by hydraulic pressure tests".*

Basis of Design (BOD) for all operational (Push/Pull, Observation and Monitoring Wells) is as follows:

- Standard well construction:
  - Drill 200mm pilot hole to 3m with stepped blade bit
  - Ream out pilot hole with 280mm stepped blade bit to 1m
  - Position 204mm ID steel conductor casing into pilot hole at 1.2m and use synthetic foam A & B to seal back to surface
  - Position collector tank down wind and fix 125mm PVC delivery pipe from conductor casing to collection tank
  - Trip in 200mm stepped blade bit and 190mm winged reamer bar to bottom of pilot hole and fit seal to top of conductor casing
  - Drill with air to blade refusal or penetration rate becomes too slow
  - Remove seal from top of conductor casing and trip out and remove blade bit
  - Fit down hole rotary hammer and trip rods back to bottom of hole
  - Drill on with high pressure air and rotary hammer to required depth
  - Back team out of hole to ensure hole is clear for casing
  - Run casing string
  - 100mm end cap 100mm PN 12 PVC slotted casing 125mm to 100mm PVC reducer and enough 125 mm PN12 PVC casing to return to surface
  - Fit cone packer 140mm (OD of 125 mm PVC casing) to 200mm 0.5m above screen with large hose clamp
  - Tape 25mm poly pipe tremie line to casing 1m above cone packer ensuring there is sufficient length to return poly pipe back to surface
  - Glue and screw all PVC joints
  - Run casing with casing elevators
  - When casing and screen in correct position pour 10 litres of 6mm gravel down annulus to ensure seal at complete packer
  - Mix cement slurry at 5% bentonite ratio and pump through Tremie line until cement returns to surface
  - Wait 24 hours go cement to cure
  - Remove conductor casing and develop well.

All wells will be constructed to the same design and screened across a consistent ore horizon.

- All casing and screen diameters will be the same.
- All wells will be screened across the same depth interval, nominally between 20 to 30m depth.

Refer Section H - Maps, Figure 32A “Diagram Showing Push-Pull Well Construction” and Figure 32B “Diagram Showing Monitoring Well Construction”.

Wells will be developed (cleaned of drill cuttings and muds) by airlifting until sediment free water is produced. All waste produced through the drilling, construction and well development (wastewater, drilling fluids and cuttings) will be captured and stored onsite until they can be disposed of appropriately.

Quality assurance checks during well construction will comprise:

- Downhole calliper run after screen placement to ensure the screen is accurately placed at the correct depth.

The wells are designed and constructed to remain following the exploration program. Following completion of the drilling, wells will be kept open and fitted with secure lockable steel caps. Any unsatisfactory wells will be grouted from bottom of hole to surface to ensure the integrity of the groundwater system.

Well Permits are applied for.

Test well configuration

Describe in both text and schematic form, the basic configuration of test well patterns and layout (includes injection, extraction and monitoring wells), including:

- infrastructure requirements;
- criteria for and the selection of a fit for purpose monitoring array; and
- design principles that minimise the disturbance and impact on sensitive receptors (e.g. native vegetation, built heritage sites, water courses etc.) and minimises excursions of injected solutions.

Electrokinetics test
KPFRT06 will be utilised due to the naturally increased levels of copper in the ground water. new test wells will be established around 1,3 and 5m away from existing well see section H Map S for proposed layout.

Observation Wells
Two (2) Observation Wells (KPFRT02 and 03) are already in place. These are positioned 5.3 m from the Push/Pull Well along the two main fracture orientations at 55 degrees and 65-80 degrees. These wells will be sampled during the trial to evaluate the movement of lixiviant through the fractures and the changes in lixiviant chemical composition over time. Lixiviant arrival is expected within one day of injection.

Monitoring Wells
Three (3) Monitoring wells (KPMON_01-03) are installed down hydraulic gradient, and in line with the three fracture orientations at the site (Along groundwater flow paths) located 25 m from the test wells.

Leak prevention and detection

Describe the leak prevention and detection system(s) which will enable the operator to promptly and accurately detect and control loss of liquids for all:

- wells; and
- associated connecting infrastructure.

Mixing and distribution equipment, connecting pipework and well heads will be regularly inspected to detect leaks. Daily maintenance and condition inspections will be carried out at the start and end of each working day. Maintenance logs will be kept of the inspections and all leaks and loss of material will be detailed in an incident report. The operational site will also be continuously crewed during the tests, allowing immediate response any leaks or losses.

Spill containment

Describe the spill containment or control system(s) as applicable, including bunding and leak prevention designs, for:

- wells; and
- associated connecting infrastructure.

Mixing and distribution equipment will be housed within a temporary floor bunding solution. Likely constructed from high-density (HD) PVC which has been UV treated. Fuels, lixiviant solutions, liquid wastes and operational quantities of chemicals will be similarly stored within these temporary bunds or on self-bunded pallets. A spill kit will be available on site to contain and collect any small spill events.

Pipework connecting mixing and distribution equipment with well-heads will be made from HDPE. Polyethylene’s toughness, immunity from corrosion, excellent resistance to chemicals and temperature, have contributed to its continued appeal for use in-situ recovery applications. To further control any spills, connecting pipework will have slight swales created into which the pipework will be laid. The swales will also be lined with black polyethylene (LDPE), to act as secondary containment in the event of a spill.

Each operational well-head (injectors and extractors) will have a purpose-built plastic tray placed at its base to contain any leaks or spills. These are commonly used for in-situ recovery wells and are an industry standard.

Liquid waste

Describe the following:

- the types, composition and quantities of liquid waste generated; and
- liquid waste treatment, storage, and disposal methods.

The following is an estimated inventory of the liquid waste likely to be generated during the tests:
Lixiviant/groundwater dilute solution – approximately 15 m^3.
All liquid waste generated will be stored in bunded above-ground tanks. All liquid wastes generated will be transported to an EPA licenced facility for disposal.

Access routes to work areas

Indicate planned access routes on a locality plan and distinguish between existing and proposed new access tracks and drill lines (including fence lines). Prepare and insert Figure.

Will existing tracks require upgrading and/or maintenance? If yes, detail the work required to upgrade/maintain existing tracks.	Yes ☒	No ☐
Perry Road is a heavy vehicle access road which leads directly to the site. All vehicles including heavy vehicles such as drilling rigs will be directed to approach via Perry Road from Kapunda. To access the site from Perry Road, vehicles will make a right turn exiting Perry Road onto East Terrace. Any queuing of traffic required will be carried out on East Terrace before entering the site. The site is accessed by an immediate left turn off East Terrace. All traffic will then enter the site and be inspected prior to entry. Facilities for spraying and cleaning will be established at or close to the site entrance. A one-way traffic flow system will be prepared with the use of bunting which will move vehicles in a clockwise direction around the site to designated locations such as drilling locations and storage for water tanks. The bunting will also designate the perimeter of the trafficable areas. The site is suitable for surface tracking and will not require the preparation of tracks.		
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 ☒	No ☐
Access to the site will be directly off East Terrace with no vegetation clearance required. See Section G – Photos of this application (refer Plates 10 and 11). A diagram showing planned access route on a locality plan is shown in Section H - Maps, Map D “Exploration Operations Site”.		

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.		
Drillers will be accommodated in Kapunda, with other contractors mobilising daily from Adelaide.		
What is the maximum number of personnel requiring accommodation?	3	
Is a campsite required to be established? If no, no further information is required.	Yes ☐	No ☒
Provide a description and justification of the camp location (e.g. previously cleared areas etc.), and any other relevant information.		
N/A		
What will be the total area (ha) of the campsite(s)?	ha	
What will be the total area (ha) of vegetation clearance for the campsite?	ha	
If vegetation clearance is required, describe the methods used to prepare the site.		
N/A		
Will any excavations be required? If yes, describe the purpose of the excavation and the maximum volume (m^3) of material to be excavated.	Yes ☐	No ☐
N/A		
Will the proposed ablution facilities be endorsed/approved for use by the Department of Health or local council, where applicable? If no, provide a reason.	Yes ☒	No ☐
N/A		

Proposed infrastructure (includes caravans, tents, offices, hydrocarbon and water storage requirements etc)	**Quantity**	**Description/capacity**
N/A		

Laydown area details		
Will laydown areas be required? If no, no further information is required.	Yes ☒	No ☐
Will the laydown area(s) be located at the same location as the campsite? N/A as there will be no campsite	Yes ☐	No ☐
What will be the maximum area (ha) required for the laydown area(s)?	1ha	
What will be the total area (ha) of vegetation clearance for the site?	0ha	
If vegetation clearance is required, describe the methods used to prepare the site.		
N/A		
Will any excavations be required? If yes, describe the purpose of the excavation and volume (m^3) of material to be excavated.	Yes ☐	No ☒
N/A		

Proposed infrastructure (includes hydrocarbon and water storage requirements)	**Quantity**	**Description/capacity**
N/A		

Provide a description and justification of the location (e.g. previously cleared areas), and any other relevant information if required.
N/A

Other exploration methods and/or ancillary activities

Are any other proposed exploration methods (e.g. seismic) and/or ancillary exploration activities required? If yes, describe the activity(s), site preparation, vegetation clearance, and safety and maintenance requirements.	Yes ☐	No ☒
Not applicable to this application.		

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 ☒	No ☐
This will be supplied to the site by water tanker. The tanker will be filled at the Light Regional Council standpipe facility in Kapunda.		
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 ☐	No ☒
Not applicable to this application.		

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 ☒	No ☐
The focus of the ISR exploration program will be the installation and testing of water wells. Full details of the work program are given in the section entitled 'Detailed description of exploration ISR operations' of this application. The following summarises the drilling required. A total of three (3) additional wells will be drilled, which will comprise the following. EKTEST01, EKTEST02, EKTEST03, (Three (3) Monitoring Wells KPMON_01, KPMON_02 and KPMON_03 are already in place). Failure Allowance: • Allowance has been made for 2 additional wells, where drilling, completion or operational difficulties are encountered. Water storage on site will be via above ground tanks and water tankers. There will be no requirement for turkey's nests/dam storage.		
Indicate if well permits have been obtained and whether or not a water extraction licence is required in accordance with the NRM Act. 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 ☒	No ☐
three (3) Well Permits have been applied for.		

Water affecting activities

Will any water affecting activities, other than drilling a water well, be undertaken (refer to s. 127 of the NRM Act)? 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 ☐	No ☒

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 ☐	No ☒
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 ☒	No ☐

The Test may require the storage and use of up to 1000 Litres of an NaCl solution The EK-ISR technology does not involve any hydraulically induced fluid movement, i.e., no fluids are injected and no injection testing will take place. The EK-ISR test will be undertaken in an ore section where conventional ISR is not viable due to low or extremely low hydraulic conductivities, hence where fluid injection and/or extraction via pumping is not effective. Solute transport of charged ions such as copper occurs solely through electromigration, but not through advective movement of aqueous solutions.

A NaCl solution is circulated within the electrode housing, which is in contact with above-ground infrastructure, in order to maintain a near-neutral pH, which will extend the life of the employed electrodes. There is a connection between the electrode housing and above-ground test infrastructure (pumps, storage container, etc). However, the electrode housing and the solution that circulates within the housing are separated from the fluids residing in the outer well section through ion exchange membranes.

The site has been disturbed by historic mining activity and may have elevated levels of copper and other contaminants in surface soils. The exploration site (Site A) shows evidence of historic mining activity, including scarring and deposition of mining waste material, including tailings.

Proposed management controls for management of residual historical contamination include:

- Limiting disturbance of soil and material by using current access tracks.
- Limiting earthworks and drill site disturbance.
- Stockpiling and stabilising any topsoil required to be removed to prepare the site.
- All drill cuttings to be removed from site and disposed of to an appropriately licensed facility.
- Stormwater generated on-site from disturbed areas where possible to be contained on site and not released to drainage lines.
- Preferred use of surface tanks rather than construction of drilling sumps to contain produced water and drill muds and cuttings.
- Reinjection or removal from site of all produced water from pump testing activities to avoid soil erosion or release of water to drainage lines.

See Section G – Photos of this application (refer Plates 2 - 5).

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).

Solid Samples

Prior to the commencement of drilling a tarpaulin will be placed beneath the drill rigs cyclone and splitter to help prevent drill cuttings contaminating the surface soil. The drilled sections of the drillholes will produce around 0.1m^3 of cuttings per 1m interval. The drill cuttings will be collected in thick green plastic bags (industry standard) from the drill rig'. These cuttings will be sub sampled to produce a 2-3kg sample for assay. From the remaining 1m sample a small portion will be washed clean for logging and then stored in a plastic "chip tray". A third subsample of approximately 250g in weight will be collected and stored calico bags at ECR's office until closure of the project. Upon closure of the project, ECR will offer the 250g sample to the DEM core library. The green plastic bags containing the drill samples will be transported to ECR storage until the assays have been returned. On return of the assays the drill cuttings that had been stored will be disposed of at an EPA licensed waste disposal operator.

Liquid Samples

Samples of solutions will be taken at defined intervals during the testing process as laid out in Section D "Description of the Proposed ISR Operations". Samples will be stored in plastic bottles and identified by sample number. A sub-set of samples will be taken for laboratory testing to confirm metals concentrations and for testing of analytes identified in the monitoring program.

Rehabilitation Strategies

Detail all activities, strategies and designs relating to the remediation of groundwater, rehabilitation of test wells and associated infrastructure.

Where active groundwater remediation is to be used as a rehabilitation strategy, detail must be provided on the proposed remediation technique to demonstrate how outcomes will ultimately be achieved.

Where natural attenuation and biodegradation of the lixiviant (or any associated by products) is to be relied on for the remediation of aquifers to achieve post exploration groundwater quality outcomes, include:

- a description of the nature and expected rates of the attenuation and biodegradation processes;
- predictions of the rate and full extent of attenuation/biodegradation supported by laboratory tests and modelling;
- a demonstration (including laboratory evidence using host rock samples) that the predicted attenuation and biodegradation can be achieved within expected timeframes;
- a description of how the predicted attenuation/biodegradation will be validated; and
- a contingency plan if attenuation/biodegradation is not demonstrated to be occurring within expected timeframes.

Rehabilitation strategies must ensure that final remediation of surface impacts, infrastructure and groundwater is completed within 3 months after the expiry of the 12-month approval period. In regard to the retention of permitted wells, provide adequate justification as to why they should not be decommissioned.

Rehabilitation Costs

State the estimated budget required to rehabilitate impacted sites.

Estimated costs of rehabilitation for the #1 Construction EPEPR scope of works are $30,000 and will comprise the following:

- Soil loosening and scarifying as required $2,500.
- Reseeding and planting (if required $2,500.)
- Removal pf pipework and gravel. Includes allowance for clean-up of any spillage, with bagging and disposal at licenced facility $5,000.
- Monitoring wells left in place for future monitoring. $0
- Injection/extraction wells recemented and closed. $2,500
- Pumping and disposal of water (as required) for rehabilitation of groundwater to baseline target levels. Allowance only $17,500K

SECTION E – LEASE CONDITIONS (s. 70B(2)(d))

Retention leases

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

Not applicable to this application.

SECTION F – MANAGEMENT OF ENVIRONMENTAL IMPACTS (s. 70B(2) and r. 65(1))

Use the table below (instructions provided) to identify all of the environmental, social and economic potential impact events that are likely to occur as a result of the proposed exploration activities, and how each of the identified impacts will be managed. Identified potential impacts events should be developed based on the proposed operational details and description of the environment and must have corresponding outcomes, measurement criteria and a monitoring plan.

The applicant is required to conduct an impact assessment to identify all of the environmental, social and economic potential 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 level of risk remaining (residual risk) 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.

Assessment of environmental impacts

Identify the actual and/or credible potential impact events associated with the proposed mineral exploration program based on the environment components identified in Section 3 (includes all environmental factors, i.e. social, natural and economic) and proposed exploration activities described.

The impact event analysis should take into account the following:

- Source – the source of the potential impact event which alone, or in combination, has the potential to cause harm to an environmental receptor.
- Pathway – the potential pathway, means or route (with consideration of any natural barriers) by which an identified environmental receptor can be exposed to, or may reasonably be expected to be affected by an identified source.
- Environmental receptor – the environmental receptors that may reasonably be expected to be adversely affected by the source, taking into account considerations for the aspect of the environment (i.e. who or what could be affected).
- Impact likelihood and consequences.
- Description of uncertainty - describe any significant degree of uncertainty pertaining to the evaluation of sources, pathways and environmental receptors, including (but not limited to) lack of site-specific information, limitations on modelling and quality of data. Describe any assumptions connected with the identified uncertainty.

In regard to uncertainty, so far as is relevant, identify the sensitivity to change of any assumption that has been made, including whether a change in assumption may result in a new environmental impact.

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. Describe the source of the potential impact and the potential pathway.
2. For each applicable potential impact (and corresponding receptor), describe control and rehabilitation 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 and rehabilitation strategies address the potential impact (i.e. reduce the risk to an acceptable level). 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. Describe any significant degree of certainty.
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									
Receptor/Source/Pathway 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 measures** Where the risk is not considered low after implementing control and rehabilitation strategies, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level – refer to Minerals Regulatory Guidelines MG22 for more information.	**Risk assessment** LH = likelihood of consequence CQ = severity of consequence			**Uncertainty (UC)** Describe any significant degree of uncertainty	**Outcomes**	**Outcome measurement criteria (Inc. monitoring plan)**
				LH	**CQ**	**Risk**	**UC**		
Stakeholders Receptor: • Freehold landowners • Local Government (Light Regional Council)Local community • Department of Environment & Water (DEW) • Environmental Protection Authority (EPA) Source: • Exploration vehicles and equipment • Exploration drilling activities • Test operations Pathway: • Movement of vehicles (traffic) • Air (noise/light/dust) • Land (leaks/spills) • Views	Interference to: • existing or permissible land use (includes loss of income, noise, dust, light and other emissions). • buildings, structures, existing tracks or other infrastructure. • aesthetic values of an area. Non-compliance with legislative requirements. Exploration activity does not align with existing community values.	**Yes** (Applicable to all programs)	Freehold Landowners: The site is located to the south of the Kapunda Historic Mine (Mine Site), on a privately owned farm property. The owner of the private land has been consulted and informed of ECR's activities. Access agreements and permits have been signed and authorised. ECR is committed to: • giving notice prior to entry onto land and negotiating and executing waivers of exemption where required; • providing a list of names of all ECR and drilling contractor personnel on site; • restrict drilling to a single day-time shift, 7:30am to 6:00pm, Monday to Saturday, with no drilling to be undertaken on Sundays; • appropriately compensating landholders at a rate to reflect the economic loss, hardship and inconvenience resulting from the proposed exploration activities; and • carrying full public liability insurance All wells drilled and not being retained will be finalised and sites rehabilitated in accordance with details in the DEM Information Sheets - M21: Mineral Exploration Drillholes - General Specifications for Construction and Backfilling, and M33: Statement of Environmental Objectives and Environmental Guidelines for Mineral Exploration Activities in South Australia, and honouring any additional commitments as agreed with the landholder. If required, after rehabilitation earthworks are completed, vegetation matter will be spread across the sites to encourage regeneration and reduce visual impact. Following consultation with the landholder, drill sites and access tracks will be re-seeded appropriately. Local Community/Council: There has been sustained consultation with Council and the Kapunda community including opening a local office for ongoing discussions. This will continue throughout the exploration program. Also, as part of the CRC-P, CSIRO Land & Water was commissioned by ECR to undertake a review of community perceptions of potential renewed Copper mining and specifically ISR mining at Kapunda. Focus groups and interviews demonstrated that renewed mining activity would generally align to town existing values provided it was done in a way that maintained town character, included historical	**2**	**B**	**Low**	Significant consultation has taken place and landowner, Council and community issues are well understood.	Stakeholders and community 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 and Local Government (LG) Act.	Any complaints from landowners, Council or the community are recorded, investigated and resolved within a two (2) week period. 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. Conditions of all DEW Well Permits, and Drainage and Discharge Permits were complied with. This will be confirmed be providing a compliance report to DEM following successful completion of the Push Pull Test. Conditions of EPA licence and permits were complied with, by providing a report on the trial to DEM as part of the compliance reporting regime.

Impact assessment									
Receptor/Source/Pathway 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 measures** Where the risk is not considered low after implementing control and rehabilitation strategies, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level – refer to Minerals Regulatory Guidelines MG22 for more information.	**Risk assessment** LH = likelihood of consequence CQ = severity of consequence			**Uncertainty (UC)** Describe any significant degree of uncertainty	**Outcomes**	**Outcome measurement criteria (Inc. monitoring plan)**
				LH	**CQ**	**Risk**	**UC**		
			links to mining, preserved the friendly and relaxed lifestyle that locals value and if it was well regulated. Potential benefits have been identified including modest economic benefits, including increased tourism and sense of renewed pride in the town's mining heritage. Concerns identified included potential noise and dust. Specific concerns related to ISR mining include the use of lixiviants and how activities may affect groundwater. Department of Environment and Water (DEW) and Environmental Protection Authority (EPA). The project requires specific licences to be in place from South Australian government agencies DEW and EPA. These specifically relate to the drilling and use of wells and the storage and use of lixiviants for the purposes and scope as described in this application for a Push Pull Test. The required licenses are as follows: • DEW Permit to undertake a Water Affecting Activity pursuant to section 112 of the Landscape South Australia Act 2019 - Well Permit (Permits 392227 to 392232) • DEW Permit to undertake a Water Affecting Activity pursuant to section 135 of the Natural Resources Management Act 2004 – Drain or Discharge Permit (Permit 336309) • EPA Licensing, pursuant to the Environment Protection Act 1993 and Water Quality Policy 2015 DEW permits have been applied for and approved, and the permit numbers shown above. For activities related to well construction and operation all DEW permit requirements will be complied with the reported against. All potential impacts from drainage and discharge activities have been identified and control measures put in place. See relevant groundwater quality and / or Quantity section below for more detail. An EPA licence has been applied for and granted for exploration activities, including the use of lixiviant (refer Attachment 15). Site Management: ECR has specifically established a Work Health and Safety Management Plan (WHSMP) in accordance with Work Health and Safety Act and Regulations 2010. Site exploration activities will be managed using this WHSMP. A Site Management Plan will be implemented to control access, traffic, and site activities for the exploration program. Drilling and exploration activity methods will be selected to reduce nuisance impacts such as dust and noise.						
Stakeholders Receptor: • Parks & Reserves – State Government, Department of Environment & Water (DEW)	Interference to: • existing or permissible land use • buildings, structures, existing tracks, or other infrastructure • aesthetic values of an area Noncompliance with legislative requirements.	**No** (Applicable to programs located adjacent to or within parks and reserves.)	Not applicable (N/A) to the proposed exploration location as it is not located within or adjacent to a regional reserve or national conservation park.	*N/A*	*N/A*	*N/A*	N/A	N/A	N/A
Native Vegetation Includes Commonwealth and State scheduled species. Receptor: • Native vegetation and habitats Source: • Exploration vehicles and equipment • Access for test operations Pathway: • Movement of vehicles • Land	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.)	The proposed exploration site is on a corner section of cleared agricultural grazing land. The site was previously the subject site for pump test exploration in October 2019. The site is clear of all native vegetation and there is no further clearing of vegetation proposed for this exploration program. Access to the site will be directly from East Terrace/Perry Road and no clearance of native vegetation is required. No clearance is required to access the site. Tracks prepared on the exploration site will be selected under supervision of the private landowner. Signage is to be used to instruct entry/exit to the site and bunting used to delineate accessible areas and no entry areas. This will avoid unnecessary traffic damage to vegetation. Photographs of the site before and after the conduct of the exploration program will be submitted with the annual exploration compliance report.	***1***	***B***	***Low***	The location of native vegetation is well defined.	No permanent loss/modification of native flora and fauna populations and their habitats through: • clearance • fire • other unless prior approval under the relevant legislation is obtained.	Maintain before, during and after photographic evidence of all exploration sites (e.g. drill sites, new track exit/entry points off existing tracks) demonstrating that: • The area and method of disturbance is consistent with that described in the PEPR. • No uncontrolled fires* occurred as a result of exploration activities. Representative photos to be included within the annual exploration compliance report.
Weeds and Plant Pathogens Receptor: • Operational rehabilitated areas • Native vegetation and habitats Source: • Exploration vehicles and equipment Pathway: • Movement of vehicles • Land	Loss/modification of the environment (biological, social, and economic) through the introduction of weeds and pathogens.	**Yes** (Applicable to all programs)	To help prevent the spread of plant pathogens and weeds, ECR will introduce facilities and procedures to wash down vehicles entering sites. Mud will be removed, and tyres will be inspected when arriving at the work site. While on site vehicles will be required to use nominated tracks, and laydown area. Vehicles will also be washed prior to departure or travelling between properties. Vehicle logs will be kept during the exploration program to record that all vehicles are clean and free of plant and mud material prior to entering properties. Land disturbance will be minimised. Inspections will identify any areas of weed infestation on the operational site or rehabilitated areas. Registered herbicides will be used to control infestations as required. Weed monitoring around the exploration location is to continue for the duration of the 12-month exploration program and for 3 months following completion of the program while rehabilitation activities are taking place, to ensure there are no weed impacts on surrounding native habitat. Any replaced topsoil is to be reseeded with native grasses endemic to the immediate vicinity. Photographs of the site before and after the conduct of the exploration program will be submitted with the annual exploration compliance report to demonstrate rehabilitated sites have no new weeds.	***2***	***B***	***Low***	The presence of weeds on site is understood. The presence of weed species and abundance may change with seasons i.e. dry and wet periods.	No introduction of new species of weeds and plant pathogens, nor increase in abundance of existing weeds species.	Provide a statement within the 'Compliance with Approved Programs' section of the annual exploration compliance report, confirming that: • 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† within the tenement areas, unless otherwise agreed to with the relevant landowners. • 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.
Native Fauna Injured or Killed Receptor: • Rare and endangered fauna Source: • Entrapment • Collision with machinery Pathway: • Movement of vehicles • Construction of sumps and excavations	Potential for rare and endangered native fauna to be injured or killed by vehicles or machinery. Entrapment of fauna through open drillholes and excavations.	**Yes** (Applicable to exploration programs that involve drilling and/or require excavations)	The use of surface tanks for water and drilling fluids is preferred to the use of sumps for this exploration program. This will deter birds and remove the risks of fauna entrapment. All bores will be capped/plugged immediately upon completion. This will reduce risks of fauna entrapment. All vehicles and equipment must comply with traffic management plan that will include a speed limit. This will reduce the risks of vehicle collision. No drilling is to take place on catastrophic fire ban days and no work that may create sparks is to take place on fire ban days. This will reduce risks to fauna resulting from vehicle and equipment related fires. Operation will be on single shift consisting of 6 days a week (Mon to Sat) from 7.30am to 6.00pm. There will be no exploration operations during night time hours. This will reduce the risks to fauna raised by night time operations.	***1***	***A***	***Low***	The sites(s) are not considered to provide high value habitat for rare and endangered fauna species.	No fauna traps created as a result of exploration activities.	Maintain before, during and after recorded and photographic evidence that: • All drillholes were permanently or temporarily capped/plugged immediately upon completion. • No fauna and livestock became trapped in drillholes and/or excavations throughout the duration of the program. • 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. • No vehicle collisions occurred involving native fauna. • No fires were reported on site. Representative photos are to be included within the annual exploration compliance report. Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report.

Impact assessment								Outcomes	Outcome measurement criteria (Inc. monitoring plan)
Receptor/Source/Pathway 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 measures** Where the risk is not considered low after implementing control and rehabilitation strategies, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level – refer to Minerals Regulatory Guidelines MG22 for more information.	**Risk assessment** LH = likelihood of consequence CQ = severity of consequence			**Uncertainty (UC)** Describe any significant degree of uncertainty		
				LH	**CQ**	**Risk**	**UC**		
Aboriginal Heritage Sites Receptor: • Aboriginal heritage object and/or site Source: • Exploration vehicles and equipment Pathway: • Exploration drilling activity • Earthworks • Movement of vehicles	Disturbance to Aboriginal heritage	**Yes** (Applicable to all programs)	The Register of Aboriginal Sites and Objects, administered by the Department of Premier and Cabinet, has advised by letter to Exploration License Holders Terramin on the 22nd of February 2018 that there is no record of Aboriginal sites in the area. There is a very low probability of discovery of Aboriginal sites and artefacts due to the site's history of agricultural and mining land disturbance. If Aboriginal heritage sites or artefacts are identified during the exploration program this will result in cessation of works and the site/artifact(s) will be reported to authorities. Work will only recommence once approval from relevant authorities is sought and confirmed.	*1*	*B*	*Low*	Whilst there is an absence of reported Aboriginal items within proximity to the site(s), it is possible that artefacts, objects or remains could exist that are not currently known about.	No disturbance to Aboriginal artefacts or sites of significance unless prior approval under the relevant legislation is obtained.	Maintain a database and provide a statement within the 'Compliance with Approved Programs' section of the annual exploration compliance report demonstrating that: • Aboriginal Heritage sites/artifacts were not impacted during the conduct of the exploration program unless prior approval was obtained under the appropriate legislation. • Work ceased on discovery of a significant site/artifact and recommenced only after authorisation. • Aboriginal heritage sites/artifacts identified during the exploration program were appropriately recorded and reported to authorities, if not previously known.
European Heritage Sites and Sites of Scientific and Environmental Significance Receptor: • Heritage object and/or site Source: • Exploration vehicles and equipment Pathway: • Exploration drilling activity • Earthworks • Movement of vehicles	Disturbance to European heritage sites and sites of scientific and environmental significance (e.g. geological monuments, fossil reserves).	**Yes** (Applicable to exploration programs located close to or within European heritage sites and sites of scientific and environmental significance)	The site (Site A) is south of the boundaries of the Kapunda Mine Historic Site, which is listed in the State Heritage Register (State Heritage Place No. 11535). Site A is not withing the Historic Mine Site. Drilling equipment will access the exploration site (Site A) via heavy vehicle public roads (Perry Road and East Terrace) and will not access the Historic Mine Site. There is a very low probability of discovery of European heritage sites and artefacts due to the site's history of agricultural land disturbance. Should any artefacts of potential heritage significance be identified, excavation works will stop in that well location and the find will be communicated to the consultant archaeologist (Australian Heritage Services (AHS). The consultant archaeologist will determine an appropriate path forward, in consultation with Heritage SA / the SA Heritage Council, as appropriate. Should a historic structure be identified, the location of the well site may need to be moved to avoid any further disturbance of significant artefacts.	*1*	*B*	*Low*	Whilst there is an absence of reported heritage items within proximity to the site(s), it is possible that artefacts, objects or remains could exist that are not currently known about.	No disturbance to European heritage sites and to sites of scientific and environmental significance unless prior approval under the relevant legislation is obtained.	Demonstrate no impact to heritage sites and sites of scientific and environmental significance through: • 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. • Providing a statement within the annual exploration compliance report confirming sites were not impacted during the conduct of the exploration program.
Soil/Vegetation/Fauna - Contamination Receptor: • Soils • Native flora and fauna • Ephemeral stream Source: • Exploration chemicals, test solutions and wastes Pathway: • Spill and leaks of chemicals, solutions and waste material.	Soil/vegetation contamination (e.g. hydrocarbons, rubbish, drill samples/cuttings, ablutions, other sources). Groundwater and lixiviant expression at surface.	**Yes** (Applicable to all programs)	All chemicals will be stored and handled on site according to The Dangerous Goods Act and Dangerous Substances Regulations. Mixing and distribution equipment will be housed within a floor bunding solution, constructed from high-density (HD) PVC which has been UV treated. Fuels, lixiviant solutions, liquid wastes and operational quantities of chemicals will be similarly stored within the bunds or self-bunded pallets. A spill kit will be available on site to contain and collect any small spill events. Regular inspections will be carried out of storage areas to ensure integrity and cleanliness. Pipework connecting mixing and distribution equipment with well-heads will be made from HDPE. Polyethylene's toughness, immunity from corrosion, excellent resistance to chemicals and temperature, have contributed to its continued appeal for use in-situ recovery applications. To further control any spills, connecting pipework will have slight swales created into which the pipework will be laid. The swales will also be lined with black polyethylene (LDPE), to act as secondary containment in the event of a spill. Storage of liquid solutions, mixing and distribution equipment, connecting pipework and well heads will be regularly inspected to detect leaks. Daily maintenance and condition inspections will be carried out at the start and end of each working day. Maintenance logs will be kept of the inspections and all leaks and loss of material will be detailed in an incident report. The operational site will also be continuously crewed during the tests, allowing immediate response any leaks or losses. No pressurised air drilling will be undertaken within 100m of the trial site until active rehabilitation is complete. Water extracted during drilling and testing will either be carted offsite for disposal or re-injected into the bore to prevent artificial wetting of native vegetation and prevent surface soil erosion. Drill fluids and cuttings will be removed from site. All domestic or industrial waste (includes general rubbish and hydrocarbons) will be disposed of in accordance with the Environment Protection Act 1993 within 3 months of the expiry of the PEPR approval. The following hydrocarbon management measures will be implemented: • Prior to the commencement of drilling a review of drilling machinery and equipment will be undertaken during which hydraulic hoses and fittings will be inspected for serviceability. • Spill mats will be carried in the event a leak does occur. • In the case of soil being contaminated by hydrocarbons, the affected soil will be bagged and taken to an EPA licensed waste disposal facility immediately. The area from where the soil was removed will be rehabilitated. The following waste management measures will be implemented: • During drilling all rubbish will be deposited in secured bins and removed from drill sites at the completion of each hole. • All rubbish removed from the drill sites will be bagged and disposed to an EPA licensed waste disposal facility. • All drill cuttings generated will be removed from site and disposed of at a licensed facility. Water extracted during drilling and testing may either be carted offsite for disposal or re-injected into the bore to prevent artificial wetting of native vegetation and prevent surface soil erosion. Drill fluids and cuttings will be removed from site to an appropriately licenced disposal facility.	*2*	*B*	*Low*	Chemicals, solutions and associated waste will be present on site. Quantities are known and not likely to change.	No contamination of soil, vegetation or surface water as a result of exploration activities. Groundwater and lixiviant will not express on the surface.	Records for the exploration program demonstrate that all domestic or industrial waste (includes general rubbish and hydrocarbons) is disposed of in accordance with the *Environment Protection Act 1993* 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: • The name, location, and contact details of the authorised waste disposal facility. • 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. • Photographic evidence within the annual exploration compliance report demonstrating that all fuel and chemical storage facilities were managed in accordance with EPA requirements (refer Section H - Maps, Map M "Chemical Storage Location with Respect to Drill Dite"). Maintain photographs of all exploration sites and provide representative photos within the annual exploration compliance report demonstrating that drill cuttings are: • Removed from site and disposed of at a licensed facility. Records for the exploration program demonstrate that any spillage or leak of material has been reported and rehabilitation measures taken. Records for the exploration program demonstrate maintenance and condition logs are kept. Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report. Any potential expression to surface detected of groundwater, within 100m of the injection bore to the surface will be recorded and subsequent reductions in injection to stop expressions will be recorded. This information will be reported to DEM.
Soil Profile and Erosion Receptor: • Land • Ephemeral stream/stormwater drainage line Source: • Earthworks Pathway: • Soil excavation • Run-off during rainfall events	Disturbance to the soil profile and topography, and accelerated soil erosion caused by exploration activities (e.g. construction of sumps, new tracks, and drill pads; ground compaction at laydown areas and camps).	**Yes** (Applicable to all programs)	All drill site activities will be carried out in compliance with guidelines (DEM Information Sheets - M21: Mineral Exploration Drillholes - General Specifications for Construction and Backfilling, and M33: Statement of Environmental Objectives and Environmental Guidelines for Mineral Exploration Activities in South Australia). Access tracks are not expected to require the disturbance of topsoil, drill site work areas may require the pads to be prepared but disturbance will be kept to a practical minimum. In areas where clearing is required, topsoil will be scraped to a depth of 0.4m and stored on site to avoid mixing as per Regulatory Guideline M21. Pipework connecting mixing and distribution equipment with well-heads, will require swales to be excavated as a secondary containment measure. The degree of disturbance will be kept to a minimum, with the principle of maximum depth at 0.4m, also applying to swale construction. Following completion of the drilling and testing program, and in consultation with the landowner, the site will be rehabilitated. Any compacted areas on site will be prepared to loosen the soil and	*2*	*B*	*Low*	The scale of excavation is understood. Quantities are known and not likely to change.	Where soil disturbance occurs as a result of exploration activities, ensure that: • Topsoil quality and quantity are maintained. • The soil profile and topography are reinstated to original conditions. • There is no accelerated soil erosion.	Records are kept of before, during and after photographic evidence of all excavations, drill sites, camps, laydown areas and new tracks demonstrating that: • 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. • 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. • There are no signs of accelerated soil erosion during and post rehabilitation of disturbed sites and surface water and erosion protection devices are preventing the release of contaminated waters leaving the site. Representative photos to be included within the annual exploration compliance report.

Impact assessment								Outcomes	Outcome measurement criteria (Inc. monitoring plan)
Receptor/Source/Pathway 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 measures** Where the risk is not considered low after implementing control and rehabilitation strategies, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level – refer to Minerals Regulatory Guidelines MG22 for more information.	**Risk assessment** LH = likelihood of consequence CQ = severity of consequence			**Uncertainty (UC)** Describe any significant degree of uncertainty		
				LH	**CQ**	**Risk**	**UC**		
			vegetation will be respread to encourage regeneration. Where vegetation is not available the areas will be reseeded. The exploration sites show evidence of historic mining activity, including scarring and deposition of mining waste material. Environmental reports from the area related to historic operations indicate this material may contain elevated levels of copper and other contaminants. Proposed management controls for this historical residual contamination include: • Limiting disturbance of soil and material by using current access tracks; • Limiting earthworks and drill site disturbance; • Stockpiling and stabilising any topsoil required to be removed to prepare the site • All drill cuttings to be removed from site and disposed of to an appropriately licensed facility; • Stormwater generated on-site from disturbed areas where possible to be contained on site and not released to drainage lines; • Preferred use of surface tanks rather than excavation of drilling sumps to contain produced water and drill muds and cuttings; and Reinjection or removal from site of all produced water from pump testing activities to avoid soil erosion or release of water to drainage lines. Photographs of the sites before and after the conduct of the exploration program will be submitted with the annual exploration compliance report. All disturbed topsoil will be stored on site and used for rehabilitation post-exploration. The topsoil will be reseeded with grass from the grazing land to quickly restabilise the area.						Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report.
Surface Water Flow Receptor: • Ephemeral stream/stormwater drainage line and downstream users (including Light River) Source: • Access and site preparation/crossing of drainage lines Pathway: • Reduce/impede stormwater flow	Alteration to surface hydrology – interference to surface drainage.	**Yes** (Applicable to exploration programs that are likely to impact on surface drainage channels)	The work program has been designed to minimise any requirement for surface-work or access to drill sites that could potentially interfere with surface drainage lines in the area surrounding the exploration sites. There will be no requirement to cross or modify drainage lines. All areas of earthworks or surface disturbance will have temporary sediment control fencing installed down slope to reduce or eliminate any sediment travel into drainage lines during heavy rainfall events. All water, including groundwater generated on site during the exploration program will either be removed from site or re-injected into the bore and will not be released to surface water drainage lines.	***2***	***B***	***Low***	Stormwater flow in defined ephemeral stream/drainage lines around the exploration sites well understood. Flow rates will vary with season.	No permanent modification to hydrological features caused by exploration activities without obtaining a water affecting permit from the relevant Natural Resource Management Board. No decrease the quantity of surface water available to water dependent ecosystems (including permanent pools) on or off the land as a result of activities.	Records of inspection are to record rainfall events and demonstrate review and maintenance of drainage line crossings to ensure stormwater flow is not impeded. Rainfall data will be collected from the BOM station located in Kapunda, to provide accurate local data. Provide before, during and after photographic evidence within the annual exploration compliance report demonstrating that original drainage contours (watercourses) 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).
Groundwater Quantity Receptor: • Groundwater users (Mantina Quarry) • Groundwater Dependant Ecosystems (GDE's) – Light River Source: • Operations: addition and abstraction of lixiviant solutions and groundwater Pathway: Groundwater movement	Reduction in water quantity available for other users; Mantina Quarry water supply bores, and ecosystems i.e. permanent pools of Light River.	**No**	The trial may use up to 1000l of NaCl solution There is no possibility of impact on the Light River, and there are no other users within 200m.	***1***	***B***	***Low***	No Uncertainty. The volumes of water to be pumped and the duration are insignificant from a water resource perspective.	No reduction of water availability to other users	None

Groundwater Quality Receptor: • Groundwater users (Mantina Quarry) • Groundwater Dependant Ecosystems (GDE's) – Light River Source: • Operations: addition and abstraction of lixiviant solutions Pathway: • Groundwater movement	Contamination of aquifer from lixiviant and mobilised metals impacting other users including ecosystems (i.e. permanent pools of Light River)	**Yes**	**Well Array Fit For Purpose** The well array will be installed such that all wells are located along the orientation of fracturing. Well location and fracture orientation will be verified by optical scanner fracture logs obtained from each well. **Operational (Lixiviant) Management** Baseline groundwater conditions for all wells has been determined during an initial pre-trial water quality monitoring program. Note as of June 2023 this has been successfully completed. Reference Baseline Sampling Section above and GMMP (Version FR004A, June 2023). For activities related to well injection testing all appropriate permits and licences will be gained and complied with. Bore Permits, Drainage Permits and EPA Licenses.	**2**	**B**	***Low***	Baseline groundwater quality is well defined. Groundwater flow direction is well understood Site specific fracture orientation is well defined by downhole logs.	No adverse impact to the quality of groundwater available to other users and water dependent ecosystems i.e. Light River, as a result of exploration activities. No adverse impact to the beneficial use category of groundwater because of exploration activities outside the recovery zone. The above will be achieved by maintaining lixiviant within the 100m radius trial area during operations and by rehabilitation of groundwater to baseline conditions at the end of the trial.	Outcome Measurement Criteria Comprise: Rehabilitation of the Trial area demonstrated by return of groundwater quality to baseline conditions. Specifically, no significant change to baseline groundwater quality as derived from statistical evaluation. Refer Section Baseline Groundwater Sampling above and GMMP (Version FR004A, June 2023) for statistical approach. Details of monitoring and management approach are found in Section D – Baseline Groundwater Sampling and Groundwater Monitoring, of this document and full detailed reference is available in Groundwater Monitoring & Management Plan (GMMP (Version FR004A, June 2023) (refer Attachment 21).
Groundwater Surface Discharge Receptor: • Native flora and fauna • Soil Source: • Groundwater Pathway: • Groundwater well overflow	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)	There is no injection pressure applied Drill sites and above ground tanks and equipment will be sited away from trees and vegetation where possible. Proposed drilling methods are Rotary Air Blast (RAB) Drill tanks preferred over the use of sumps. Tanks will only overflow if they are over filled. Tanks will be continuously monitored to avoid overflow.	**1**	**B**	**Low**	Volumes and the potential for spillage from wells and tanks is well understood. Chemicals, solutions and associated waste will be present on site. Quantities are known and not likely to change.	No discharge of groundwater outside of the exploration site (e.g., drill site) into the surrounding environment and no discharge of water into a watercourse, unless prior approval under the relevant legislation is obtained.	Maintain photographic evidence of all drill sites 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. Representative photos and water affecting activity permits (where applicable) to be included within the annual exploration compliance report.
Soil/Vegetation/Fauna – Degradation of Rehabilitated Access Tracks Receptor: • Operational rehabilitated areas • Native flora, fauna and habitats Source: • Exploration vehicles and equipment. • Third party vehicles Pathway: • Movement of vehicles • Land	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)	The site is located on fenced freehold land and only accessible to the owner and ECR. ECR will monitor entry and access to the sites during the 12-month exploration program and during a further 3-month rehabilitation period. As the wells will be maintained for future use, fencing and access track maintenance and control will continue beyond the exploration period. Photographs of the sites before and after the conduct of the exploration program will be submitted with the annual exploration compliance report.	**1**	**A**	**Low**	The requirement for rehabilitation of access tracks is fully understood. Access to the site and vehicle movements is strictly controlled.	Rehabilitated access tracks remain permanently closed unless prior approval under the relevant legislation is obtained.	Maintain before and after photographic evidence demonstrating that all tracks are in good condition and are being maintained for future use. Provide the information requested within the 'Rehabilitation' section of the annual exploration compliance report. Where access tracks have been rehabilitated and closed, maintain photographic evidence and submit for inclusion within the annual exploration compliance report.

Community/Landowners
Receptor:
• Land and buildings
• Infrastructure
• Flora, fauna and habitats
Source:
• Exploration vehicles and equipment
• Exploration drilling activities
• Test operations
Pathway:
• Vehicle movement
• Vegetation
• Spillage of fuel and chemicals.
	Damage to infrastructure and loss of income through fire.	**Yes**
		(Applicable to all programs)
			The following fire-prevention procedure (see below) will be implemented by ECR on the drill sites, dry pasture grass and stubble will be removed from sites where these present a fire risk.
			
			Fire prevention requirements are:
			• Availability of a long-handled shovel and rake.
			• Availability of at least one 20L backpack fire-fighting unit.
			• Availability of at least one 9L water-based fire extinguisher.
			• Natural grass fire load is cleared for at least 5m around the drilling rig.
			• Communications equipment (mobile telephones / two-way radio) to be present at the site always.
			• Immediately call '000' on the outbreak of fire.
			• If grinding and/or welding is to be carried out the equipment that needs repairing will be moved to a site (e.g. bit sharpening and repairs) that meets the following requirements:
			  ○ An area of 10m around the cutting, welding or grinding site clear of flammable material, or maintained in a wetted down state for the duration of the activity.
			  ○ Screens erected around each cutting, welding or grinding site to prevent the escape of sparks.
			  ○ On-site trailer or vehicle mounted firefighting unit with minimum 1000L water tank, powered pump, 30m of hose.
			  ○ The hose is to be deployed.
			  ○ One or more persons whose sole job is to act as "Fire Spotter".
			  ○ Notify the appropriate SACFS Regional HQ of work location on a day of Total Fire Ban.
			
			ECR and the drilling contractor acknowledge that, if a fire is started, even if all the conditions of the permit have been followed, the person who lit the fire is still accountable.
				2	**B**	**Low**	The potential impacts to third-party property are well understood based on observations and monitoring from previous and current exploration activity.	No loss of infrastructure or income through fire as a result of exploration activities.	Provide a statement within the 'Compliance with Approved Programs' section of the annual exploration compliance report confirming that no uncontrolled fires* occurred.
									
									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.

General Public – Health & Safety Receptor: • Member of the public Source: • Exploration vehicles and equipment • Exploration drilling activities • Test operations Pathway: • Movement of vehicles (traffic) • Unauthorised public access to exploration area	Injury or death to members of the public as a result of exploration activities.	**Yes** (Applicable to all programs)	The following procedures will apply to prevent accidents and injury to members of the public: • Gates to work sites will be closed and "Authorised Entry Only" signage erected; • Signage warning of drilling in progress and required PPE to be placed along access tracks; • Requirement of site induction of all visitors prior to entering work sites; • Active drilling will stop when unannounced public are on site; • Vehicles to be cleaned prior to entering the road to prevent drag out of material onto the roadway; • Spotter required for heavy vehicles entering the road; • A Traffic Management Plan is to be put in place for drill rig entering or exiting the property access gate on Perry road via access gate; and • No drilling at night restricts the use of flood lights that might dazzle/distract drivers.	**2**	**B**	**Low**	Exploration activities are high regulated. Health and safety management systems govern the exploration operation. Fencing and access control will be implemented for exploration sites.	No accidents involving the public that could have been reasonably prevented.	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. If an accident involving the public did occur, provide a copy of the independent investigation report with the annual exploration compliance report demonstrating that the licensee could not have reasonably prevented the accident through the implementation of precautionary measures.
General public, employees, contractors and the environment Receptor: • N/A Source: • N/A Pathway: • N/A	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.)	This potential impact does not apply to the exploration program. N/A	N/A	N/A	N/A	N/A	N/A	N/A

* 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 – PHOTOS

Include photographs in this section:

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

To insert photos, copy and paste the photo into the template below. Resize photos to fit page width. Ensure that all information about each photo is completed and refer to the photo number in the relevant section of the PEPR.

Site identification/details	Date taken	Photo number and PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Comments
Site, East Terrace, Kapunda	02/11/18	Plate 1	308589	6196746	54 H	Diagram Showing Photo Position & View Directions

Site identification/details	Date taken	Photo number and PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Comments
Site, East Terrace, Kapunda	02/11/18	Plate 3	308589	6196746	54 H	View of Site Looking East

Site identification/details	Date taken	Photo number and PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Comments
Site, East Terrace, Kapunda	02/11/18	Plate 4	308589	6196746	54 H	View of Site Looking South East

Plate 12: Image showing Leon Dickenson Drilling Equipment Suitable for Proposed Terrain

Plate 13: Image showing Leon Dickenson Drilling Equipment Suitable for Proposed Terrain (2)

SECTION H – MAPS

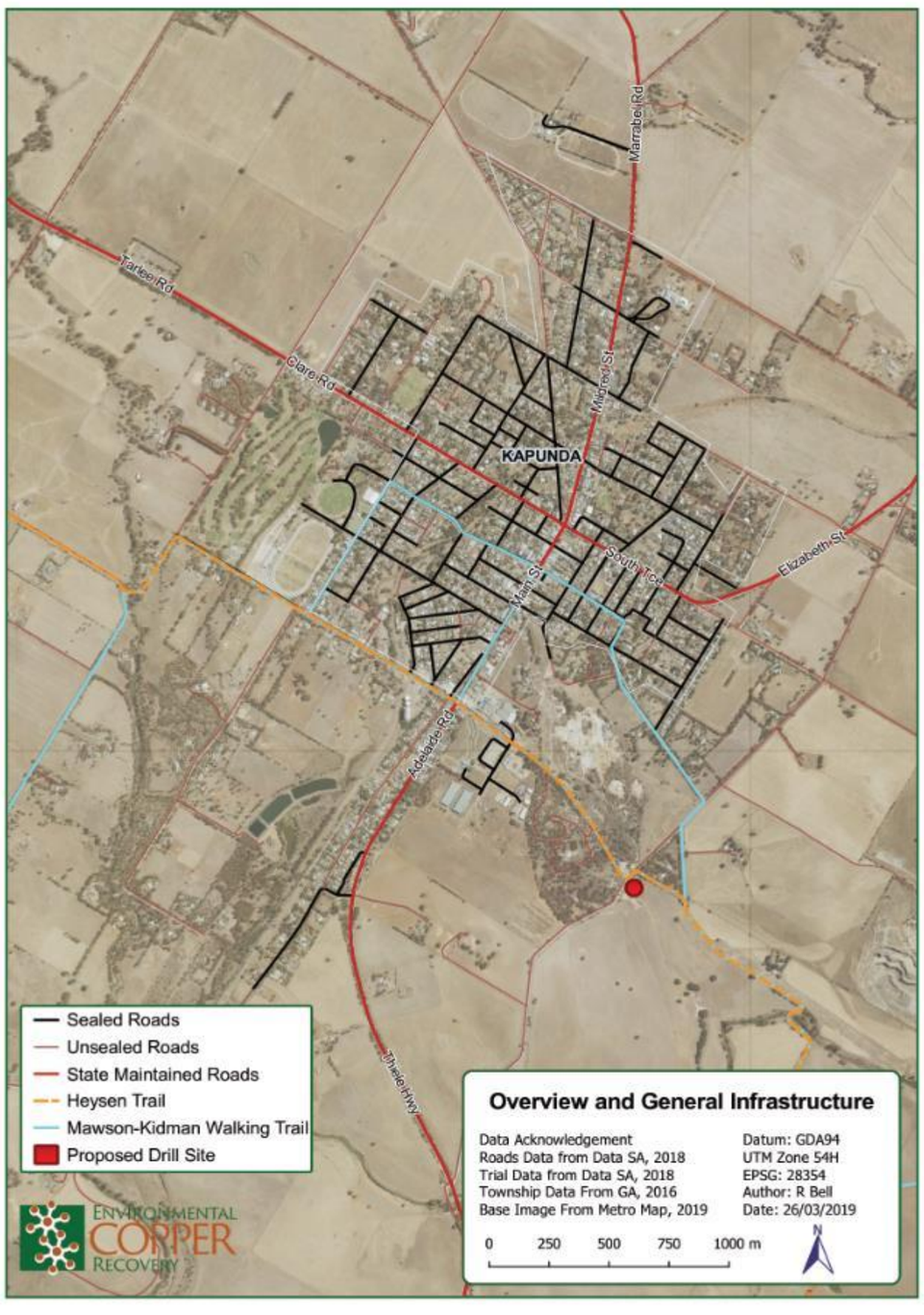
Provide a map(s) showing the following information, where applicable:

- tenement boundaries,
- location of existing ephemeral and permanent rivers, creeks, swamps, streams or watercourses, and water management structures,
- location of towns, existing roads, rails, fences, transmission lines, buildings, dams and pipelines,
- location and extent of any environmentally sensitive areas located within the tenement boundaries,
- any relevant land use types (e.g. parks and reserves, Aboriginal land, Woomera Prohibited Area).

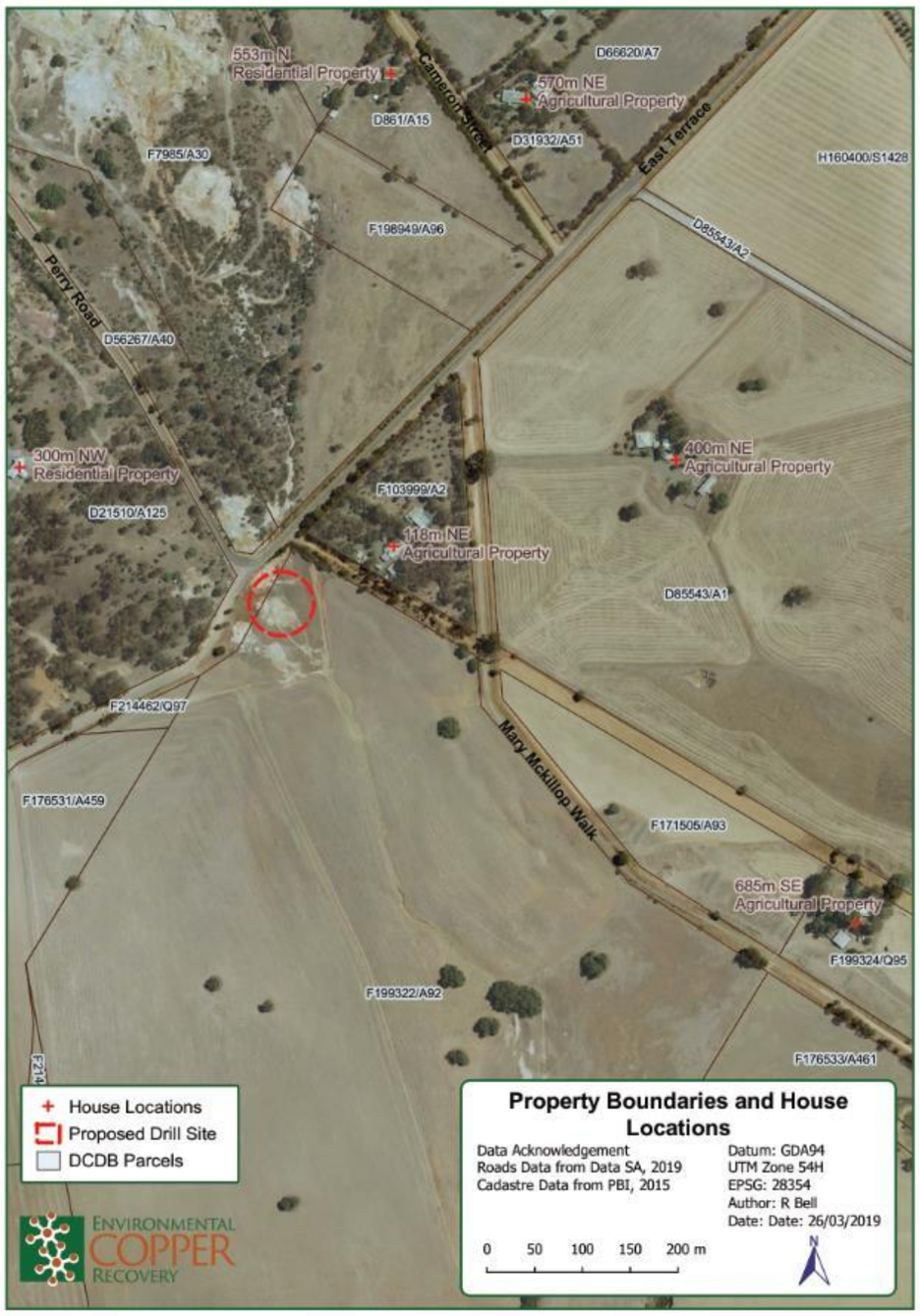
All maps and sections must conform to the following standards:

- state the relevant datum (e.g. GDA2020, GDA94, WGS84);
- use metric units;
- include a title, north arrow, scale bar, text and legend;
- state the date prepared and author;
- be of appropriate resolution and scale to show the represented information.

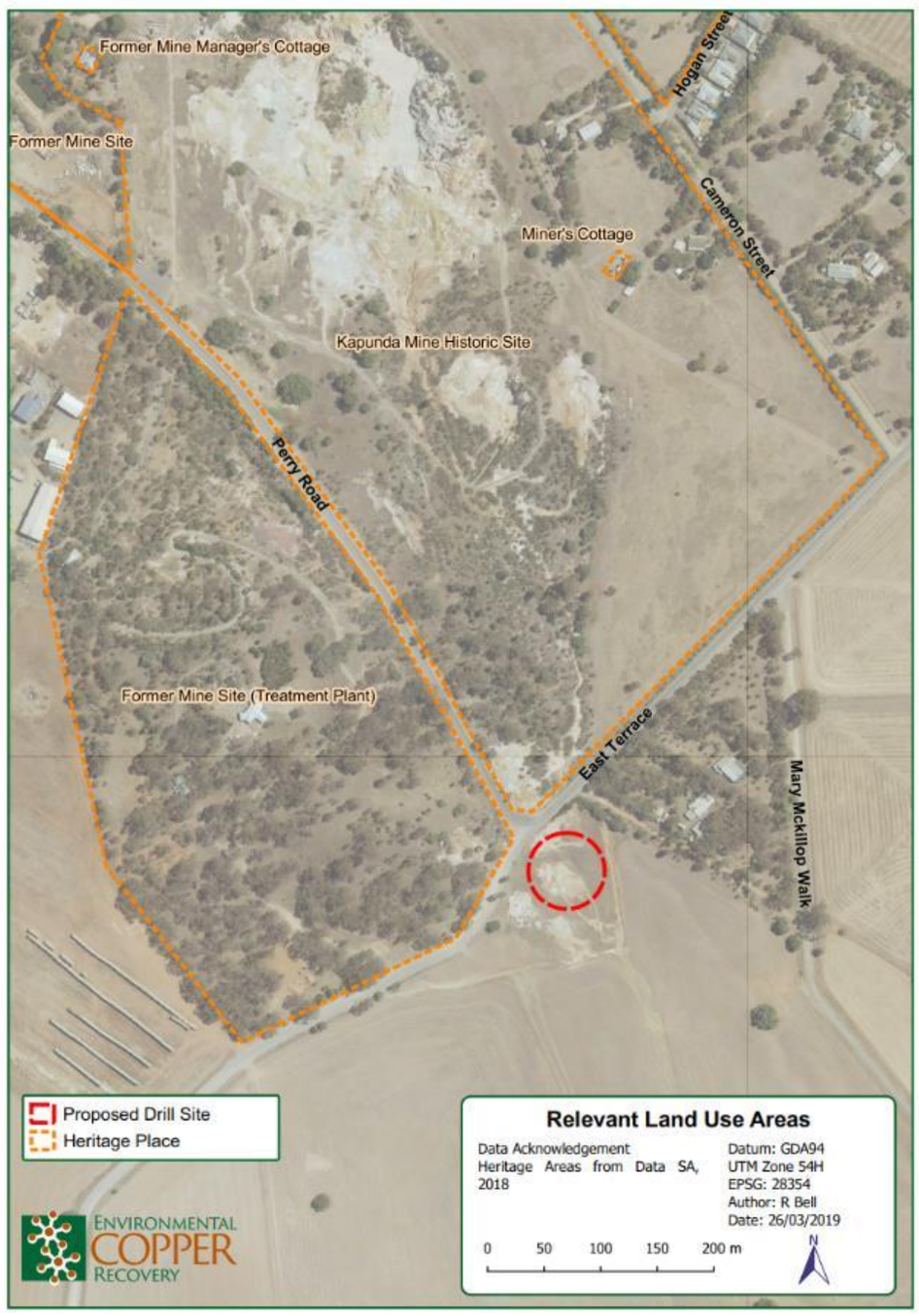
Ensure maps provided in this section are **NOT** commercially sensitive or confidential. All maps and sections must conform to the standards outlined in the determination for exploration PEPRs (Ministerial Determination 013).



Map A: Proposed Exploration Site and General Infrastructure

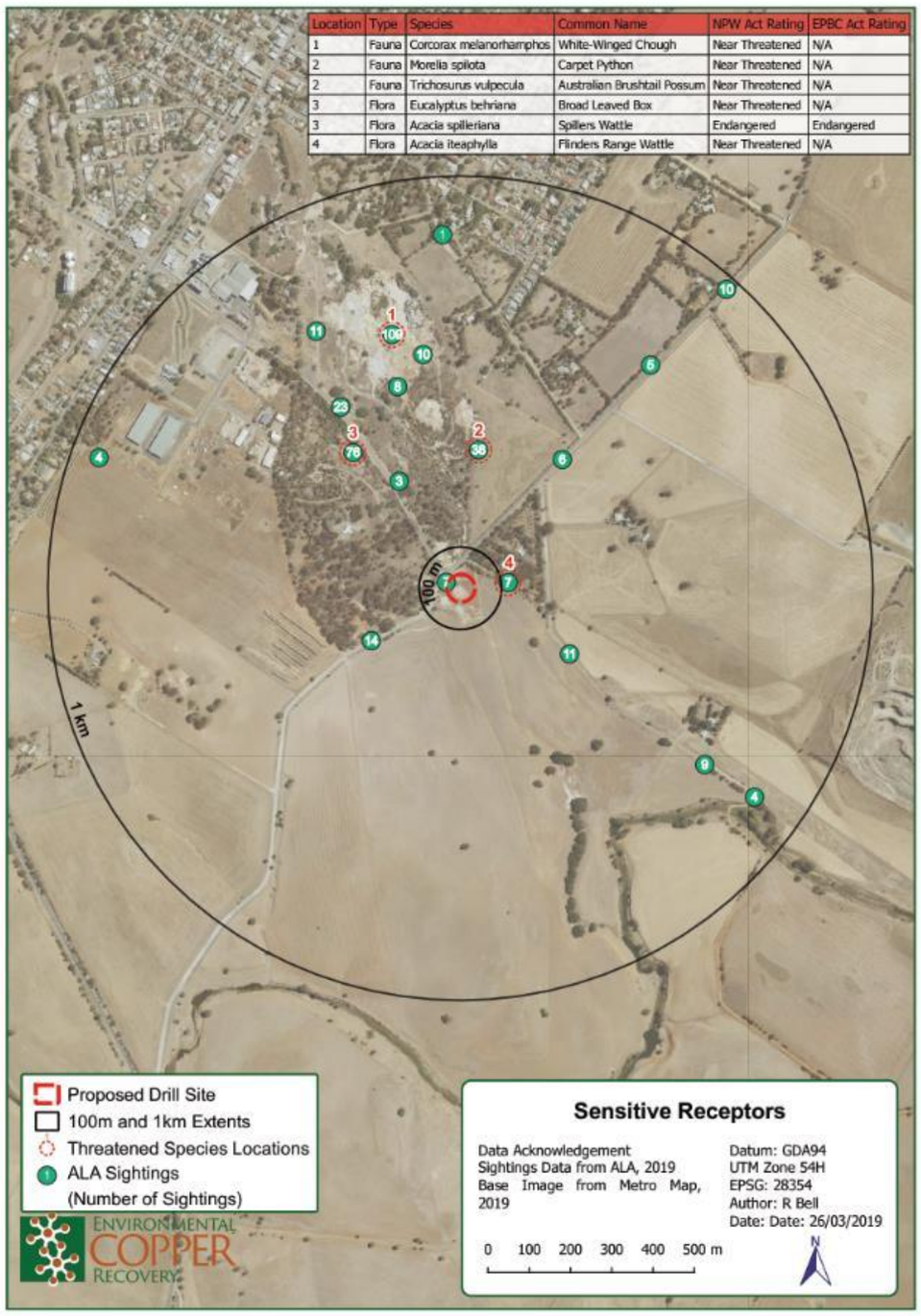


Map B: Property Boundaries and House Locations

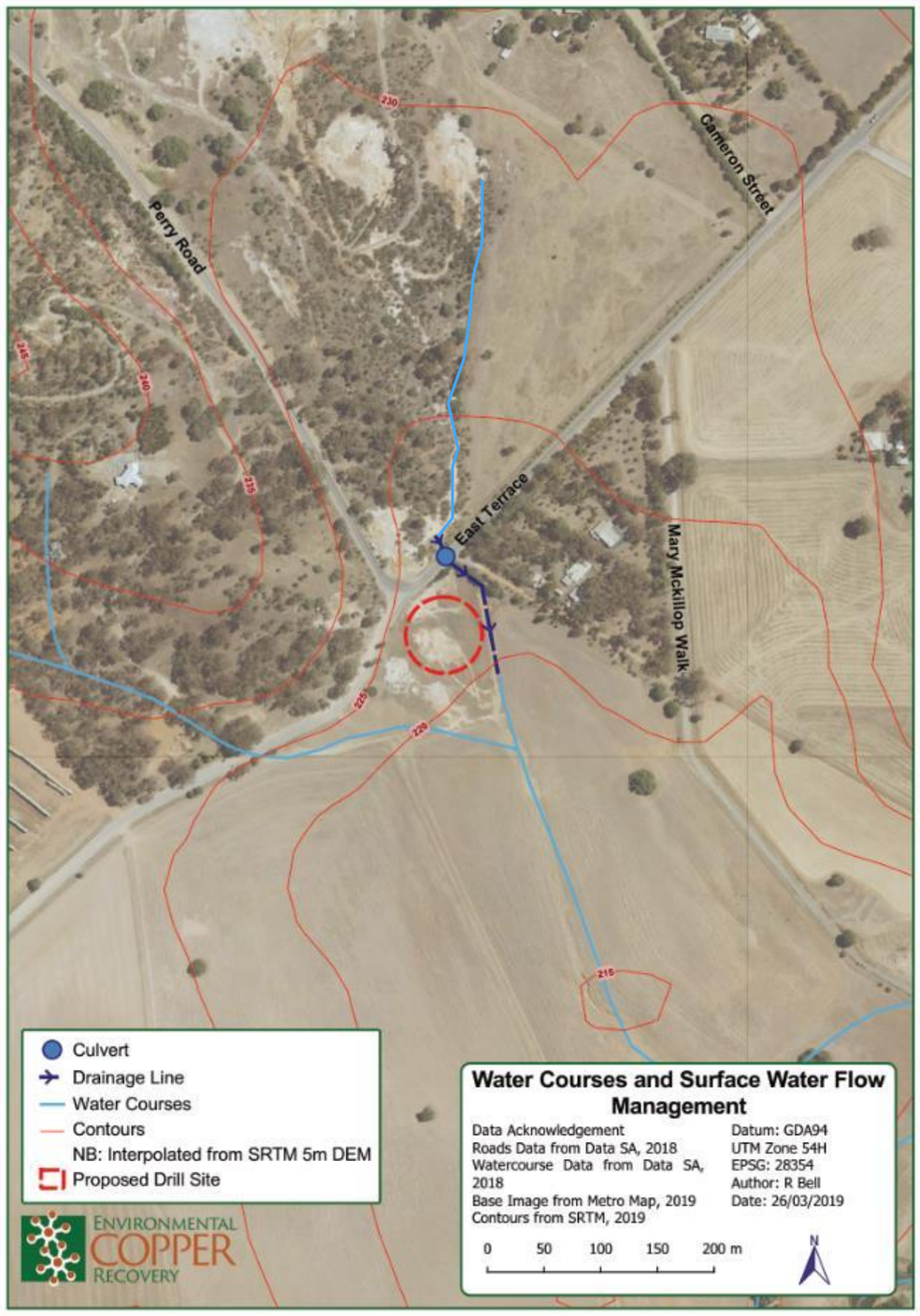


Map C: Relevant Land Use Areas

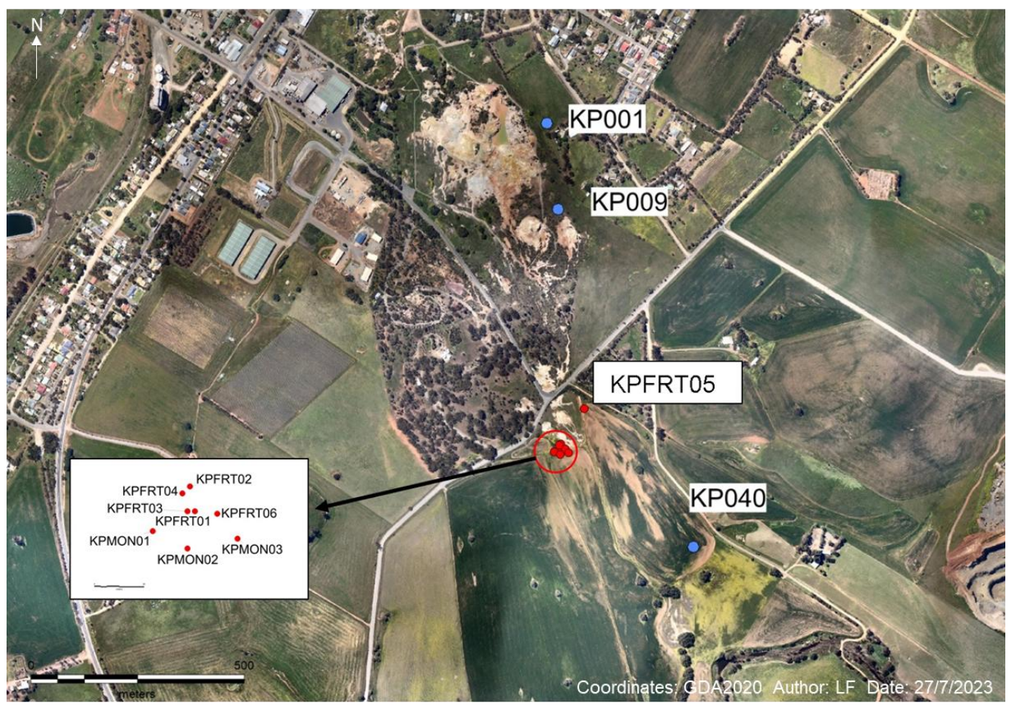
Map D: Exploration Operations Site



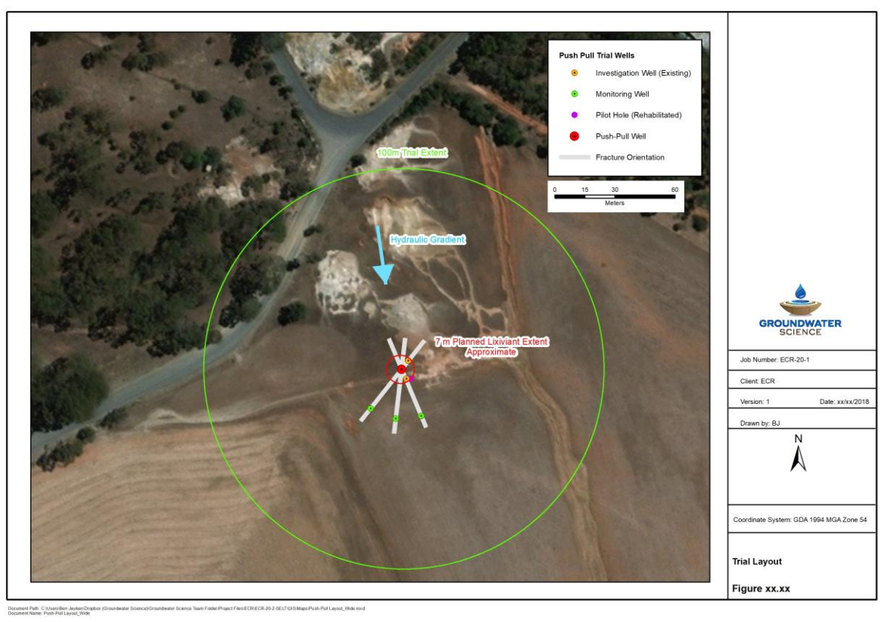
Map E: Sensitive Receptors



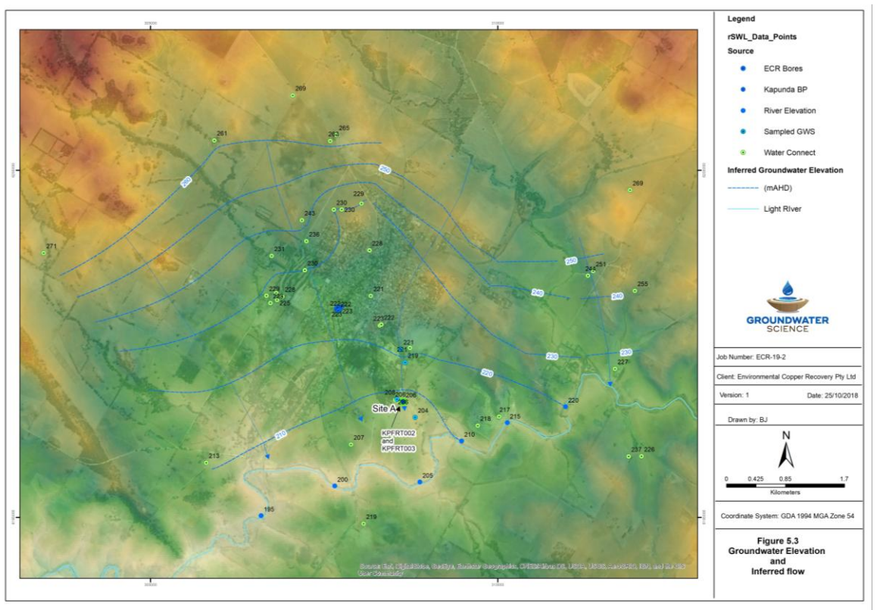
Map F: Water Courses and Surface Water Flow Management



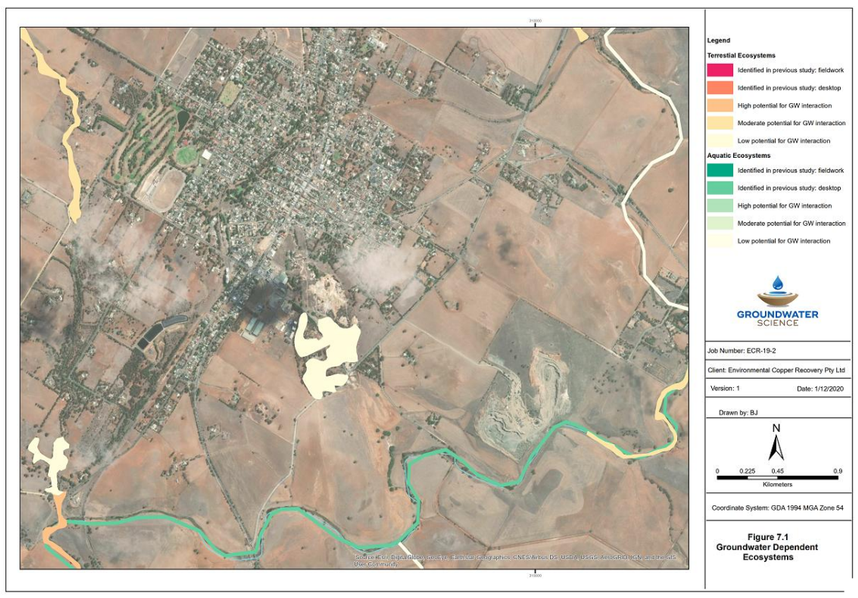
Map G: Groundwater Monitoring Sites



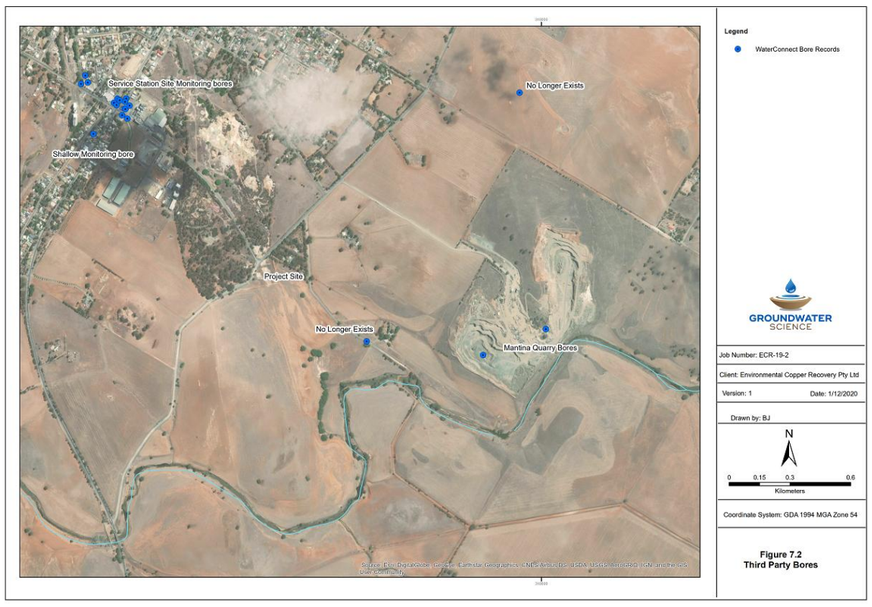
Map H: Site Detail



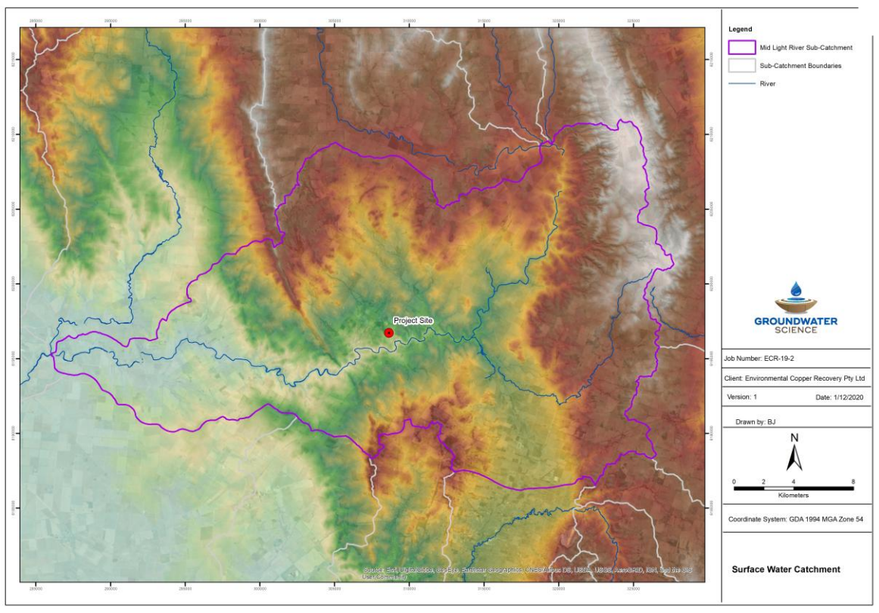
Map I: Groundwater Elevation and Inferred Flow



Map J: Groundwater Dependent Ecosystems

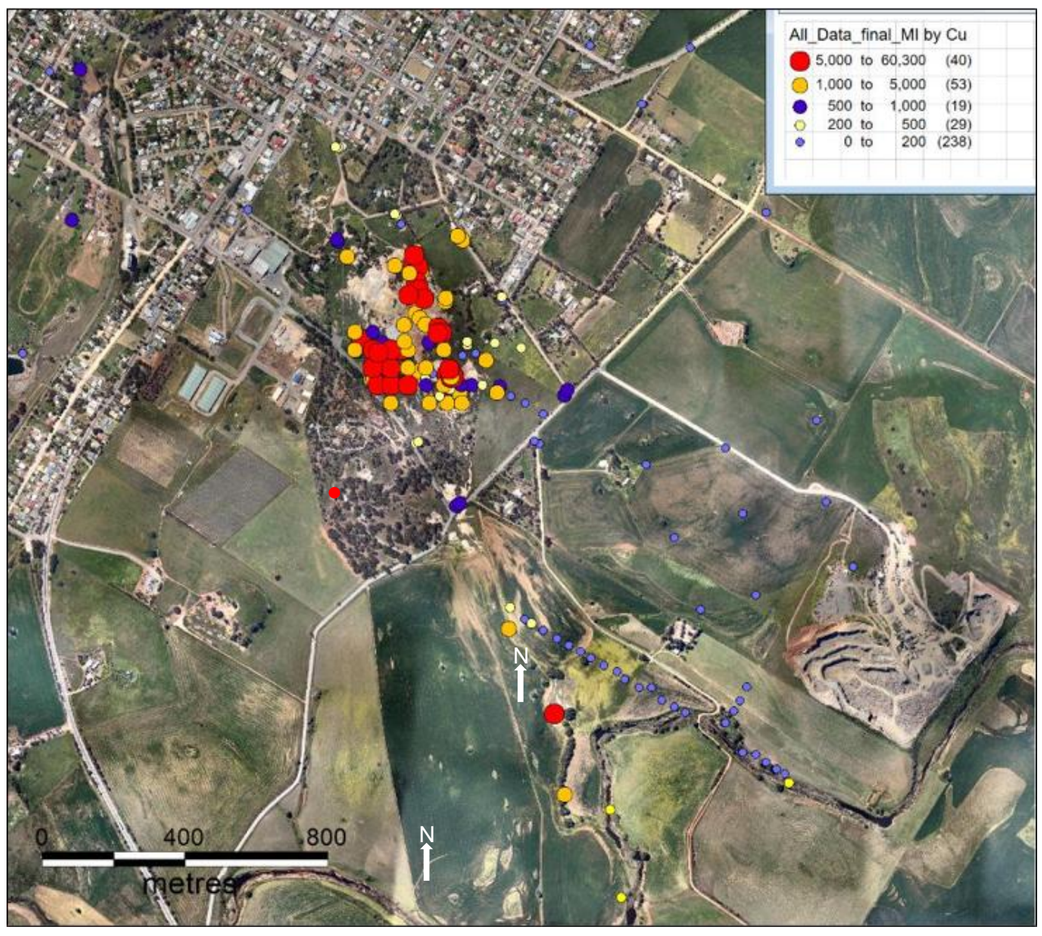


Map K: Third Party Bores



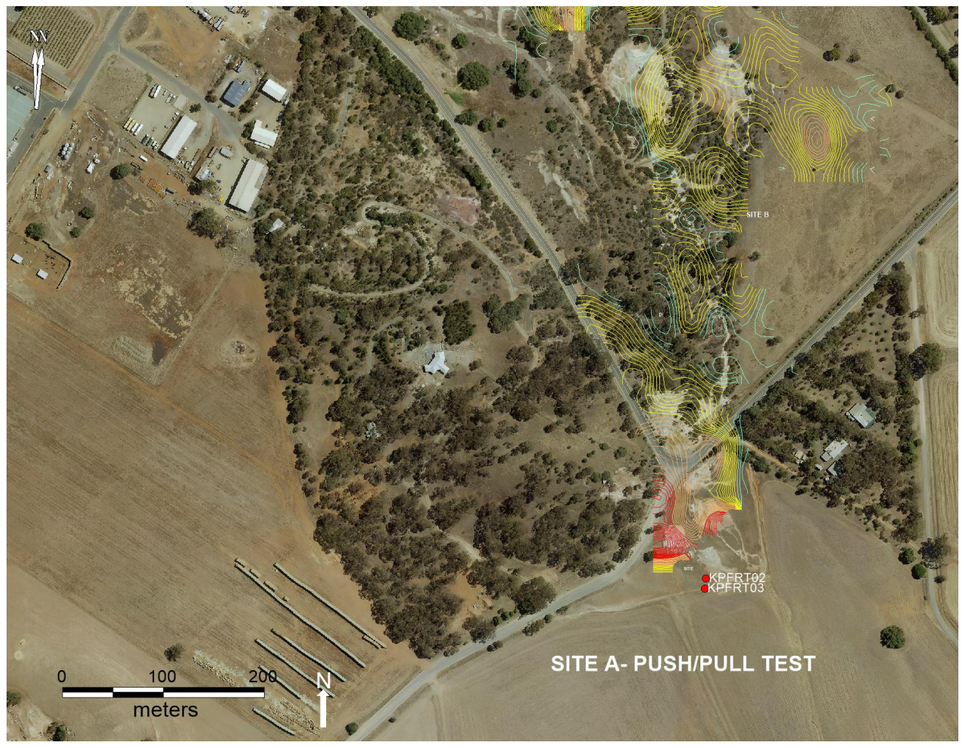
Map L: Exploration Area Surface Water Catchment

Map M: Chemical Storage Location With Respect To Drill Site

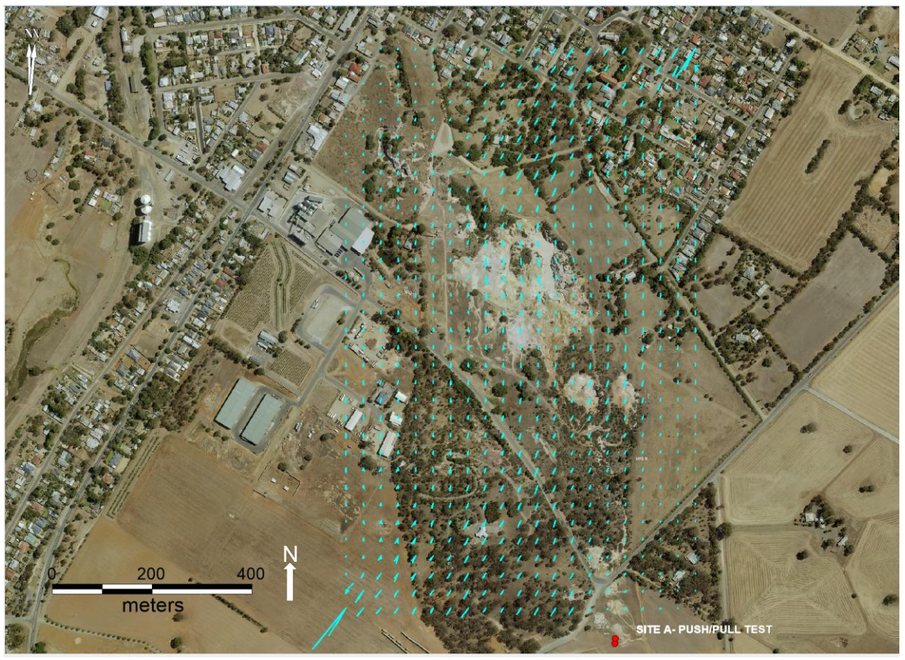


Map N: Soil Chemistry Copper (Cu) mg/L or PPM

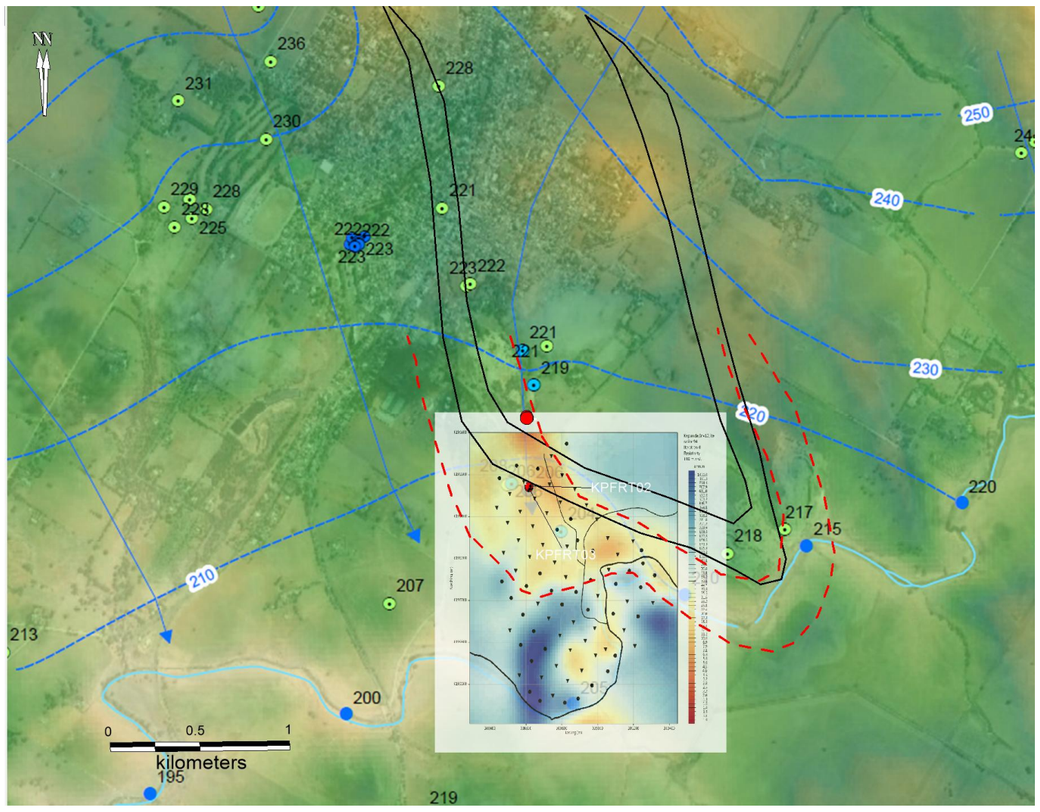
Map O: Copper Soil Values In Ppm In The Vicinity Of Exploration Site



Map P: Diagram Showing Approximate Well Locations, Cu Concentration Contours From Cu Resource Block Model And Section Line



Map Q: Darcy Vectors



Map R: MT Geophysics

Note: Black lines indicate extent of Eudunda Arkose Member from the 1:00K Geological Map. Lines in Red denote the inferred higher electrical conductivity zone inferred from the AMT survey and extended based on geological interpretation (following the Eudunda Arkose orientation).

Map S: MT Location of Electrokinetic Test Wells

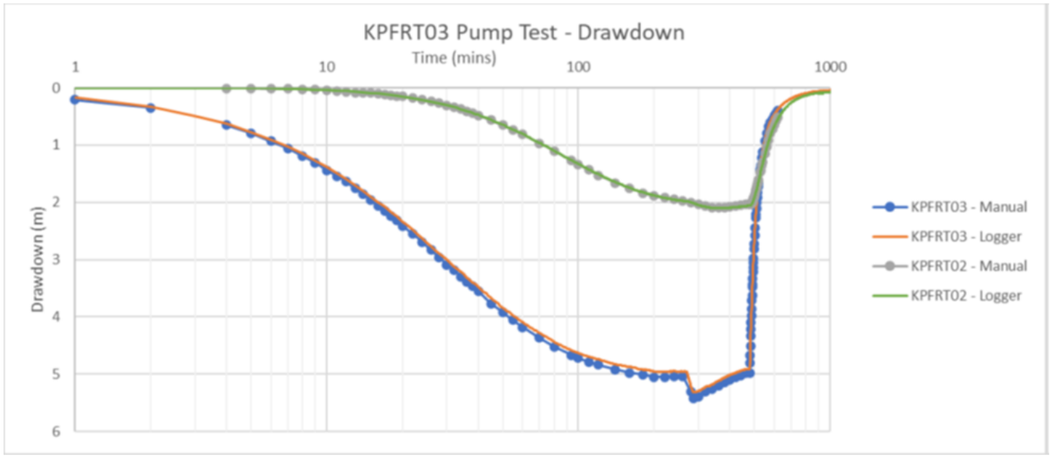


Figure 1: 2019 Exploration Pump Test Results

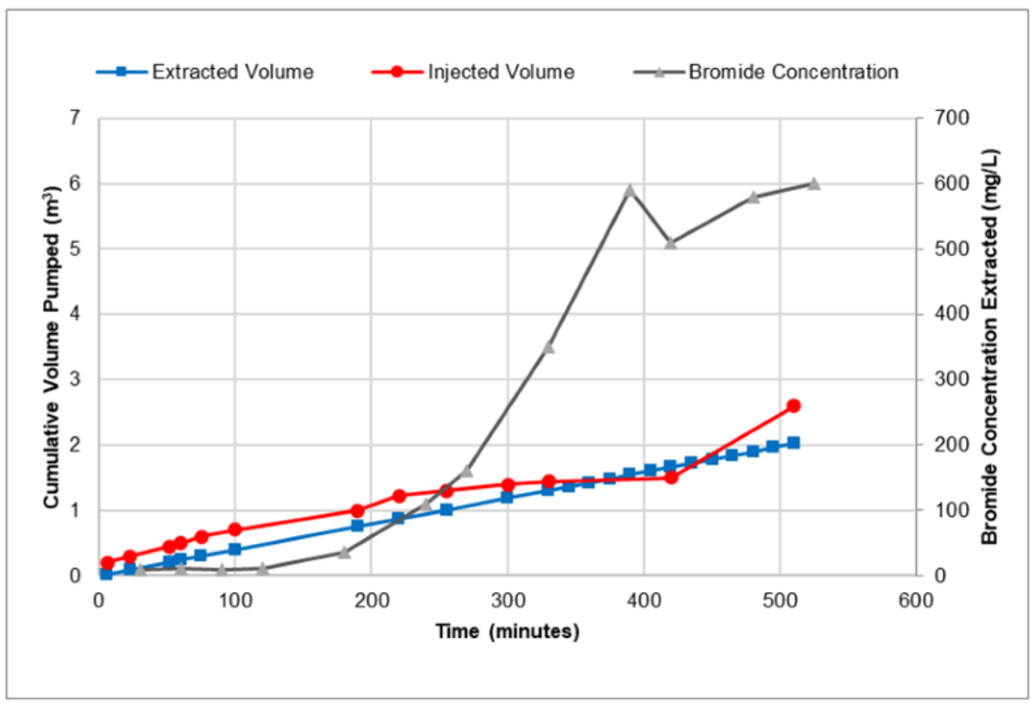


Figure 2: Tracer Test Results

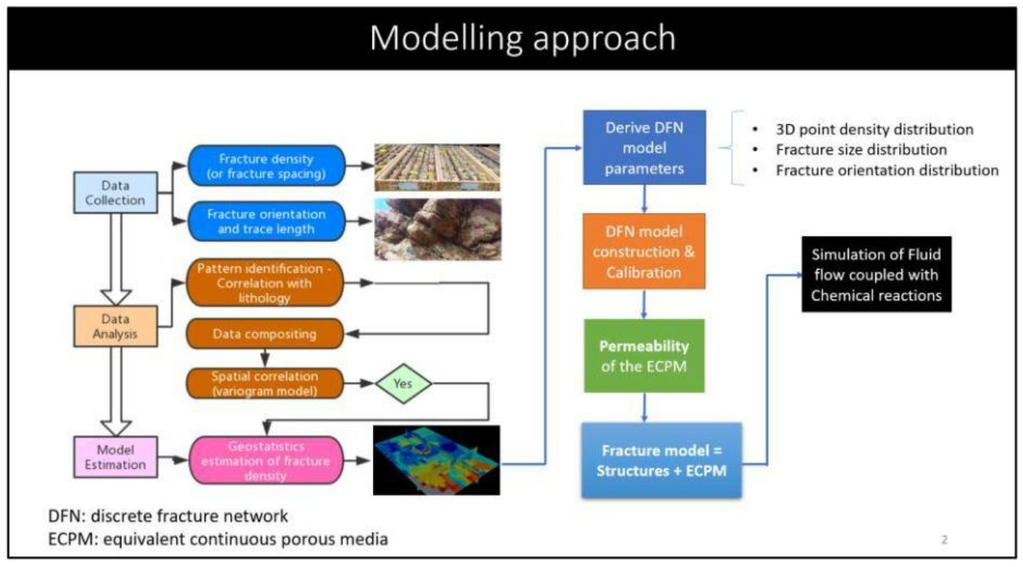


Figure 3: Fracture Modelling Approach

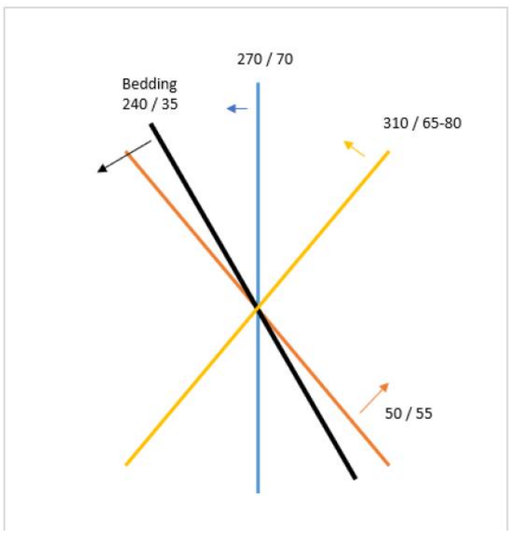


Figure 4: Fracture and Bedding Orientation

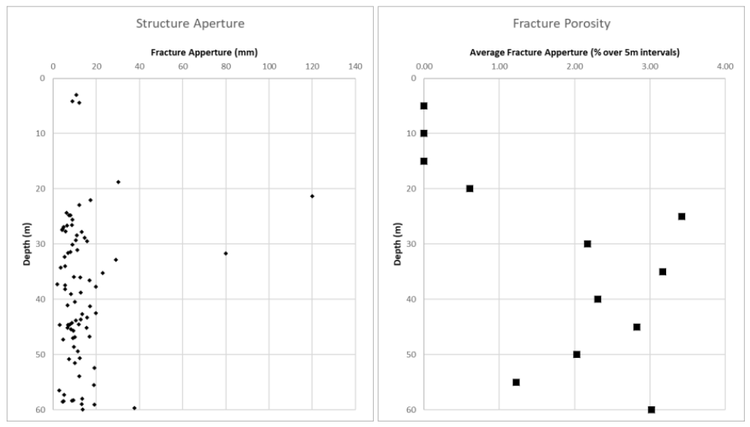


Figure 5: Graph showing Fracture Apertures and Porosity

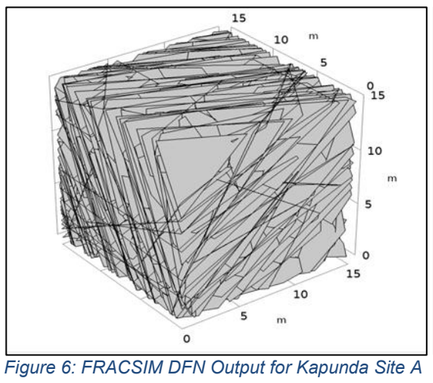


Figure 6: FRACSIM DFN Output for Kapunda Site A

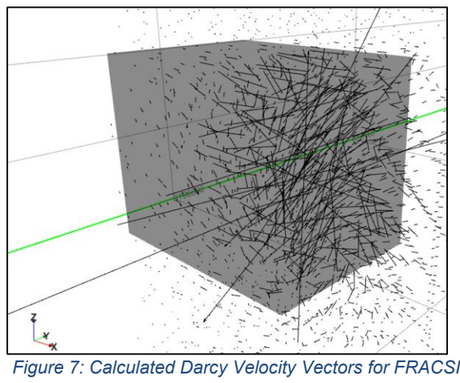


Figure 7: Calculated Darcy Velocity Vectors for FRACSIM Model

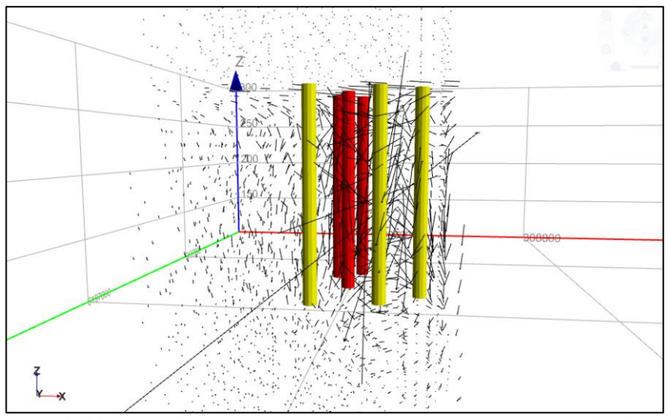


Figure 8: 3D View of Calculated Permeability Tensors (decimated for clarity) Showing Intersection with Monitor Bores

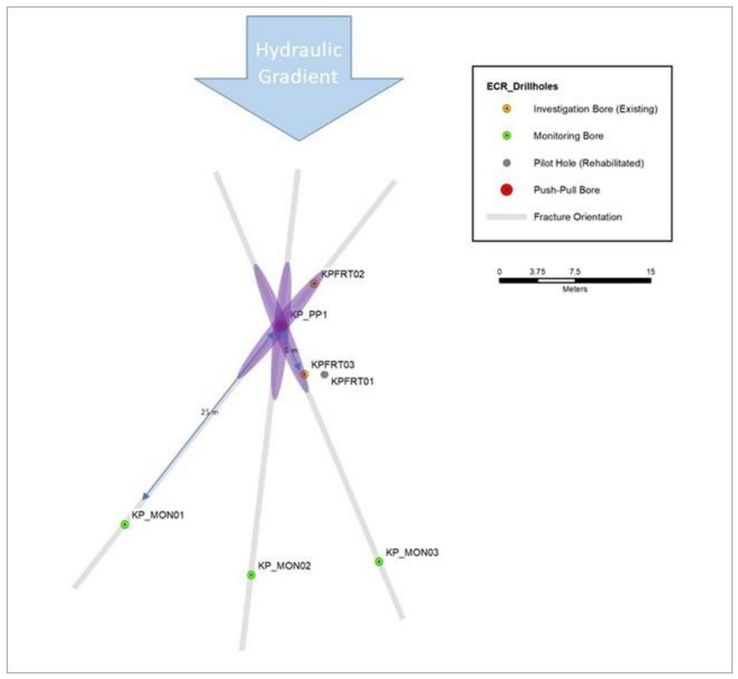


Figure 9: Push/Pull Test Array

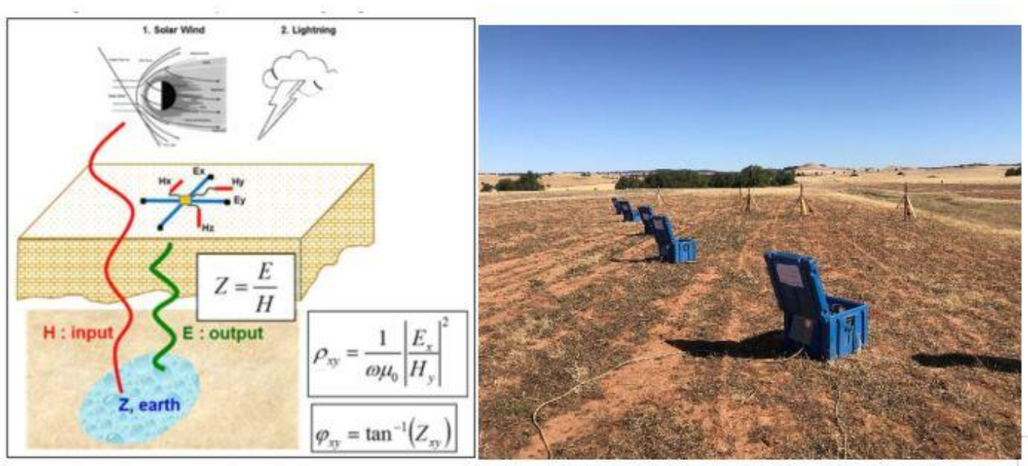


Figure 10: AMT Ground Survey

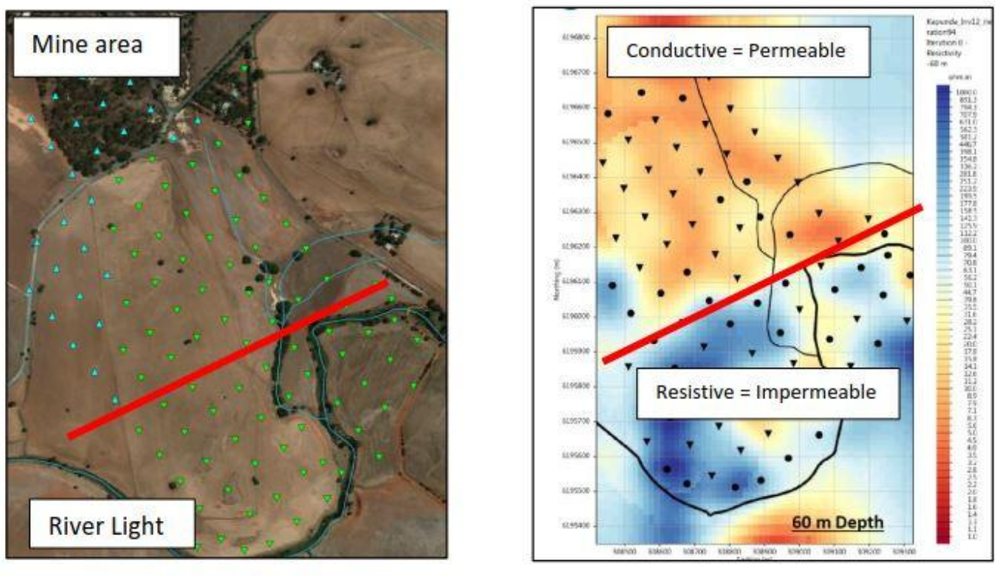


Figure 11: AMT Measurement Sites and Results

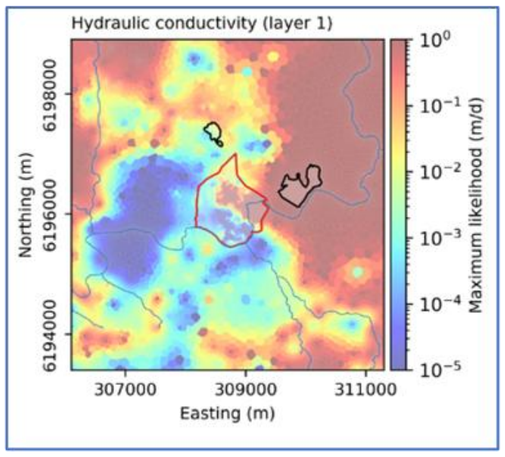


Figure 12: Hydraulic Conductivity Layer 1

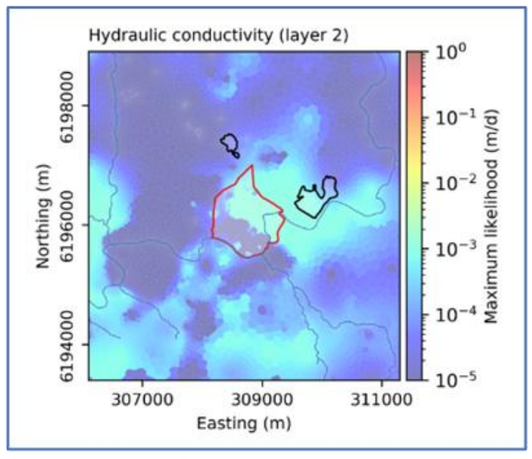


Figure 13: Hydraulic Conductivity Layer 2

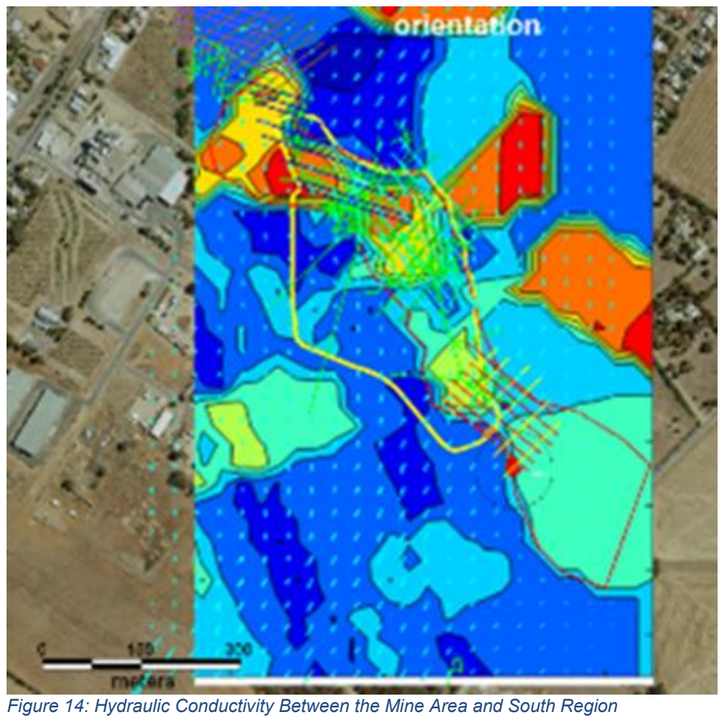


Figure 14: Hydraulic Conductivity Between the Mine Area and South Region

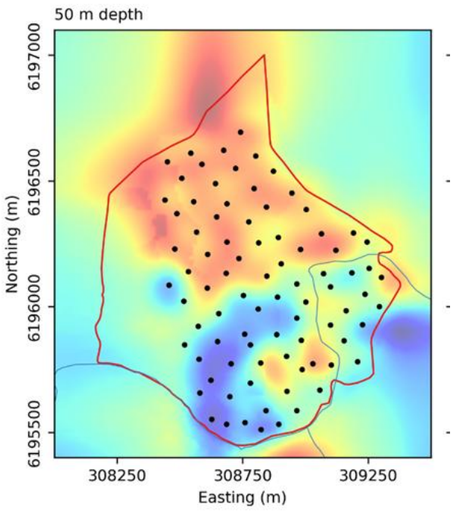


Figure 15: EC depth slice of the inverted AMT data at 50 m depth

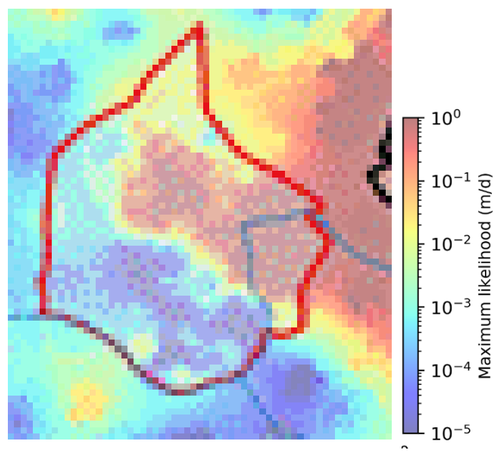


Figure 16: Hydraulic Conductivity of Model Layer 1. Scaled to be comparable to Figure 10

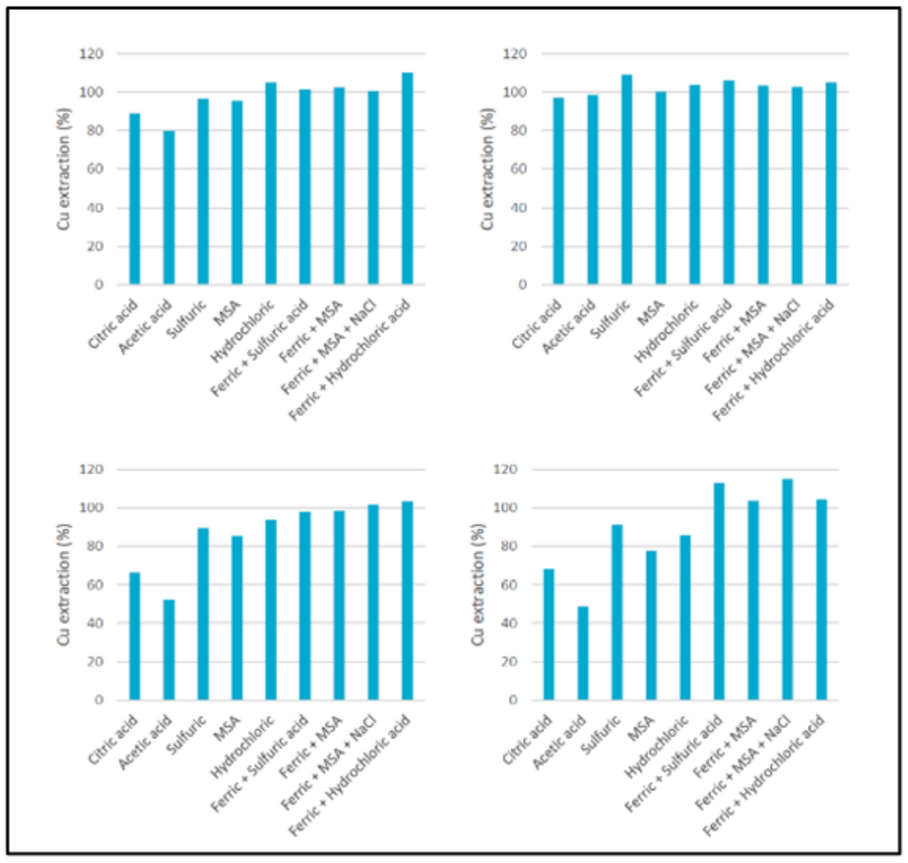


Figure 17: Mild acid proof of Concept Bottle Roll Test

Figure 18: Mini Column Leach Test Results

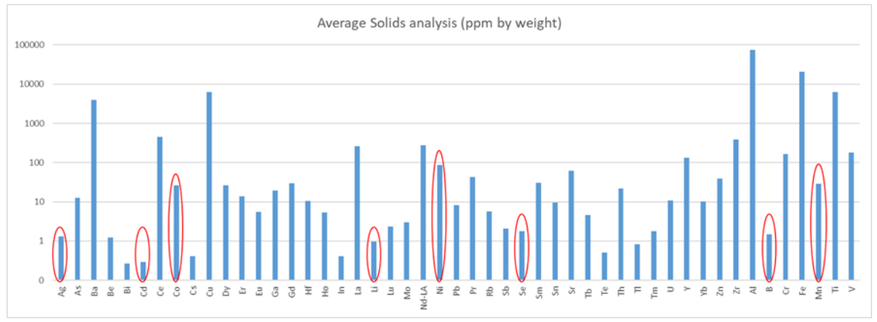


Figure 19: Mini Column Leach Test Results Showing Average Concentration of Moderately Leachable Elements in Solid Samples.

Element	Degree of Leachability
Ag, Cd, Co, Cu, Li, Ni, Se, Zn, B, Mn	Moderate to high leachability:
As, In, Sb	Low leachability
Ba, Be, Ce, Dy, Er, Eu, Ga, Gd, Ho, La, Lu, Nd, Pb, Pr, Rb, Sm, Sr, Tb, Th, Tl, Tm, U, Y, Yb, Zr, Al, Cr, Fe, Ti, V	Trace leachability
Bi, Cs, Hf, Mo, Sn, Te	Zero leachability

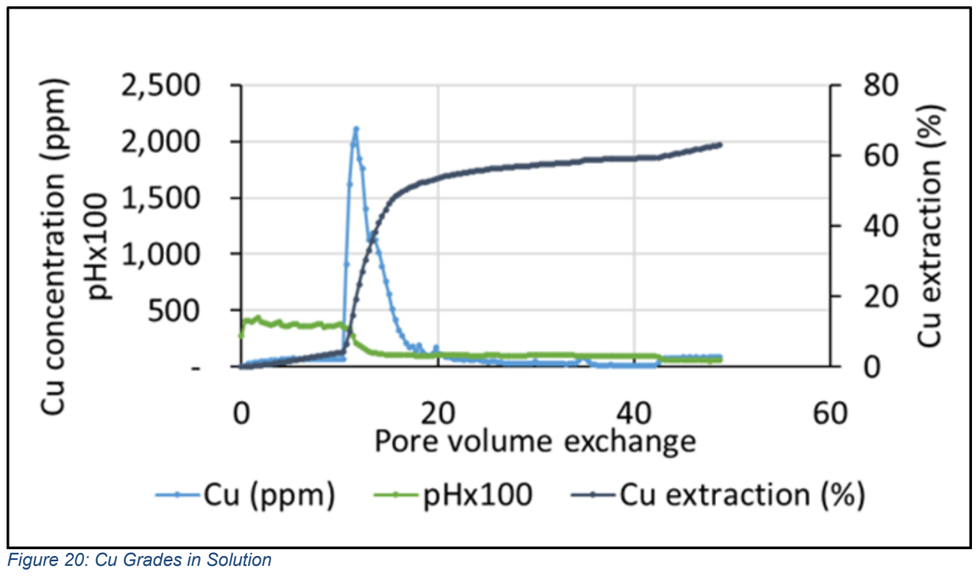


Figure 20: Cu Grades in Solution

	Thiosulphate	MSA
PBT Chemical	No	No
Toxicity	Not of potential concern	Potentially harmful chemical to algae, invertebrates, and fish but biodegradability mitigates this risk in geographical environment. (EC50 >10 mg/L but<=100 mg/L=Harmful)
Bioaccumulation	Not expected to bioaccumulate	Not expected to bioaccumulate (DOC Die Away Test)
Persistence / Biodegradation	Dependent on pH (lixiviant pH stable; mine site groundwater is acidic so rapid conversion to sulphate expected)	Readily biodegradable (OECD guidelines 301 and 306) MSA is part of the natural environment as part of the sulfur cycle

Source: European Chemicals Agency – REACH Registration (Registration, Evaluation, Authorisation and Restriction of Chemicals)

Figure 21: Lixiviant Selection Criteria and Assessment Outcomes

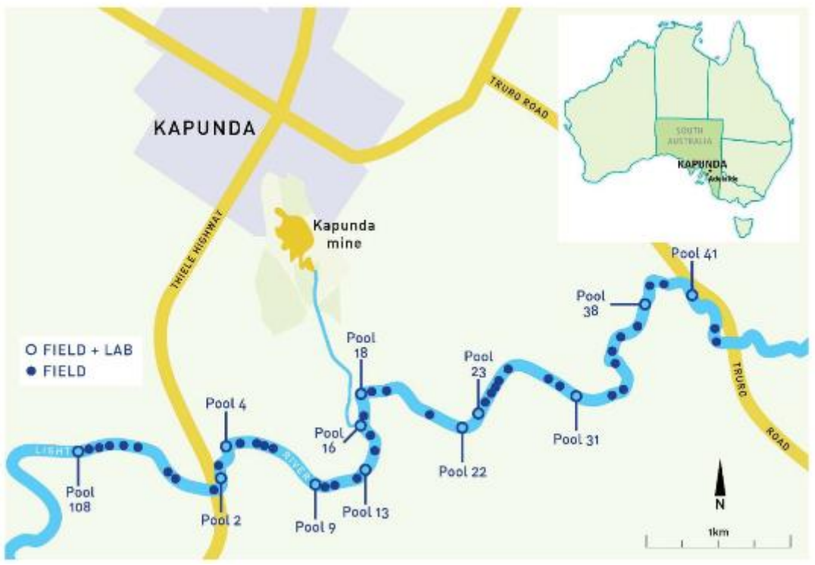


Figure 22: Study Area Showing Location of Mine Site, Ephemeral Stream Line and Pools Along the Light River

Water quality indicator	No exceedance of DGV or ANZG values	Minor change	Moderate change	Major change
EC (µS/cm)	<13,000	13,000-19,000	19,000-21,000	>21,000
pH	6.5-8.0	8.0-8.5 (alkaline) 6.0-6.5 (acidic)	8.5-9.0 (alkaline) 5.5-6.0 (acidic)	>9.0 (alkaline) <5.5 acidic
DO (% saturation)	>90	80-90	60-80	<60
Copper (µg/l)	<4	4-7	7-10	>10
Zinc (µg/l)	<11	11-15	15-19	>19
Other nutrients, metals, metalloids (% change > ANZG)	0	0-25	25-50	>50

Scorecard grade	Management action
No exceedance of DGV or ANZG values	No action; continue seasonal monitoring plan
Minor change	Increased monitoring to identify source(s) and variability.
Moderate change	Increased monitoring to determine source(s) and variation; if identified to be associated with ISR activities then management actions are undertaken as soon as reasonably possible to control and mitigate impacts on water quality.
Major change	Increased monitoring to determine source(s) and variation; if identified to be a major incident due to ISR activity than operations are restricted/stopped until management actions have been undertaken to control and mitigate impacts on water quality.

Figure 23: Proposed Water Quality Environmental Scorecard

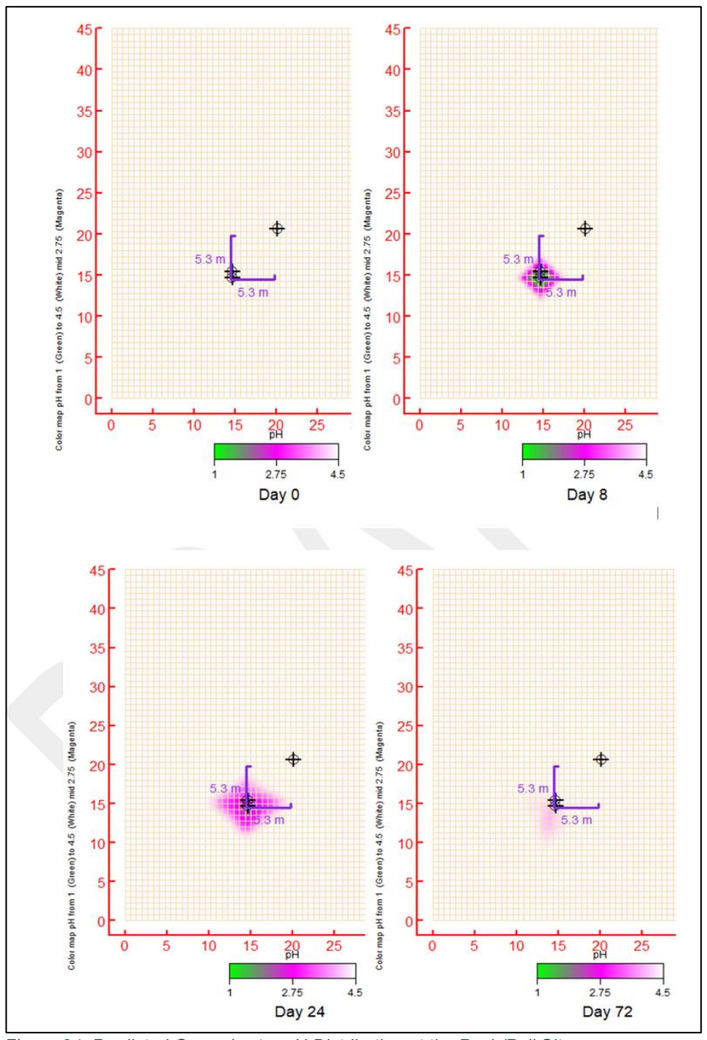


Figure 24: Predicted Groundwater pH Distribution at the Push/Pull Site

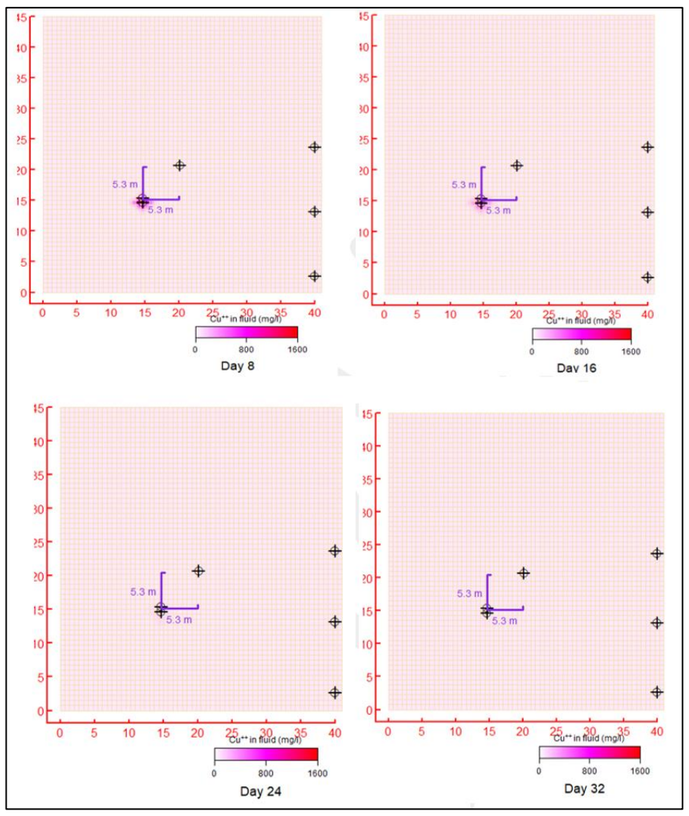
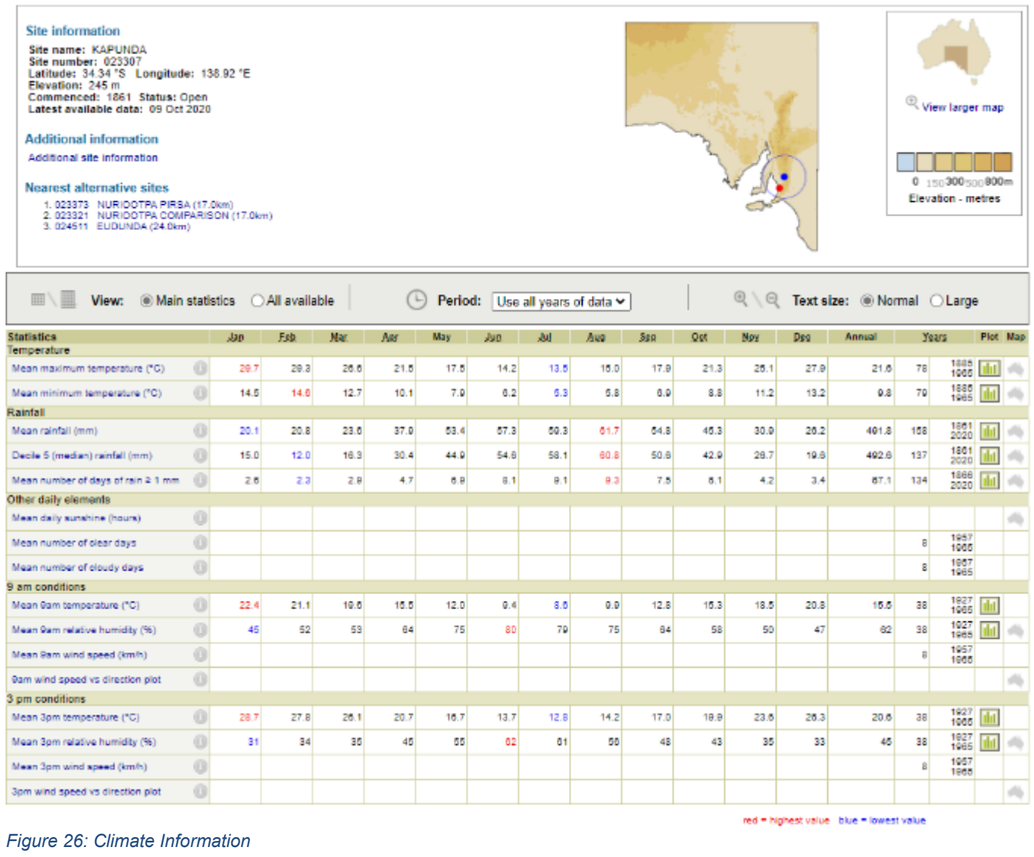


Figure25: Predicted Groundwater Copper Distribution During Push/Pull Test as Function of Copper



Site information

Site name: KAPUNDA
Site number: 023307
Latitude: 34.34 °S **Longitude:** 138.92 °E
Elevation: 245 m
Commenced: 1861 **Status:** Open
Latest available data: 09 Oct 2020

Additional information

Additional site information

Nearest alternative sites

1. 023373 NURIOOTPA PIRSA (17.0km)
2. 023321 NURIOOTPA COMPARISON (17.0km)
3. 024511 ELDUNDA (24.0km)

View larger map

0 150 300 500 800m
Elevation - metres

View: Main statistics / All available | Period: Use all years of data | Text size: Normal / Large

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	Years		Plot	Map
Temperature																	
Mean maximum temperature (°C)	29.7	29.3	26.6	21.5	17.5	14.2	13.5	15.0	17.9	21.3	25.1	27.9	21.6	78	1885 1966		
Mean minimum temperature (°C)	14.5	14.6	12.7	10.1	7.9	6.2	5.3	5.8	6.9	8.8	11.2	13.2	9.8	79	1885 1965		
Rainfall																	
Mean rainfall (mm)	20.1	20.8	23.6	37.0	53.4	57.3	59.3	61.7	54.8	45.3	30.9	26.2	401.8	158	1861 2020		
Decile 5 (median) rainfall (mm)	15.0	12.0	16.3	30.4	44.9	54.6	58.1	60.8	50.6	42.9	28.7	19.6	402.6	137	1861 2020		
Mean number of days of rain ≥ 1 mm	2.6	2.3	2.8	4.7	6.9	8.1	9.1	9.3	7.5	6.1	4.2	3.4	67.1	134	1866 2020		
Other daily elements																	
Mean daily sunshine (hours)																	
Mean number of clear days														8	1957 1965		
Mean number of cloudy days														8	1957 1965		
9 am conditions																	
Mean 9am temperature (°C)	22.4	21.1	19.0	15.5	12.0	9.4	8.5	9.9	12.8	15.3	18.5	20.8	15.5	38	1927 1965		
Mean 9am relative humidity (%)	46	52	59	64	75	80	79	75	64	58	50	47	62	38	1927 1965		
Mean 9am wind speed (km/h)														8	1957 1965		
9am wind speed vs direction plot																	
3 pm conditions																	
Mean 3pm temperature (°C)	28.7	27.8	26.1	20.7	16.7	13.7	12.8	14.2	17.0	19.9	23.5	26.3	20.6	38	1927 1965		
Mean 3pm relative humidity (%)	31	34	35	45	55	62	61	55	48	43	35	33	45	38	1927 1965		
Mean 3pm wind speed (km/h)														8	1957 1965		
3pm wind speed vs direction plot																	

red = highest value, blue = lowest value

Figure 26: Climate Information

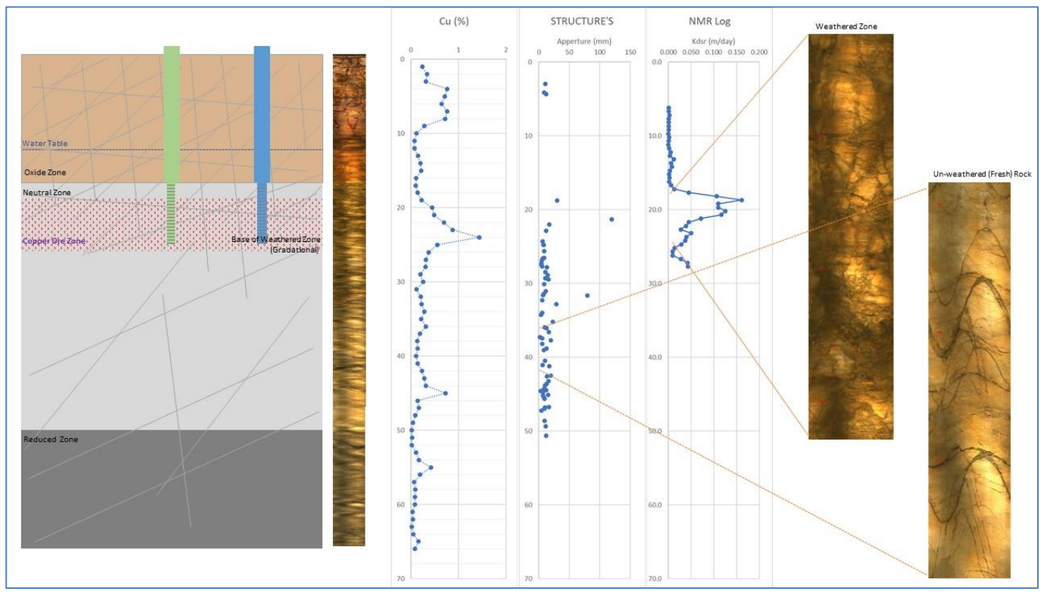


Figure 27: Site Specific Hydrogeological Setting

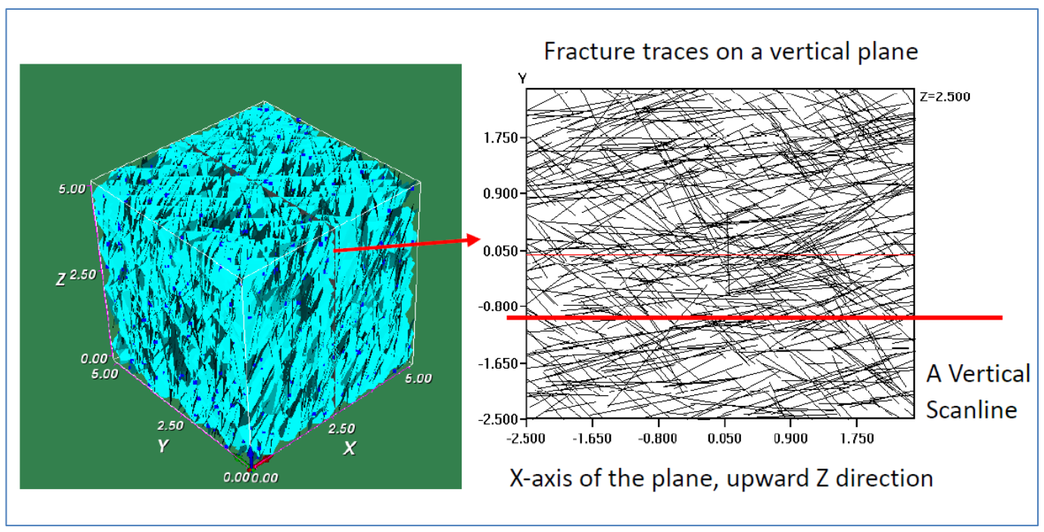


Figure 28: Visual Representation of Fracture Network based on Fracture Statistics

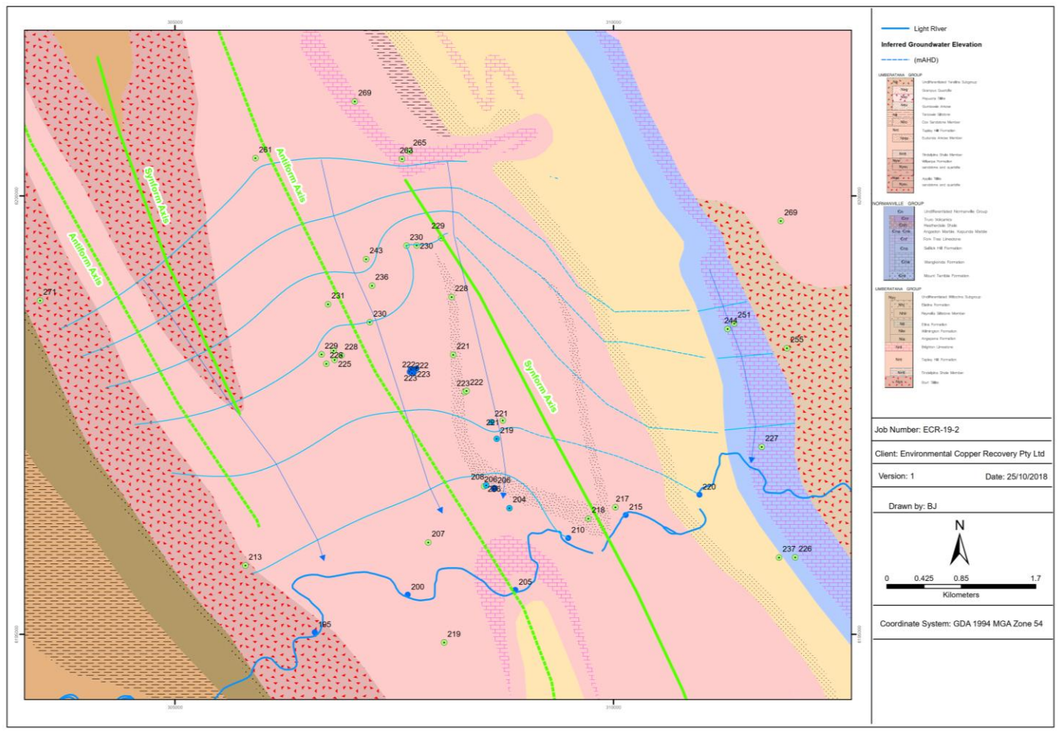


Figure 29: Regional Geology and Inferred Groundwater Flow

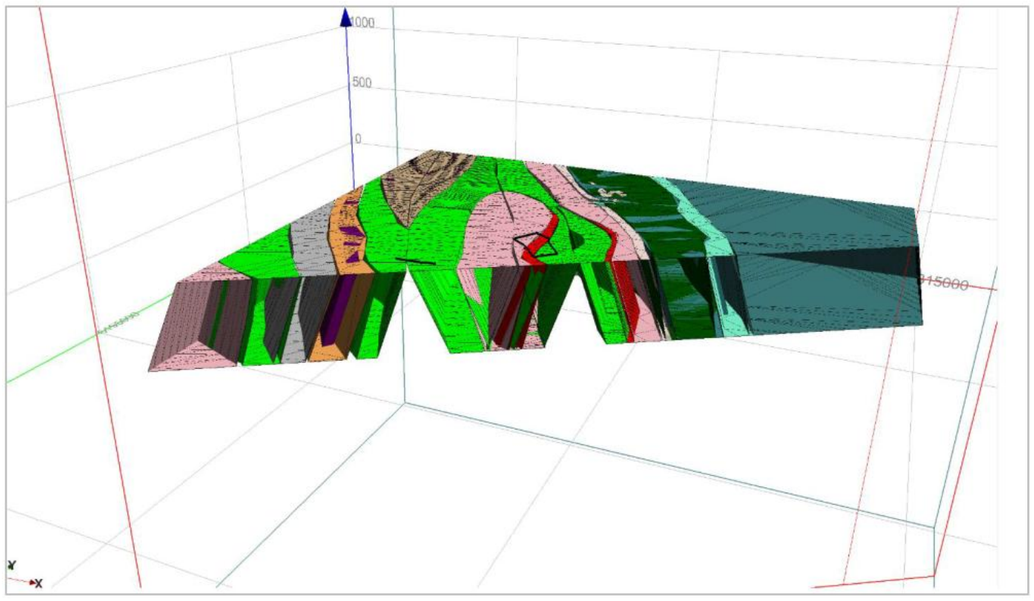


Figure 30: Block Diagram

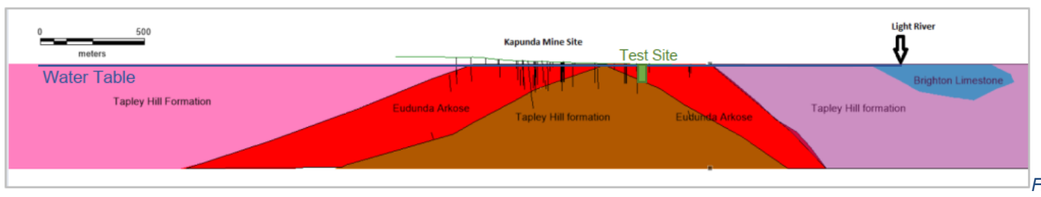


Figure 31: North-South Cross Section

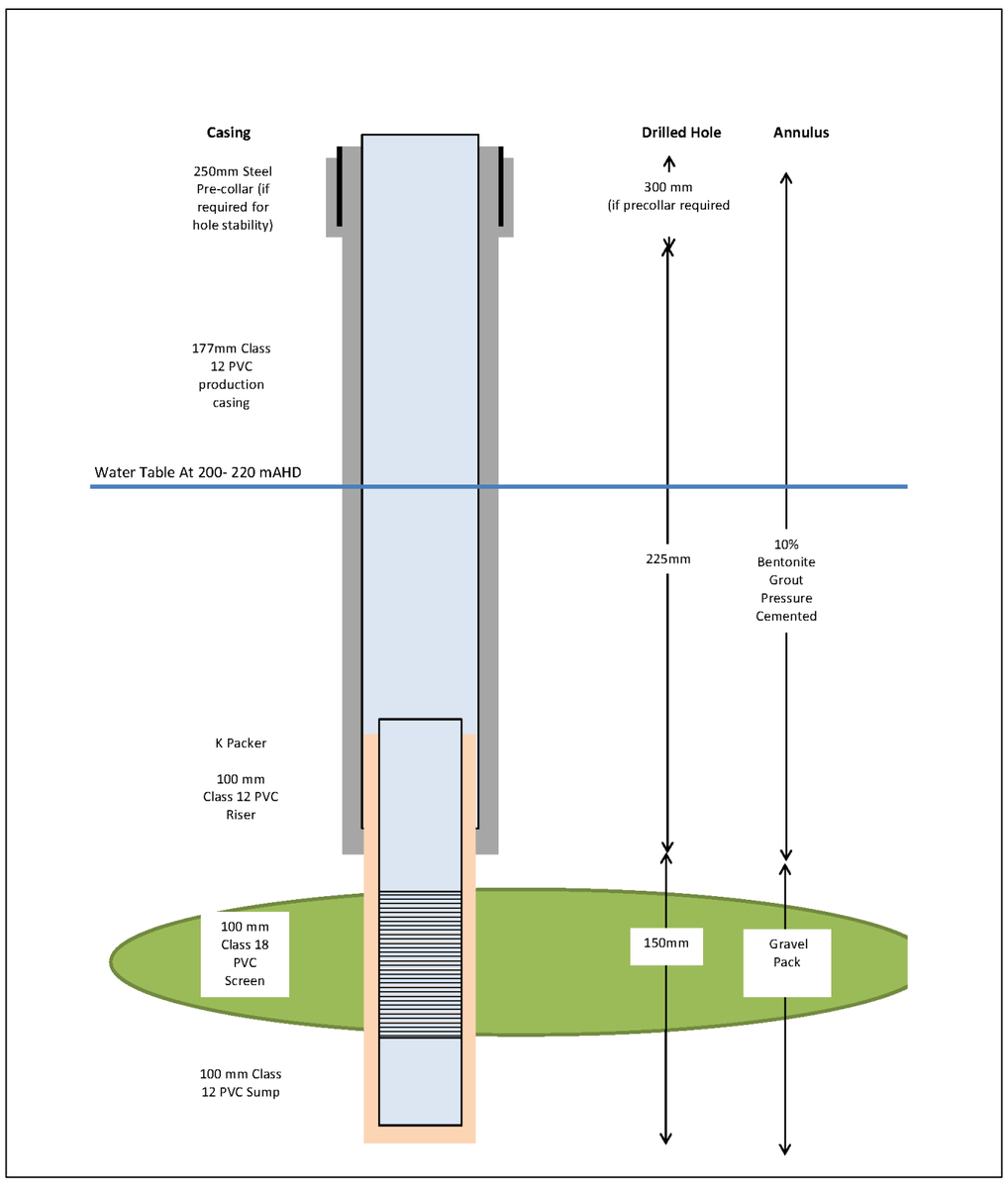


Figure 32A: Diagram showing push-pull well construction

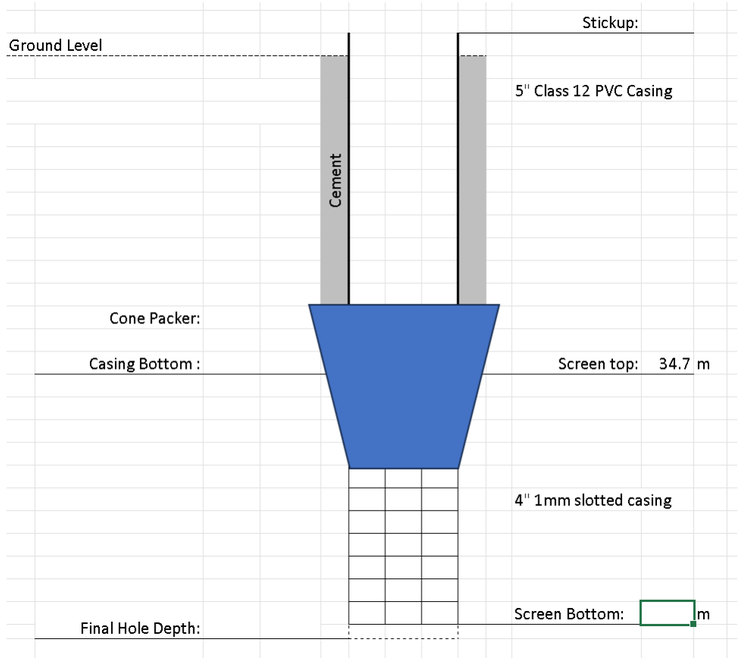


Figure 32B: Diagram showing monitoring well construction

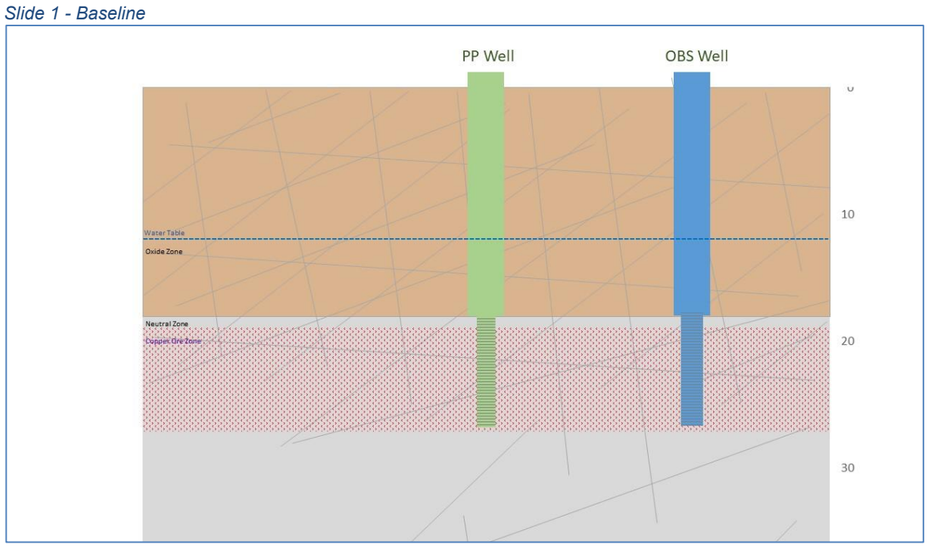
Monitoring Fit For Purpose

Element	Purpose	Fit For Purpose Criteria	Demonstration of Fit For Purpose	Monitoring	Action Logic	Rehab Standard
Push_Pull Well	Drain Lixiviant into the copper ore zone and extract lixiviant from the copper ore zone	Hydraulically connected to The Ore zone.	Well screen across the ore zone as determined by XRF assay of drilling samples	Baseline: Full Suite A 6 Sample events	N/A	Return to baseline chemistry for Rehabilitation Parameters
				Push Phase Hourly Site Suite B – All samples Full Suite A – Selected samples		
				Residence Phase Daily Site Suite B – All samples Full Suite A – Selected samples		
		Sealed off from overlying material	Casing is grouted in place from the top of the screen to surface Casing integrity is checked by caliper log	Extraction and Remediation Twice Daily Site Suite B – All samples Full Suite A – Selected samples		
		Accommodate a pump	Minimum internal diameter of 100mm			
Observation well	Monitor arrival of Lixiviant during push phase and recession of lixiviant during pull phase	Hydraulically connected to Push-Pull Well.	Well is positioned using site-specific fracture mapping from downhole imagery. Hydraulic connection is confirmed by tracer test. Tracer must be detected at the Observation well during the tracer test	Baseline: Full Suite A 6 Sample events	If contacted during 5000L injection with approximately 50% tracer concentration at completion then 0.5% effective porosity (EPM equivalent) assumption is validated.	Return to baseline chemistry for Rehabilitation Parameters
	Monitor composition of lixiviant during leaching			Push Phase: Hourly Site Suite B – All samples Full Suite A – Selected samples		
	Validate effective porosity values applied in conceptual model			Residence Phase Daily Site Suite B – All samples Full Suite A – Selected samples		
	Secondary Recovery Location for Impacted Groundwater	Capable of accommodating a recovery pump	Casing internal diameter to be a minimum of 50mm to accommodate 50mm submersible pump	Extraction and Remediation Twice Daily Site Suite B – All samples Full Suite A – 1:2 samples	If not contacted during 5000L injection, then effective porosity is higher than 0.5 % and the leached radius and tonnage is less than estimated	
Monitoring Well (Compliance)	Demonstrate that Lixiviant is contained within the trial area	Hydraulically connected to Push-Pull Well.	Well is positioned using site-specific fracture mapping from downhole imagery. Hydraulic connection is confirmed by tracer test. Tracer must be detected at the Observation well during the tracer test	Baseline: Full Suite A 6 Sample events	If ECL exceeded during trial, then: -stop trial -commence extraction -Continue extraction until rehabilitation is achieved	Return to baseline chemistry for Rehabilitation Parameters
	Allowing time to act before an excursion occurs			Push Phase 6 Hourly Site Suite B – All samples Full Suite A – Selected samples		
				Residence Phase Daily Site Suite B – All samples Full Suite A – Selected samples		
	Secondary Recovery Location for Impacted Groundwater	Capable of accommodating a recovery pump	Casing internal diameter to be a minimum of 50mm to accommodate 50mm submersible pump	Extraction and Remediation Daily Site Suite B – All samples Full Suite A – Selected samples		

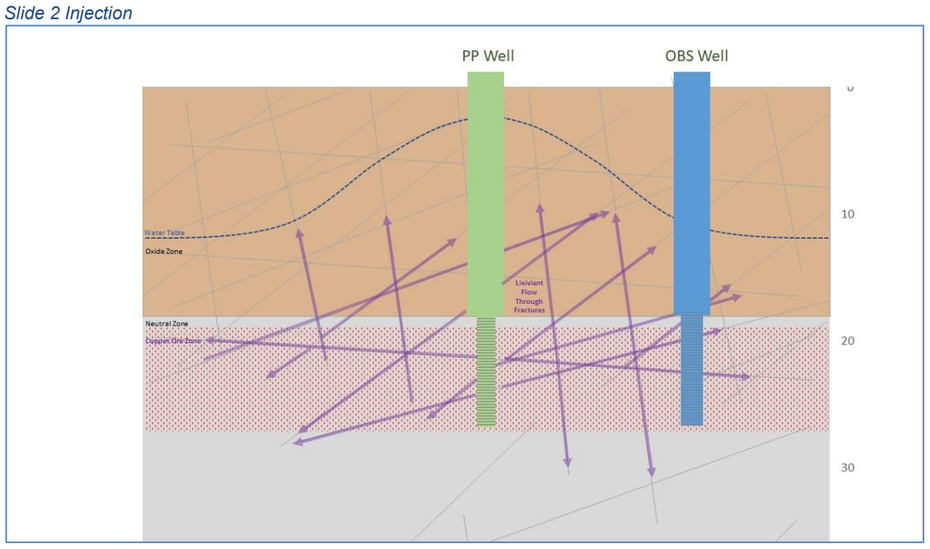
Figure 33: Fit for Purpose Approach to Well Array

Figure 34: "Visual Representation of Push/Pull Test Progression" (note 6 slides)

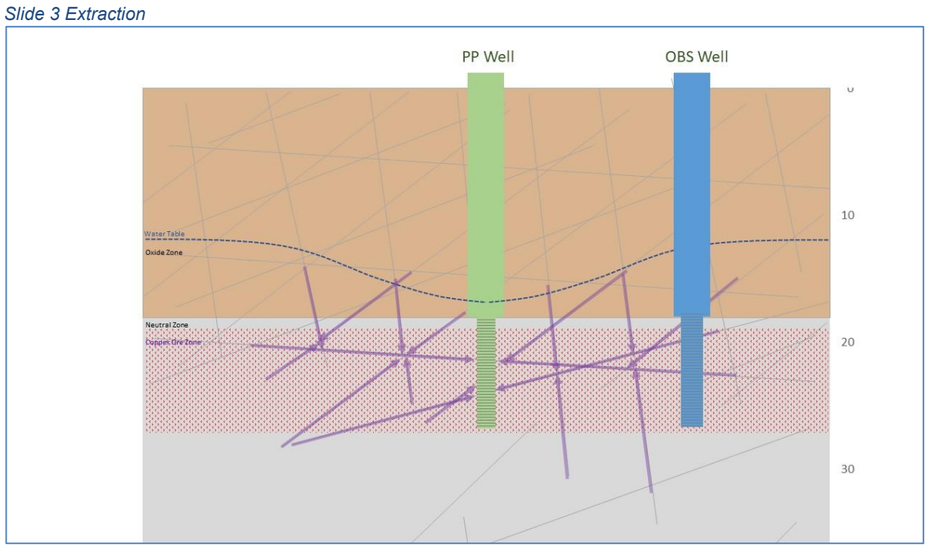
Slide 1 - Baseline



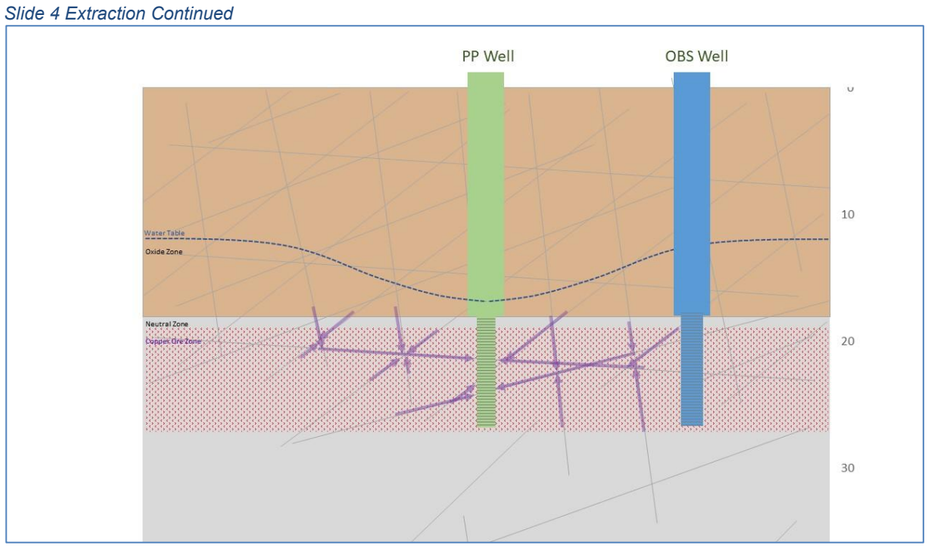
Slide 2 Injection



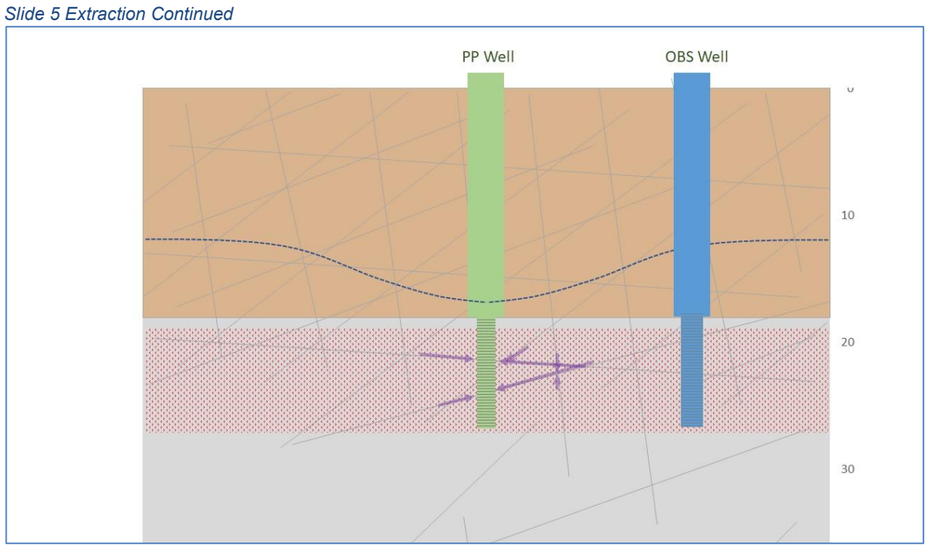
Slide 3 Extraction



Slide 4 Extraction Continued



Slide 5 Extraction Continued



Slide 6 Rehabilitated

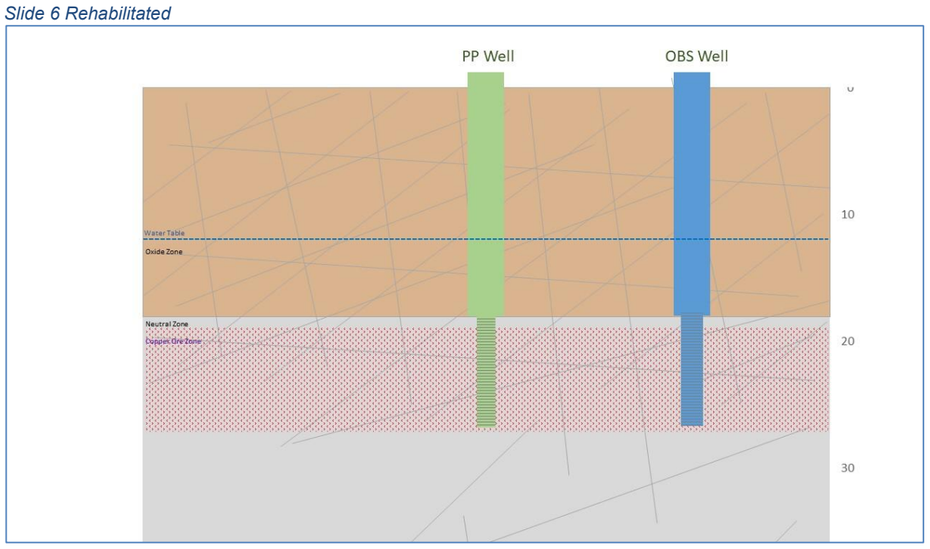


Figure 34: Visual Representation of Push Pull Test Progression

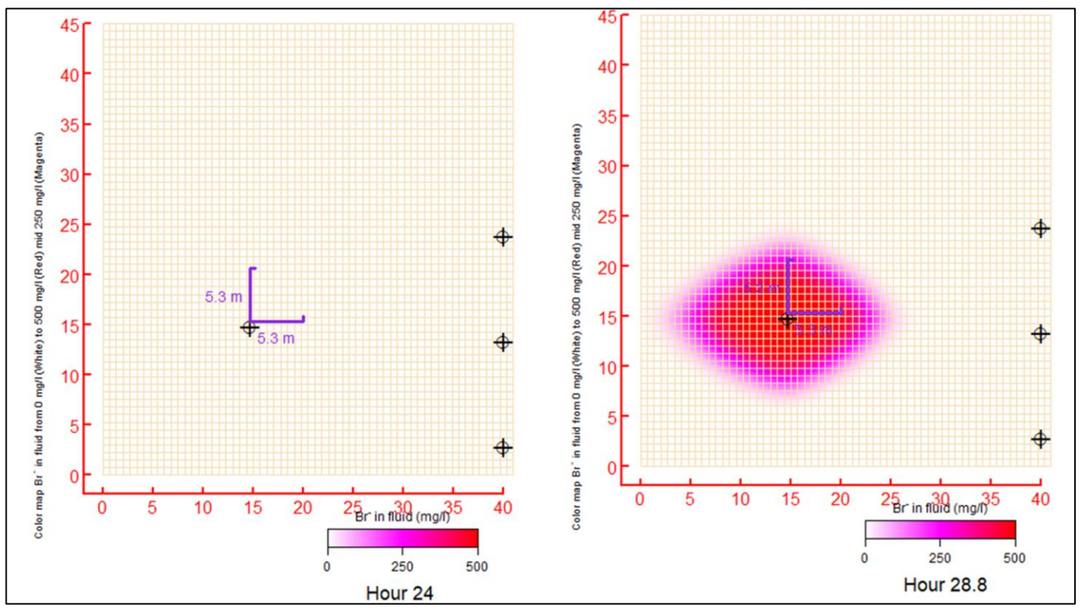


Figure 35: Geochemist Workbench Predictive Modelling of Bromide Tracer from Push/Pull Well

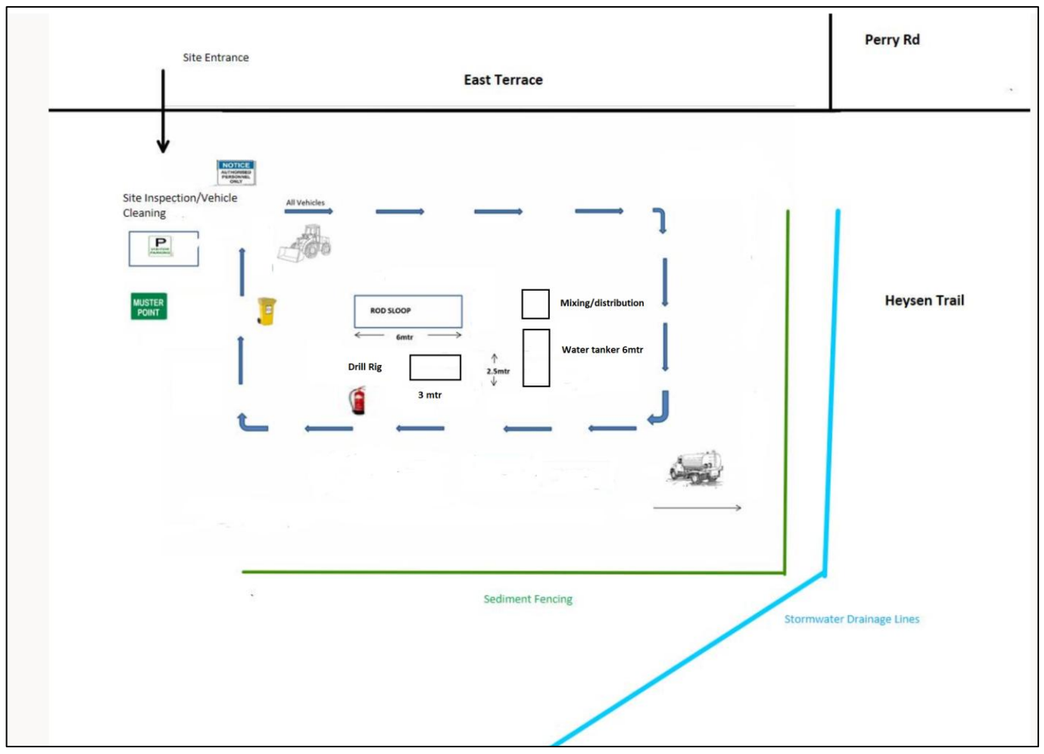


Figure 36: Site Layout

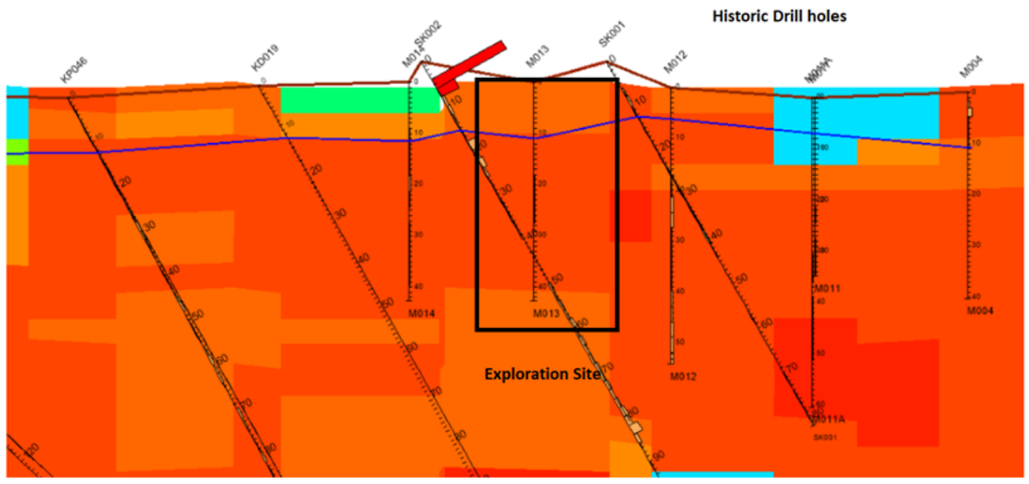


Figure 37: Diagram showing cross section of exploration site with topography, expected water table and shaded by Cu resource block model

Figure 38: Proof of Concept Column Test Work

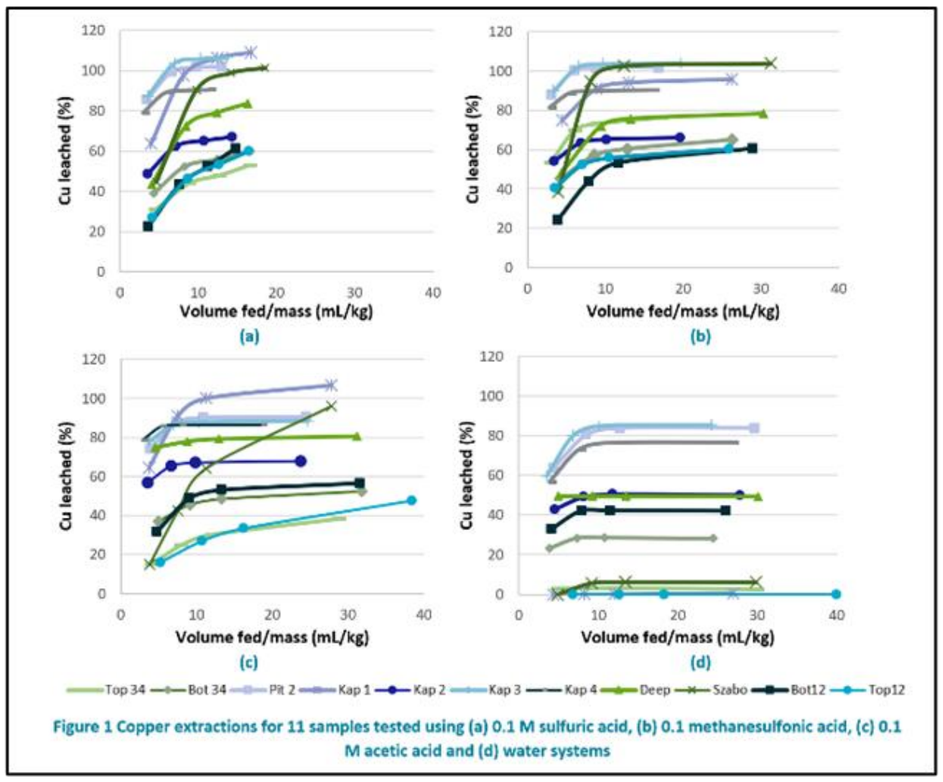


Figure 1 Copper extractions for 11 samples tested using (a) 0.1 M sulfuric acid, (b) 0.1 methanesulfonic acid, (c) 0.1 M acetic acid and (d) water systems

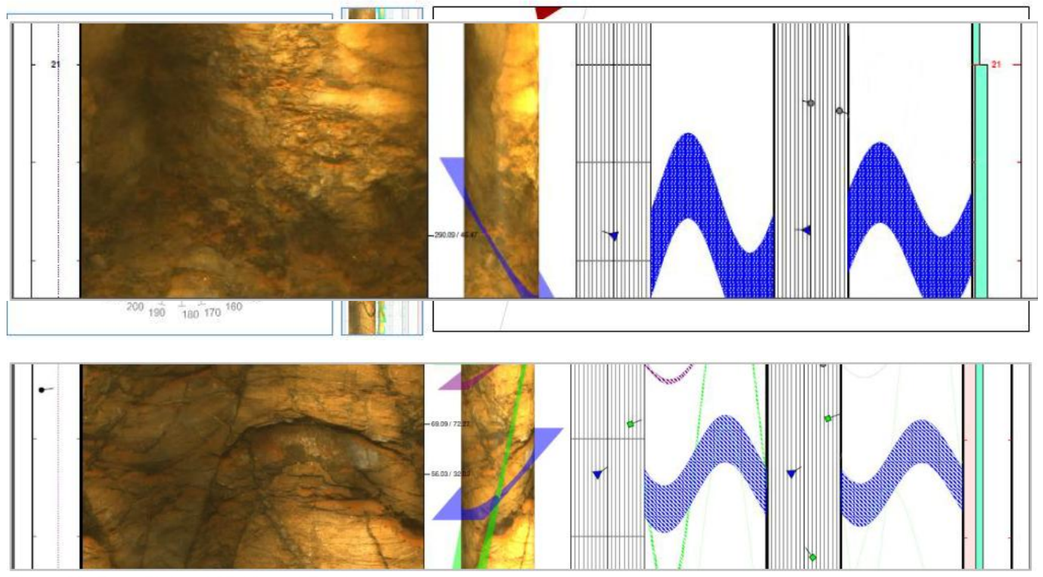


Figure 39: Rose Plot and 3D View of Fractures

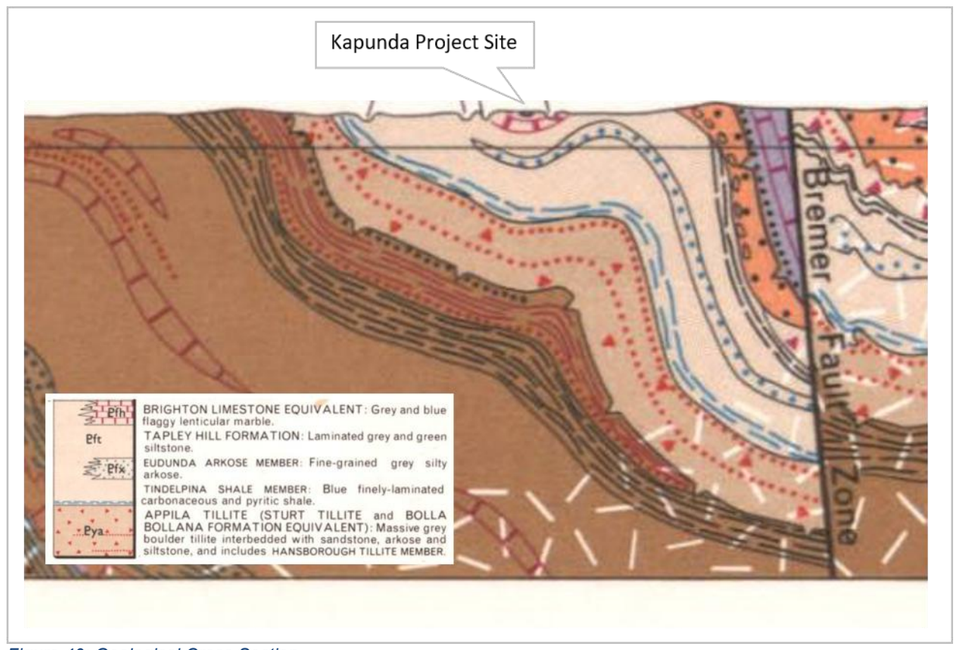


Figure 40: Geological Cross Section

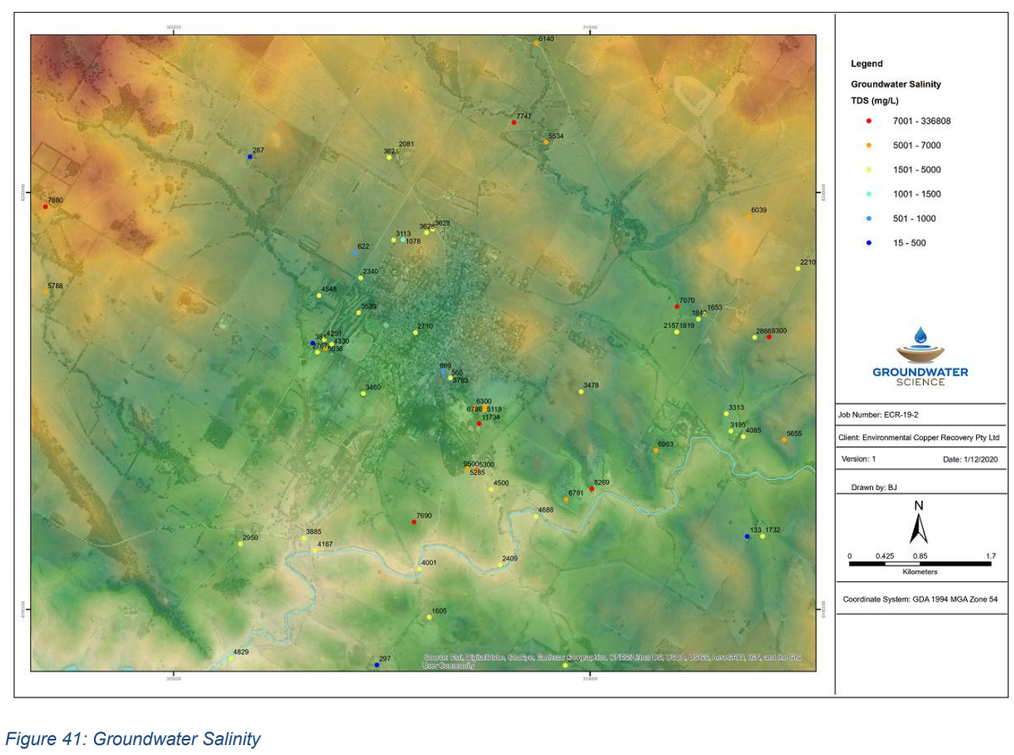


Figure 41: Groundwater Salinity

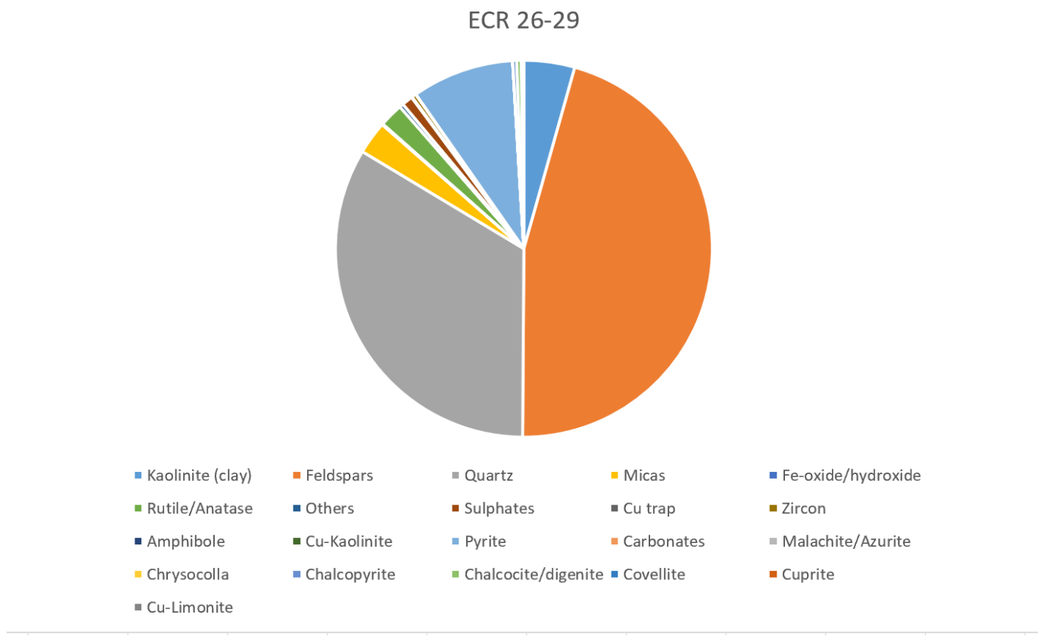


Figure 42: Mineralogy Graph

Figure43: Large Fractures Infill Depth 21.35m

Figure 44: Large Fractures Infill Depth 31.67m

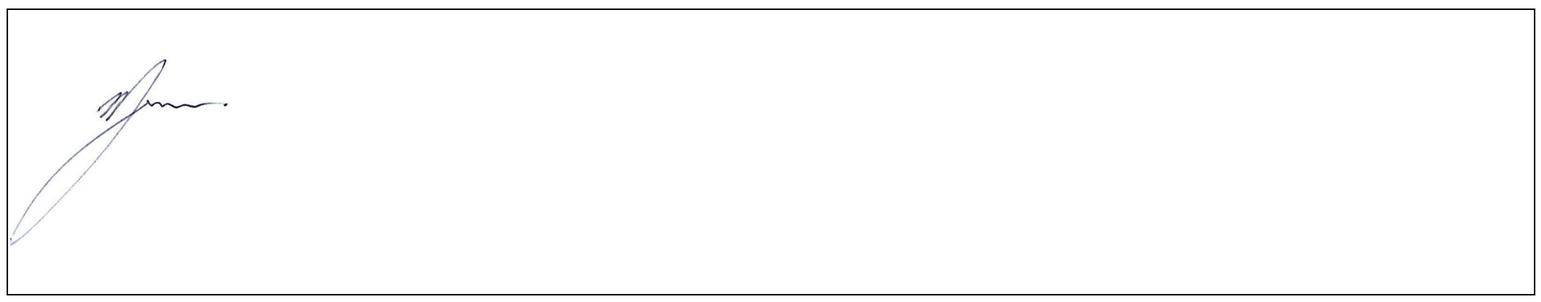
SECTION I – PUBLIC RELEASE OF INFORMATION

In accordance with DEM procedures on the public release of exploration PEPRs (refer to Minerals Regulatory Guidelines MG22, *Guidelines for conducting mineral exploration in South Australia*), please advise if you object to the release of any information included within this application (with the exception of sections marked 'not for public release'). If yes, specify the section(s) that you object to being publicly released and provide clear reasons why.	Yes ☐	No ☒
N/A		

SECTION J – SUBMISSION OF 12-MONTH EXPLORATION PEPR APPLICATION

Declaration of Accuracy

The exploration proposal must include a signed (digital signatures allowed) statement by the applicant in accordance with regulation 65(8) declaring that the content of the PEPR has been reviewed and is accurate. Inert signatures below.



An electronic version (PDF preferred) is to be submitted to DEM. A hard copy of the 12-month exploration PEPR application together with an electronic version can be submitted if the file size is too large to email. The information in both the hard copy and electronic version must be identical.

Submissions should be marked 'Attention: Exploration Regulation' and forwarded by email, post or courier:

Email
DEM.Exploration@sa.gov.au

Post
Mineral Tenements and Exploration Branch
Resources and Energy
Department for Energy and Mining
GPO Box 320
Adelaide SA 5001

Courier
Mineral Tenements and Exploration Branch
Resources and Energy
Department for Energy and Mining
c/- Level 4, 11 Waymouth Street
Adelaide SA 5000

ADDITIONAL INFORMATION – not for public release

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.

Copies of Notice of Entry (Form 21B) for D. Hampel and Waiver of Exemption for Russel Weber are provided as Attachment 22.

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)

All activities undertaken by EnviroCopper are done so in a manner that is aimed to achieve “zero harm”. EnviroCopper is committed to ensuring the following objectives are met during every phase of the exploration program:

- Legislative compliance with respect to health, safety, the environment and community
- The protection of the natural environment, public safety and amenity
- Achievement of agreed environmental outcomes.

EnviroCopper has an existing Work Health and Safety Management System (WHSMS) that describes how work health and safety and can be maintained. Working conditions will be continually improved and will ensure environmental and ePEPR compliance. The WHSMS includes policies and procedures, checklists and forms. Employees and contractors are inducted and trained in the WHSMS and relevant procedures.

The WHSMS has established procedures for environmental and safety hazard identification & risk management and incident reporting (in accordance with regulation 79(3)) & investigation.

An overview of the WHSMS is provided on the following page along with the Flow Sheet of the WHSMS is attached below for reference.

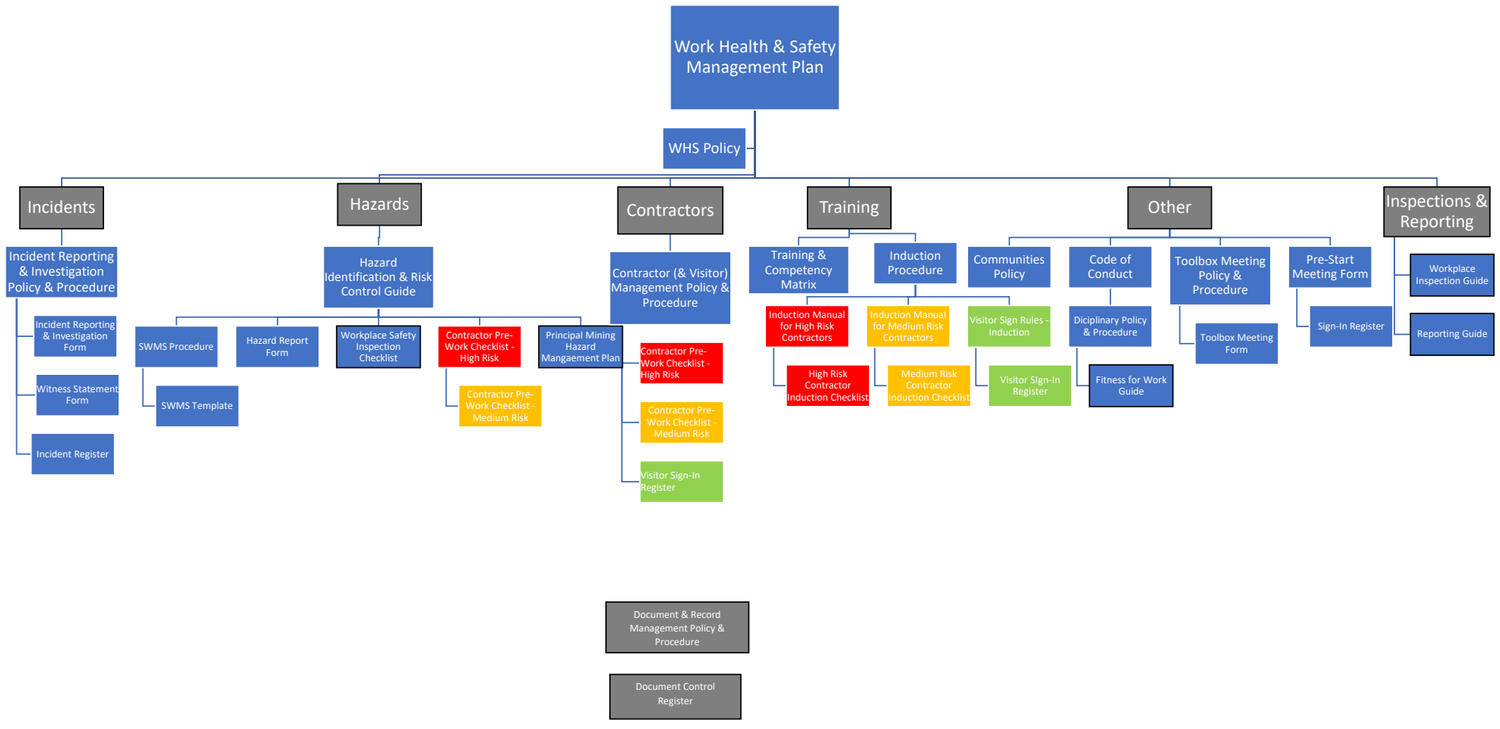
EnviroCopper and contactors will also be inducted and trained in the relevant environmental outcomes stated in the approved EPEPR (refer Section F – Management of Environmental Impacts). Compliance with the outcome measurement criteria will be reported by EnviroCopper in the relevant sections of the Annual Exploration Compliance Report.

EnviroCopper has already developed and implemented a stakeholder and community engagement plan and have been active in the Kapunda community for a number of years.

As described in the EPEPR (refer Section F – Management of Environmental Impacts), any complaints from landowners, Light Regional Council or the community will be recorded, investigated and resolved within a two (2) week period. Complaints and actions will also be reported in the ‘Complaints’ section of the annual exploration compliance report.

As previously discussed, the exploration activities are accounted for within the Light Regional Councils Community Land Management Plan (CLMP) for the Kapunda Historic Mine Site.

EnviroCopper – WHSMS Overview



ADDITIONAL MAPS – not for public release

General maps and plans:

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 access 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 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,
- Surface water systems
- any relevant land use types (e.g. parks and reserves, Aboriginal land, Woomera Prohibited Area).

Hydrogeological profile

Where applicable, include a series of hydrogeological cross-sections that represent the following at a project scale, as specified:

- major geological units (regional scale);
- geological units showing aquifer and confining units (tenement scale);
- aquifer systems (regional and tenement scale);
- faults and fracture systems (regional and tenement scale);
- mineralised zone (tenement scale);
- location of representative drill log sites from which geological information was obtained (regional and tenement scale); and
- location of representative monitoring bores (target aquifer) from which baseline groundwater quality information was obtained.

Aquifer potentiometric surface maps

For all aquifer systems that occur within the application area include:

- potentiometric surface contours based on measured borehole groundwater pressures;
- direction(s) of groundwater flow; and
- location of representative bores used to establish this information.

All maps and sections must conform to the standards outlined in the determination for exploration PEPRs (Ministerial Determination 013). All maps and sections must conform to the following standards:

- state the relevant datum (e.g. GDA2020, GDA94, WGS84);
- use metric units;
- include a title, north arrow, scale bar, text and legend;
- state the date prepared and author;
- be of appropriate resolution and scale to show the represented information.

Attachments:

Attachment Number	Title/Description
Attachment 1	Modelling of Coupled Hydro-Thermo-Chemical Fluid Flow through Rock Fracture Networks and Its Applications' Geosciences 2021 Review, University of Adelaide
Attachment 2	Structural Review Regarding Monitoring Well Placement, ECR August 2021
Attachment 3	ECR-20-2-R001Hydrogeological Description of the Environment; A Groundwater Science Report for Environmental Copper Recovery, Ben Jeuken and Paul Magarey, August 2021
Attachment 4	Estimation of the Kapunda Fracture Model and Hydraulic Conductivity Model. University of Adelaide, Hang Wang, March 2021
Attachment 5	Fracture Flow Modelling Overview, Hang Wang, August 2021
Attachment 6	CSIRO Methane Sulfonic acid Degradation Study
Attachment 7	Groundwater – surface water connectivity in a chain-of-ponds semiarid river' - A CSIRO Report (draft) for Environmental Copper Recovery, Sebastian Lamontagne and Jason Kirby, 9 April 2019
Attachment 8	Establishment of the baseline water quality data and benchmarks for the Light River, Kapunda SA - A CSIRO Report (draft) for Environmental Copper Recovery, Anu Kumar and Jason Kirby, July 2020
Attachment 9	Community perceptions of potential renewed Copper mining, Kapunda, SA (CSIRO 30 October 2019) Tom Measham, Simone Carr-Cornish and Andrea Walton
Attachment 10	Conceptual Site Model and Predictive Assessment - Kapunda ISR Hydrogeochemistry Support for SELT
Attachment 11	Kapunda Copper Project Baseline Hydrogeological Assessment – A Groundwater Science Report for Environmental Copper Recovery, Ben Jeuken and Paul Magarey, 29 September 2017
Attachment 12	Permit to Undertake a Water Affecting Activity - Six (6) Well Permits # 392227 to #392232
Attachment 13	Drainage and Discharge Permit # 336309
Attachment 14A Attachment 14B	Information sheets for proposed Lixiviant Lutropur (Methane Sulphonic Acid)
Attachment 15	EPA Licence 51363
Attachment 16	Re-thinking complex orebodies: Consequences for the future world supply of Copper; Valenta et al., Journal of Cleaner Production.
Attachment 17	Trends in ISR Technology, Dr Horst Maerten VP Technology, Heathgate Resources, ALTA 2019
Attachment 18	Literature review of groundwater baseline assessments and monitoring guidelines for in situ Cu and U recovery' - A CSIRO Report for Environmental Copper Recovery, Sebastian Lamontagne and Jason Kirby, 9 April 2019
Attachment 19	Groundwater Analysis Laboratory Reports
Attachment 20	Constraining Regional Scale Groundwater Transport Predictions with Geophysics, Chris Li et al
Attachment 21	Groundwater Monitoring & Management Plan (GMMP) Version FR004A, LWC Consulting, June 2023 ("GMMP (Version FR004A, June 2023)")
Attachment 22	Notice of Entry (Form 21B) for D. Hampel Waiver of Exemption for Russel Weber