APPLICATION Mining Act 1971 and Mining Regulations 2020

PROGRAM FOR ENVIRONMENT PROTECTION AND REHABILITATION (PEPR) FOR A MINERAL LEASE

Further information on requirements for a PEPR is available on the Department for Energy and Mining (DEM) Minerals website www.energymining.sa.gov.au .

SECTION A – GENERAL DETAILS

Tenement details	ML6498, ML6499, ML6500, and MPL158.
Tenement holder(s) (for each tenement)	Kalkaroo Copper Pty Ltd. (Havilah Resources Limited, PO Box 3, Fullarton SA 5063)
Operating company	Sandfire South Australia Pty Ltd (ABN 15 693 498 467), Level 2, 10 Kings Park Road, West Perth WA 6005
Agency agreement (if applicable)	Agent Authority and Operator Authority Letters for Sandfire South Australia Pty Ltd submitted on MERS 09 February 2026 and approved on 10 April 2026 (**Appendix 5**).
PEPR prepared by	Amy Jacka, Havilah Resources Limited, amy.jacka@havilah-resources.com.au, 0438 822 771 Claire Tolley, Sandfire Resources Limited, Principal Environment, Claire.Tolley@sandfire.com.au
Project supervisor/contact person(s)	Claire Tolley, Sandfire Resources Limited, Principal Environment, Claire.Tolley@sandfire.com.au
Project/prospect name	Kalkaroo Project
Location details	The project area is in the northeast of South Australia close to the NSW border (**Figures 1 and 2**). Geologically the project is in the Curnamona Province.
Project description, commodity type and mineralisation model	Drilling of up to 275 Diamond (DD) or Reverse Circulation (RC) drill holes within the bounds of ML6498, ML6499 and ML6500 for resource verification, metallurgical bulk samples and geotechnical verification purposes. A combination of existing and new tracks will be utilised. A temporary drillers laydown yard will be established within ML6498 to support drilling activities. To support the program activities the following key supporting infrastructure items will be established on MPL 158. • Exploration camp and amenities – to accommodate up to 80 personnel. • Wastewater treatment plant and disposal area. • Diesel storage and diesel generators • Potable water storage and treatment plant • Core processing facility Key program activities and supporting infrastructure locations are shown conceptually in **Figures 3 to 8**.

Proposed project schedule	Start date	30/04/2026	End date	30/04/2032

DECLARATION

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

Name	Chris Giles	Signature (digital allowed)	
Position	Technical Director	Date	30/04/2026

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

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

SECTION B – PROGRAM PREPARATION AND ACCESS TO LAND

Work undertaken in preparing the proposal

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

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

Drill hole locations have been planned following review of Havilah's Kalkaroo Project data and recent drilling results. Drill hole sighting has involved extensive collation and interpretation of existing data (both historical from previous companies and from Havilah's ongoing regional exploration) in combination with the local geological knowledge which the Havilah geologists, who have been working in the area for many years. Native Title heritage clearance surveys were completed by NAWNTAC in September 2022 and May-June 2023. Note that, Havilah Resources owns Kalkaroo Station on which the drilling will occur.

Consultation (r. 64)

Using the table below, provide a summary of the landowners consulted and the results of consultation undertaken on the proposed operations.

Tenement	Stakeholder, landowner and station name	Land tenure	Land use	Date notice of entry (Form 21) served	Date use of declared equipment (Form 22) served	Type of exempt land	Date waiver of exemption (Forms 23A, 23B) obtained	Date consultation/access agreement and/or permits signed/authorised	Landowner concerns raised and how addressed
ML6498 ML6499 ML6500 MPL158	Kalkaroo Pastoral Company Pty Ltd (Kalkaroo Station)	Crown Lease CL 6162/839	Grazing	02/02/2026 Form 21B	N/A	N/A	N/A	Kalkaroo Pastoral is a wholly owned subsidiary of Havilah Resources and relevant consultation has taken place. Form 21B submitted in person to Kalkaroo Manager and Owner.	None

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

Stakeholder consultation

Using the table below, summarise the results of consultation that has been undertaken with Stakeholders (other than the above landowners) on the proposed operation. This must include consultation undertaken with Traditional Owners in relation to matters of Aboriginal Heritage in the area.

Tenement	Stakeholder	Date of consultation	Stakeholder concerns raised and how addressed
ML6498 ML6499 ML6500 MPL158	Ngadjuri Adnyamathanha Wilyakali Native Title Aboriginal Corporation	September 2022 – notification and communication regarding heritage survey covering the proposed camp area on MPL158 May 2023 – notification and communication regarding heritage survey covering the Kalkaroo MLs and proposed drilling area. February 2026 - Meeting with NAWNTAC, Havilah and Sandfire to provide an update on the Kalkaroo Project. March 2026 and ongoing – Request to NAWNTAC to provide heritage monitors for monitoring of disturbances as part of this MPEPR.	Heritage clearance surveys were completed in September 2022 and May-June 2023 for the current proposed disturbance areas. Exclusion zones were identified where archaeological artefacts were noted. The current proposed drill program has been designed to ensure that all drill pads and associated infrastructure are located entirely within the heritage clearance boundary defined during the September 2022 and May–June 2023 surveys and that all identified heritage exclusion zones are avoided. No ground disturbing activities will occur within exclusion zones. In March 2026, Sandfire requested NAWNTAC to supply Aboriginal heritage monitors for the program. Heritage monitors were engaged in late April 2026 to confirm the delineation of heritage exclusion zones on the ground and will be engaged over the program to monitor excavation and other ground works during the drilling program, in accordance with agreed heritage management practices. Any future drilling activities beyond the existing heritage clearance area will be subject to a new Aboriginal heritage clearance survey specific to those locations. A subsequent MPEPR application will then be submitted to DEM following completion of that survey and receipt of heritage clearance.

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.

Ongoing consultation with landowners and occupiers, including site visits, phone calls and email correspondence.

SECTION C – DESCRIPTION OF THE ENVIRONMENT

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

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

Proximity to infrastructure and housing

Provide the following information:

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

Provide this information on a locality plan/map.

There are no settlements or places of human habitation within the area of proposed drilling. Station roads, tracks, fences, bores, tanks, and dams are the only infrastructure, none of which will be affected by the proposed drilling activities. Havilah's preexisting workers camp is located at the Kalkaroo Homestead, which is the closest to any of the areas of proposed drilling and is owned by the Kalkaroo Pastoral Company Pty. Ltd., a wholly owned subsidiary of Havilah Resources Limited. No drilling will occur within or near exempt areas associated with dams (which in any case are owned by Havilah) (**Figure 3 and 4**).

Land use and tenure

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

Land tenure/type	Applicable
Freehold	☐
Pastoral lease	☒
Perpetual lease	☐
Crown land	☒
Mining reserve	☐
Aboriginal freehold/leasehold land (e.g. Anangu Pitjantjatjara Yankunytjatjara and Maralinga Tjarutja lands)	☐
Forestry reserve	☐
Marine parks	☐
National parks, conservation parks, conservation reserves, regional reserves*	☐
Adelaide Dolphin Sanctuary	☐
Murray Darling Basin	☐
N/A	
Other*	☐
N/A	

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	☐
N/A	
*Other (e.g. historic mining)	
N/A	

* Indicates more information required in field immediately below.

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

N/A

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

N/A

Provide any additional relevant information.

Note that, Havilah Resources owns Kalkaroo Station on which the drilling will occur. The property is currently not stocked.

Woomera Prohibited Area (WPA)

Will activities be conducted within the WPA	Yes ☐ No ☒ (If no, no further information in this section required.)		
In which zone will activities be conducted?	Do you have a resource exploration permit in place?	Yes ☐	No ☐
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.			

Land owned or controlled by the Commonwealth Department of Defence

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

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

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

Native title

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

Native title			
Is the proposed area of operations 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 operations?	Yes ☒ No ☐	NAWNTAC Consent Determination 14/12/2018, East area.	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 ☐	Instrument number 426
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.

N/A

Landform and topography

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

The area of proposed drilling lies within the plains of the Lake Frome Basin. The plains are flat to slightly undulating, with the land surface falling gradually at a gradient of about 1 in 1,000 towards Lake Frome, 100 km to the northwest of the project area.

Apart from three isolated basement ridges (Mooleulooloo Hills and Mt. John) near Mooleulooloo Homestead and a rocky knoll at Kalkaroo (Johnny Hill), the nearest areas of elevated topography are the Olary Ranges about 60 km to the south. To the east, the Barrier Range lies beyond the New South Wales border.

The landscape surrounding the project area is characterised by a flat to slightly undulating sandy plain, with low sandy dunes and shallow interdunal areas, scattered with small claypans, trending in a south westerly – north easterly direction (**Photo 1**).

Soil and surface cover

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

Topsoil development in the project area is limited to a 0.1-1 m layer of light red soils occurring on alluvial material near drainages and a 1-2 m layer of aeolian sand, comprising mostly quartz grains in other areas. Sandy clays +/- gypsum occur at the basal interface between the quaternary and underlying Tertiary clays.

Minor dust and track compaction are expected to be associated with the drilling activities and will be rehabilitated. Given the lack of topography, the project area is not susceptible to runoff and associated erosion.

Surface water

Will the proposed program interfere with surface water bodies and natural drainage (e.g. drainage lines, creeks, floodplains, wetlands)? If yes, describe the potential interference and surface water bodies and natural drainage on maps. If no, indicate why.	Yes ☐	No ☒

There is an ephemeral drainage line running through the Kalkaroo Deposit that lies within the area of proposed drilling (**Figures 3 and 4**). No drilling or related disturbance will occur within 25m of the top of the creek channel (bank). A 25m setback from the top of the channel is considered sufficient to minimise the risks to surface water quality and riparian vegetation by preventing direct disturbance to the channel and reducing the potential for sediment mobilisation or accidental spills. (**Figure 5**). **Plates 1 and 2** show the defined nature of the creek within the area of proposed drilling.

Plate 1. Aerial view of defined creek channel

Plate 2. Creek channel definition

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 *Landscape South Australia Act 2019*? If yes, provide the name(s).	Yes ☐	No ☒

N/A

Groundwater

Is groundwater likely to be intersected when conducting the program? If yes, use the table below to describe the expected groundwater (hydrogeological) conditions, and identify groundwater aquifers in the area(s) that may be affected. Indicate the approximate depth of drillholes in each area. Copy and paste a new table for each area where different groundwater conditions are expected. If no, provide evidence or any supporting information demonstrating this.	Yes ☒	No ☐

A high-level groundwater impact assessment for the Kalkaroo mining lease area was completed by Water Technology in December 2021 in response to DEM's review of the draft MPEPR for the Kalkaroo Starter Pit (now withdrawn). The assessment provides a detailed description of the regional and local hydrogeological framework and forms the basis for understanding potential groundwater interactions associated with proposed activities.

Based on this assessment, the regional water table in the vicinity of the Kalkaroo deposit occurs at approximately 45-50 meters below ground level (mbgl), typically within the weathered basement (saprolite) horizon. Proposed drilling associated with this MEPER application is expected to extend below this depth and therefore intersect groundwater.

Groundwater in the area is hosted primarily within weathered and fractured Proterozoic basement rocks, rather than within unconsolidated sedimentary aquifers. Shallow Quaternary and Tertiary sediments (including the Namba Formation) are predominantly unsaturated in the project area due to the relatively deep water table, low regional recharge rates, and the low-permeability, clay-rich nature of these units.

The dominant hydrogeological units likely to be intersected are:

- Saprolite (weathered basement): generally low permeability, clay-rich material representing weathered Proterozoic basement. Localised increases in permeability and groundwater inflows occur when saprolite is intersected by basement shear zones and structural features.
- Saprock and fresh basement: underlying transitional weathered and fresh Proterozoic bedrock that is typically of very low permeability except where intersected by shear zones and structural features. These structures act as preferential groundwater pathways.

No continuous paleochannel aquifers (Eyre Formation) are present beneath or proximal to the Kalkaroo mining leases (**Figure 9**). Water Technology's review of extensive historical drilling data (including hundreds of resource and exploration holes) identified only isolated and discontinuous occurrences of silty or sandy material at the base of the Namba Formation. These occurrences are not laterally connected and are interpreted to be associated with the Namba Formation rather than representing significant palaeochannel systems. The nearest

recognised palaeochannel is the Yarramba Palaeochannel, located approximately 12 km east of the Kalkaroo deposit.

Water Technology conceptualise groundwater at the site as occurring within subvertical “strip aquifers” associated with basement shear zones. These structures extend upward through the saprolite and to depth within fresh basement and are hydraulically connected within a broader saturated but low permeability basement aquifer system. Groundwater within these structural zones and the surrounding basement rock responds to the same regional water table, although localised hydraulic gradients occur near higher permeability shear zones.

The conclusions of the Water Technology assessment regarding the absence of palaeochannels and the structurally controlled nature of groundwater flow are consistent with hydrogeological conditions observed during historical drilling programs undertaken by Havilah Resources and prior exploration companies across the mining lease area.

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
Quaternary sediments (undifferentiated alluvial, fluvial and aeolian deposits)	0 to ~10 m	Not an aquifer (unsaturated)	Not applicable	Unsaturated (no permanent aquifer)	Clay-rich, very low permeability sediments. No evidence of permanent groundwater. Very low risk of groundwater interception.
Tertiary - Namba Formation (Miocene lacustrine clays and silts)	10 to 30 m	Not an aquifer (unsaturated)	Not applicable	Potentially unconfined aquifer (uncertain)[1]	The Namba Formation is interpreted to be predominantly unsaturated and of low permeability within the mining lease area. However, limited site-specific hydrogeological data targeting this unit means its aquifer status cannot be fully discounted under all conditions although it is not a recognised regional aquifer. A conservative approach is therefore adopted for drilling and rehabilitation consistent with M21 requirements.
Proterozoic basement – Saprolite (weathered basement)	~30 m – 60 m	Saprolite aquifer	~45 m – 60 m (saturated interval begins at ~45 m – 50 mbgl)	Unconfined aquifer	The regional water table occurs at approximately 45-50 mbgl, typically within the saprolite. Permeability is low overall, but localized higher inflows may occur where saprolite intersects shear zones. Groundwater is brackish to saline (typically >9,000 mg/L TDS).
Proterozoic basement - Saprolite / Fresh basement	60 m - >110 m	Fractured basement aquifer	~60 m – 110+ m	Unconfined to semi-confined fractured rock aquifer	Groundwater occurs primarily in fracture and shear zones. Background permeability is very low outside these structures. Salinity ranges from brackish to saline (up to ~34,000 mg/L TDS).
Basement shear zones and structural features	Variable, extending through saprolite and fresh basement	Structural “strip aquifers”	Discrete zones	Unconfined to locally confined	High permeability fracture zones acting as preferential groundwater pathways. These zones mostly control groundwater inflows encountered during drilling.

[1] The December 2021 Water Technology Groundwater Impact Assessment describes the Namba Formation as a predominantly clay rich, low permeability unit that is generally unsaturated within the Kalkaroo mining lease area. However, the assessment also acknowledges that shallow units were not the focus of site specific hydrogeological investigations and that limited quantitative data are available to fully validate the hydrogeological behaviour of the Namba Formation under all conditions.
In recognition of this uncertainty, and consistent with the requirements of Earth Resources Information Sheet M21, the aquifer type associated with the Namba Formation has been updated to “potentially unconfined aquifer (uncertain)”. This conservative classification ensures that drill hole design, sealing and rehabilitation methods are protective of groundwater values and outcome achievability, irrespective of localised saturation or perched groundwater conditions.

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

Based on salinity of groundwater from the higher permeability shear zones (>13,000 mg/L), water quality is not suitable for the environmental value: primary industries – livestock drinking water (salinity between 3,000 and 13,000 mg/L). There are no known operational groundwater wells within 10 km of the mining leases extracting groundwater for stock use.

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

A review of the Australian GDE Atlas indicates that no high-value or high-likelihood GDEs occur within the project area. The ecosystems mapped in and around the site are generally classified as having a low likelihood of groundwater dependence, consistent with local groundwater conditions where the water table occurs at depths greater than 30m and is brackish to saline.

Aquatic GDEs:

- The nearest potential GDEs are ~7km northeast of the Kalkaroo deposit, associated with low-lying salt lakes and alluvial pans.
- Additional potential aquatic GDEs occur along ephemeral drainage lines at greater distances (Calico Creek 15km west, Oonartra Creek 23km south, Mingary Creek 22km west).
- All are classified as low likelihood of groundwater dependence.

Terrestrial GDEs:

- The project area is dominated by low shrubland communities (e.g. *Sclerolaena divaricata, Atriplex vesicaria, Maireana aphylla*), mapped as low likelihood of groundwater dependence.
- A *Eucalyptus camaldulensis* woodland located 5km southeast is identified as having a high likelihood of groundwater reliance, but it lies outside of the project area.

Overall, no significant or high-value GDEs occur within the project footprint, and the nearest high-likelihood GDE is several kilometres away.

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 any additional information, if required.

The groundwater in the drilling area is too saline for stock use and for this reason there are no active bores in the general area that are used by pastoralists.

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. If yes, a Native Vegetation Management Plan (NVMP) prepared by an accredited consultant must be included with the PEPR. The NVMP must: • describe the vegetation type to be cleared and include a map showing the proposed clearance area; and • state the quantum of significant environmental benefit (SEB) to be gained in exchange for the clearance and describe how the SEB will be provided. If no, indicate why you will not be working within areas of native vegetation?	Yes ☒	No ☐

The project area is located within the Flinders Lofty Block Bioregion (Olary Spur Subregion) and consists of arid pastoral landscapes dominated by sparsely vegetated chenopod shrublands and ephemeral grasslands. Vegetation communities have demonstrated high resilience and strong natural regeneration capacity, largely due to destocking since 2009 and historically low relief landforms.

Six vegetation associations have been identified within the general project area, all of which are disturbance-adapted and largely regenerated following previous exploration activities. The vegetation associations in the lease area include:

- Ephemeral Herb/Grassland
- *Maireana astrotricha* (Low Bluebush) / Atriplex vesicaria (Bladder Saltbush) Low shrubland
- *Maireana aphylla* (Cotton-bush) Low Shrubland
- *Gunniopsis quadrifida* (Sturt's Pigface) Low Open Shrubland
- *Rhagodia spinescens* (Spiny Saltbush) mixed chenopod Shrubland +/- emergent *Acacia victoriae* (Elegant Wattle) and *Eucalyptus largiflorens* (Black Box)
- *Maireana pyramidata* (Black Bluebush) mixed chenopod shrubland

Vegetation condition across the lease areas is generally good to excellent, with no trees or large shrubs requiring removal. All vegetation disturbance associated with the proposed drilling program is temporary and will be progressively rehabilitated.

Appendix 2 – Native Vegetation Management Plan prepared by Ecosphere Ecological Solutions Pty Ltd for this exploration drilling MPEPR.

In accordance with the conditions of the mining leases, planned work under this MPEPR will not result in a loss of abundance or diversity of native vegetation by using the Native Vegetation Clearance Mitigation Hierarchy as documented in the Native Vegetation Management Plan.

Disturbance and Rehabilitation of native vegetation will be fully documented in Environmental Compliance Reports to be submitted to DEM.

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.

No Threatened Ecological Communities (TECs) or conservation-significant vegetation communities have been identified within the project area. The mapped vegetation associations are not listed as conservation significant under state or national legislation.

Habitats present include:

- Open chenopod shrublands on clay and sandy clay soils
- Ephemeral drainage lines supporting higher productivity shrub assemblages
- Grassland and ephemeral herb communities responding to seasonal rainfall

These habitats are common within the region and are well represented in the wider landscape. No threatened or priority flora species have been recorded within the proposed disturbance areas.

Two species, the Purple-wood Wattle and the Broughton Pea have been recorded in the broader region, however these species have not been recorded within the proposed drilling or camp area.

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

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

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

Weeds and pathogens

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

Weed presence within the broader project area is generally low, with higher densities observed locally within ephemeral drainage lines. Potential weeds of concern include:

- *Lycium ferocissimum* (African Boxthorn – declared weed)
- *Echium plantagineum* (Salvation Jane)
- *Xanthium spinosum* (Bathurst Burr)
- *Cenchrus ciliaris* (Buffel Grass)
- *Xanthium strumarium* (Noogoora Burr)

No significant plant pathogens were identified, and the risk of pathogen spread is considered low with appropriate controls in place.

The project area is in the Buffel Grass (Plate 3) Management Zone 2 (Contain Spread) however there are no known occurrences of Buffel Grass within the area. Should an area of Buffel Grass infestation be encountered during the drilling program, cleaning procedures will be implemented when leaving the area of infestation and the area avoided.

Plate 3: Buffel Grass

Badman (2008) recognised twenty introduced species of which two *Echium plantagineum* (Salvation Jane) (Plate 4) and *Lycium ferocissimum* (African Boxthorn) (Plate 5) *are* Proclaimed Species, as listed by APCC (2004). The introduced species recorded during the October 2007 survey represent 16% of the total species list for this survey.

Plate 4: Salvation Jane

Plate 5: African Boxthorn

Fauna

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

The fauna assemblage of the project area is typical of arid pastoral environments, supporting a range of common reptiles, birds, and small mammals. Habitat values are generally moderate, reflecting open vegetation structure, limited ground complexity, and historic pastoral disturbance.

Fauna use is primarily opportunistic, with species moving through the landscape rather than relying on discrete or sensitive habitat features. Temporary disturbances are expected to cause short-term displacement only, with negligible long-term impact following rehabilitation.

Three nationally threatened species have historical records within the broader region, however these species have not been recorded within the proposed drilling or camp area:

- Plains-wanderer (*Pedionomus torquatus*)
- Dusky Hopping-mouse (*Notomys fuscus*)
- Yellow-footed Rock-wallaby (*Petrogale xanthopus*)

Of these:

- The Plains-wanderer may periodically utilise suitable grassland habitat within the pastoral landscape.
- The Dusky Hopping-mouse could occur opportunistically in favourable seasons.
- The Yellow-footed Rock-wallaby is considered unlikely due to a lack of suitable rocky habitat.

Additionally, 15 state-listed fauna species are known within 50 km of the project area. Based on habitat quality, historical disturbance, and the temporary nature of works, the risk of impact to significant fauna is assessed as low (Ecosphere, 2026).

Fauna protection measures include sump escape ramps, minimisation of clearing, and progressive rehabilitation.

Feral species known or expected to occur in the area include:

- Rabbits
- Feral cats
- Feral dogs
- Feral goats
- Feral pigs

Significant fauna

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

Species	Common name	NPW Act rating	EPBC Act rating
None recorded within immediate project area that may be impacted by the proposed program			

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 locations

Are there any environmentally sensitive locations within or close to the proposed area of operations (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 ☒
No environmentally sensitive areas (such as conservation reserves, TECs, wetlands of international significance, or heritage vegetation areas) occur within the proposed disturbance footprint. Ephemeral drainage lines are present but are not conservation-listed and will be avoided where practicable. Where disturbance cannot be avoided, impacts will be minor, temporary, and fully rehabilitated. No drilling will occur within 25m of the drainage centre-line (**Figure 5**).		
Are you likely to impact on the environmentally sensitive area? If yes, detail the likely effects the proposed program may have.	Yes ☐	No ☒
N/A		

Include a statement concerning whether or not an Aboriginal heritage survey has been conducted by the proponent and if so, the results of the survey.

Aboriginal heritage surveys have been completed by NAWNTAC, with two heritage clearance surveys relevant to the proposed program.

A heritage clearance survey of the camp area was undertaken in September 2022. The purpose of this survey was to provide heritage clearance for diamond drilling areas on ML6498 and to assess the proposed temporary camp area (associated with the former OZ Minerals camp) located on the southern boundary of MPL158. Native title holders and Traditional Owners participated in the survey and provided heritage clearance for the assessed areas. As a result, seven heritage exclusion zones were identified within the drilling area, and one exclusion zone was established within the camp area.

A further heritage clearance survey of the drilling area was undertaken in June 2023. This survey was conducted to provide heritage clearance for RC and diamond drilling activities. Native title holders and Traditional Owners surveyed and cleared four areas totalling approximately 380ha, covering portions of ML6498, ML6499, ML6500 and MPL158. A number of additional heritage exclusion zones were identified within the clearance area.

For the current exploration drilling program, all drill sites and associated infrastructure will be located entirely within previously heritage-cleared areas, and all identified heritage exclusion zones will be strictly avoided. In addition, Sandfire is working with NAWNTAC to engage Aboriginal heritage monitors, who will be present during ground disturbance works to ensure ongoing protection of Aboriginal heritage values.

SECTION D – DESCRIPTION OF PROPOSED OPERATIONS

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

Equipment and personnel requirements

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

Type of personnel	Number	Name of contractor company (if applicable)
Geologists	6	Sandfire South Australia Pty Ltd
Field assistants/technicians	10	Sandfire South Australia Pty Ltd
Drilling crew Diamond / RC	35	Drilling contractor company not yet finalised
Medic	1	Contractor company not yet finalised.
Site preparation and rehabilitation	1	Sandfire South Australia Pty Ltd, Havilah Resources Limited and/or drilling contractor
Camp catering/cleaning	8	Contractor company not yet finalised
NAWNTAC Heritage Monitors	4	NAWNTAC RNTBC
Study Team + approvals	4-6	Sandfire South Australia Pty Ltd and Havilah Resources Limited (part-time on site)

Shifts worked per day	Hours worked per day	Days worked per week
2	12 hrs per shift	7

Equipment type	Owner/operator	Description/capacity	Activity/purpose
Drilling Operations			
Drill Rigs: - 4 Diamond Drill rigs - 2 RC rigs	DDH1 Drilling Pty Ltd (DD) McKay Drilling Pty Ltd (RC)	UDR 650/1000 or similar	Drilling
Compressor/rod Trucks	As above	1 x 6 or 8 wheel flat bed	Drilling support vehicles
Water Truck	As above	1 x 8 wheel 20,000L	To supply drilling water, only when too far to pipe e.g., >3km. No tanks required.
Backhoe	As above	Backhoe	Site Preparation (including digging of Sumps) & Rehabilitation
Forklift	Sandfire South Australia Pty Ltd	1 x rough terrain diesel forklift	Core processing activities
4WD Utilities	Sandfire South Australia Pty Ltd and drilling contractor	9 x Dual-cab vehicles	Field crew vehicles for access, sampling & logging. In addition to transportation for drilling crew to and from the site.
Core Processing Facility			
Office Block / Ablutions	Sandfire South Australia Pty Ltd	3 x 12 m x 3 m demountable 1 x 6 m x 3 m male/female ablution demountable	Supporting core processing facility operations
Dome Shelter	Sandfire South Australia Pty Ltd	48 m x 19 m dome shelter mounted on 8 sea containers	Provision of shade cover for core processing facility staff while processing drill core
Core cutting and weighing containers	Sandfire South Australia Pty Ltd	2 x 20 ft sea containers containing core saws 2 x 10 ft containers containing gravity station	Supporting core processing facility operations
Roller Racks	Sandfire South Australia Pty Ltd	Roller racks to move and process drill core, including photography station and pallet lift	Core processing facility operations
Diesel Generator and self-bunded diesel tank	Sandfire South Australia Pty Ltd	1 x 150 kVA generator connected to a 5,000L self-bunded diesel tank	Supporting core processing facility operations
Water tank	Sandfire South Australia Pty Ltd	30,000 potable water tank	Supply ablution block and core processing equipment

Provide any additional information, if required.

The proposed resource drilling program will utilise up to four (4) diamond and up to two (2) reverse circulation (RC) drill rigs, supported by ancillary vehicles and equipment, including rod trucks and water trucks. Drilling activities will be undertaken on a continuous basis, operating two 12-hour shifts per day, seven days per week.

The drilling program will be overseen by Sandfire South Australia Pty Ltd, including qualified geologists responsible for supervising drilling activities. Field technicians will support the program through drill-site preparation, sample handling and management, and the implementation of rehabilitation measures.

All personnel engaged in on-ground drilling and support activities will be accommodated within a temporary camp facility. The camp will provide dedicated catering and cleaning services to support workforce welfare and site operations.

Low impact exploration activities

Will low impact exploration operations be conducted that are not covered by the Generic program for environment protection and rehabilitation – low impact mineral exploration in South Australia, (generic PEPR)? If yes, describe each type of low impact operations proposed.	Yes ☐	No ☒
N/A		

Drilling activities

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

Tenement	Drilling type	Maximum number of drillholes	Maximum drillhole depth (m)	Maximum number of sumps required at each site	Maximum size of sumps (length x depth x width) (m^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)
ML6498, ML6499, ML6500	DD/RC	275	400m (average) 800m (maximum)	2	6m x 2m x 4m ($48m^3$)	Drill Pad Size: 25m x 35m ($875m^2$)	-	-
TOTAL		**275**	**220,000 m**	**550**	**26,400 m^3**	**240,625 m^2**	**-**	**-**
		Total number of drillholes (add each row to calculate the total).	Total metres proposed (maximum number of holes x average depth for each row, then add each row to calculate the total).	Total number of sumps (maximum number of sumps x drillsites for each row, then add each row to calculate the total).	Total volume of sumps (maximum size of sumps x number of sumps for each row, then add each row to calculate the total).	Total area of disturbance (number of holes x average size for each row, then add each row to calculate the total).	Total number of pads requiring excavation (add each row to calculate the total).	Total volume of material to be excavated (number of sites requiring excavation x average volume for each row, then add each row to calculate the total).

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

Drillsite preparation

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

Drill sites will be prepared using low-impact methods to minimise disturbance to vegetation and soils.

Access to drill pads from existing roads and station tracks will be via controlled overland travel through areas of sparse vegetation. No mechanical vegetation clearing is anticipated for access or pad preparation.

A total of up to 275 drill pads, each measuring approximately 25m x 35m ($875m^2$), will be established across the program area. Drill pads have been designed to accommodate both RC and diamond drill rigs, allow for sample storage (approximately 20m x 10m), core handling, and sump construction (**Plate 6**).

Mechanical clearing will not be required for drill pads, except where necessary for sump excavation. Where low-lying vegetation (e.g. small shrubs or bushed) is present within the pad footprint, it will be manually trimmed using hand tools only to provide a safe working area.

Each drill pad will contain two sumps, each approximately 6m x 4m and 2m deep. Approximately $48m^3$ of soil will be excavated per drill pad. Prior to sump excavation, topsoil will be stripped and stockpiled adjacent to the drill pad, separately from subsoil, for later use in rehabilitation. Sumps will be bunded to prevent overtopping and leakage.

Fauna escape ramps will be installed in sumps to allow animal egress, and sumps will be inspected regularly while open.

Drill pad and sump locations have been selected to avoid drainage lines, and identified heritage exclusion zones (**Figure 4, Figure 5**).

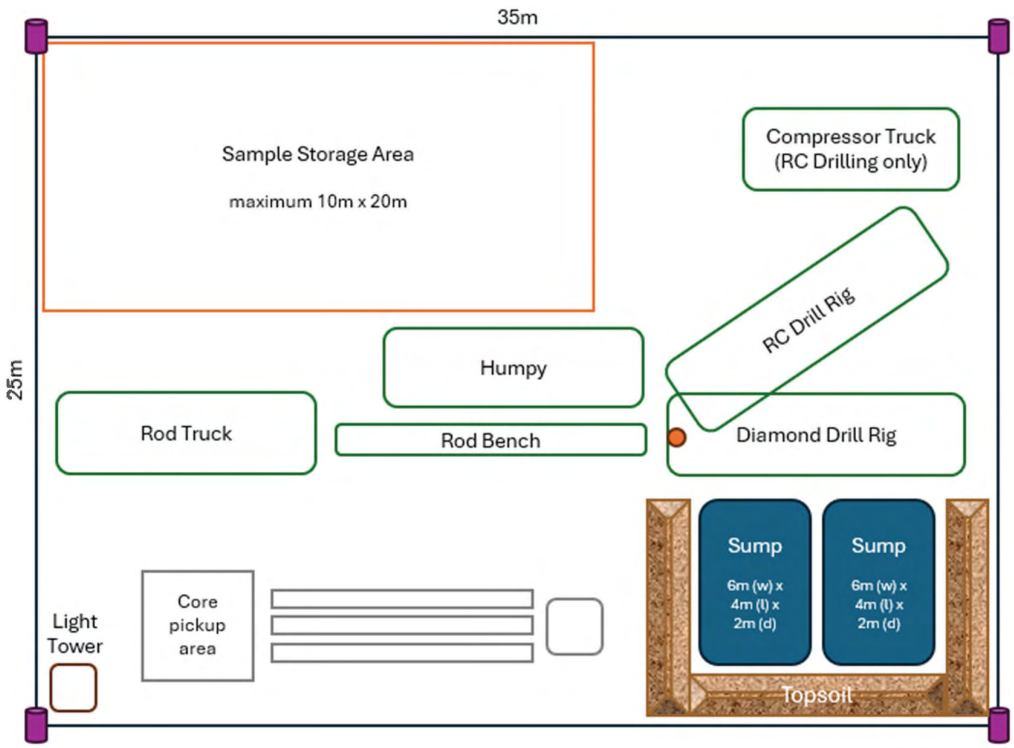


Plate 6. Typical drill pad layout

Drillhole construction and decommissioning

Have the personnel responsible for implementing the proposed program read and understood the Earth Resources Information Sheet M21, Mineral exploration drillholes – general specifications for construction and backfilling?	Yes ☒	No ☐

Describe how drillholes will be constructed, including the casing material to be used, depth of casing, if the casing will be cemented, cementing intervals and the class of driller that will install the casing.

Diamond drill holes will be constructed using one of the following methods, depending on site conditions and geological requirements.

Some drillholes will be cored directly from surface using PQ or HQ-diameter triple-tube diamond drill rods. Other drill holes will be established using a pre-collar drilled by reverse circulation (RC) methods through unconsolidated weathered materials, including Quaternary sands and clays, Namba Formation clays, and saprolite, until competent fresh rock is intersected at approximately 130m. PVC casing will be installed through unconsolidated cover to maintain hole stability.

Upon completion of the pre-collar, diamond coring will be undertaken using HQ-sized core barrels from the base of the pre-collar through the target mineralized zone, to an average depth of 400m and a maximum depth of up to 800m.

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

Groundwater at the Kalkaroo site is interpreted to occur within connected Cenozoic sediments and fractured basement aquifers, with the regional water table typically at approximately 45-50 m below ground level. There is no conclusive evidence supporting the presence of unconfined aquifers; however, due to limited site-specific data for shallow units (including the Tertiary Namba Formation), aquifer classification remains uncertain. This PEPR adopts a conservative approach to drillhole decommissioning, assuming that the Proterozoic fractured basement or fractured rock aquifer is confined.

Timing of decommissioning

- Drillholes will be kept open and securely capped where practicable to allow for future re-entry.
- Drillholes that are no longer required, or that are located within potential future underground mining areas, will be fully decommissioned as soon as practicable following completion of drilling, in line with the rehabilitation plan.

Casing and materials

- Drillholes will be cased through weathered and unstable strata, including saprolite and clay-rich intervals.
- Casing will generally not be removed, due to the risk of hole collapse and practical constraints in clay-rich formations. Sealing will occur inside the casing, consistent with Earth Resources Information Sheet M21.
- Cement or cement-bentonite grout will be used to seal groundwater bearing or transmissive zones.
- Sodium bentonite pellets or chips may be used in unsaturated intervals, with water added where required to ensure hydration. Bentonite is preferred where future open-pit mining is anticipated.

Decommissioning Strategy

Drillhole decommissioning will be based on observed groundwater conditions during drilling, rather than fixed depths. As a minimum:

- Groundwater intercepts will be decommissioned in accordance with Earth Resources Information Sheet M21.
- Where a single unconfined aquifer is intercepted, the hole will be backfilled with drill cuttings, bentonite or cement.
- Where a confined aquifer is intercepted a plug (Van Ruth or similar) will be inserted and grouted in accordance with Earth Resources Information Sheet M21 Figure 3.
- If multiple aquifers are intersected, a confined plug will be inserted and backfilled to the confining bed above, at a minimum of 20m of grout in accordance with Earth Resources Information Sheet M21 Figure 4.
- Seals will extend from the deepest groundwater intercept to at least 10m above the standing water level where applicable.
- The upper portion of each drillhole will be backfilled and sealed to prevent surface water and wildlife ingress.

Consideration of Namba Formation self-sealing behaviour

In October–November 2025, Havilah undertook a Namba Formation Self-sealing Test to assess whether drillholes penetrating clay-rich Namba Formation strata may naturally seal when exposed to wetting, effectively reestablishing hydraulic separation between shallow sediments and underlying groundwater bearing strata. The fieldwork was supervised by DEM and DEW (Drilling Inspector) personnel and reported to DEM (*Havilah, November 2025: Namba Formation Strata Self Sealing Test Report*).

The test demonstrated that Namba Formation clays typically swell when wetted and, under test conditions, were capable of progressively sealing an open, unsupported drillhole intersection. Water was deliberately added during the test to simulate wetting conditions expected where a drillhole intersects groundwater at depth and therefore assumes groundwater would normally be present.

Internal DEW comments on the Namba Formation self-sealing test (dated 16 February 2026) included as Appendix A in DEM's Request for Further Information noted that:

- While the test demonstrates swelling and potential self-sealing behaviour, it remains uncertain whether groundwater below the Namba Formation is consistently under sufficient pressure to reliably induce passive sealing in all circumstances; and
- Where casing is left in place, clay expansion and self-sealing cannot occur.

Accordingly, while the self-sealing test provides supporting evidence that Namba Formation clays may contribute to long term isolation of drillhole voids under certain conditions, self-sealing is not relied upon as the sole decommissioning mechanism. Conservative, M21compliant sealing methods will continue to be applied.

Options-based approach for the Namba Formation

To address uncertainty in groundwater occurrence within the Namba Formation, the following approaches will be applied based on conditions encountered during drilling:

- Hole decommissioning within the Namba Formation will be done in accordance with M21.
- Where groundwater is intersected in the Namba formation hole rehabilitation will be conducted but not limited to installing a Van Ruth (or similar) to the base of Namba and grouting 15m above the contact to ensure no transmission between geological units.

Drillhole groundwater inflow behaviour, pressures and recovery will be monitored during drilling, and decommissioning methods adjusted if site-specific conditions indicate that passive sealing may be inadequate. Sandfire will liaise with the DEW Drilling Inspector and seek agreement before decommissioning methods are adjusted.

Have the personnel responsible for implementing the proposed program read and understood the Earth Resources Information Sheet M21, Mineral exploration drillholes – general specifications for construction and backfilling?	Yes ☒	No ☐

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

Costeans and trial mining pits

Will trial mining/costeans/trial mining/bulk sample disposal pits be required for the proposed program? If yes, fill out the table below.	Yes ☐	No ☒

Tenement	Number of costeans/pits	Size of costean (length x width) (m^2)	Average depth (m)	Volume excavated (m^3)	Total volume excavated (m^3) (number of costeans/pits x volume)	Total area of disturbance* (length x width) (m^2)
N/A						
TOTAL						
	Total number of costeans/pits (add each row to calculate the total).				Total volume of material to be excavated (add each row to calculate the total)	Total area of disturbance (number of costeans/pits x area of disturbance for each row, then add each row to calculate the total).

*Includes storage of excavated material at the site (e.g. topsoil and subsoil segregation).

Costeans and trial mining pit preparation

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

N/A

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).

SAMPLE MANAGEMENT - DRILL SITES An area (20 m x 10m) within each drill pad will be reserved for samples (**Plate 6**). No clearing will be necessary, apart from the removal of any bushes by hand (shovel), if required. Plastic-bagged, coarse reject samples will be racked out in 5m runs. Riffle split, calico-bagged samples (1m, 3-5kg each) will be laid out on top of the corresponding plastic-bagged coarse rejects on the ground prior to collection. Coarse reject samples will be disposed in sumps during the site rehabilitation. No bulk sample storage pit or bag farms are required. No sample material will remain on the surface at the cessation of activities. All plastic sample bags and rubbish will be removed. CORE PROCESSING The core processing facility is located within the existing Havilah core farm area and will extend to the north onto disturbed land utilised by the pastoral station. The core processing facility is shown in **Figure 6**. **Appendix 2** (NVMP) notes that the core processing facility is in an existing disturbance footprint and no vegetation disturbance is required. The core processing facility is a controlled area that will receive, handle, log, sample and store drill core and related samples during the drilling program. Geologists will log core, recording lithology, structure, alteration, mineralisation and geotechnical features. The core will be cut, photographed and sampled. Samples will be dispatched to an accredited laboratory for further testing. Residual core will be stored on-site.

Access routes to work areas

Will existing tracks require upgrading and/or maintenance? If yes, detail the work required to upgrade/maintain existing tracks.	Yes ☐	No ☒
N/A		
Will access be required across adjoining tenements? If yes, detail the method(s) for gaining access, and if an agreement is in place with all stakeholders. Include the total area of disturbance required (i.e. length (km) and width (m) of tracks) and provide on a locality map.	Yes ☐	No ☒
N/A		
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 ☐
Yes, Limited access off existing tracks will be required to reach drill sites and to move along drill lines. Approximately 10.03 km of overland access off existing tracks will be required across the project area. Access will be by controlled overland travel rather than the construction of new tracks. Much of the overland access along drill lines will fall within the drill pad footprints, as drill holes are closely spaced (**Figure 4**). Where overland access is required outside of drill pad areas, vehicle movements will follow the naturally clearest path through vegetation wherever practicable, with the aim of minimising vegetation disturbance. No mechanical clearing or formal track construction is proposed. The nominal width of overland access is 3m, resulting in an estimated footprint of approximately 3.01ha. The terrain is predominantly sandy, and vegetation primarily comprises bluebush and saltbush, with occasional minor patches of Acacia shrubs and isolated sheoak or black oak trees. Larger shrubs and trees will be avoided where practicable. Where low vegetation is present, access will be achieved by driving overland without clearing. All access routes will avoid identified heritage exclusion zones established during heritage surveys. Existing and proposed access, including overland travel, is shown on **Figures 2, 3** and **4**.		

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

Campsites, storage and equipment laydown areas

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

Campsite details		
Indicate where staff and contractors will be accommodated during the exploration program.		
Staff and contractors will be accommodated in a temporary camp that is proposed to be situated on the southern boundary of MPL 158.		
What is the maximum number of personnel requiring accommodation?	80	
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.		
The proposed temporary camp is located entirely within an area previously cleared under MPEPR2022/160 for the OZ Minerals camp and therefore does not require any additional native vegetation clearance. The approved MPEPR2022/160 and associated Native Vegetation Management Plan identify that up to 0.64ha of native vegetation was approved for clearance for the camp, with a Significant Environmental Benefit (SEB) payment applied as part of the broader disturbance footprint (13.37ha; total SEB payment of $46,865). The MPEPR approval documentation confirms that a SEB obligation applied to the disturbance, including the camp area. Review of available aerial and drone imagery indicates that the area disturbed for the former camp extends across approximately 1.3ha, which encompasses the full extent of the proposed camp infrastructure footprint (**Figure 7**). No new access tracks or additional disturbance are required. The area associated with the wastewater sprayfield will be established over existing vegetation without clearance. Infrastructure will be limited to above-ground pipework and sprinklers, with no excavation or removal of vegetation. Accordingly, the sprayfield does not constitute native vegetation clearance. Based on the above, the proposed development is wholly contained within previously disturbed areas, and no additional native vegetation clearance or SEB offset is triggered. Description of proposed temporary accommodation camp The temporary accommodation camp will provide accommodation for up to 80 personnel, comprising single-occupancy rooms with ensuites, along with shared facilities including dining, laundry and gym (**Figure 7**). The camp will be installed on a hire arrangement from Ausco Modular Pty Ltd. The temporary camp will be constructed in three stages: 1. Carpark The carpark area will not require any physical vegetation clearance as the area is an existing hardstand area. The existing hardstand area covers an area of approximately 0.5ha. 2. Temporary buildings Temporary buildings will be established in the same vicinity as the former OZ Minerals camp. The area is bare of vegetation. Compacting and rolling will occur in the area prior to placement of the buildings. 3. Spray Field Irrigation lines and sprinklers will be placed within the spray field area. No physical vegetation clearance will occur.		
What will be the total area (ha) of the campsite(s)?	1.85 ha	
What will be the total area (ha) of vegetation clearance for the campsite?	0 ha	
If vegetation clearance is required, describe the methods used to prepare the site.		
The Native Vegetation Management Plan (**Appendix 2**) notes that the proposed camp location utilises the previously approved footprint for the OZ Minerals temporary camp and will not require the construction of a new access track or result in any additional vegetation disturbance. Temporary infrastructure will be placed on the ground surface (i.e. no excavation required and no new hardstand) (Ecosphere, 2026) (**Figure 7, Appendix 2**).		
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 ☒
There may be a requirement for minor shallow excavations to facilitate the construction of the camp (i.e. establishment of footings). The volume of material to be excavated will be less than $5m^3$.		
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 ☐
A Wastewater works approval was submitted to the Department for Health and Wellbeing (DHW) on 1 April 2026 and is currently under assessment. This application includes design documentation for the wastewater treatment system, the design of the effluent disposal system, site assessment, effluent application rates, irrigation system details and a risk management plan.		

Proposed infrastructure (includes caravans, tents, offices, hydrocarbon and water storage requirements etc)	**Quantity**	**Description/capacity**
Accommodation units	20	12m demountable units (4 rooms with ensuite). 80-person capacity.
Kitchen	1	12m x 3m demountable (with external grease trap)
Servery/dining	3	12m x 3m demountable

Wet Mess	1	12m x 6m demountable including ice store
Food store	1	12m containers (dry food, cold store, freezer)
Recreation room	2	12m x 3m demountable (1x 12m x 6m room)
Laundry / Linen / Services	2	12m x 3m demountable
Camp office	1	12m x 3m demountable
Gym	4	12m x 3m demountable (2x 12m x 6m rooms)
First Aid / Medical	1	12m treatment room and medic office
Communications Room	1	3m x 3m demountable
Maintenance / General Storage	2	12m containers
Walkway systems	300m	Lineal metres of raised walkways (removable/temporary) (**Photo 3**)
Covered patio area	1	140m^2 covered patio area (rated)
Generators	3	150 kVa diesel generators (possibly 2x 250 kVa)
Toilets and grey water	1	Ensuite toilets for rooms plus 1x 6m toilet block. Sewage treatment will be via pipes to effluent treatment area and include kitchen grey water disposal subject to appropriate DHW approvals
Hydrocarbon Storage (bunded areas)	1	A 25,000L self-bunded tank, designed in accordance with AS1692 and AS1940, will be located in the camp footprint.
Potable Water tanks	1	Potable water to be used for camp. Tanks with a capacity of 150,000L positioned as close to camp as possible (**Photo 6**)
Waste Water Treatment Plant	3	Waste Water Treatment Plant with a capacity of 100,000L, including spray field irrigation (Class C) (**Photo 7**)
Waste Management Bins Waste removed from site	15 (Yes)	Rubbish will be segregated and recycled where practical and stored in secure bins in designated areas to prevent scavenging by animals. Rubbish is regularly removed and transported to the nearest registered disposal site. The company implements management strategies that discourage the activities of feral pests, particularly foxes and cats. Campsites present the major risk for attracting feral animals. The company place food in vermin proof receptacles and return those wastes to (Broken Hill) for appropriate disposal.

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

Justification of camp location

The proposed camp location was surveyed by NAWNTAC in September 2022 to confirm that no heritage sites would be disturbed. The camp has been sited within the footprint of the previous OZ Minerals camp disturbance footprint to reduce traffic movements during the drill program, thereby lowering the risk of vehicle-related incidents. The camp is located as close as practicable to existing infrastructure, including Havilah's workers camp, and is adjacent to well-formed access tracks and roads.

Secondary approvals for camp operations

Secondary approvals supporting the camp development include:

- Building permits will be obtained by the camp building supply contractor (Ausco Modular Pty Ltd).
- Wastewater works approval from the Department for Health and Wellbeing – application submitted 1 April 2026 and under assessment.
- Potable water will be sourced by registered drinking water providers. Sandfire will notify SA Health of the provider company and extraction point once these details have been finalised.
- A Food Business Notification Form will be submitted to SA Health following the engagement of the camp services contractor. The camp services contractor will also apply for relevant food and liquor licences.

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? If no, has the location(s) been discussed with the landowner?	Yes ☐	No ☒
What will be the maximum area (ha) required for the laydown area(s)?	2.18 ha	
What will be the total area (ha) of vegetation clearance for the site?	2.18 ha	

If vegetation clearance is required, describe the methods used to prepare the site.

The temporary drillers laydown area has been located in the vicinity of the existing Havilah laydown area in an effort to minimise vegetation disturbance. Havilah have recently undertaken rehabilitation earthworks (light scarification/ripping) across a large area of the laydown, however

for the purposes of this MPEPR, the total area of clearance is aligned to the maximum laydown area footprint. **Appendix 2** – Native Vegetation Management Plan notes the following disturbance associated with the drillers laydown area:

- Drillers (ML) Laydown area: 1.5ha
- Existing laydown area not previously rehabilitated (fuel farm): 0.67ha

Plates 7 and **8** below show recent drone imagery (February 2026) of the proposed laydown area footprint (yellow boundary) and the recent earthworks undertaken within the proposed footprint. **Figure 8** shows the entire drillers laydown footprint.

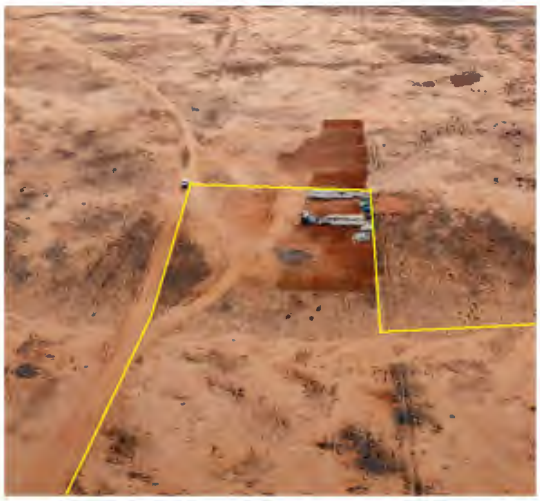


Plate 7:View of drillers laydown area looking east

Plate 8 Aerial view of drillers laydown yard showing extent of ripping activities

Temporary clearance of vegetation will be required. Where this occurs, vegetation and topsoil will be pushed to stockpiles on the edge of the laydown area (within the approved footprint) for future rehabilitation activities.

The fuel farm (comprising of a 70,000L self-bunded tank) will be located within the 0.67ha existing laydown area.

Will any excavations be required? If yes, describe the purpose of the excavation and volume (m^3) of material to be excavated.	Yes ☐	No ☒

No excavations will be required for the establishment of the drillers laydown yard. All infrastructure (including the fuel farm) and materials storage is temporary and will be placed on the surface.

Proposed infrastructure (includes hydrocarbon and water storage requirements)	Quantity	Description/capacity
Sea Containers	4	Maximum size 40ft standard (12.19m L x 2.44m W x 2.59m H) to store drilling consumables
Hydrocarbon Storage (bunded areas)	1	A 70,000L self-bunded tank, designed in accordance with AS1692 and AS1940, will be placed in the drillers laydown yard to supply diesel to exploration vehicles and drill rigs. All hydrocarbons located within the driller's laydown (e.g. grease, oil) will be stored within mobile bunds with sufficient storage capacity.

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

A laydown area is required to support the proposed drilling operations and will be established within ML6498 (**Figure 8**), entirely within the previously heritage-cleared area.

The facility will accommodate parking and manoeuvring of drilling contractor vehicles and equipment, including drill rigs, rod trucks, crew vehicles and booster trucks. It will also provide space for the temporary storage of drill rods, PVC casing, and general drilling equipment. Drilling consumables, including hydrocarbons, will be stored onsite within a designated bunded area in accordance with relevant environmental and safety requirements. Up to four sea containers will also be installed within the laydown yard to provide secure storage for tools, spare parts and ancillary equipment.

Other exploration methods and/or ancillary operations

Are any other proposed exploration methods (e.g. seismic) and/or ancillary operations required? If yes, describe the activity(s), site preparation, vegetation clearance, and safety and maintenance requirements.	Yes ☒	No ☐

Install a weather station, to collect baseline data for future mine development, adjacent to an existing track within ML 6498 consisting of post mounted instruments and a 10 mast (with support wires). Measurement devices may include automatic tipping rain gauge, wind speed sensor, wind direction sensor, digital air temperature, relative humidity sensor, solar radiation sensor, barometric pressure sensor, and a Class A evaporation pan (automatic) with water storage tank. Indicative photos:

Water supply and management

Will camp and/or drilling or trial mining 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 ☐

Diamond drilling water will initially be obtained from existing dams located on Kalkaroo Pastoral Station in the region, located in the immediate vicinity of the proposed diamond drillholes.

Water will be contained in bunded sumps within the drill pad, which prevents any waste water escape. Usage of no more than 20,000 L/day is envisaged, although this depends on how many drilling rigs are employed and on the ground conditions that will dictate water loss. The water will either be piped directly to the drill site from the dam or transported by water truck.

Potable water for camp will be trucked in from Peterborough and will be stored within six 25,000-litre tanks. The expected potable water consumption is expected to be approximately 12,000 L/day at maximum camp capacity.

A 100,000L capacity waste water treatment plant will treat the camp water, and the treated water will be dispersed via a spray irrigation field.

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 ☐

Surface water from Johnny Hill Dam will be used to support diamond drilling activities, with written consent to be obtained from Kalkaroo Pastoral Station. The dams on Kalkaroo Station were constructed to capture surface runoff for stock watering purposes. Kalkaroo Station was destocked in 2009, and therefore the use of this surface water for drilling will not conflict with or impact its original purpose.

Sandfire is separately progressing the permitting and construction of dedicated groundwater supply wells to support long term drilling and associated activities. In relation to the proposed groundwater supply wells, it is noted that

- Kalkaroo is not located within a Prescribed Wells Area.
- Groundwater will be sourced from the same fractured rock aquifer and geological units targeted by drilling, with no potential for of cross-aquifer contamination.
- The fractured rock aquifer represents the only water bearing zone expected to be encountered during drilling on the MLs.
- Groundwater will be extracted in small, intermittent volumes (approximately 5,000 to 10,000 L per event) as required during drilling.
- Pumping will be non-continuous.
- There are no alternative competing uses for this groundwater on Kalkaroo Station due to its elevated salinity.

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 ☒
This proposed drilling program focusses on exploration drilling for resource verification with drilling water sourced from surface water (dams). Water occurrences from mineral exploration drilling activities will be noted on drilling logs. This data will inform a future water exploration program to support future tenement applications and/or a Mining Program for Environment Protection and Rehabilitation.		
Indicate if well permits have been obtained and whether or not a water extraction licence is required in accordance with the Landscape South Australia Act 2019. If yes, attach a copy of the permit(s)/licences. If no, provide a statement confirming that permits/licences will be obtained prior to commencement of water investigation activities.	Yes ☐	No ☒

Water affecting activities

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

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 ☒
N/A		

Description of rehabilitation and liability estimate

Provide a description of the progressive rehabilitation of the operation, including:

- Use of topsoil and overburden
- Battering of pit faces and other earthworks
- Revegetation

Other activities designed to return the site to a safe and stable condition

DRILL SITE REHABILITATION

- Drillholes will be securely capped post-drilling to stop any ingress into the collar.
- Drill spoil material will be deposited in the bottom of sumps prior to backfill and rehabilitation. After completion of the drilling program, all plastic bags, grid pegs and other artificial debris and waste will be removed from site and disposed of appropriately.
- When it has been determined that drillholes are no longer required, they will be fully decommissioned in accordance with M21 General Specifications for construction and backfilling.
- Progressive rehabilitation of drill pads and decommissioning of drillholes will be completed as the program progresses. A maximum of 100 drill sites will be awaiting full rehabilitation at any one time. The sequencing of drilling and any requirement to re-enter drillholes for further sampling will determine the final rehabilitation sequencing. Ideally, rehabilitation will occur on a drill line basis (typically moving south to north) however is dependent on drilling conditions once the drilling program commences.
- All compacted areas will be lightly scarified to encourage vegetation growth.
- **Photo 8** shows an example of a rehabilitated area.

TEMPORARY CAMP / DRILLERS' LAYDOWN AREA

- Disassembling and demobilising of the temporary camp and associated infrastructure including buildings, self-bunded fuel tank and other hydrocarbon storage facilities, waste water treatment plant, tanks, waste bins. **The is the responsibility of the camp and infrastructure owners and is costed into the rental agreement for the camp.**
- Disassembling and demobilising temporary self-bunded diesel refuelling facilities (drillers laydown yard). **This facility is under a rental agreement which includes removal by owner.**
- All external waste material is removed from site to an approved waste facility.
- No fires are lit during the summer months, and only at other times if there is a clear area surrounding and fire danger is minimal (e.g., lack of burnable material and no fire ban period).
- Fire management procedures in places, including policy for "extreme fire danger rating" and firefighting equipment/extinguisher are always available.
- The land surface will be returned to its original profile and topsoil replaced where required.
- Final soil surface scarified to promote natural seed collection and germination.

CORE PROCESSING FACILITY REHABILITATION

- The core processing facility is an existing facility (**Figure 6**) and will be used by Havilah following the completion of the Program, for ongoing exploration activities on the ML and the regional Curnamona Province exploration leases held by the company.

Provide the maximum third party cost of rehabilitation at any time over the life of mine covered by the PEPR. The estimate must be based on reasonable third party costs of undertaking the rehabilitation and include costs for project management, inflation, normal project variation, and contingency provision for risk associated with the strategies and uncertainty in the cost estimates.

The rehabilitation liability estimate calculates that the maximum third-party cost of rehabilitation at any one time for the proposed activities is $886,650. These costs are based entirely on DEM's default rates.

SECTION E – LEASE CONDITIONS

Mineral leases

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

Mineral Lease	Lease condition	How has the condition been complied with
First Schedule – Additional Terms		
MPL 158	Authorised Activities 1. The grant of the Mining Tenement authorises activities for the purposes of construction, operating, maintaining, rehabilitation and closure of the following: 1.1. run of mine pad; 1.2. processing plant; 1.3. gravel storage area; 1.4. topsoil stockpiles; 1.5. power plant; 1.6. mineralised waste dump; 1.7. administration infrastructure; 1.8. workshop and store; and 1.9. landfill; directly related to the conduct of mining operations authorised under mining tenements ML6498, ML6499 and ML6500. 2. Authorised activities on the Land must be consistent with the activities described in the Miscellaneous Purposes Licence management plan dated 11 September 2014 and subsequent Response Documents dated 30 November 2015 and 19 January 2017.	Acknowledged
ML 6498, ML 6499, ML 6500	1. The grant of the Mining Tenement authorises mining operations (only) for the recovery of: 1.1. Copper; 1.2. Gold; 1.3. Molybdenum; and 1.4. Cobalt. 2. In accordance with section 39(2) of the Act, the grant of the Mining Tenement authorises the recovery of extractive minerals including, but not limited to: 2.1. Quartzite; 2.2. Clay; and 2.3. Shale; produced as a result of mining operations conducted in pursuance of this Mining Tenement. 3. The grant of the Mining Tenement authorises mining operations (only) that are consistent with the mining operations described in the Mining Proposal document dated 11 September 2014 and subsequent Response Documents dated 30 November 2015 and 19 January 2017.	Acknowledged

Mineral Lease	Lease condition	How has the condition been complied with
Second Schedule – Additional Conditions		
MPL 158	See **Appendix 4**	Acknowledged
ML 6498, ML 6499, ML 6500	See **Appendix 4**	Acknowledged
Sixth Schedule – Environmental Outcomes		
MPL 158, and ML 6498, ML 6499, ML 6500	See **Appendix 3** for full description.	
	Clause 1: Air Quality Outcome	Acknowledged – drilling only.
	Clause 2: Air Quality Strategy	Section E – Rehabilitation, and Section F.
	Clause 3: Noise Outcome	Hearing PPE worn during rig operation.
	Clause 4: Waste Management Outcome	See Section F.
	Clause 5: Waste Management Strategies	See Section F, or N/A (mining activity).
	Clause 6-7: Surface Water Outcomes	See Section F.
	Clause 8: Surface Water Strategies	See Section F.
	Clause 9: Groundwater Outcome	See Section F.
	Clause 10: Groundwater Strategies	See Section F, or N/A (mining activity).
	Clause 11: Groundwater Criteria	N/A – drilling only.
	Clause 12: Native Vegetation Outcome	See Section F.
	Clause 13: Native Vegetation Criteria	See Section C – Native Vegetation.
	Clause 14: Weeds, Pests and Plant Pathogens Outcome	See Section C – Weeds and pathogens, and Section F.
	Clause 15: Weeds, Pests and Plant Pathogens Criteria	See Section C – Weeds and pathogens, and Section F.
	Clause 16: Fauna Outcome	See Section F.
	Clause 17: Soil Outcome	See Section F.
	Clause 18: Soil Strategies	See Section F.
	Clause 19: Visual Amenity Outcome	See Section F.
	Clause 20: Visual Amenity Strategies	See Section F – rehabilitation, no mining being undertaken.
	Clause 21: Traffic Outcome	See Section F.
	Clause 22: Traffic Strategy	See Section F.
	Clause 23-26: Public Safety and Land Use Outcome	See Section F.
	Clause 27: Public Safety and Land Use Strategies	(ML's Only) See Section F.
	Clause 28: Heritage Outcome	See Section F.
	Clause 29: Blasting Outcome	N/A – no blasting to occur
	Clause 30: Blasting Strategies	N/A – no blasting to occur

SECTION F – MANAGEMENT OF ENVIRONMENTAL IMPACTS

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

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

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

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

How to fill out the table

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

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

Impact assessment							Outcomes	Outcome measurement criteria (inc. monitoring plan)
Receptor Lists are not exhaustive.	**Potential impacts** Lists are not exhaustive.	**Is the potential impact applicable (Yes/No)** Some potential impacts are applicable to all programs.	**Control strategies** Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to Minerals Regulatory Guidelines MG2b for more information.	**Risk assessment** LH = likelihood of consequence CQ = severity of consequence				
				LH	**CQ**	**Risk**		
Stakeholders: • freehold land owners • perpetual lease holders • pastoral lease holders • Aboriginal land (Anangu Pitjantjatjara Yankunytjatjara and Maralinga Tjarutja lands) • Department of Defence • state government departments. • local government (councils) • federal government • native title parties.	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. Noncompliance with legislative requirements.	Yes (Applicable to all programs.)	• Serve Form 21B – Notice of Entry on Land to: ◦ Native Title Claimants NAWNTAC ◦ SANTS ◦ Kalkaroo Pastoral Company PtyLtd • Contacting and liaison with Kalkaroo Pastoral will not be necessary as it is a fully owned subsidiary of Havilah Resources Limited. • Avoiding use of station tracks after heavy rains so that they are not damaged. • Strict adherence to sign posted speed limits on station tracks. • Mining Native Title Agreements pursuant to Part 9B in place and registered with DEM	2	B	Low	**Stakeholders are fully informed and satisfied with the proposed methods used to conduct mining operations on their land, and all prescribed forms are served and agreements obtained in accordance with the Mining Act.**	Engage heritage monitors to delineate known heritage exclusion zones identified in previous heritage clearance surveys. Engage heritage monitors over the program to monitor excavation and other ground works, in accordance with agreed heritage management practices [with NANWTAC]. Provide the information requested within the 'annual 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 program, without the involvement of DEM. Provide information within the annual compliance report demonstrating that prescribed forms were served and agreements obtained in accordance with the Mining Act prior to the commencement of operations.
Flora and fauna and their habitats; includes Commonwealth and state scheduled species.	Loss/modification of native vegetation and associated habitats through the clearance of vegetation.	Yes (Applicable to programs located within or impacting on native vegetation.)	• Drill sites and access tracks avoid areas of substantial native vegetation (e.g., tree groves). • There is minor disturbance of native vegetation (Havilah as standard practice never clears its drill sites). • Drill sites and access tracks are rehabilitated in such a way as to promote regrowth of native vegetation. • Materials excavated during sump preparation will be sequentially placed back in the order of removal during rehabilitation. • Vehicles are restricted to a single access track to minimise disturbance of native vegetation. • No fires are lit during the summer months, and only at other times if there is a clear area surrounding and fire danger is minimal (e.g., lack of burnable material and no fire ban period) • Fire management procedures in place, including policy for "extreme fire danger rating".	2	B	Low	**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 operational sites (e.g. pits, drillsites, new track exit/entry points off existing tracks, costeans, campsites) demonstrating that: • The area and method of disturbance is consistent with that described in the PEPR. • No uncontrolled fires* occur as a result of mining operations. Representative photos to be included within the annual compliance report.

Impact assessment							Outcomes	Outcome measurement criteria (inc. monitoring plan)
Receptor Lists are not exhaustive.	**Potential impacts** Lists are not exhaustive.	**Is the potential impact applicable (Yes/No)** Some potential impacts are applicable to all programs.	**Control strategies** Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to Minerals Regulatory Guidelines MG2b for more information.	**Risk assessment** LH = likelihood of consequence CQ = severity of consequence				
				LH	**CQ**	**Risk**		
			• Monitor CFS warnings, all fire bans, regulations, and directions from the country fire service (CFS) to be observed. • Firefighting equipment/ extinguisher are always available					
All flora and fauna, especially listed species.	Loss/modification of the environment (biological, social and economic) through the introduction of weeds and pathogens.	Yes (Applicable to all programs.)	• Weed Watch Fact Sheet supplied to all field personnel. • Vehicles are kept clean and free of mud if they come from an area of known weed species. • Inspection of former drill sites to check for any introduced species and removal if found	2	B	Low	**No introduction of new species of weeds and plant pathogens, nor increase in abundance of existing weeds species.**	Provide a statement within the annual compliance report, confirming that: • Vehicle logs were kept during the 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. Provide 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. Monitor vegetation species composition, recruitment and weed cover on an annual basis to assess rehabilitation performance. Undertake visual assessment of soil stability indicators on an annual basis to monitor erosion on rehabilitated areas.
All fauna	Entrapment of fauna through open drillholes and excavations.	Yes (Applicable to programs that involve drilling and/or require excavations.)	• All holes are capped following completion. • Excavations are constructed with a shallow angle ramp to allow small animals to escape. • Excavations are appropriately barricaded/bunded to prevent access	2	B	Low	**No fauna traps created as a result of mining operations.**	Maintain before, during and after photographic evidence of all drillholes and/or excavations demonstrating 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 excavations are rehabilitated prior to completion of the program to ensure these do not present a trapping risk to fauna Representative photos are to be included within the annual compliance report. Provide the information requested within the annual compliance report.
Aboriginal heritage sites	Disturbance to Aboriginal heritage.	Yes (Applicable to all programs.)	• An Aboriginal Heritage Clearance Survey is conducted with the traditional owners to clear the drill sites and access prior to commencement of drilling. • All employees and contractors on-site are properly advised of the significance of Aboriginal heritage and culture and are to take care to preserve all Aboriginal Sites and Objects as defined by the *Aboriginal Heritage Act 1988*	2	B	Low	**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 annual compliance report demonstrating that: • Heritage sites were not impacted during the conduct of the program, unless prior approval was obtained under the appropriate legislation. • Work ceased on discovery of a significant site and recommenced only after authorisation. • Aboriginal heritage sites identified during the program were appropriately recorded and reported to authorities, if not previously known.
Soil/vegetation/fauna	Soil/vegetation contamination (e.g. hydrocarbons, rubbish, drill samples/cuttings, ablutions, other sources).	Yes (Applicable to all programs.)	• All external waste material is removed from site to an approved waste facility. • Unwanted drill samples are emptied into sumps/pits, which are back filled, covered with topsoil, and lightly scarified to promote seed germination. The empty plastic bags are removed from site. • Drilling rig and ancillary equipment is properly maintained and regularly inspected to ensure there are no diesel or oil leaks. • Stored fuel correctly bunded, spill kits used, contaminated soil immediately removed off site to an approved waste management facility. • No visible drill chips or drill samples remain on site. • Drill site is rehabilitated to best practice standards to promote new vegetation growth. • Fuel storage managed in accordance with EPA requirements.	2	B	Low	**No contamination of soil and vegetation as a result of mining operations.**	Demonstrate that all domestic or industrial waste (includes general rubbish and hydrocarbons) is disposed of in accordance with the *Environment Protection Act 1993*, 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 annual compliance report confirming domestic and industrial waste was removed from all operational sites and disposed of at an authorised waste disposal facility. • Photographic evidence within the annual compliance report demonstrating that all fuel and chemical storage facilities were managed in accordance with EPA requirements. Provide the information requested within the annual compliance report.

Impact assessment							Outcomes	Outcome measurement criteria (inc. monitoring plan)
Receptor Lists are not exhaustive.	**Potential impacts** Lists are not exhaustive.	**Is the potential impact applicable (Yes/No)** Some potential impacts are applicable to all programs.	**Control strategies** Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to Minerals Regulatory Guidelines MG2b for more information.	**Risk assessment** LH = likelihood of consequence CQ = severity of consequence				
				LH	**CQ**	**Risk**		
Soil	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.)	• No grading of tracks or preparation of drill sites that will cause permanent disturbance to topsoil profile or topography. • Rehabilitation of each site will be finalised by raking or lightly scarifying to promote seed germination and new vegetation growth. • Heavy vehicle tracks will be scarified and filled in if there is judged to be any danger of gullying and erosion. • The land surface will be returned to its original profile. • All sample material and spoil from the sumps will be backfilled into the sumps. • Topsoil from sumps will be stockpiled separately, spread back over the filled in sumps and lightly scarified to minimise wind and water erosion and promote seed germination and plant regrowth. • If water does have to be carted for diamond drilling, truck movements will be kept to a minimum, and tracks will be rehabilitated as described above. Tracks can be watered down if required.	1	B	Low	**Where soil disturbance occurs as a result of mining operations, ensure that:** • **topsoil quality and quantity is maintained** • **the soil profile and topography is reinstated to original conditions** • **there is no accelerated soil erosion.**	Maintain before, during and after photographic evidence of all excavations, drillsites, camps, laydown areas and new tracks demonstrating that at the completion of the program: • The soil profile and topography is reinstated to original conditions and is consistent with natural surroundings • Where required, sufficient topsoil is removed (depending on soil profile), stored separately from subsoil and reinstated (in the correct order). • There are no signs of accelerated soil erosion during and post rehabilitation of disturbed sites. Representative photos to be included within the annual compliance report. Undertake visual assessment of soil stability indicators on an annual basis to monitor erosion on rehabilitated areas.
Surface water	Alteration to surface water – interference to surface drainage.	No (Applicable to exploration programs that are likely to impact on surface drainage channels.)	• Surface drainage will not be interfered with.				**No permanent modification to hydrological features caused by mining operations without obtaining a water affecting permit from the relevant Landscape Board (under Landscapes Act SA 2019).**	Provide before, during and after photographic evidence within the annual compliance report demonstrating that: • Drilling operations have not occurred within 25m of the top of the creek channel (bank) of any watercourse; and • original drainage contours (watercourses and lakes) are consistent with the natural relief post rehabilitation. Alternatively, provide copies of water affecting permits within the annual compliance report.
Groundwater/aquifer	Groundwater contamination: • contamination of aquifers through entry of pollutants from the surface • interconnection between aquifers • degradation of natural hydrostatic conditions (maintain pre-drilling pressures).	Yes (Applicable to all programs that may intersect groundwater.)	• Contamination of the fractured rock aquifer because of lost circulation will be prevented using industry standard biodegradable drill mud and additives where required. • Natural hydrogeological are unconfined groundwater (saturated fractured basement strata) reporting to a regional water table. Hole decommissioning in accordance with M21 to include natural sealing of overlying Namba Formation strata (refer Appendix 2) and drill hole backfilling.	2	B	Low	**Drillholes restored to controlling geological conditions that existed before the hole was drilled or, where it is intended to re-enter the hole, the hole must be completed with casing of adequate strength and the casing cemented so that all aquifers are isolated to prevent the movement of any fluids behind the casing.**	Maintain evidence demonstrating that drillholes are decommissioned in accordance with Earth Resources Information Sheet M21, *Mineral exploration drillholes – general specifications for construction and backfilling*, and/or specific conditions from DEW (Groundwater). Provide the information requested within the annual compliance report.
Soil/vegetation/fauna	Discharge of groundwater into the surrounding environment.	Yes (Applicable to all programs that may intersect groundwater or where activities require the discharge of groundwater into the surrounding environment.)	• Groundwater will be contained within the sumps and circulation system. Any inadvertent spillages will be immediately cleaned up and returned to the sumps.	2	A	Low	**No discharge of groundwater outside of the lease 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 compliance report.
Soil/vegetation/fauna	Degradation of rehabilitated access tracks caused by third party access (includes previously closed and rehabilitated access tracks).	Yes (Applicable to programs that create new access tracks.)	• Existing access tracks to be used as much as possible. • Access drill sites by driving vehicles cross country from existing station tracks, deviating around shrubs and trees etc. • Minimise disturbance by confining heavy equipment to a single access track. • Rectify any significant residual compaction along the wheel tracks, if necessary, by light scarifying.	2	B	Low	**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 closed and rehabilitated at the completion of the program, unless otherwise authorised. Representative photos are to be included within the annual compliance report.
Community/landowners	Damage to infrastructure and loss of income through fire.	Yes (Applicable to all programs.)	• No fires are lit during the summer months, and only at other times if there is a clear area surrounding and fire danger is minimal (e.g., lack of burnable material and no fire ban period) • Fire management procedures in place, including policy for "extreme fire danger rating". • Firefighting equipment/ extinguisher are always available.	2	D	High	**No loss of infrastructure or income through fire as a result of mining operations.**	Provide a statement within the annual 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.

Impact assessment							Outcomes	Outcome measurement criteria (inc. monitoring plan)
Receptor Lists are not exhaustive.	**Potential impacts** Lists are not exhaustive.	**Is the potential impact applicable (Yes/No)** Some potential impacts are applicable to all programs.	**Control strategies** Indicate where there is uncertainty pertaining to the likely effectiveness of the control strategies. Where the risk is not considered low, provide justification that the risk is acceptable, or consider additional strategies to reduce the risk to an acceptable level. – refer to Minerals Regulatory Guidelines MG2b for more information.	**Risk assessment** LH = likelihood of consequence CQ = severity of consequence				
				LH	**CQ**	**Risk**		
General public	Injury or death to members of the public as a result of mining operations.	Yes (Applicable to all programs.)	• Restricting access to only Company personnel as far as possible, and only to others (e.g., Contractors) who have had induction. • Enforcing best practice OHS measures. • Appropriate danger signs erected. • Enforcing speed limits.	1	E	High	**No accidents involving the public that could have been reasonably prevented by the tenement holder.**	Provide a statement within the annual compliance report confirming no accidents occurred involving the public during and after the program. If an accident involving the public did occur, provide a copy of the independent investigation report within the annual compliance report demonstrating that the tenement holder could not have reasonably prevented the accident through the implementation of precautionary measures.
Other (if applicable)								

* Uncontrolled fires = fires that escape outside of the work area.

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

SECTION G - OPERATOR CAPABILITY

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

- Manuals or standard operating procedures that outline the safe and environmentally sound operation of all critical operations associated with the 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)

The drilling program will be managed by Sandfire South Australia Pty Ltd (Sandfire), an experienced operator of mineral exploration and mining projects in Australia and internationally. Havilah Resources Limited will be involved to the extent requested by Sandfire.

Sandfire South Australia operates under the corporate management system of Sandfire Resources Limited, which provides an integrated framework for governance, risk management, health and safety, environmental management, and continuous improvement across its operations. This system is structured to ensure that activities are planned and executed in a manner that achieves approved environmental outcomes and complies with statutory requirements.

Management Plans and Operational Controls

All activities associated with the Kalkaroo exploration program will be undertaken in accordance with project-specific management plans, including:

- Health and Safety Management Plan
- Environmental Management Plan
- Aboriginal Heritage Management Plan

These plans establish performance objectives, environmental outcomes, risk controls, monitoring requirements, and reporting obligations consistent with the approved PEPR.

Key supporting procedures and standard operating documents include, but are not limited to:

- Project-specific inductions covering safety, environmental, heritage, and legal obligations
- Hazard identification and risk assessment procedures
- Land access and disturbance control procedures
- Hydrocarbon and hazardous substance management procedures
- Drill site preparation and rehabilitation procedures
- Incident reporting and investigation procedures
- Emergency response plans
- Stakeholder engagement and landholder communication procedures
- Training and competency requirements

These documents ensure critical operational activities are undertaken in a safe, environmentally responsible, and compliant manner.

Monitoring, Audit and Assurance

Sandfire will implement structured monitoring and assurance processes to assess compliance with approved PEPR criteria and environmental outcomes. These will include:

- Routine environmental inspections during drilling activities
- Monitoring of disturbance footprint, rehabilitation progress, and environmental controls
- Internal compliance audits against PEPR commitments and regulatory conditions
- Periodic management review of performance and corrective actions

Monitoring results will be documented and reviewed to verify effectiveness of controls and support continuous improvement.

Non-Compliance and Incident Reporting

Sandfire maintains formal systems for identifying, recording, investigating, and reporting non-compliances and incidents. All environmental incidents and breaches of regulatory requirements will be:

- Recorded within the Sandfire incident management system
- Investigated to determine root cause
- Assigned corrective and preventative actions
- Reported to the Department for Energy and Mining in accordance with statutory requirements, including Regulation 79(3) where applicable

This ensures transparency, regulatory compliance, and timely implementation of corrective measures.

Communication and Competency

All employees and contractors are required to complete project-specific inductions prior to commencing work. Inductions communicate:

- Approved PEPR outcomes and compliance obligations
- Environmental and heritage protection requirements
- Incident reporting obligations
- Landholder conduct expectations

Ongoing supervision and toolbox meetings reinforce regulatory and environmental obligations throughout the program.

Stakeholder and Landholder Engagement

Sandfire maintains established procedures for communication with landholders, pastoralists, Traditional Owners, regulators, and other stakeholders. These procedures include:

- Pre-program consultation and notification
- Agreed access arrangements
- Clear points of contact for enquiries
- A documented complaints management process
- Timely response and resolution of compliance concerns

Stakeholder interactions are recorded and managed to ensure commitments are met and issues are addressed promptly.

Through implementation of Sandfire's corporate management system, project-specific management plans, structured monitoring and audit processes, formal incident reporting systems, and defined stakeholder engagement procedures, Sandfire South Australia demonstrates the organisational capability, systems, and governance necessary to conduct the proposed exploration program in a manner that consistently achieves the environmental outcomes approved under the PEPR.

SECTION H –ADDITIONAL INFORMATION

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

N/A

SECTION I – PHOTOS

Include photographs in this section:

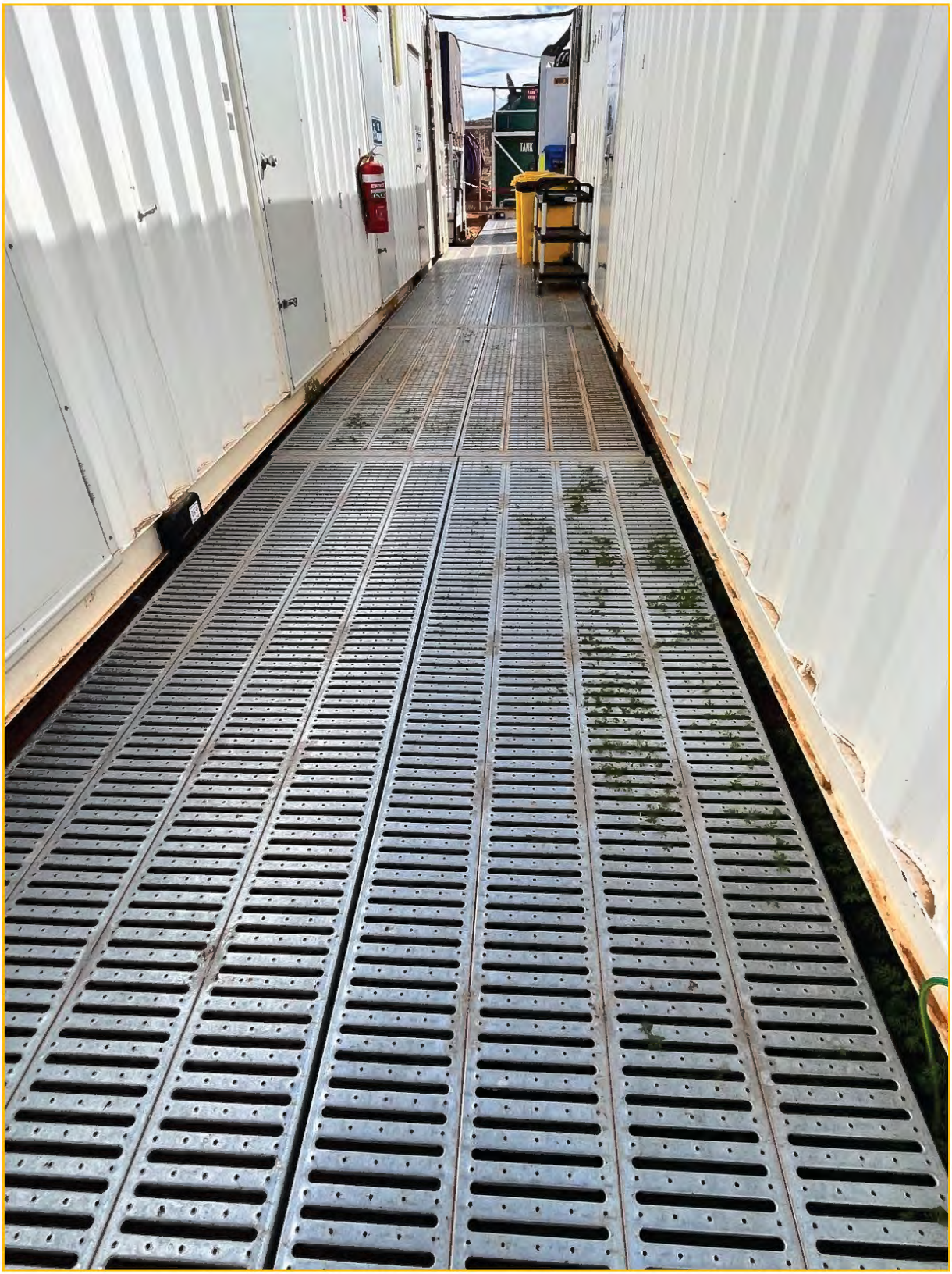
- that have been obtained during site visits
- that help describe relevant environmental and operational aspects in the PEPR.

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	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Kalkaroo Project	Nov 2013	Photo 1, Section C	454442	6488573	54	General area of proposed drilling looking east at Kalkaroo West.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Kalkaroo Temporary Camp	03/06/2023	Photo 2, Section D	.	~6487000	54	Ground view of proposed camp area (See **Map 5** for aerial view). Photo taken during operation of former 32-person camp.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Kalkaroo Temporary Camp	03/06/2023	Photo 3, Section D	~454700	~6487000	54	Example of camp walkway.



Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Kalkaroo Temporary Camp	03/06/2023	Photo 4, Section D	~454700	~6487000	54	Example of 200 kva generator.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Kalkaroo Temporary Camp	03/06/2023	Photo 5, Section D	~454700	~6487000	54	Example of 4,000 L self-bunded fuel cell to work with the generator.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Kalkaroo Temporary Camp	03/06/2023	Photo 6, Section D	~454700	~6487000	54	Example of camp potable water.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Kalkaroo Temporary Camp	03/06/2023	Photo 7, Section D	~454700	~6487000	54	Example of camp waste water.

Site identification	Date taken	Photo number & PEPR section reference	Easting (GDA94)	Northing (GDA94)	Zone	Details and Comments
Kalkaroo Project	11/06/2020 / 27/02/2022	Photo 8, Section D	454758	6488838	54	2020 drillhole KKAC0540 after drilling (top), after rehabilitation (bottom).

SECTION J – MAPS

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

- tenement boundaries,
- cadastral information,
- existing surface contours,
- existing vegetation,
- location of the proposed 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 towns, houses and homesteads, existing roads, rails, fences, transmission lines, buildings, dams and pipelines
- known sightings of listed species,
- location and extent of all environmentally sensitive areas,
- any relevant land use types (e.g. parks and reserves, Aboriginal freehold land, Woomera Prohibited Area).

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

Figure 1: Regional location of Kalkaroo Project.

Figure 2: Kalkaroo Project MLs and MPLs.

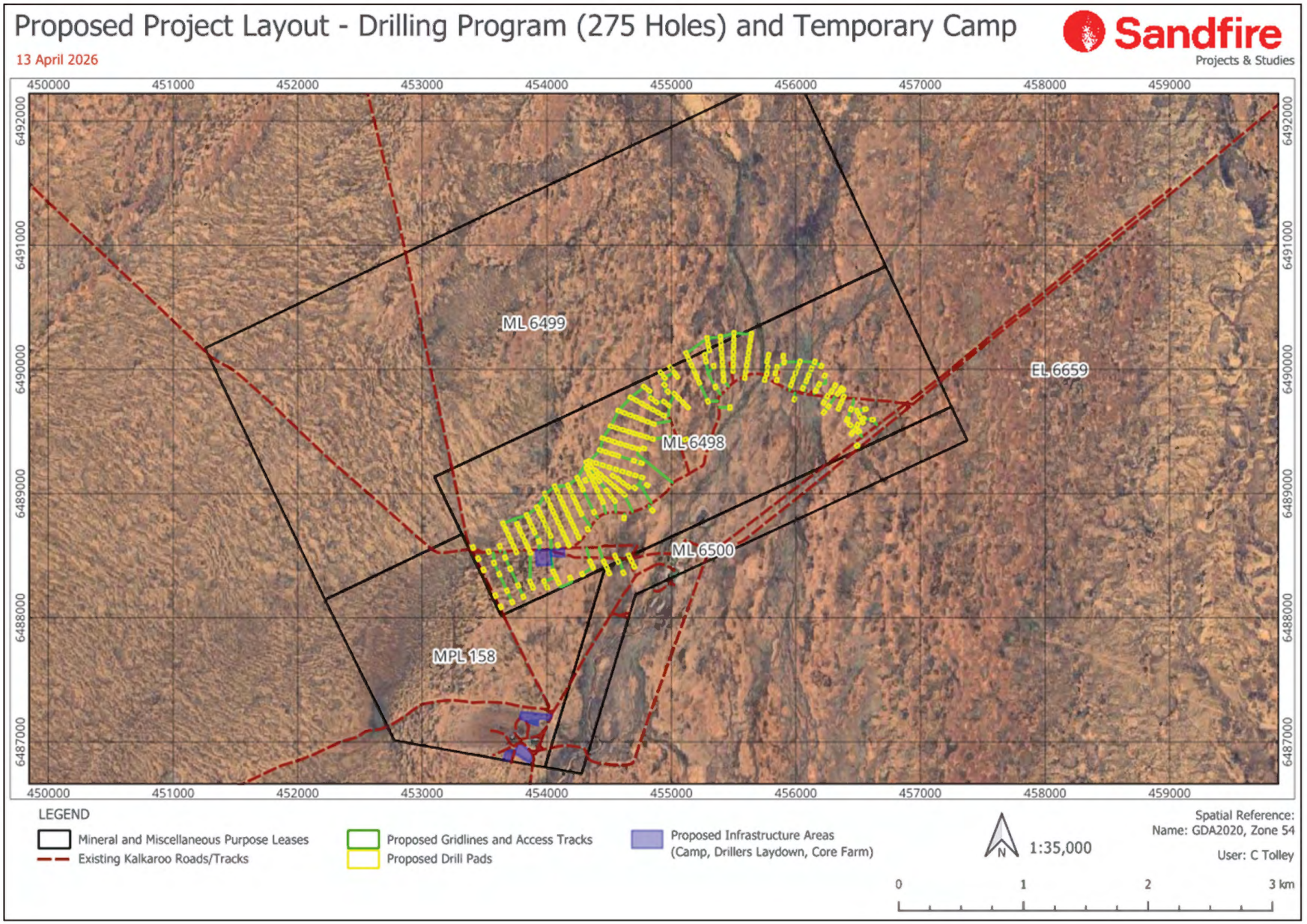


Figure 3: Project layout overview

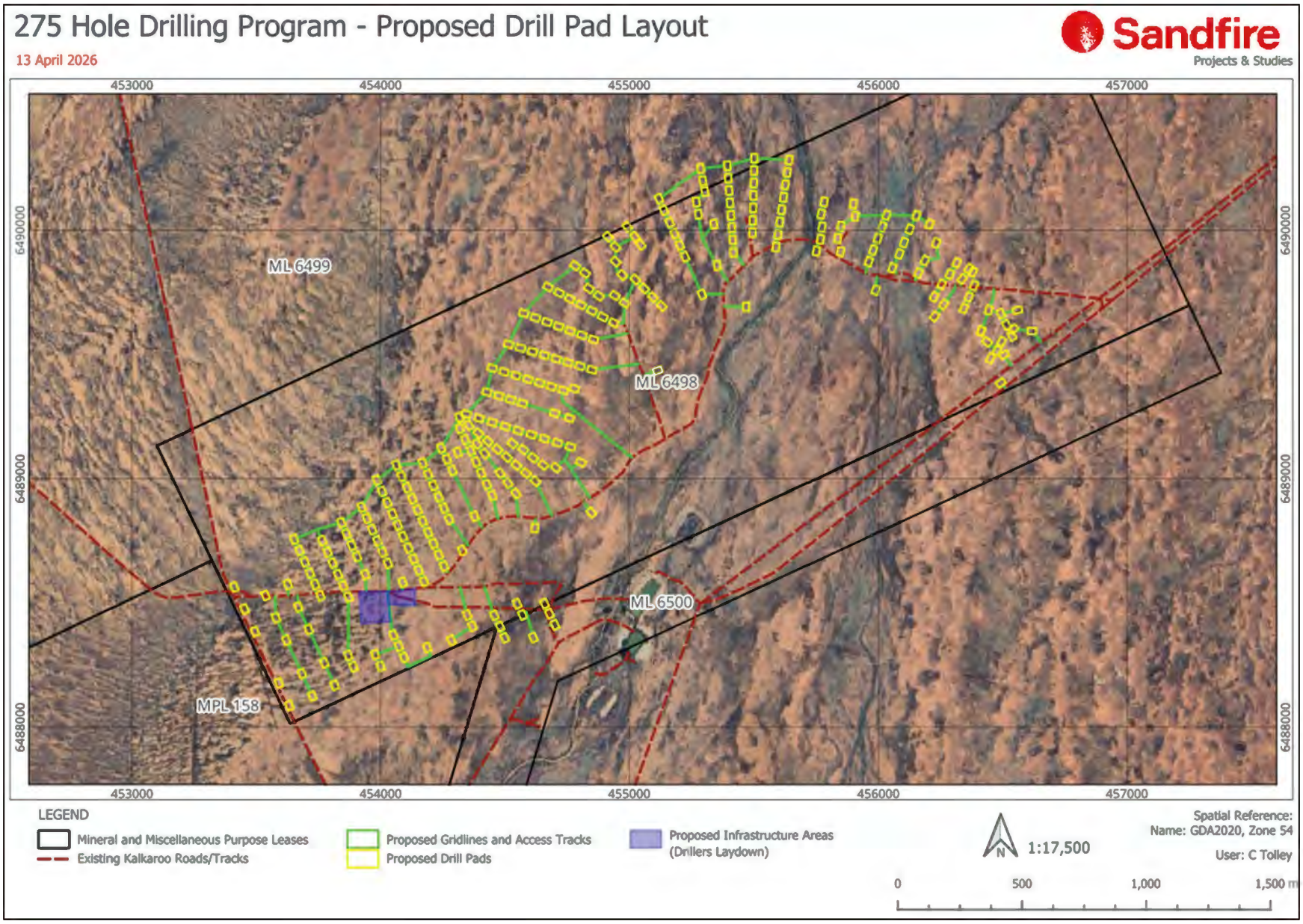


Figure 4: Location of proposed drill collars, access tracks, and laydown area

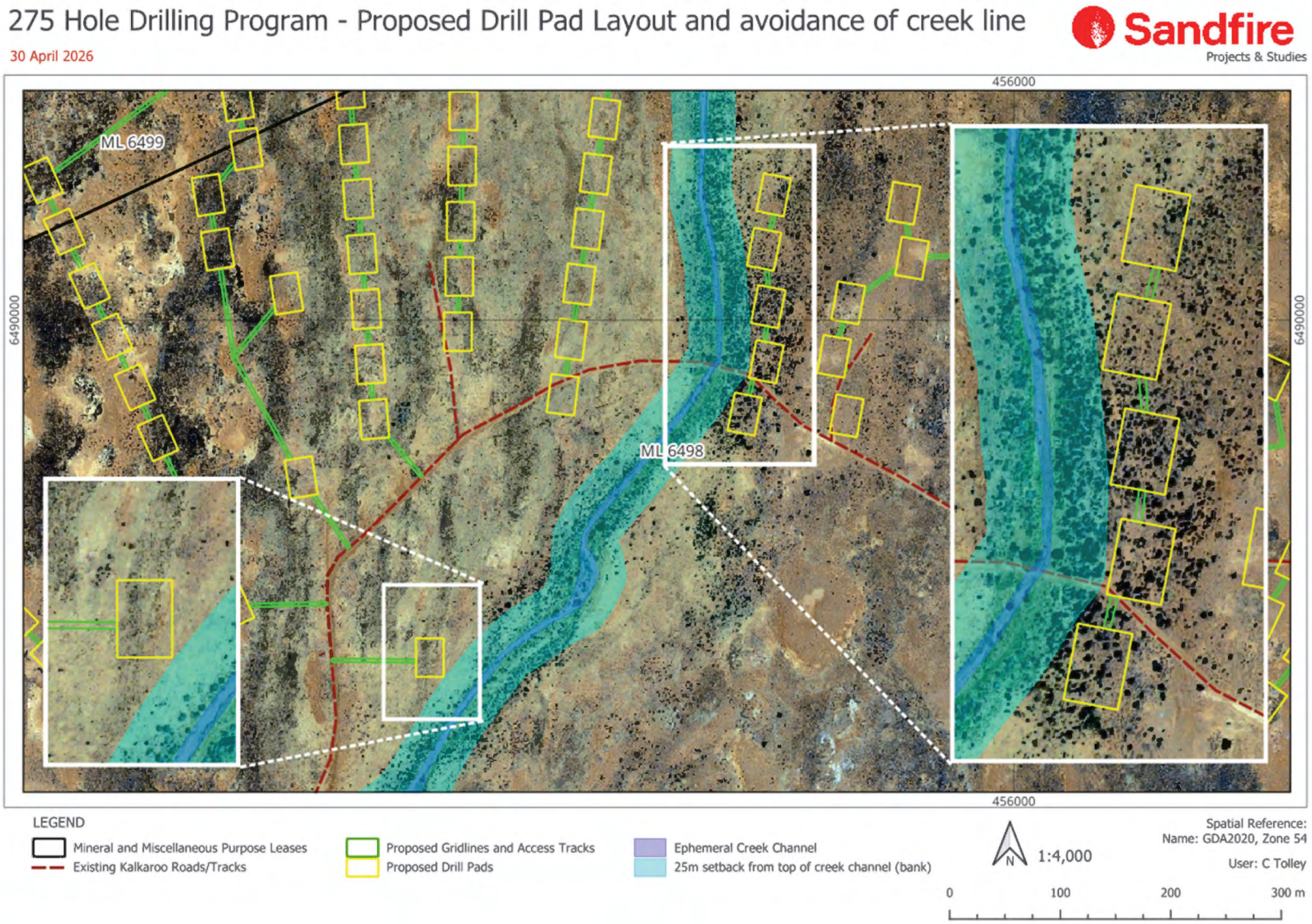
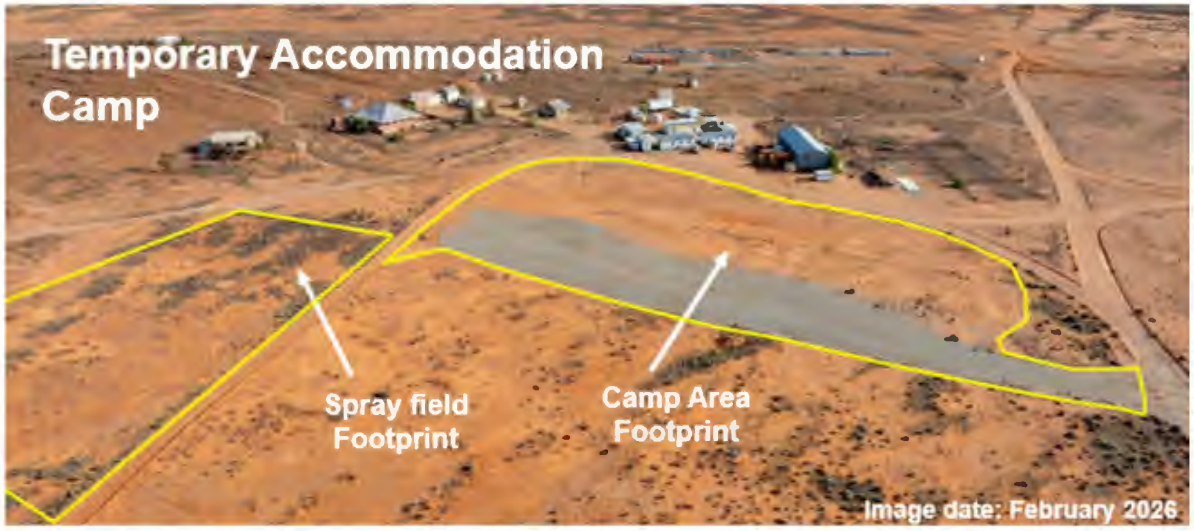


Figure 5: Location of proposed drill collars, access tracks, over aerial image in relation to ephemeral watercourse.

Figure 6: Proposed camp and core farm location



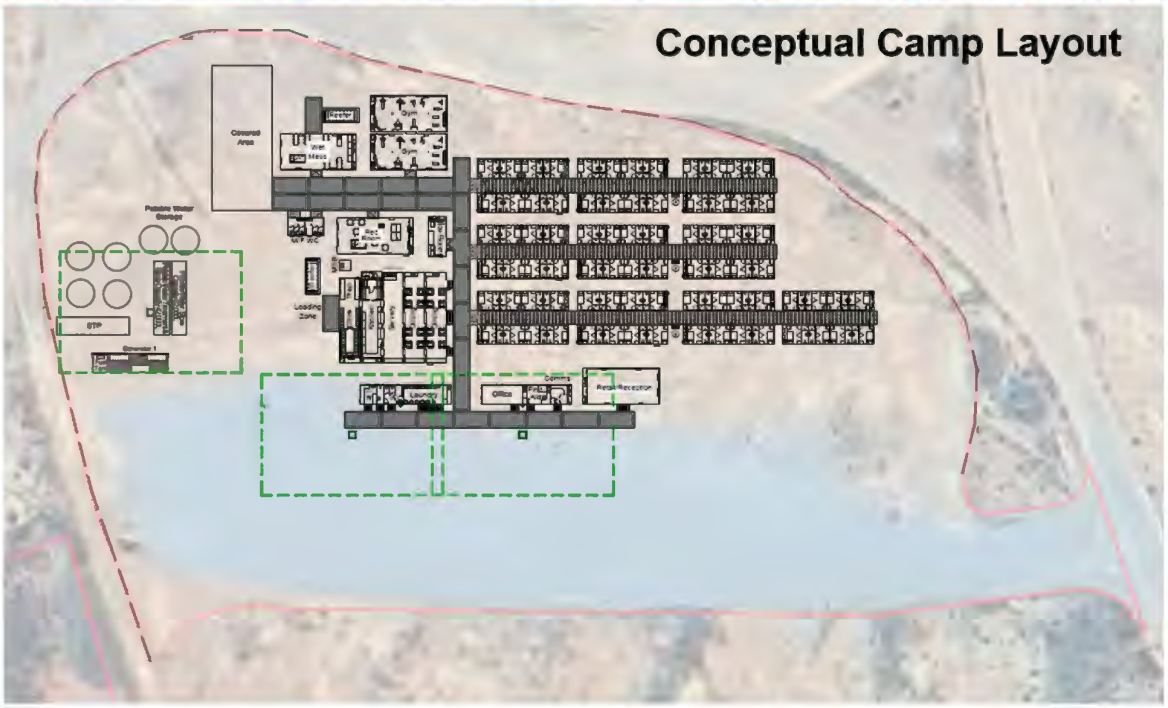


Figure 7: Camp view and conceptual layout

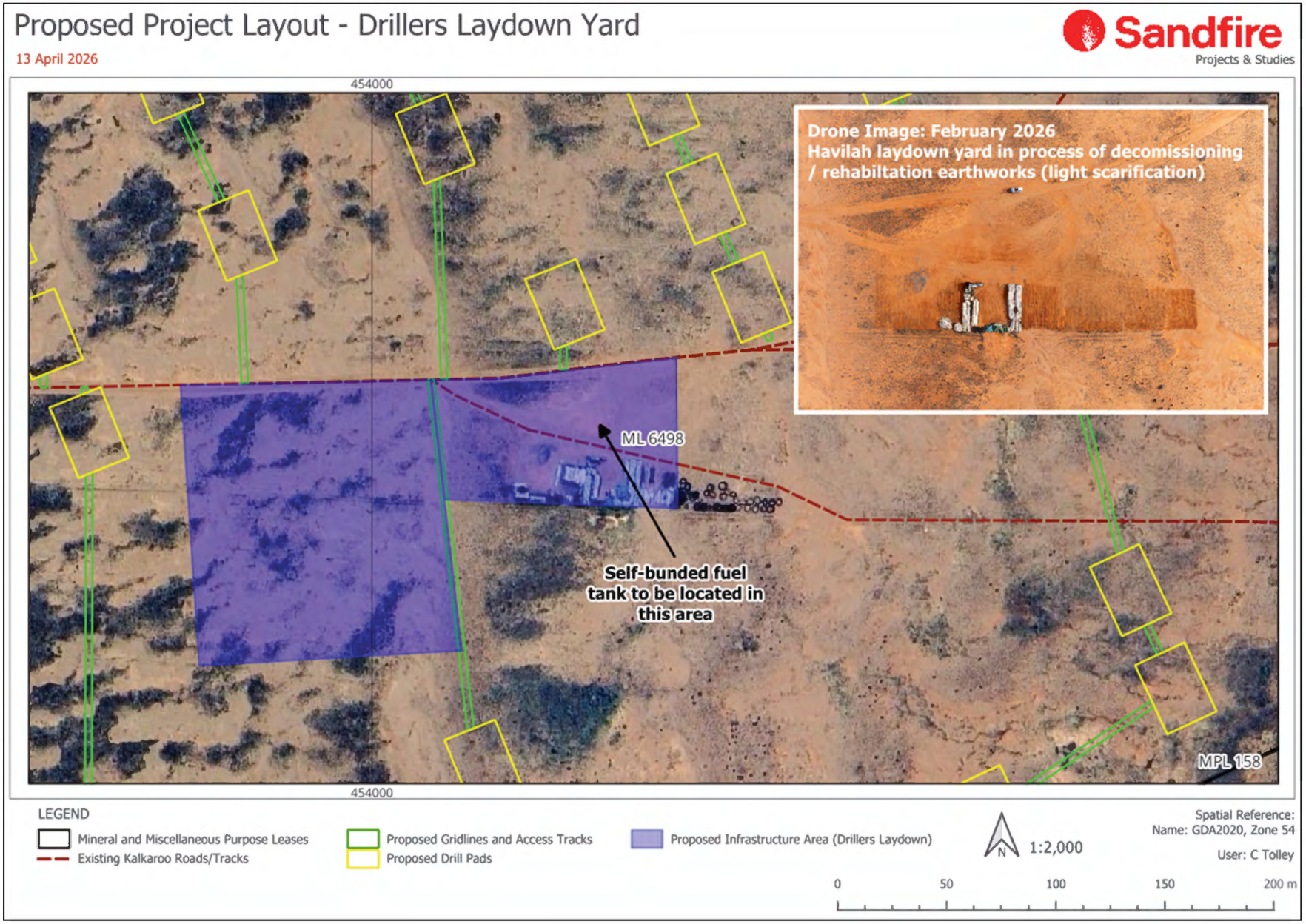


Figure 8: Proposed Drillers Laydown Yard

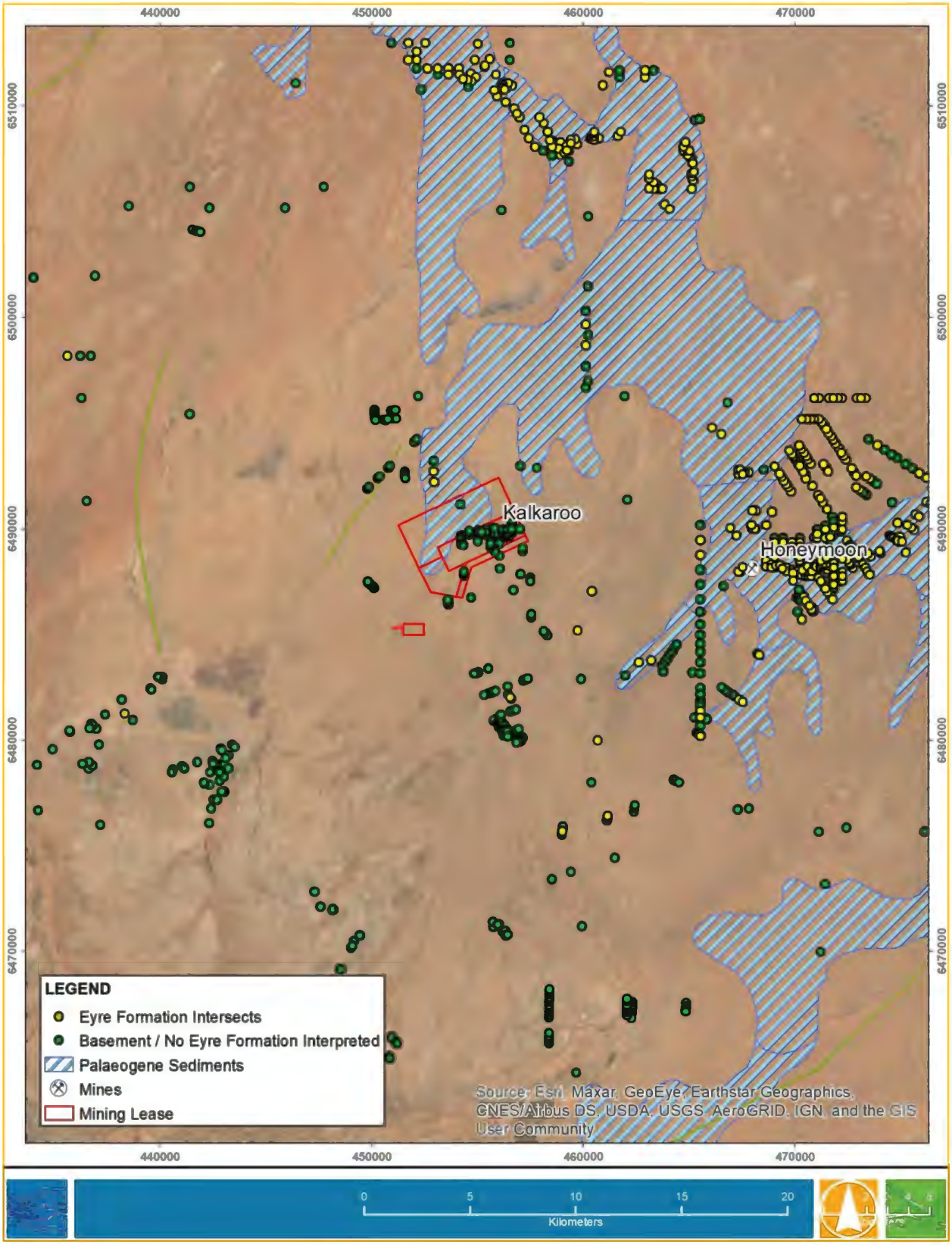


Figure 9: Tertiary (Palaeogene) Sedimentary Distribution (SARIG).

SECTION K – PUBLIC RELEASE

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

SECTION L – SUBMISSION OF THE APPLICATION

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

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

APPENDIX 1

Groundwater Impact Assessment

Kalkaroo Copper-Gold Mine

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Groundwater Impact Assessment

Kalkaroo Copper-Gold Mine

Kalkaroo Copper Pty Ltd

1 December 2021

Document Status

Version	Doc type	Reviewed by	Approved by	Date issued
1.0	Draft	NW	RB	01/12/2021

Project Details

Project Name	Kalkaroo Copper-Gold Mine
Client	Kalkaroo Copper Pty Ltd
Client Project Manager	Geoff Borg
Water Technology Project Manager	Rohan Baird
Water Technology Project Director	Andrew Telfer
Authors	Rohan Baird, Nick Watkins and James Hopkinson
Document Number	21030310_R01v01_Kalkaroo GW Impact Assessment_211201

1/198 Greenhill Road
Eastwood SA 5063
Telephone (08) 8378 8000
Fax (08) 8357 8988
ACN 093 377 283
ABN 60 093 377 283

CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Project Description

The Kalkaroo Cu-Au deposit is located 60 kilometres northwest of Cockburn and comprises 249 Mt of ore at a grade of 0.36 g/t gold and 0.49 % copper. The project and associated infrastructure are located on approximately 1,910 hectares (ha) which are covered by ML 6498, ML 6499, ML 6500, MPL 158 and MPL 159 (Figure 1-1). The initial open pit is based on mining 3 Mt of ore at a grade of 1 g/t Gold and 0.5% Copper, which will be delivered to a run of mine (ROM) ore pad. In accessing the ore, 19 Mt of waste material will be mined. The pit will cover an area of approximately 27 ha and will have a maximum depth of 110 m. The mined ore will be treated using conventional gravity copper and gold carbon in pulp (CIP) circuits at an annualised processing throughput rate of 750 ktpa. Mining and processing are expected to take approximately five years.

Kalkaroo lies within the South Australia Arid Lands (SAAL) Landscape Board Region. The site is not located within a prescribed water resources or wells area as defined by the Landscape South Australia Act 2019. The Far North Prescribed Wells Area is the nearest prescribed area located 40 km to the north of the site.

This report provides a description of the hydrogeological environment at and around the site leading to the development of a hydrogeological conceptual model and the design and construction of a numerical groundwater flow model to assess the hydrogeological impacts of the proposed mining operation and post-closure period. This report builds on previous groundwater assessments undertaken at the site and considers regulatory feedback related to these assessments, focusing on the hydrogeological conceptualisation of the site and translation of the conceptual model to a numerical groundwater flow model.

1.2 Objectives

The objectives of this assessment are to:

- Provide a description of the hydrogeological environment in which the site is located.
- Identify groundwater receptors which may be impacted by the proposed mining operation.
- Develop a hydrogeological conceptual model of the project area.
- Develop a numerical groundwater flow model based on the hydrogeological conceptualisation to assess the operational and closure impacts of mining on the groundwater system.
- Assess the level of impact to groundwater receptors.
- Develop a groundwater management and monitoring plan to manage identified risks.
- Review and address PEPR review responses by Agencies (DEM, DEW, EPA) and other respondents.

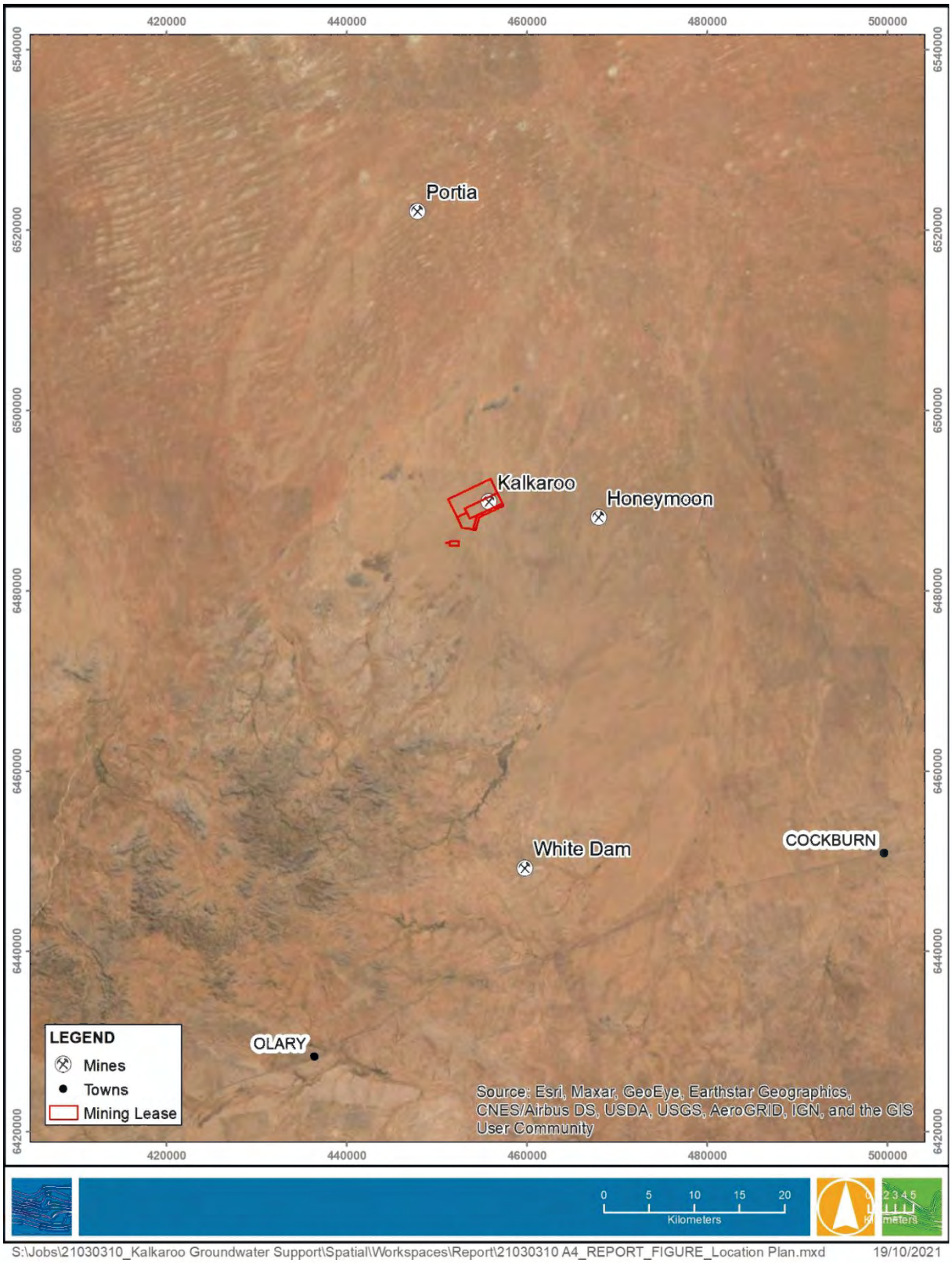


Figure 1-1 Site Location Map

2 PREVIOUS HYDROGEOLOGICAL ASSESSMENTS AND REGULATORY REVIEWS

In 2015 a mining lease was granted for the Kalkaroo Copper Gold Mine Project. The 2015 MLP was supported by a 2013 groundwater assessment completed by Australian Groundwater Technologies (AGT). AGTs assessment drew much of its information from hydrogeological investigations completed by Adam Geoscience in 2009. AGTs 2013 groundwater assessment included numerical groundwater flow modelling completed by Lisdon Associates with the details of the numerical modelling documented in AGTs report. The 2015 mining lease approval included several Sixth Schedule conditions specifically relating to groundwater as summarised below:

10.1. The Tenement Holder must provide a calibrated groundwater model.

10.1.1. The model must include modelling of groundwater mounding caused by the TSF operations;

10.1.2. Adequacy of the current closure modelling approach is to be verified by:

10.1.2.1. Providing volumes of groundwater extracted by the 'drain' cells representing the pit lake;

10.1.2.2. Providing a comparison of the pit lake levels to the regional potentiometric surface immediately adjacent to the pit.

10.1.3. References must be provided for the sensitivity analyses undertaken on the groundwater model.

10.2. The Tenement Holder must establish a program for the establishment and ongoing calibration of the transient groundwater model using data obtained from groundwater monitoring within the proposed PEPR.

10.3. The Tenement Holder must establish a program for the ongoing calibration of the pit lake geochemistry and hydrogeological models using data obtained from operational monitoring to address any assumptions and uncertainty within the model.

10.4. The Tenement Holder must provide further explanation and evidence to support the conclusion that the saprolite and saprock material will behave as a porous media. If evidence cannot be provided, the model must be updated to include a layer representing the saprolite as an aquitard.

In March 2021 Kalkaroo Copper Pty Ltd submitted a PEPR for the Kalkaroo Copper Gold Mine Project. The 2021 PEPR included several notable changes from the 2015 mine plan, specifically, the depth of the pit was reduced from 160 m to 90 m and the mining duration from seven years to five years. The extent of the pit has also been reduced from 33.5 ha to 27 ha.

A request for further information was issued to Kalkaroo Copper Pty Ltd from the Department for Energy and Mining during August 2021. The request for information included comments from DEM, the Department for Environment and Water (DEW), the Environment Protection Authority (EPA), the South Australian Arid Lands Landscape Board and SafeWork SA. Of particular note to this assessment are the comments relating to the hydrogeological conceptualisation, groundwater modelling and groundwater baseline conditions. In response to this, Kalkaroo Copper Pty Ltd have engaged Water Technology to review the existing hydrogeological assessments and to address the issues raised in the request for further information and sixth schedule lease conditions.

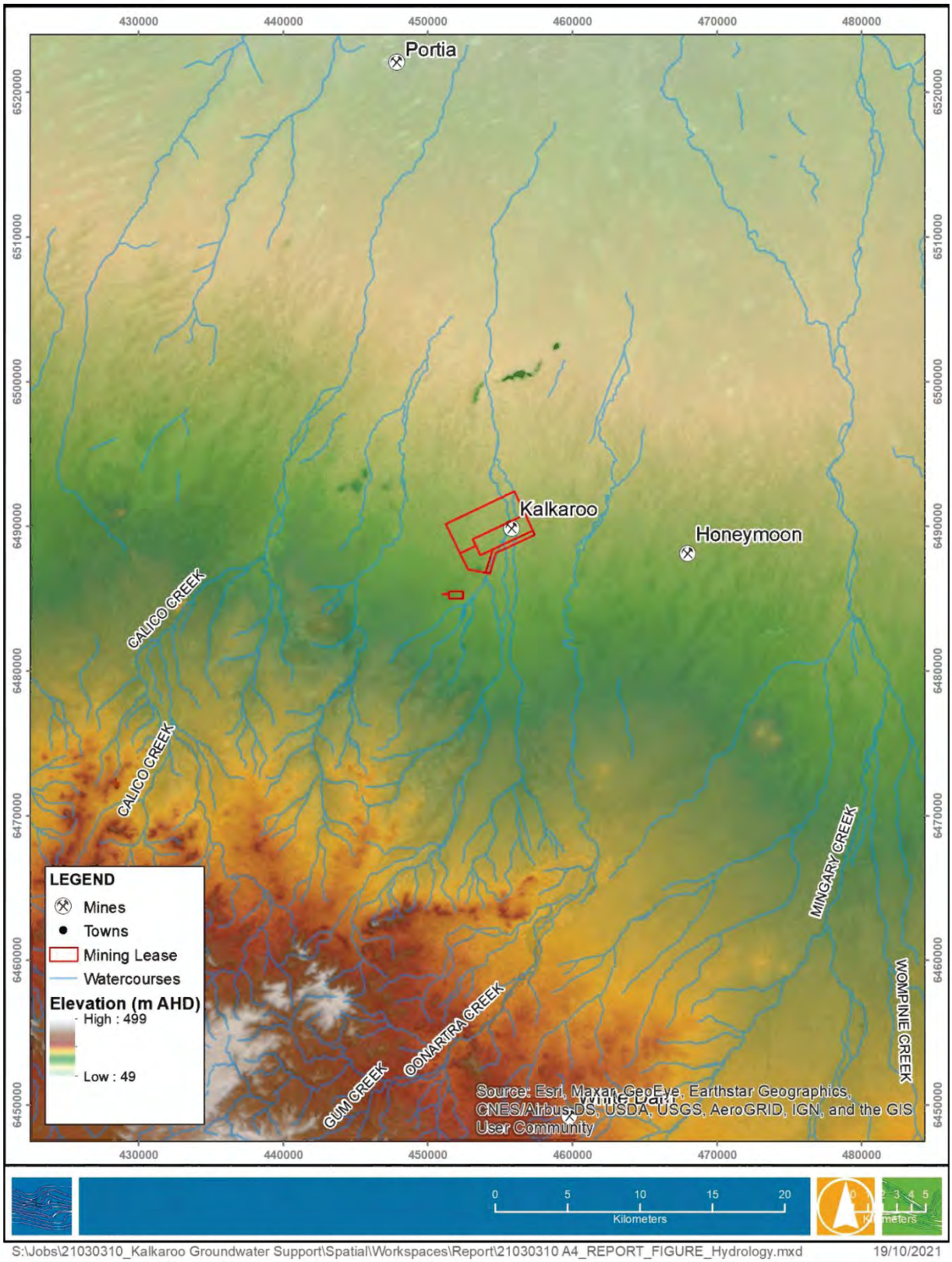
The following hydrogeological reports and data sets have been used to inform this assessment:

- Phase 1 and 2 Summary Report (Aldam Geoscience, 2009). This report presents an initial data review and the methodologies and outcomes of drilling, aquifer testing and numerical groundwater modelling, the latter carried out by Lisdon Associates.
- Well completion reports (Schedule 8) for the water wells drilled to support the Phase 1 Aldam Geoscience report.
- Excel data files and outputs from the Clarke Groundwater Software (Clarke ,1988) for the Phase 1 aquifer testing.
- Data files for the various MODFLOW groundwater model versions developed by Lisdon Associates for the Phase 2 report.
- Kalkaroo Mine Dewatering and Hydrogeological Impact Assessment (AGT, 2013). This report builds on the Aldam Geoscience (2009) assessment and includes the results of an extended and updated groundwater model. The report is appended to the current PEPR document (March, 2021).
- Data files for the various updated MODFLOW versions developed by Lisdon Associates for the AGT report.
- Kalkaroo Copper block model data and structural mapping data and advice.

3 CLIMATE AND HYDROLOGY

The Climate of the area is arid with annual average rainfall of 200 mm at Mooleulooloo Station (1982 to current) and 225 mm at Broken Hill Airport (1994 to current). Average annual pan evaporation is around 2,400 to 2,800 mm per year. The distribution of rainfall is reasonably even throughout the calendar year, ranging from 13.1 mm in April to 21.3 mm in February at Mooleulooloo, and 14 mm in May to 26.1 mm in February at Broken Hill Airport. The average number of rain days remains similar throughout the year suggesting higher rainfall in summer months is likely to be associated with infrequent storm events.

The site lies within the plains of the Lake Frome Basin, specifically the Curnamona Plains which are slightly undulating to flat and falling gradually at a gradient of around 1:1,000 towards Lake Frome. The Olary Ranges 60 km to the south form a regional topographic high (Figure 3-1). Local watercourses are ephemeral, responding to high intensity rainfall events. The closest recognised creeks to the Kalkaroo Deposit are Calico and Booloomata Creeks to the west, and Oonartra and Mingary Creeks to the East. These and other smaller ephemeral watercourse in the area flow in a northerly direction towards Lake Frome (Figure 3-1).



S:\Jobs\21030310_Kalkaroo Groundwater Support\Spatial\Workspaces\Report\21030310 A4_REPORT_FIGURE_Hydrology.mxd 19/10/2021

Figure 3-1 Regional Drainage

4 GEOLOGY

4.1 Regional Setting

The Kalkaroo Deposit is located within the Curnamona Geological Province on the Benagerie Ridge (Figure 4-1). At a regional scale the site is flanked by the Olary Ranges to the south, Flinders Ranges to the west and Barrier Ranges to the east (Figure 4-1). Basement rocks of the Willyama Supergroup outcrop in the Olary Ranges south of the site, as shown on the 1:100,000 geological map sheet (Figure 4-2). Locally, flat broad alluvial plains surround the site and comprise Quaternary and Tertiary age sedimentary deposits overlying older Neoproterozoic Basement rocks. Quaternary deposits consist of fluvial and aeolian clays and sandy clays (Magee, 2009) while Tertiary sediments consist of Miocene lacustrine clays and silts of the Namba Formation (Waterhouse and Beal 1978; Magee, 2009).

Tertiary Eyre Formation sediments consisting of Eocene fluvial sands are known to exist in the broader study area. The extent of these sediments has been assessed using several data sources including the SARIG Eocene Palaeochannel extent, stratigraphic logs from WaterConnect and palaeochannel interpretations from Southern Cross Resources and Geoscience Australia (Magee, 2009). The extent of the SARIG Eocene Palaeochannel layer is shown in Figure 4-3 along with (1) drillholes which have intersected basement with no Eyre Formation sediments interpreted and (2) drillholes which have intersected basement and have been interpreted to intersect Eyre Formation Sediments. The data suggests that most of the drillholes within 10 km of the Kalkaroo deposit have not intersected Eyre Formation sediments. The lithological descriptions of those that did were reviewed and were found to be more consistent with the Namba Formation than with clean fluvial sands of the Eyre Formation. In addition to this, inferred palaeochannel extents from Geoscience Australia (Magee, 2009) and Southern Cross Resources were reviewed to validate the SARIG interpretation. Review of these data sets suggests that the palaeochannel extent is more constrained than the SARIG interpretation. From this review, it has been concluded that the Eyre Formation is not continuous or connected enough to define a channel or layer of any significance near the Kalkaroo deposit. The data review confirms that the nearest Tertiary palaeochannel sediments exist within the Yarramba Palaeochannel which hosts the Honeymoon Uranium deposit, 12 km east of the Kalkaroo deposit site.

Regional geological cross sections constructed for this project based on WaterConnect stratigraphic logs and site data are provided in Figure 4-4 and Figure 4-5. The north-south section indicates that the basement palaeo-topography slopes away from the ranges under the Curnamona Plains (Figure 4-5) toward the north. A lens of sand is interpreted 5 km north of Kalkaroo (7034-1397), however, as discussed above these lenses are not considered to be continuous or connected enough to define a channel or layer of any significance. The east-west hydrogeological cross section shows the interpreted extent of the Tertiary Eyre Formation 12 km to the east of Kalkaroo.

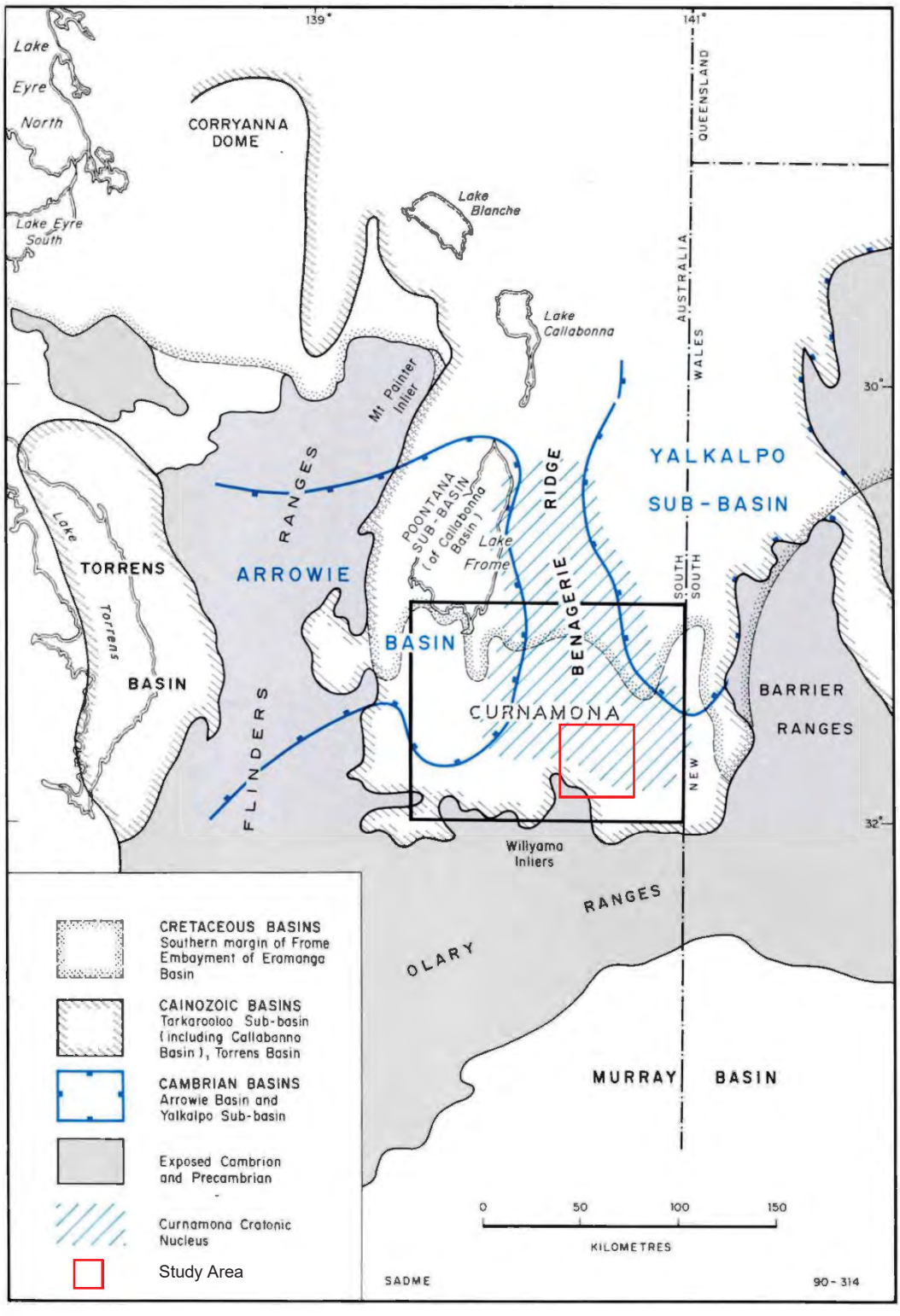


Figure 4-1 Sedimentary Basins (Callen, 1990)

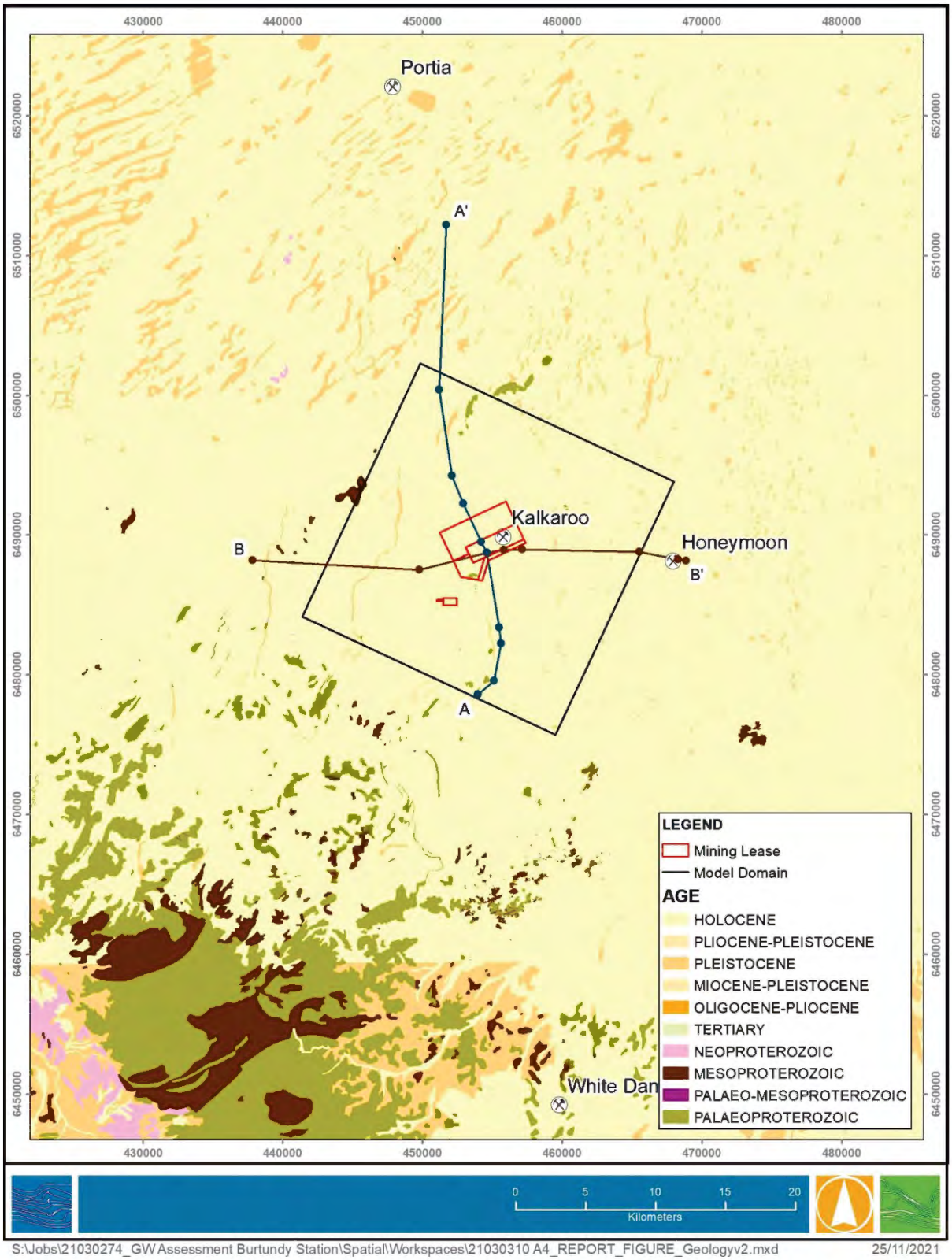


Figure 4-2 Regional Geology and Cross Section Locations (SARIG 1:100,000)

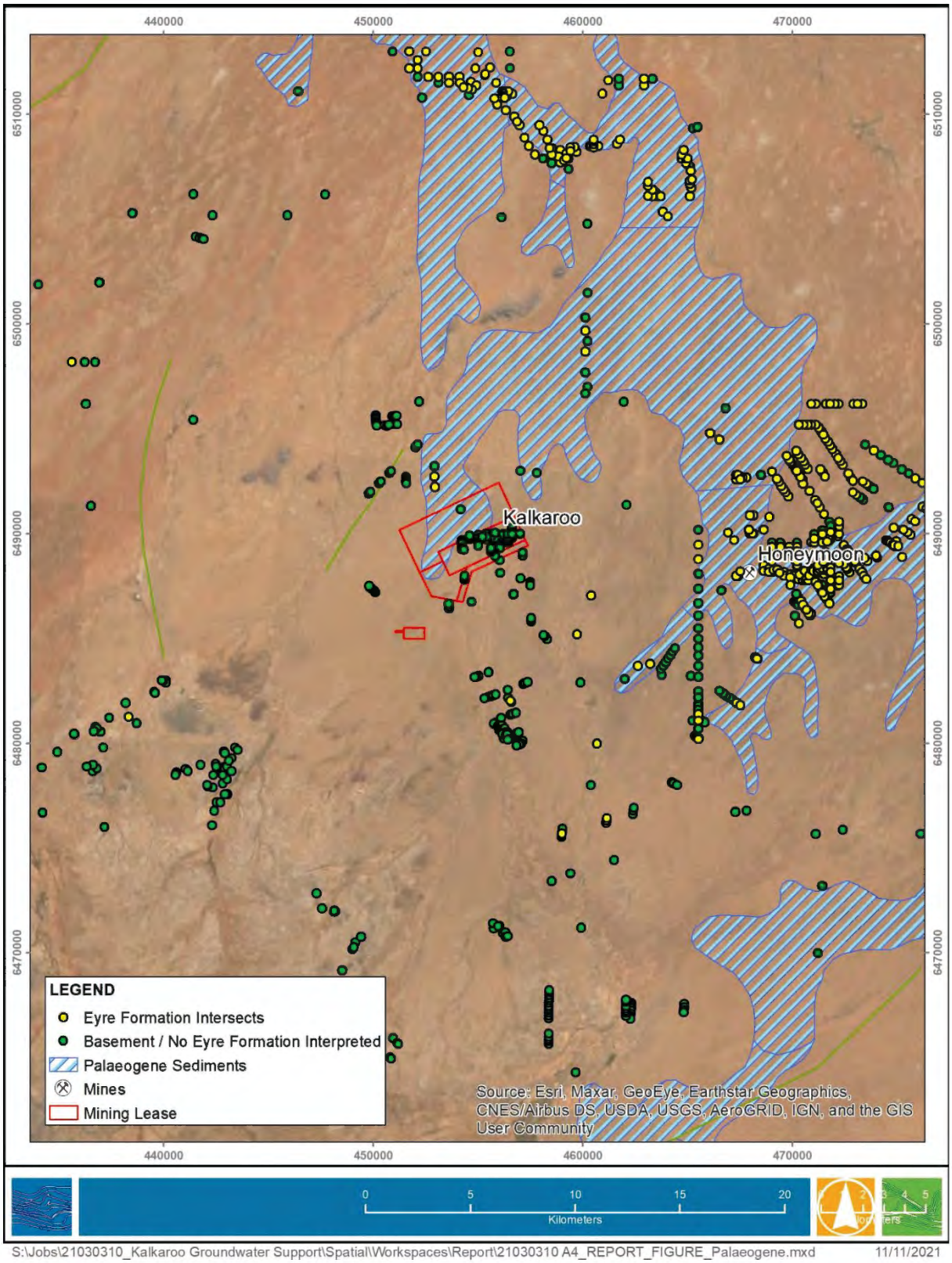


Figure 4-3 Tertiary (Palaeogene) Sedimentary Distribution (SARIG)

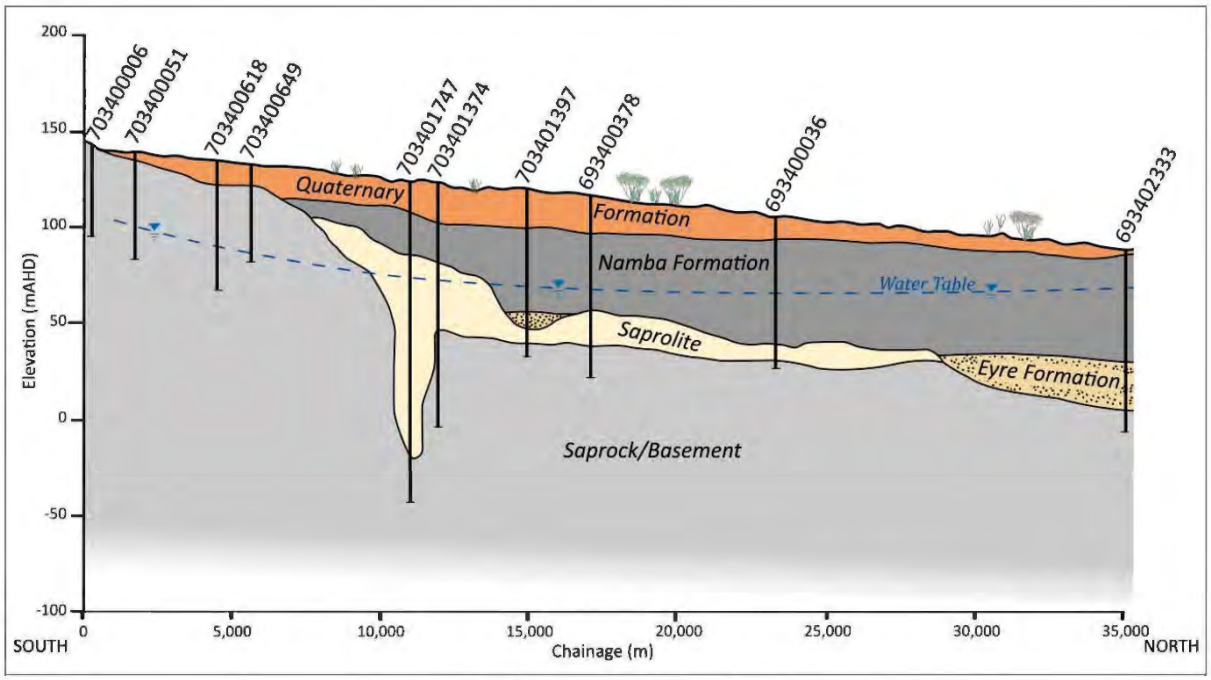


Figure 4-4 North South Regional Hydrogeological Cross Section (A-A')

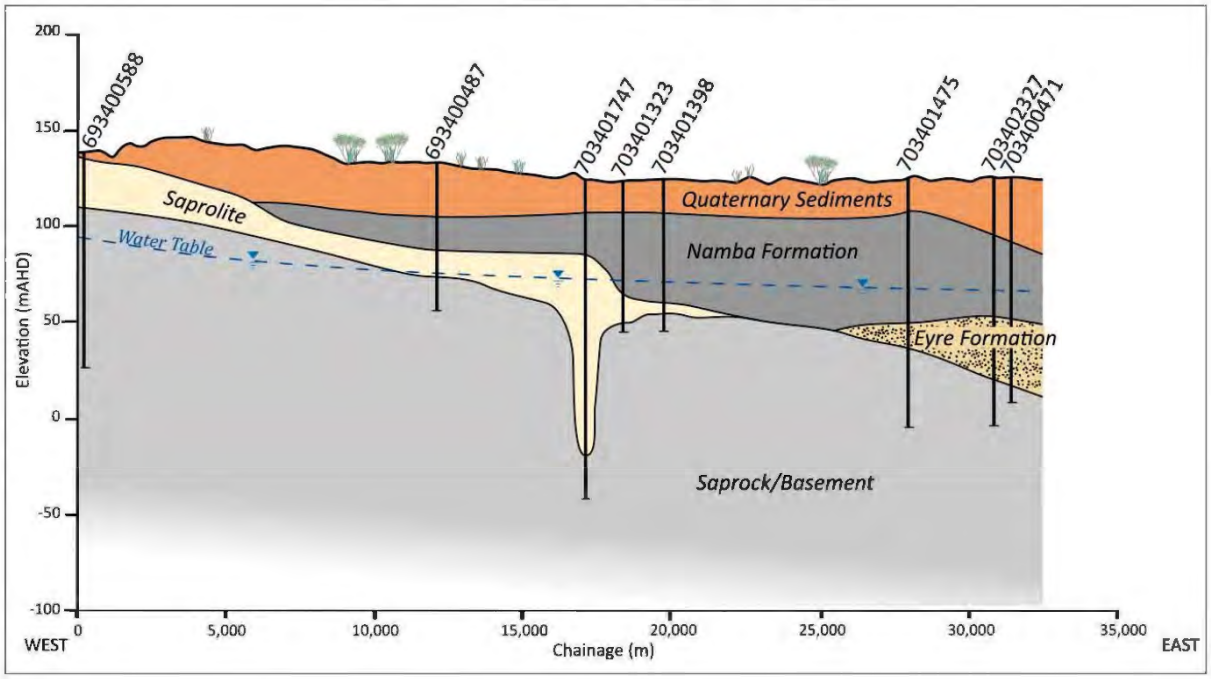


Figure 4-5 East West Regional Hydrogeological Cross Section (B-B')

4.2 Site Geology

The Kalkaroo copper gold deposit is located at depths of between 30 m and 90 m below ground surface within weathered (saprolitic) and fresh Proterozoic graphitic pelite and albitite units of the Broken Hill Group. Core photos of the weathered saprolite material showing remnant bedding and jointing structures are presented in Figure 4-6. The mineralisation is reported to be associated with an approximately east west trending quartzose infilled shear and dome structure (Kalkaroo Copper, 2021). Major structural features reported by Kalkaroo Copper based on interpretation from over 500 exploration drillholes are shown in a plan view in Figure 4-7 and include:

- The Kalkaroo Dome structure which is reported to be a north plunging anticline characterised by a sub-vertical fractured zone causing an area of increased permeability within the mining sequence.
- Kalkaroo West shear which trends approximately east to west, dips steeply and is thought to be about 50 m wide. The shear zone contains fractured quartz and carbonate breccias which appear to be of high secondary porosity and permeability. Deep oxidation and weathering are reported to have produced a trough of saprolitic rocks along this shear zone. A subsidiary shear is also thought to be present about 50 m north of the Kalkaroo West shear.
- Western Limb shear which trends approximately north to south and is quartzitic and steeply dipping.
- Central shear through the dome which is reported to be steeply dipping and trending approximately east northeast to west southwest. It is possible that it is a continuation of the Kalkaroo West shear, with relative displacement to the north along the Western Limb Shear.

Quaternary and Tertiary Sediments overlie the saprolite, saprock and fresh basement throughout the project area. Quaternary sediments comprise undifferentiated alluvial, fluvial and aeolian deposits while Tertiary sediments are associated with the Namba Formation. In additional to the mineralisation within the saprolite, Kalkaroo Copper report that a gold-enriched horizon of supergene origin has been deposited in the organic clays within the Namba Formation due to upward migration from the underlying Kalkaroo orebody (Kalkaroo Copper, 2021). Geological cross sections showing the interpreted stratigraphic layers and mineralisation are presented in Figure 4-8 and Figure 4-9. The cross sections are based on Kalkaroo Copper's exploration drilling.

Isolated occurrences of Tertiary sand at the base of the Namba Formation have been intersected in a few basement topographic low areas over the deposit, but these are not continuous or connected enough to define a channel or layer of any significance. The closest recognised palaeochannel to the Kalkaroo Deposit is the Yarramba Palaeochannel located 12 km to the east. An interpreted tributary palaeochannel trends to the southwest from the Yarramba Palaeochannel towards Kalkaroo as shown in Figure 4-3, but this has not been proven to contain significant deposits of Tertiary sand. Review of available drill hole logs from SARIG suggest that these materials are predominantly silty clays, and it is therefore interpreted that they are associated with the Tertiary Namba Formation.

Advice provided by Kalkaroo Copper indicates that data from a limited number of rotary mud Uranium exploration holes indicates this area could be underlain by weathered granite basement rather than Tertiary sand. Note that the Yarramba paleochannel is actually filled with old Cenozoic Eyre Formation sands, which are unconformably overlain by the Namba Formation. The Eyre Formation is now only found in depressions and paleochannels as it was largely eroded away pre-deposition of the Namba Formation.

Figure 4-6 Core Photo of Weathered Saprolite Material (KKDD00289 74 to 80 m) (Kalkaroo Copper, 2021)

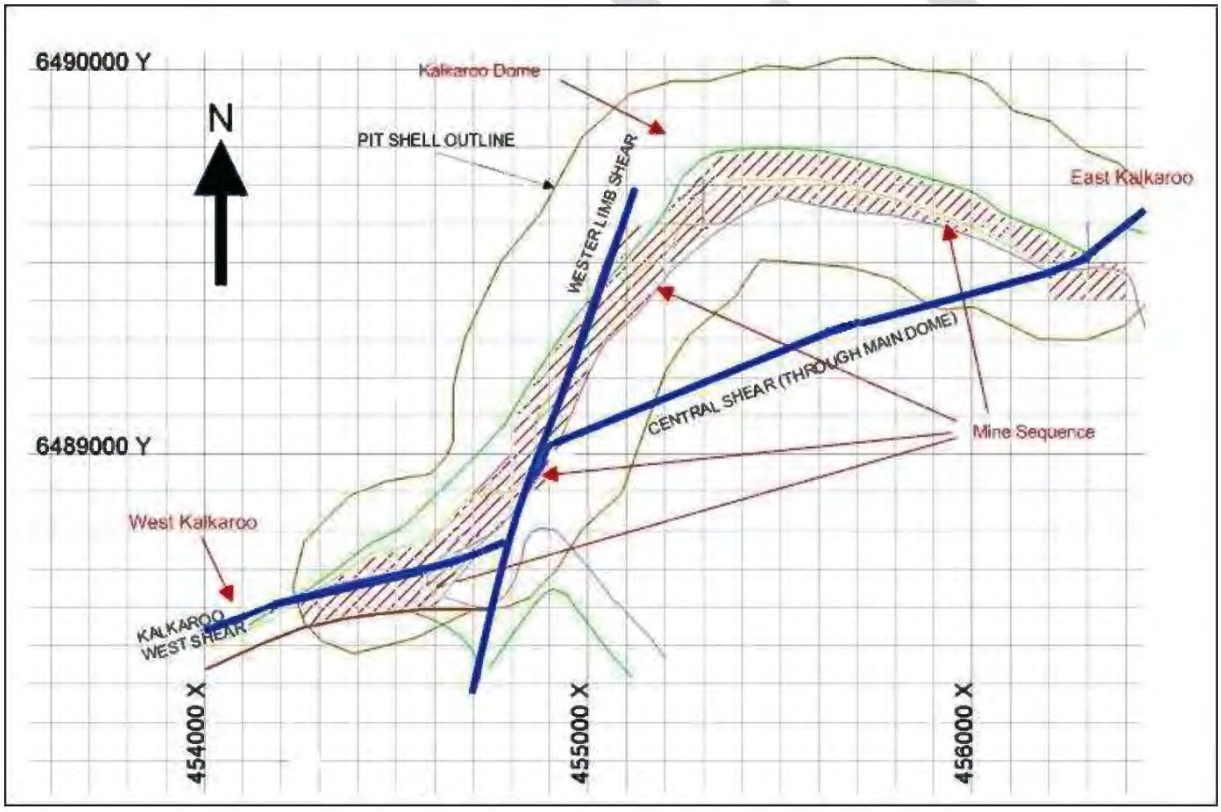


Figure 4-7 Basement Geology and Major Structural Features (Kalkaroo Copper, 2021)

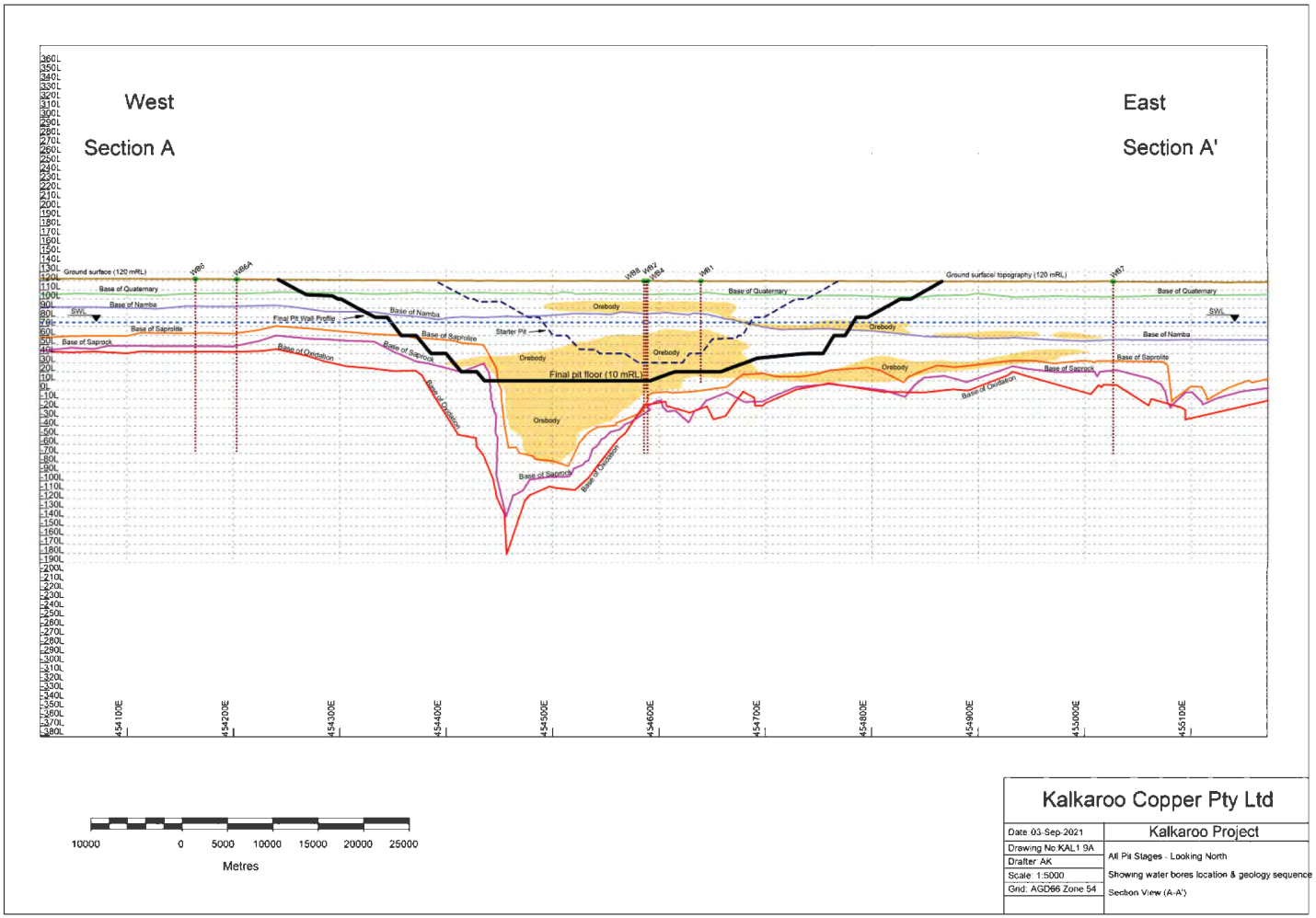


Figure 4-8 Site Geological cross section A-A'

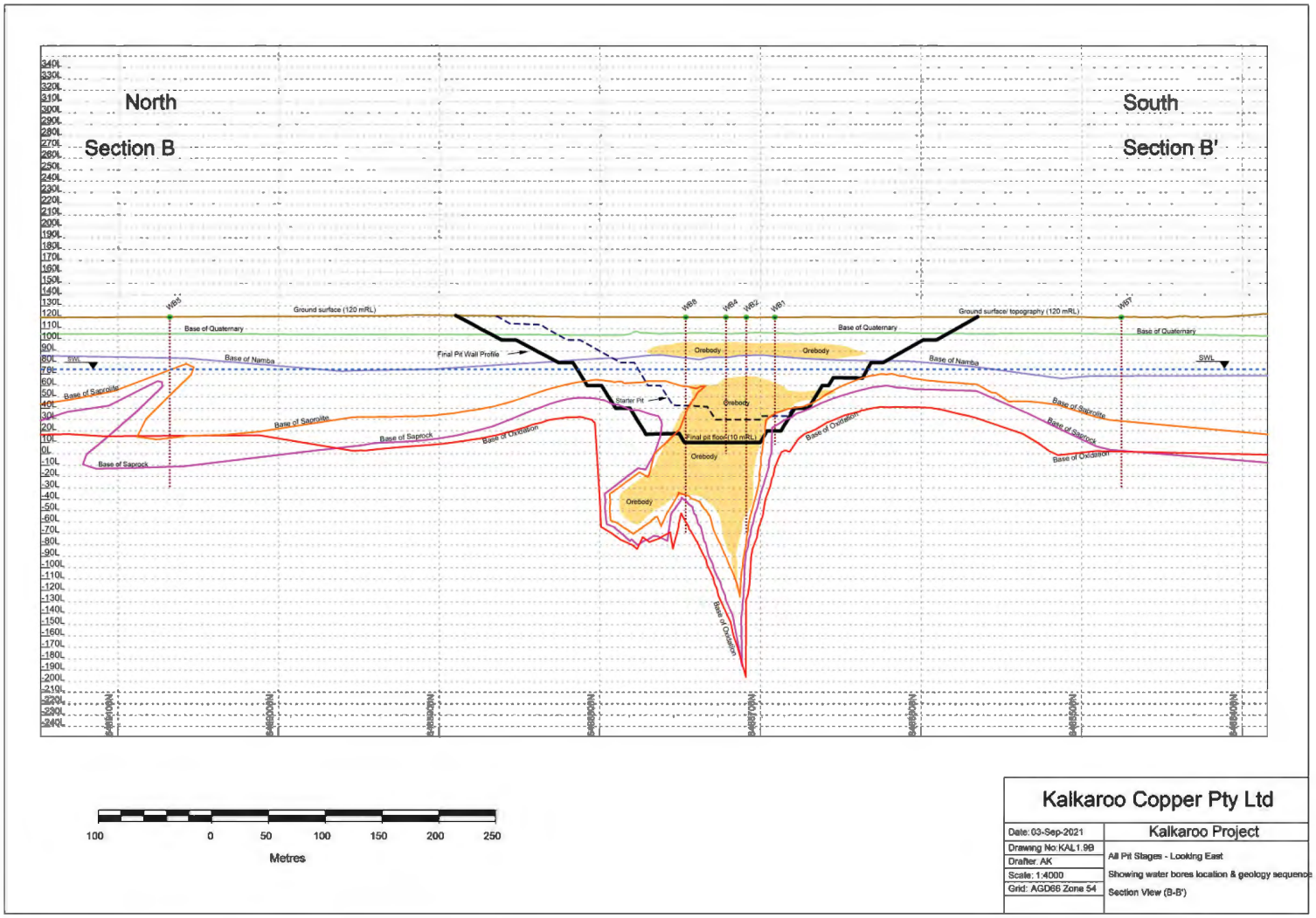


Figure 4-9 Site Geological cross section B-B'

5 HYDROGEOLOGY

5.1 Groundwater Levels and Flow Directions

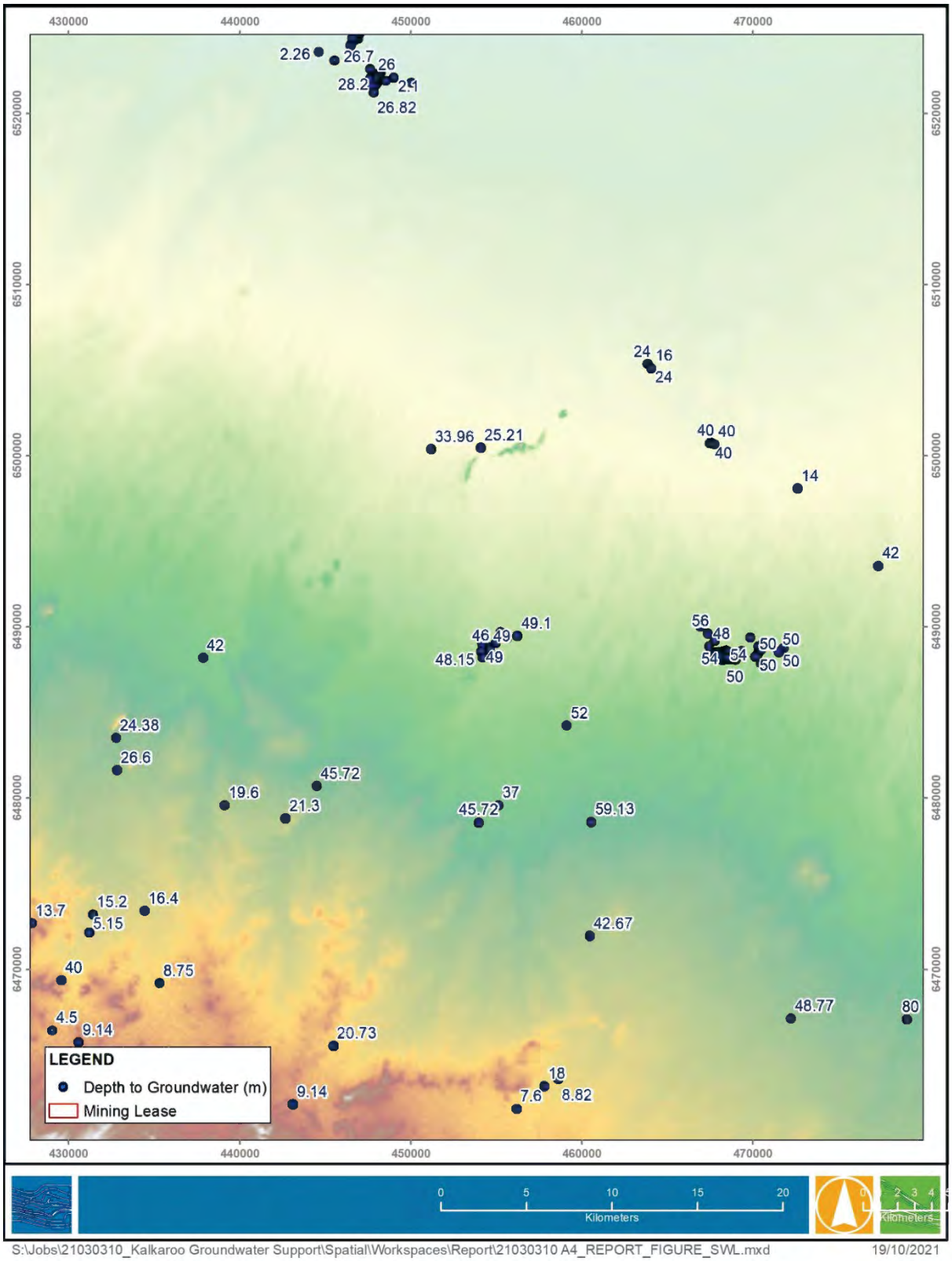
Groundwater data within 20 km of the site were obtained from the WaterConnect database and analysed to provide further information on groundwater levels and flow directions. Analysis of the data indicates that the water table is within the basement to the south, through the site, and transitions into the Tertiary Namba Formation to the north and east of the site as the basement surface deepens. This is illustrated schematically in regional cross sections A-A' and B-B' (Figure 4-4 and Figure 4-5). Groundwater levels occur at depths of 45 to 50 m below ground level near the Kalkaroo deposit (Figure 5-1).

Quaternary sediments are not known to be saturated within the study area with the water table occurring around 30 m below the base of these sediments. The Tertiary Namba Formation is also unsaturated to the south of the orebody and partially saturated in the north and northeast as the basement topographic level falls away from the Olary Ranges. The low permeability Namba Formation overlies the Saprolite (weathered basement) which is of a similar permeability and the available data suggests that this contact is generally above the water table within the proposed pit footprint. There is currently no evidence to suggest enhanced permeability at the contact between these two low permeability formations. Stratigraphic conditions reported by Kalkaroo Copper in resource drillholes completed on 25 m spacing over the area of the pit indicated little variation in the contact between the Namba Formation and the Saprolite and absence of the Eyre Formation.

Some localised perching may exist in the Quaternary sediments or at the boundary with the lower permeability Namba Formation, however, as this has not been the focus of previous investigations, there is no data to support the occurrence of such conditions. Geotechnical test pit logs around the proposed tailings storage facility reported very stiff to hard clays at depths of up to 2.0 m (BTM Solutions, 2012). These observations are consistent with anecdotal evidence from fauna trenches dug on-site to around 0.5 m which also reported a stiff impenetrable clay layer. The clay layer was reported to be present on the plains and within ephemeral watercourses near the proposed pit. The presence of this clay layer has the potential to significantly reduce recharge, and hence, establishment of perched water tables. Given the paucity of data however, it is suggested that additional drilling investigations be undertaken to determine whether the shallow soil profile (<20 m) between the water course and the pit contains significant intervals of sediments capable of transmitting surface water flows vertically to form a perched water table during flow events, and horizontally towards the pit walls.

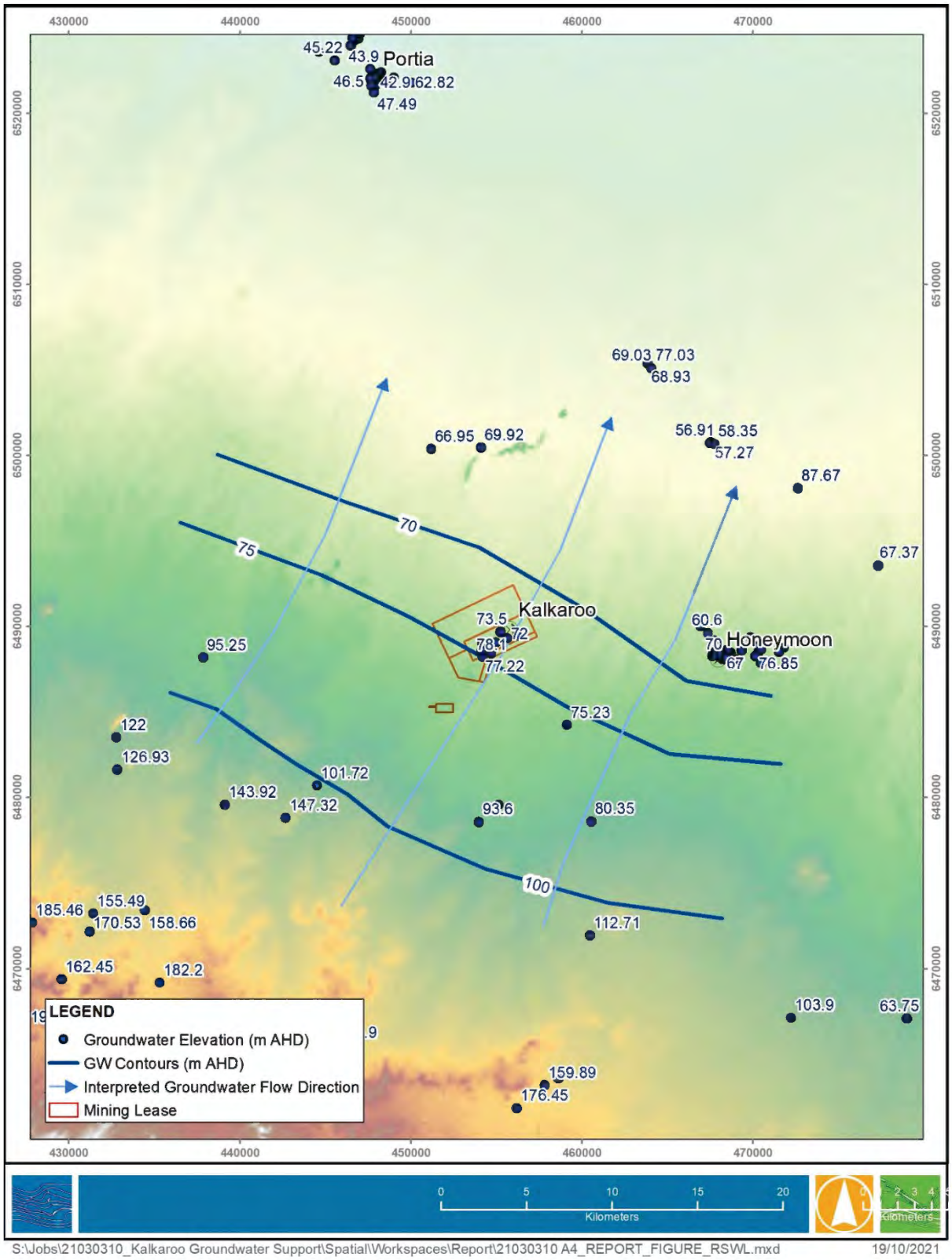
The regional groundwater flow within the basement aquifer is interpreted to be in a north-easterly direction from the elevated ranges in the southwest to the low-lying plains in the north and northeast, consistent with the regional topographic gradient (Figure 5-2). Although the potentiometric surface has been derived from groundwater levels spanning several decades, it is considered that the data provides a reasonable representation of the groundwater flow direction within the study area. Localised variations to this generalised flow pattern may be observed within individual hydrogeological units depending on proximity to influencing features such as higher permeability deposits within Tertiary palaeochannels or significant areas of enhanced permeability such as shear zones within the basement rocks.

There is no time series data available within the study area to assess seasonal or long-term climatic influences. Groundwater levels from the site wells (Figure 6-1) were gauged in November 2021 with data indicating that levels were on average around 1 m higher than the levels gauged in 2009, with a range between approximately 0.6 and 1.2 m higher. The cause of this increase is unknown, however, in the absence of any known stresses on the groundwater system it is most likely attributed to long-term climatic conditions.



S:\Jobs\21030310_Kalkaroo Groundwater Support\Spatial\Workspaces\Report\21030310 A4_REPORT_FIGURE_SWL.mxd 19/10/2021

Figure 5-1 Depth to Groundwater from Surface Level



S:\Jobs\21030310_Kalkaroo Groundwater Support\Spatial\Workspaces\Report\21030310 A4_REPORT_FIGURE_RSWL.mxd 19/10/2021

Figure 5-2 Regional Groundwater Contours and Flow Directions

5.2 Groundwater Quality

Regional groundwater salinities range from 1,105 to 34,536 mg/L based on data sourced from site wells and WaterConnect (Figure 5-3). The data has been classified using the salinity ranges presented in the South Australian EPA Water Quality Policy (2015) which has been used as the basis for defining environmental values for the site (refer to section 11.2). Lower salinity groundwater found within the ranges to the southwest is likely to be associated with enhanced recharge into the outcropping basement formations. Data from well 7034-40 approximately 19 km to the northeast of Kalkaroo records a low salinity of 1,334 mg/L. This salinity is not consistent with other readings in this area and this data is thought to be erroneous.

5.3 Groundwater Recharge and Discharge

Recharge to the basement aquifer is thought to occur by infiltration of rainfall in outcropping areas of the Olary Ranges approximately 30 km to the south, as well as those near the site (Johnny Hill and Mooleulooloo Hill). The distribution of groundwater salinity shown on Figure 5-3 supports the conceptualisation that higher recharge occurs in the ranges to the southwest, resulting in lower groundwater salinity in this area, noting that there are some exceptions to this general trend.

Diffuse recharge on the Curnamona Plain is expected to be low due to low rainfall and high potential evaporation rates. Recharge investigations under natural vegetation in low rainfall areas of southern Australia consistently show recharge values of around 1 mm/y (Dawes, 2002). The available data does not indicate areas of enhanced recharge on the Curnamona Plains (assuming that the salinity in well 7034-40 is erroneous).

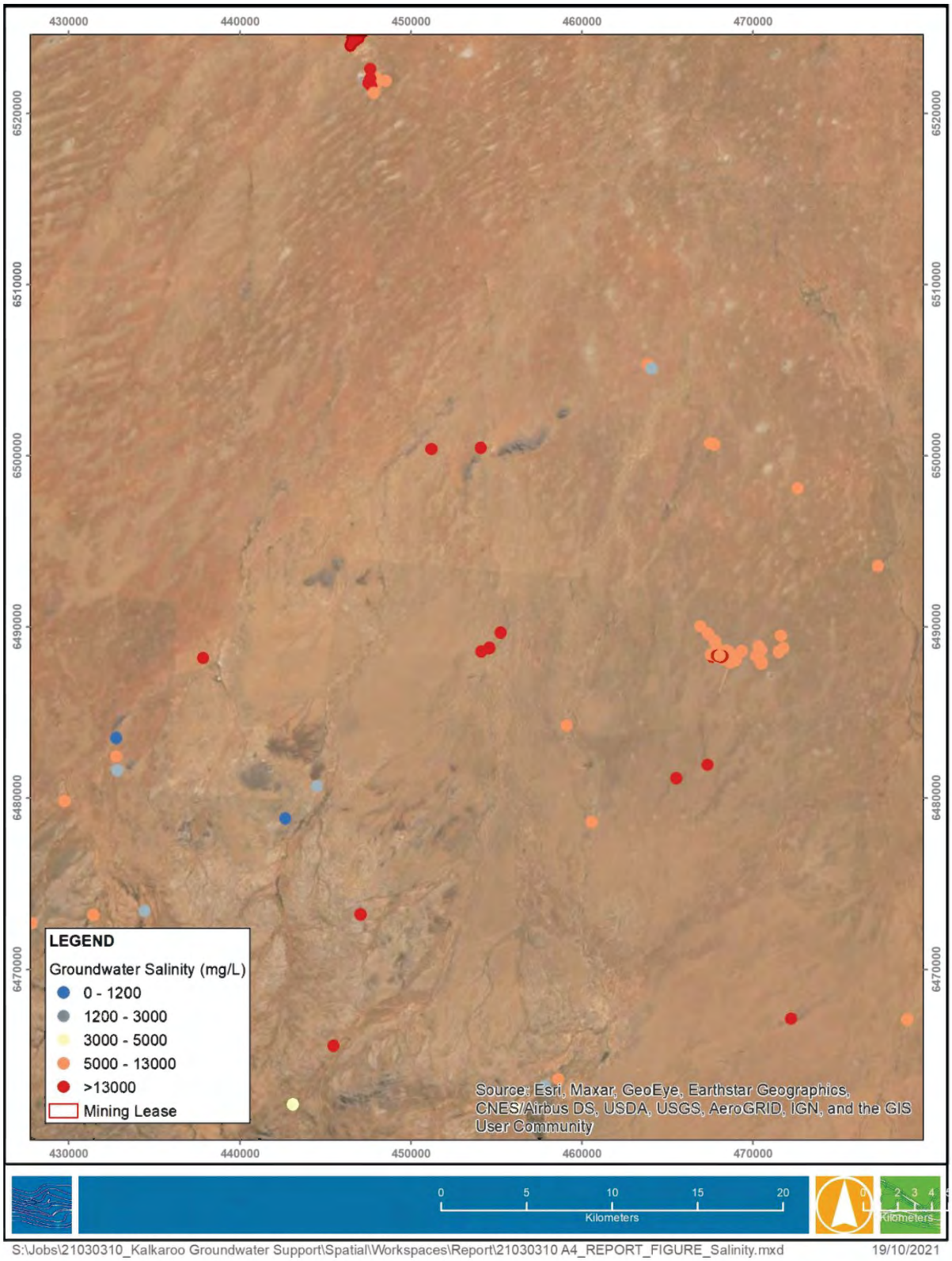


Figure 5-3 Regional Groundwater Salinity

5.4 Well Yields

Well yields recorded in the WaterConnect database in litres per second (L/s) are shown in Figure 5-4. The data indicates regional well yields are generally less than 2 L/s with higher yields more than 20 L/s recorded from the site investigation wells and at the Honeymoon Uranium mine within the Yarramba Palaeochannel. Recorded well yields can be a function of the measurement method, for example airlift during drilling, windmill yield or pumped yield, and therefore may not reflect the true potential well yield. The data does however indicate that shear and fracture zones at the site and palaeochannel sediments at the Honeymoon mine can provide higher yields than are generally measured in the region. This is likely to be a direct function of higher permeability within the shear zones and palaeochannel sediments within the low-permeability regional basement setting.

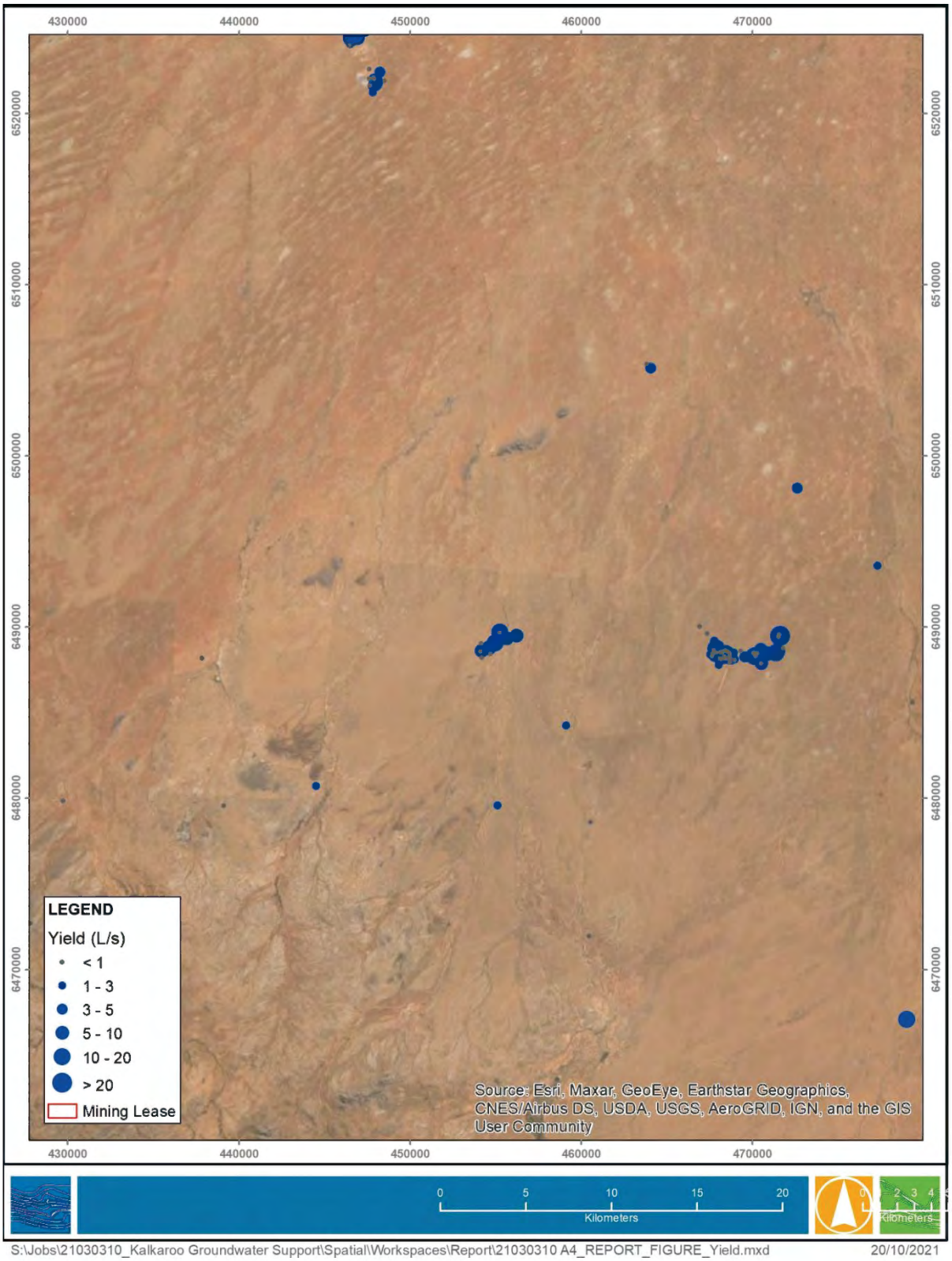


Figure 5-4 Well Yields

6 SITE GROUNDWATER INVESTIGATIONS

6.1 WB Series Groundwater Investigation Wells

Groundwater drilling and aquifer testing was carried out between November 2008 and February 2009 resulting in the installation of twelve site specific investigation wells. The well locations are shown in Figure 6-1 with summary details provided in Table 6-1. Additional descriptive details regarding the drilling and installation program are provided in Aldam Geoscience (2009).

Table 6-1 Kalkaroo Groundwater Investigation Wells

Water Well No.	Unit Number	Depth Drilled (m)	Hydrogeological Unit	Airlift Yield (L/s)	Laboratory Salinity (mg/L)	Comment
WB 2	703401747	165	Basement	10	19,100	West Kalkaroo shear
WB 3	703401746	169	Basement	0.5	9,520	South of west Kalkaroo shear
WB 4	703401745	69	Saprolite	-	-	West Kalkaroo shear
WB 5	703401744	122	Basement	0.5	24,600	North of west Kalkaroo shear
WB 6	NA	150	-	1	-	Re-drilled due to formation collapsing
WB 6a	703401742	174	Basement	10	34,100	West Kalkaroo shear
WB 7	703401741	138	Basement	0.8	12,800	Outside and adjacent western limb shear
WB 8	703401740	174	Basement	8	-	Subsidiary shear at West Kalkaroo
WB 9	703401739	153	Basement	15	25,100	Central shear through dome near junction with western limb shear and mining sequence
WB 10	703401738	123	Basement	7	26,200	Central shear through dome
WB 11	703401737	180	Basement	8	30,000	East Kalkaroo, central shear through dome
WB 13	703401736	162	Basement	15	15,200	Mining sequence dome structure
WB 14	703401735	90	Saprolite	0.1	-	Mining sequence dome structure

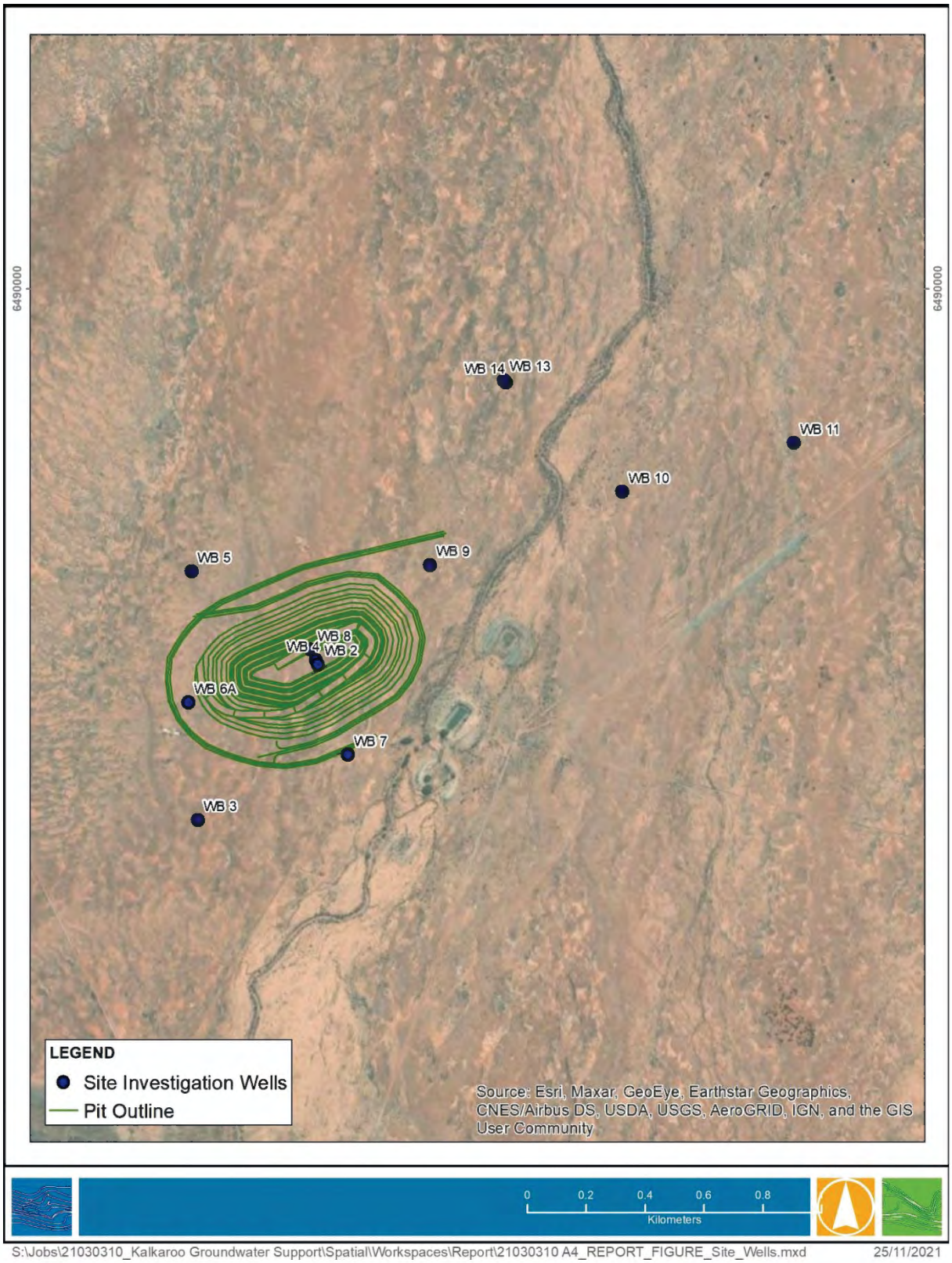


Figure 6-1 WB Series Groundwater Well Locations and Structural Zones

6.2 Groundwater Chemistry

Groundwater samples for a number of the Kalkaroo groundwater investigation wells (WB series) were submitted for laboratory analysis. The major ion data was interpreted using a Piper Plot (Figure 6-2) along with other historical data obtained for 21 other wells in the surrounding area from WaterConnect. Some of these samples are from the Honeymoon site to the east with others to the northeast, west and south of Kalkaroo. The samples from the Kalkaroo water wells show similarity with the historical data, all plotting as sodium-chloride type with high proportions of these ions present. There is some minor spread in sulphate concentration and one of the historic samples shows elevated calcium compared to sodium and potassium, this well is located to the west in an area of potential higher recharge and with a much lower TDS than the other wells. Other historic wells are likely sampling water hosted in similar geology, either the sedimentary rocks of the Eyre Formation or the basement below.

Though the Kalkaroo water wells have been drilled in different domains within the site-specific limbs, shears and dome, the data suggests that they are likely sampling water of the same connected aquifer. WB2 sees slightly elevated concentrations of all major ions compared to the other wells, and WB5 has a slightly higher potassium concentration. The lack of major compositional variation within this set of samples is perhaps unsurprising due to the limited distance between the wells.

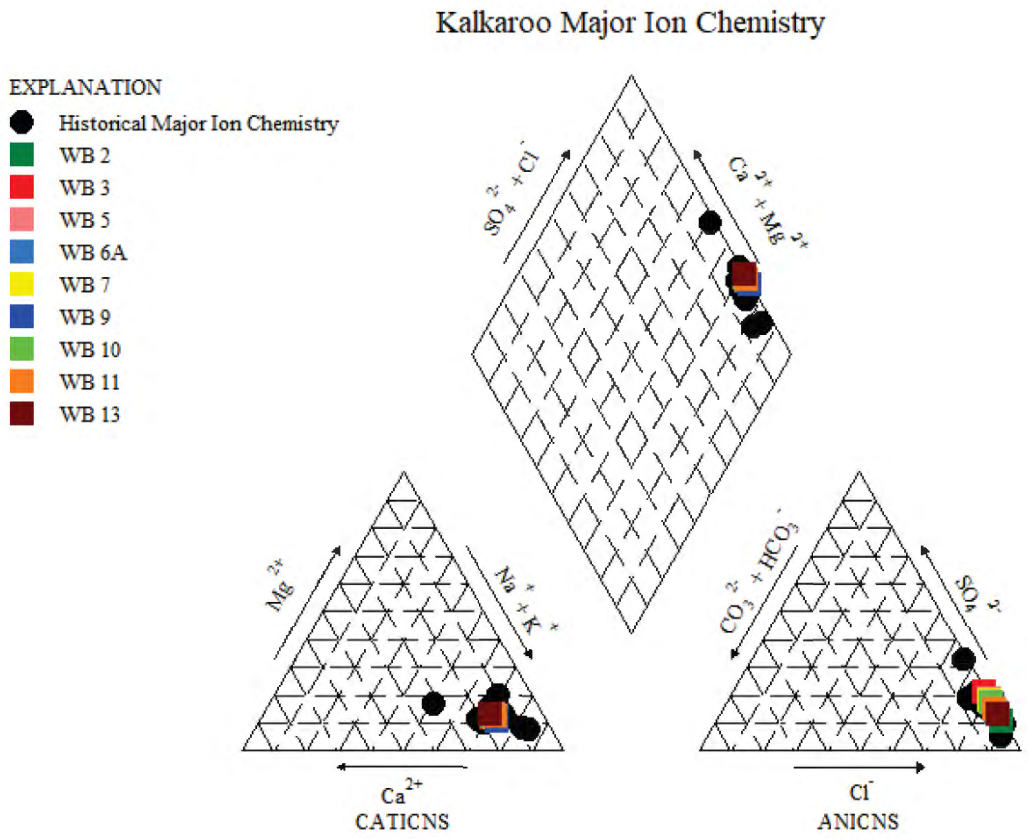


Figure 6-2 Piper Plot of Kalkaroo Groundwater Investigation Wells and Available Historic Data

6.3 Aquifer Testing and Hydraulic Parameters

Aquifer testing was carried out on the site investigation wells as summarised in Table 6-2. Further details regarding the testing program are described in Aldam Geoscience (2009) and test analysis graphs are presented Appendix A

The aquifer testing analysis results have been consolidated to favour those from the pumped well and observation well results from the same unit or hydraulic zone within the Basement. Hydraulic conductivity values have been derived from the analysis results by dividing the thickness of interval tested by the calculated transmissivity.

Table 6-2 Aquifer Test Analysis Summary

WB No.	Unit	Well Yield (L/s)	CD Test Rate (L/s)	Average T (m^2/d)	b (m)	K (m/d)	Average Storativity	Specific Storage (/m)	Analysis	Comment
WB 2	West Kalkaroo shear	10	3.1	158	9	18	$3.4x10^{-4}$	4E-05	Leaky strip	Adopted results from pumping WB 2 and WB 6a ignoring high outlier of 1,864 m2/d
WB 3	South of west Kalkaroo shear	0.5	NA	NA	95	0.002	NA	NA	Hvorslev	
WB 4	Saprolite	-	NA	NA	24	0.02	NA	NA	Hvorslev	
WB 5	Outside west Kalkaroo shear	0.5	NA	NA	4	0.02	NA	NA	Hvorslev	
WB 6a	West Kalkaroo shear	10	3.6	2,630	101	26	$1.9x10^{-4}$	2E-06	Leaky strip	Results from pumping WB 6a
WB 7	Outside west Kalkaroo shear	0.8	0.2	0.6	19	0.03	NA	NA	Jacob	Results from pumping WB 7
WB 8	Subsidiary shear at West Kalkaroo	8	1.3	18	57	0.3	$8x10^{-3}$	1E-04	Leaky strip	Results from pumping WB 8

WB No.	Unit	Well Yield (L/s)	CD Test Rate (L/s)	Average T (m^2/d)	b (m)	K (m/d)	Average Storativity	Specific Storage (/m)	Analysis	Comment
WB 9	Central shear through dome, junction with mine sequence	15	3.6	617	72	9	$1x10^{-3}$	1E-05	Leaky strip	Results from pumping WB 9
WB 10	Central shear through dome	7	3.2	30	11	3	$6x10^{-6}$	5E-07	Jacob and leaky semi bounded strip	Results from pumping WB 10
WB 11	East Kalkaroo, central shear through dome	8	3.2	57	87	1	NA	NA	Jacob	Results from pumping WB 11
WB 13	Dome	15	2.5	173	66	3	$2.9x10^{-4}$	4E-06	Jacob, confined strip and partially bounded strip	Results from pumping WB 13
WB 14	Saprolite	0.1	NA	NA	12	0.0005	NA	NA	Hvorslev	

Notes: 1. NA = Not Applicable

7 GROUNDWATER RECEPTORS

7.1 Existing Users

In arid regions of South Australia where surface water is scarce, groundwater is often used to support stock and domestic users, town water supplies and mining operations. Existing stock and domestic groundwater users within 20 km of the site have been identified using data from WaterConnect. The following filters were applied prior to reviewing the data:

- Removed all drillholes not assigned as water wells (WW).
- Removed all water wells classified as backfilled (BCK).

The remaining wells have been classified by their primary purpose and are presented in Figure 7-1. The data shows that there are relatively few wells in the study area which are likely to be accessing groundwater. Kalkaroo Copper visited the locations of the nearest wells 7034-51, 7034-30 and 7034-1103 during the period 4 to 6 May 2015 to determine their status (refer to Figure 7-1 for locations). None of the wells were found to be operational for stock watering purposes (i.e. no pump/windmills present), however, it is possible that pumping infrastructure may be re-instated in the future and these wells should therefore be classified as not in use. A summary of the well audit details is provided in Table 7-1 below. The closest of the stock wells, 7034-1103 could not be found within a 500 m radius of the coordinates given in WaterConnect, and it is assumed that this well has been has either been abandoned, has collapsed, or the standpipe height is short and possibly obscured by vegetation and debris.

Further to the east, a network of extraction, injection and observation wells exists at the Honeymoon Uranium mine. These wells are completed in the Yarramba Palaeochannel and target the Tertiary Eyre Formation Sediments.

Table 7-1 Existing Users Well Survey (May 2015)

Unit Number (Name)	Distance from pit (km)	Status	Comments
7034-1103 (Mooleulool oo HS.)	6	Not Located	Well 7034-1103 could not be located despite extensive searching of an area surrounding the coordinates given in the Well Connect database of 459125 E 6484232 N (MGA Zone 54). To account for an error in the coordinate system stated, an approximate 500 m radius around the coordinates was searched on 06 May 2015 by vehicle and foot on a grid basis. This would suggest that 7034-1103 has either been backfilled / abandoned, has collapsed or the standpipe height is short and possibly obscured by vegetation and debris.
7034-51	10	Not in use	Approximately 325 m west and 166 m south of the coordinates recorded in Water Connect database. Revised Coordinates 454797 E 6479412 N (GDA94, MGA Zone 54). SWL was recorded on 04 May 2015 to be 39.89 m below TOC. Evidence of a windmill footing was present however there was no water supply infrastructure installed other than the concrete footing and steel standpipe. It is understood that this well has historically been used for water supply across Kalkaroo Station. Although currently not being used, its status as 'not in use' would therefore be appropriate.

Unit Number (Name)	Distance from pit (km)	Status	Comments
7034-30	11	Not in Use	Well 7034-30 is believed to be located at coordinates 453944 E 6500318 N (GDA94, MGA Zone 54). This was approximately 138 m west and 145 m south of the coordinates recorded in the Water Connect database. The SWL was recorded on 06 May 15 to be 24.40 m below TOC. There was no evidence of water supply infrastructure being present.
693400036	12	Abandoned	Not included in field survey as status description in Water Connect as abandoned.

Notes: 1. NA = No Data

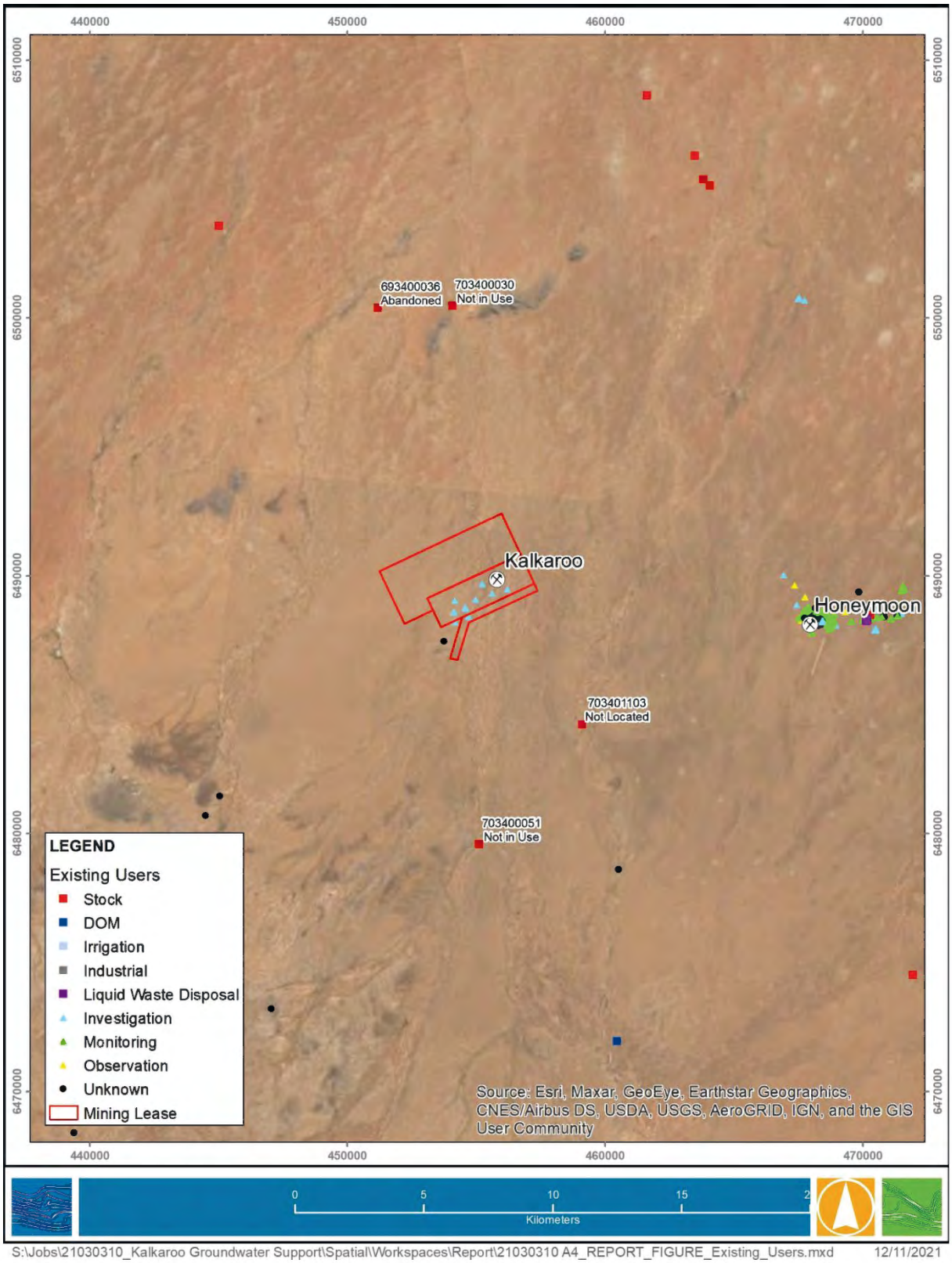


Figure 7-1 Existing Groundwater Users

7.2 Groundwater Dependent Ecosystems

Some ecosystems rely on groundwater to meet ecological water requirements, and as such may be sensitive to changes in the natural groundwater regime. These ecosystems are defined as Groundwater Dependent Ecosystems (GDEs). The Australian GDE Atlas published by the National Water Commission (2012) provides locations of potential GDEs based on broad scale analysis, existing data sets and remote sensing. GDEs are broadly categorised into the following types.

- Aquatic ecosystems that rely on the surface expression of groundwater; this includes surface water ecosystems which may have a groundwater component, such as rivers, wetlands and springs.
- Terrestrial ecosystems that rely on the subsurface presence of groundwater; this includes all vegetation ecosystems.
- Subterranean ecosystems; this includes cave and aquifer ecosystems.

Inspection of the Australian GDE Atlas via the Bureau of Meteorology (BoM) web-based mapping application indicates that the nearest potential aquatic GDEs are located around 7 km northeast of the Kalkaroo pit. These and other potential GDE features in the areas are associated with low lying salt lakes and alluvial plains (Figure 7-2). The likelihood that these systems are supported by groundwater is classified as low within the GDE atlas. Other potential aquatic GDEs in the area include Calico Creek 15 km to the west, Oonartra Creek 23 km to the south and Mingary Creek 22 km to the west of the Kalkaroo deposit. These GDEs are associated with ephemeral drainage lines which discharge in a north to north-westerly direction towards Lake Frome.

Terrestrial GDEs include low level shrublands (less than 1 m) consisting of Sclerolaena divaricate, Atriplex vesicaria ssp and Maireana aphylla (mixed). These low level shrublands are identified as covering the majority of the project area (Figure 7-3). The likelihood that these systems are supported by groundwater is classified as low within the GDE atlas. This classification is consistent with the available groundwater data which suggests that permanent groundwater is in excess of 30 m below ground level and that groundwater is brackish to saline. Other features of interest include a Eucalyptus camaldulensis var. woodland 5 km to the southeast of the Kalkaroo deposit which has been identified as having a high likelihood of being supported by Groundwater.

It is possible that some seasonal vegetation is supported by perched creek sediments which are saturated during wet periods, however, the connection between the permanent water table at depths in excess of 30m and surface vegetation is likely to be low.

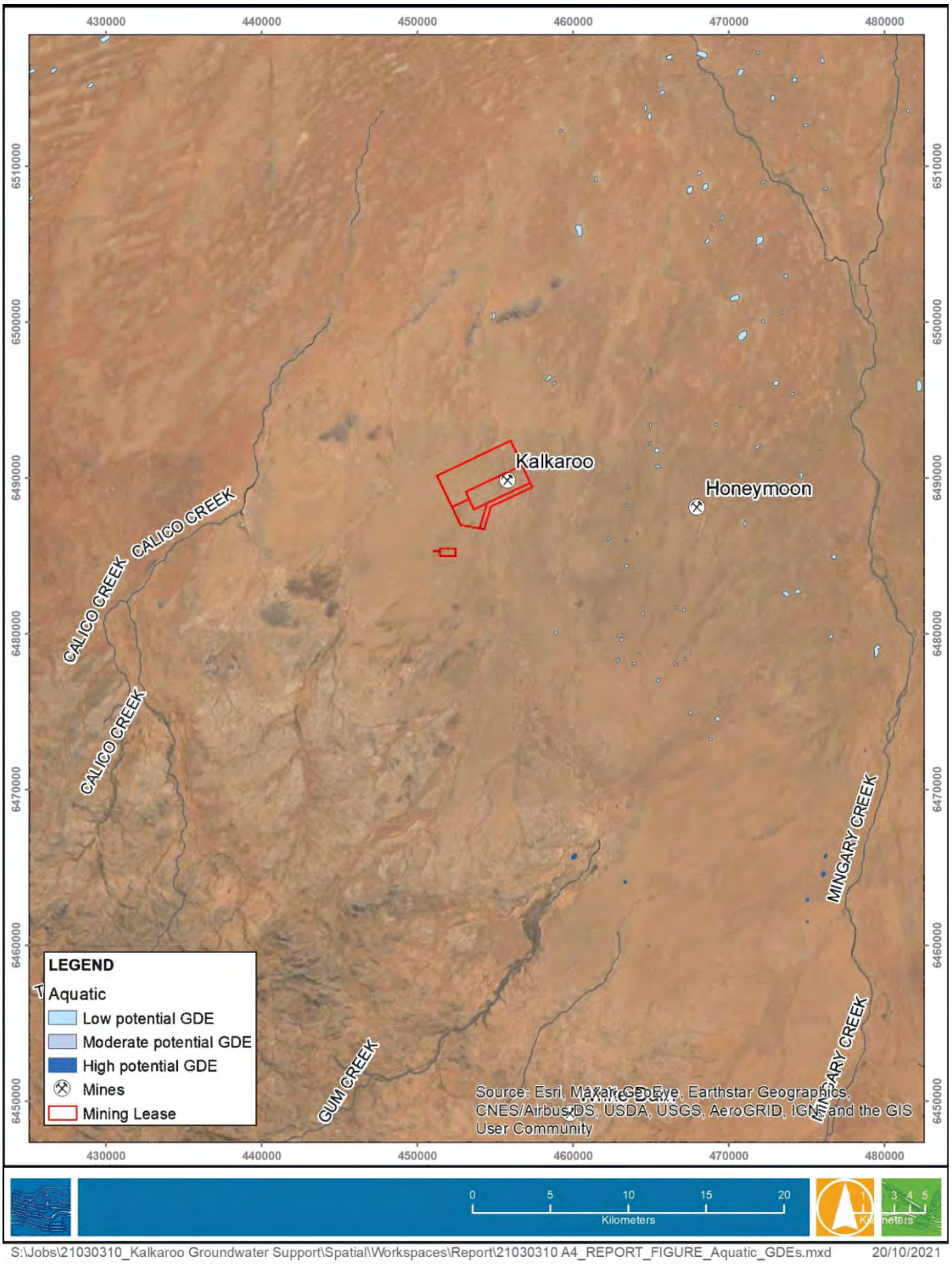


Figure 7-2 Potential Aquatic Groundwater Dependent Ecosystems (BoM GDE Atlas)

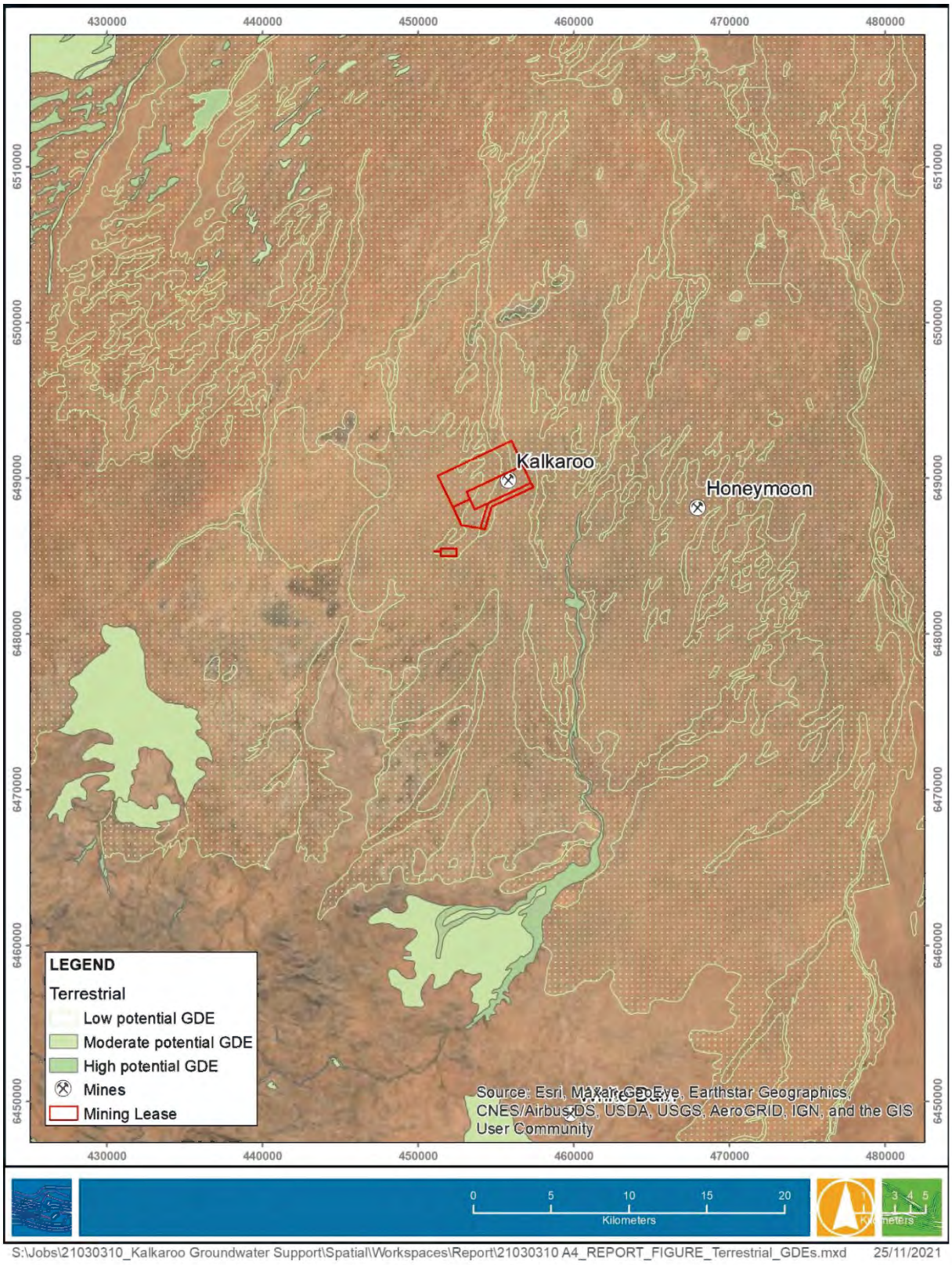


Figure 7-3 Potential Terrestrial Groundwater Dependent Ecosystems (BoM GDE Atlas)

8 CONCEPTUAL HYDROGEOLOGICAL MODEL

The interpretation of the regional geological and groundwater-related data indicates the Kalkaroo project area is characterised by low permeability Quaternary and Tertiary deposits unconformably overlying saprolitic weathered basement rocks, which grade into fresh basement. Tertiary palaeochannels are incised into the underlying basement and contain deposits of Eyre Formation sediments which can provide layers of higher permeability than the overlying material. These sediments can host roll front uranium deposits such as those mined at Honeymoon Uranium mine 12 km to the east of the site. Analysis of available stratigraphic data and inferred extents from Southern Cross Resources and Geoscience Australia (Magee, 2009) suggests that the Yarramba Palaeochannel is the closest defined palaeochannel to the Kalkaroo deposit.

Regional groundwater throughflow is inferred to be driven by recharge in the elevated basement rocks to the southwest of the site, with regional groundwater flow from the south and southwest to northeast and north towards Lake Frome. It is possible that this process contributes groundwater to the overlying Quaternary and Tertiary sediments on the Curnamona Plain through inter-aquifer leakage., however, there appears to be very limited areas of saturation within these sediments between the ranges and the Yarramba palaeochannel. Areal recharge through the Quaternary sediments on the Curnamona Plain is likely to be very low, possibly enhanced in places depending on surface sediment type and proximity to watercourses but this level of complexity is not able to be understood from the available data. Areas of higher recharge in the ranges are indicated by relatively low recorded groundwater salinity values in this area. In addition to the regional data sets, some important aspects of the local site hydrogeology were obtained from inspection of exploration drill cuttings and cores, and the drilling of the site investigation wells as reported in Aldam Geoscience (2009).

Based on the data review and analysis undertaken, the key hydrogeological features can be summarised as follows:

- The Quaternary sediments and Tertiary Namba Formation are clay rich and are of very low permeability. They are unsaturated over the area surrounding the Kalkaroo site with the water table transitioning to the Namba Formation away from the site as the basement topographic level falls.
- The Eyre Formation in the region appears predominantly as sand deposits within the Yarramba palaeochannel to the northeast and east of the site. The Eyre Formation sand deposits were largely eroded away prior to deposition of the Namba Formation and although remnant deposits may be found in depressions within the basement topography, these sediments are not continuous or connected enough to define a channel or layer of any significance near the Kalkaroo deposit.
- The saprolitic materials within the basement-weathered profile are clay rich and are of low permeability. The basement shear zones extend through the saprolite, are brecciated with quartz veining and have significantly higher permeability than the surrounding saprolite. Exploration drilling has identified appreciable water inflows from these features within the saprolite horizon.
- The shear zones within the underlying less weathered transitional saprock horizon are also interpreted to provide zones of higher permeability.
- Significant fracturing in basement shear zones provide areas of relatively high permeability and correspondingly high well yields. These can be conceptualised as strip aquifers within the surrounding low-permeability basement rock mass. To the immediate east of Kalkaroo and for a few kilometres to the west, the Kalkaroo fault zone, comprising the Central and West Kalkaroo shear zones, passes into very tight graphitic pelites which tend to shear and slip rather than brittle fracture, hence it is interpreted that the permeability of these shear zones will be somewhat reduced away from Kalkaroo. The shear zones are assumed to be sub-vertical and extend to depth within the basement rocks.

- The mining sequence forms a north-plunging anticline structure in the central Kalkaroo area and aquifer testing indicates this is a unit of relatively high permeability, probably due to fracturing associated with the structural deformation. Discussions with Kalkaroo Copper personnel indicate that the fracturing within this unit forms a sub-vertical zone of enhanced permeability within the mining sequence.
- Basement rocks away from the shear zones appear to be relatively unfractured with a very low permeability.

A graphical presentation of the key regional and local scale hydrogeological processes is presented as a conceptual block diagram in Figure 8-1.

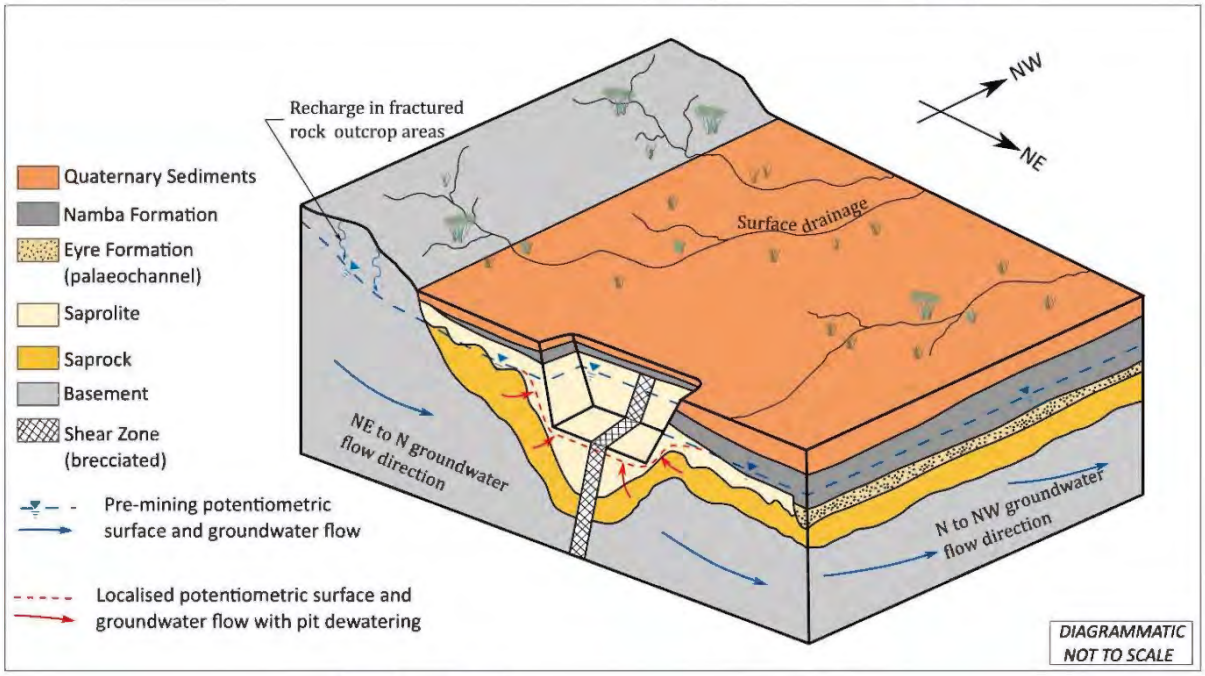


Figure 8-1 Kalkaroo Conceptual Hydrogeological Model

9 PLANNED MINING ACTIVITIES

9.1 Potential Water Affecting Activities

There are several activities on site which have been identified as having the potential to result in groundwater impacts including:

- Local and regional groundwater level drawdown due to pit dewatering and pumping from groundwater supply wells. Previous modelling reported in AGT (2013) and Aldam Geoscience (2009) have modelled the drawdown extents associated with the then proposed operations. The current mining proposal is for a significantly shorter time period, has a much lower proposed pit depth and smaller pit extent than that previously modelled. The revised modelling is therefore required to confirm the drawdown response to these changes.
- Seepage from process water management infrastructure including:
  - A Raw Water Dam (RWD) of 20,000 m^3 capacity which will receive untreated water for site needs including dust suppression and construction activities. The dams will be lined with a 1.5 mm thick HDPE liner on a compacted clay base and seepage is therefore assumed to be negligible.
  - Two Process Water Dams (PWD) of 5,000 m^3 capacity, both of which will be HDPE lined. Seepage from these dams is also assumed to be negligible.
  - Tailings Storage Facility (TSF) which will have a compacted clay floor layer with a vertical hydraulic conductivity (Kv) estimate of 10^{-9} m/s. The consolidated tailings are expected to have a very low permeability of 3 x 10^{-9} m/s. A seepage assessment for the TSF was undertaken by Golder Associates (2021) and this indicated a long-term seepage flux through the compacted clay floor of 56 m^3/day, equating to an approximate seepage flux of 0.00015 m/d over the approximate 600 x 600 m TSF footprint. Seepage from the TSF has been included in the numerical groundwater flow mode at the rates described above.

9.2 Proposed Mining Schedule and Water Balance

Data has been provided by Kalkaroo Copper on the proposed mine excavation schedule and project water requirements. For the purposes of this assessment, mining has been separated into the following key phases:

- Pre-production;
- Production and processing above the water table;
- Production and processing below the water table; and
- Processing with no further excavation.

Figure 9-1 illustrates the proposed pit elevation over the 2.5-year excavation period. Under the proposed mining schedule (Figure 9-1), the water table would be intersected during quarter three and dewatering of the pit would be required from this time through to the end of mining. Prior to the pit reaching the water table and following the completion of pit excavation, a water supply is required for construction and processing activities. It is intended that make-up water will be sourced from production wells in the basement shear zones adjacent the pit prior to pit dewatering, with the well supply to be used to augment later pit dewatering supplies if required. Table 9-1 summarises the key mining stages, pit excavation schedule and water requirements for the project with the excavation stages above and below the water table identified as separate periods for modelling purposes.

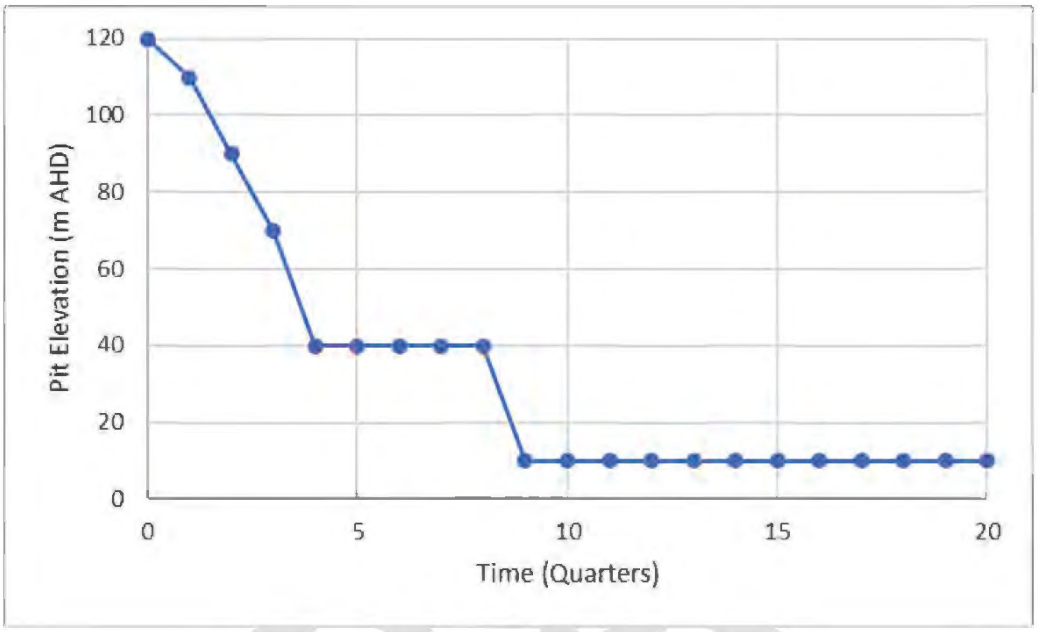


Figure 9-1 Pit Excavation Levels Over Time

Table 9-1 Project Pit Schedule and Groundwater Requirements

Year	Quarter	Stage	Phase 2 Pit Excavation	Phase 3 Pit Excavation	Phase 2 Pit RL	Phase 3 Pit RL	Groundwater Requirement (m^3/d)
1	1	Pre-production and initial pit excavation	Above water table	Above water table	Above water table to RL 90	Above water table to RL 90	1,728
	2						
	3		Below water table	Above water table	Below water table to RL 40	Above water table to RL 90	1,728
	4						
2	5	Production and processing	Below water table	Below water table	Expanded at RL 40	Below water table to RL 40	2,274
	6						
	7						
	8						
3	9				Deepened from RL 40 to RL 10	Deepened from RL 40 to RL 10	2,274
	10						
	11						
	12						
4	13		No further excavation below RL 10	No further excavation below RL 10	RL 10	RL 10	2,274
	14						
	15						
	16						
5	17				RL 10	RL 10	2,665
	18						
	19						
	20						

10 GROUNDWATER FLOW MODELLING

10.1 Overview

10.1.1 Model Objectives

A numerical groundwater flow model was constructed to meet the following objectives:

- Estimate the average rates and volumes of groundwater pumping required to dewater the pit consistent with the mine pit schedule and design depths;
- Identify the groundwater supply balance between that sourced from pit dewatering and from wells outside the pit to meet the project water demands for the life of the project;
- Assess the drawdown impacts associated with the pit dewatering and groundwater supply wells;
- Model the groundwater level recovery post-closure including from pit dewatering and well pumping;
- Estimate the long-term post-closure pit lake level; and
- Assess the fate of potential seepage from the TSF.

10.1.2 Model Design and Class

A summary of the hydrogeological units and permeability estimates for the hydrogeological units within the study area is presented in Table 10-1. Aquifer parameter estimates are available for the fresh basement, the major structural features and the saprolite unit. The structural features within the basement are observed to extend through the entire weathered-to-fresh basement sequence.

The data indicates that the saprolite and fresh basement rock masses likely have similar and very low permeability. The structural features provide high permeability zones within these rock masses. The Quaternary and Tertiary sediments overlying the weathered basement are unsaturated around the site and the water table transitions from the saprolite into the Namba Formation to the north and east of the pit. The Namba Formation can be effectively included as part of the underlying low-permeability saprolite unit.

The above points indicate that the system can be modelled as a two-layer system containing vertical zones of high permeability to represent the main structural features within low permeability geological units.

Based on the available data which has been reviewed and analysed in this study, the revised model could be deemed to have a Class 2 model confidence classification, although there are some inconsistencies in comparing the model inputs with the typical characteristics for model class described in the Australian Groundwater Modelling Guidelines (Barnett et al, 2012). This Class 2 assignment is based on the model characteristics listed below:

- The model objectives relate to providing mine dewatering estimates, regional drawdown impacts of groundwater extraction from pit excavation and wells and undertaking particle tracking of seepage from site infrastructure.
- There are no time series groundwater monitoring data, but recent site and historical regional water level data provide a reasonable basis for initial model steady-state calibration.
- Site investigations have provided estimates of hydraulic parameters for key hydrogeological units of interest. The regional extent and consistency of these parameters is uncertain.
- The site geology has been characterised in detail from exploration and delineation of the ore body through drilling.
- The regional geology is well understood based on Agency mapping and interpretation of regional geophysical data.

Table 10-1 Summary of Hydrogeological Units

Geological Unit or Structural Feature	Hydrogeology	Permeability Estimates (m/d)	Comment
Quaternary sediments	Low permeability sediments above the water table	Kv ~ 0.02 m/d (Table 26, App. F, PEPR – test pit constant head tests)	May contain seasonally perched water tables during wet periods, no effective areal recharge to the water table
Namba Formation	Low permeability sediments above the water table which transitions into this unit away from the site towards the east and north	Kv ~ 0.01 - 10^{-5} m/d (Table 26, App. F, PEPR – laboratory values adopted by Golders as test pit constant head tests appeared high at ~ 0.01 m/d)	Unconformably overlies the basement and confines the Eyre Formation deposits in the Yarramba Palaeochannel outside of the model extent
Eyre Formation	Confined aquifer sand deposits in Yarramba Palaeochannel to the east and north, not identified at or around site or within the current model domain	Nil	Hosts Honeymoon Uranium deposit 12 km east of the Kalkaroo deposit and outside of the model domain
Saprolite	Highly weathered basement, contains relict structural features	Kh 0.01 m/d	Extensive across the region
Saprock	Transitional weathered basement, contains relict structural features	Nil	Extensive across the region
Fresh Basement	Fractured rock	Kh 0.03 m/d	Receives recharge where outcropping or shallow
Mining Sequence Dome	Enhanced structural fracturing	Kh = 3 m/d	Structural features are observed to extend from the fresh basement and into the saprolite zone although variations of permeability with depth are unknown
Kalkaroo West Shear	Shear zone with fracturing and secondary porosity	Kh = 17 – 26 m/d	
Western Limb Shear	Shear zone with fracturing and secondary porosity	Kh = 9 m/d	
Central Shear through dome	Shear zone with fracturing and secondary porosity	Kh = 1 – 9 m/d	

10.1.3 Review of Existing Model

The existing numerical groundwater model developed by Lisdon Associates and reported in AGT (2013) was reviewed to determine its suitability for this phase of modelling. The review showed that:

- The model was developed using appropriate software and an appropriate modelling interface;
- The model was likely to be of sufficient extent to model the expected drawdown impacts with the reduced scale and timing of the proposed pit; and
- The model provides sufficient flexibility in terms of discretising the model spatial grid, model time periods, model layering and parameter zoning.

The review identified several features of the existing numerical model which are not necessarily supported by the hydrogeological conceptual model developed in this study. Given these inconsistencies, and taking into account Agency comments detailed in the request for further information, it was concluded that the following changes would be required to the existing numerical model:

- Removing existing layer 1 (Quaternary) which is above the water table;
- Assign layer 1 as the unconfined Namba and saprolite layer. The high depth to water table (greater than 30 m across the model domain) means that evapotranspiration can be considered to be negligible;
- Assign layer 2 as the confined saprock/fresh basement layer;
- Develop a boundary between layers 1 and 2 based on data derived from the Kalkaroo Copper block model and other available regional data;
- Assign appropriate hydraulic parameters to the regional rock mass and structural features consistent with the results of the aquifer test data review. Discussions with Kalkaroo Copper personnel indicate that well yields increase through the saprolite and into the underlying saprock and fresh basement. The 2-layer model allows the permeability of the structural features to be varied to reflect this;
- Estimating and assigning specific yield and storativity values regionally and to the structural features;
- Adjust the model grid orientation and general head boundaries to reflect the groundwater flow field generated from the regional and site water level data;
- Undertake a steady-state calibration to the observed site and regional water level data set used to generate the groundwater contour map; and
- Use the updated and calibrated model to undertake the required transient predictive dewatering and recovery stage modelling, including sensitivity runs. The dewatering stage time periods will be adopted from the construction and pit expansion schedule, and groundwater demand schedule as identified in this report.

10.1.4 Model Code

The United States Geological Survey (USGS) industry standard groundwater modelling code MODFLOW-2000 was selected with the model constructed in the PMWIN platform (Chiang and Kinzelbach, 1998). The advective transport model PMPATH (Pollock, 1989) was used to carry out the particle tracking modelling of potential seepage from the TSF during the post-mining recovery period.

10.2 Groundwater Model Construction

10.2.1 Model Extent and Grid

The model domain extends for a length parallel to the regional groundwater flow direction of 20 km and a width of 20 km, approximately centred on the proposed mining area (Figure 10-1). The area of the model domain was chosen to include the inferred basement outcrop recharge areas to the southwest and to be of sufficient

size to minimise potential boundary effects on model results. The Yarramba Palaeochannel and the Honeymoon Uranium mining operation were not included in the model domain.

Model grid cell sizes range from 12.5 m square in the vicinity of the proposed pit to enable detail of the hydrogeological zones (shears, dome structure) around the pit to be adequately represented. Model grid cell sizes were increased to 100 m square away from the pit. The model extent, grid and general head boundary conditions are shown on Figure 10-1.

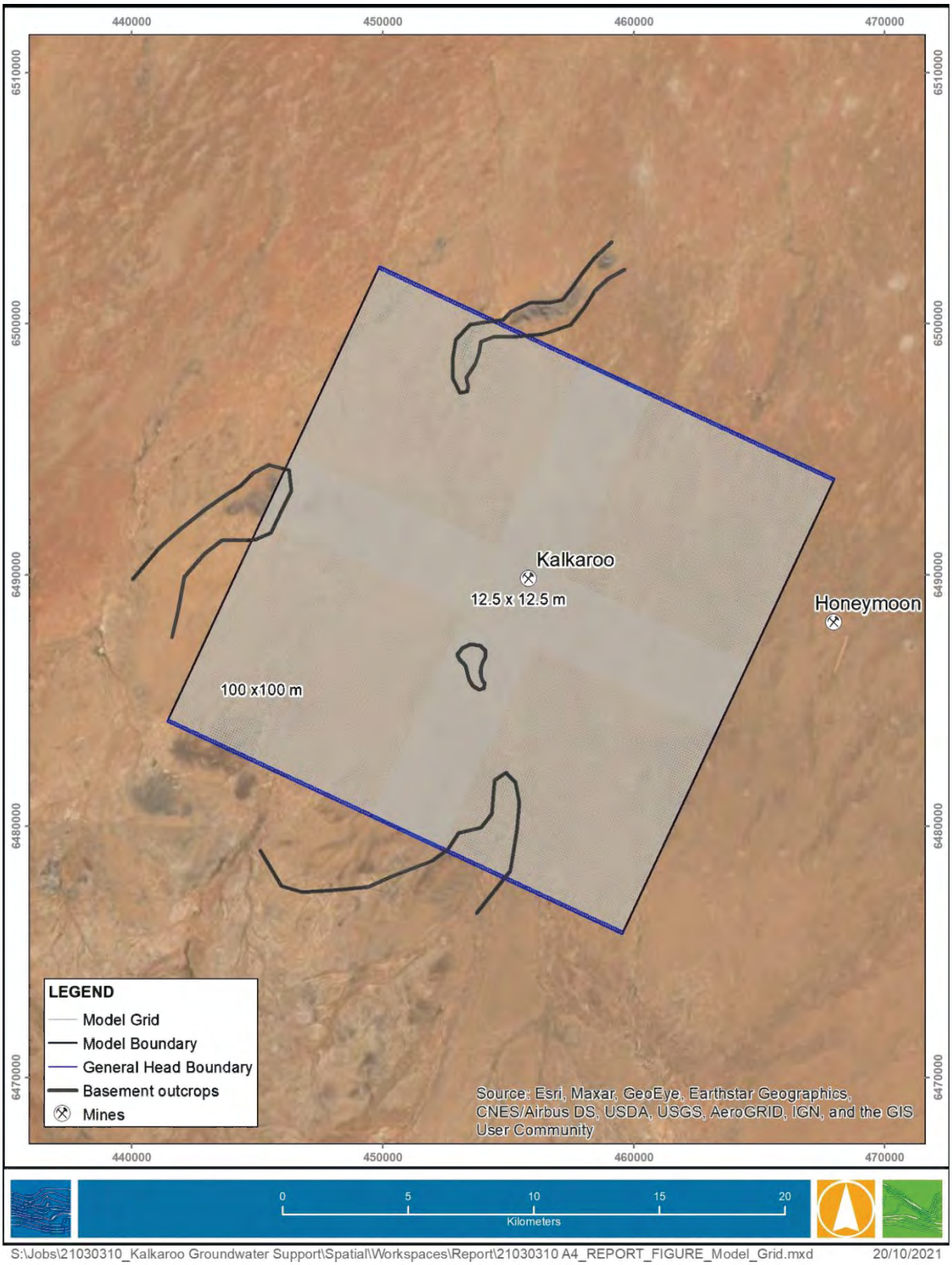


Figure 10-1 Model Extent, Grid and Boundary Cells

10.2.2 Model Layers

10.2.2.1 Layer 1 Saprolite

The water table has been identified as being within the saprolite layer in and around the mine site and is also inferred to be within the saprolite at distance from the mine (Figure 4-4 and Figure 4-5). North and east of the pit, the water table is interpreted to transition into the overlying Namba Formation. The Namba Formation is interpreted to be of low permeability similar to the Saprolite unit and is effectively incorporated into layer 1 for the purposes of modelling (i.e. both units are essentially low permeability and clay rich). This approximation is considered reasonable given the likelihood of small drawdowns being experienced beyond the transition zone and the relative unimportance of whether these drawdowns are assigned to the Namba Formation or to the saprolite.

Several areas of basement outcrop have been identified in the model domain and are shown on Figure 10-1. These have been incorporated into the model by assigning these zones with the basement (layer 2) hydraulic parameters (Figure 10-1). The layer is assigned as Type 1 unconfined and assigned hydraulic parameters are shown in Table 10-2. The base of layer 1 (saprolite) was derived from site and regional data provided by Kalkaroo Copper using the Field Interpolater program in PMWIM. The resulting layer surface is shown on Figure 10-2.

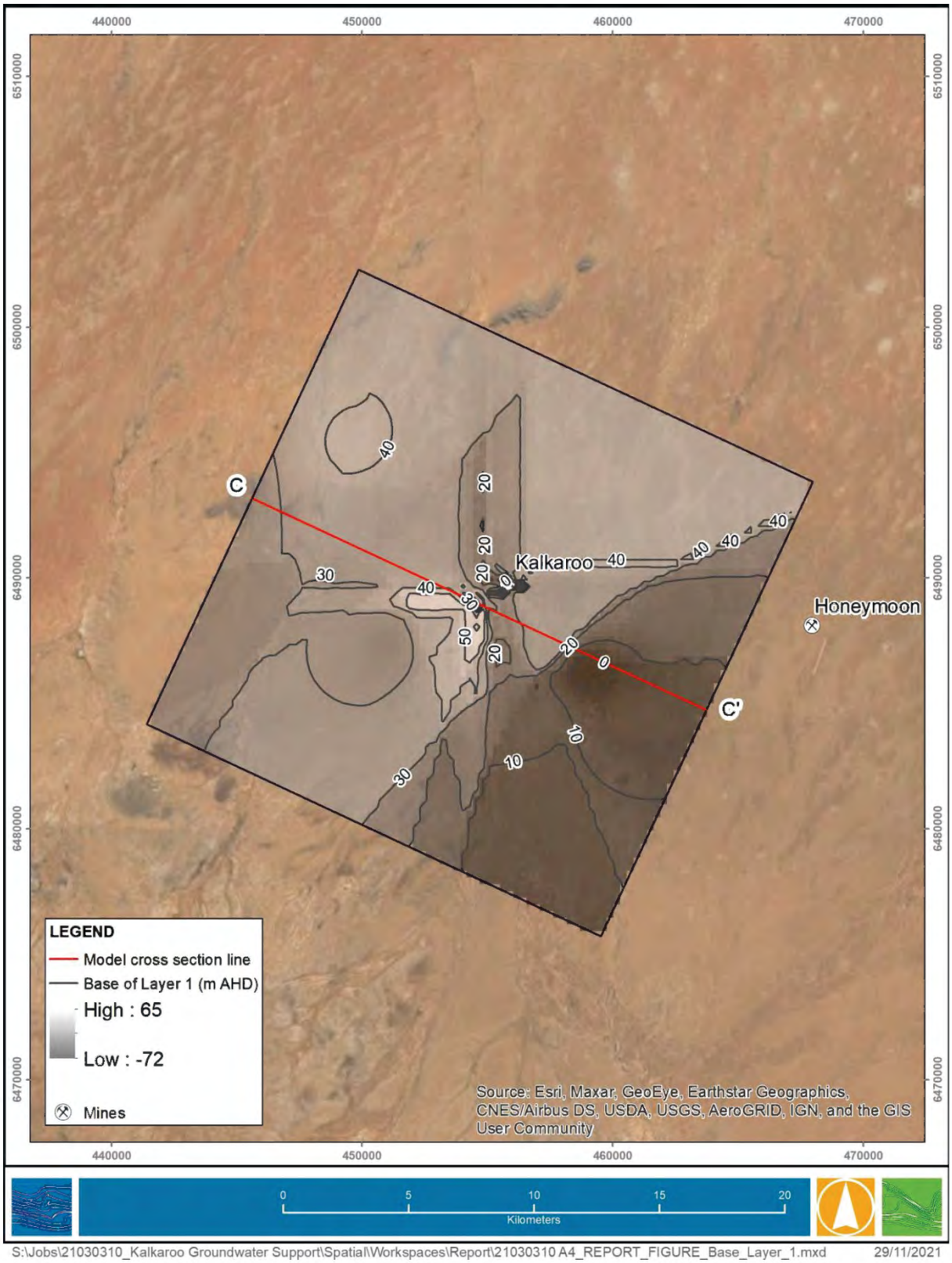


Figure 10-2 Interpolated Base of Saprolite (Layer 1)

10.2.2.2 Layer 2 Saprock and Basement

The transitional saprock horizon has not been hydraulically differentiated from the underlying fresh basement and these units form model layer 2. The layer is assigned as Type 3 confined/unconfined and assigned hydraulic parameters are shown in Table 10-2. The top of layer 2 was set equal to the base of layer 1 and a constant thickness of 100 m was adopted for layer 2. The resulting layer elevations are shown in the example model cross section shown in Figure 10-3 (refer to Figure 10-2 for cross section line).

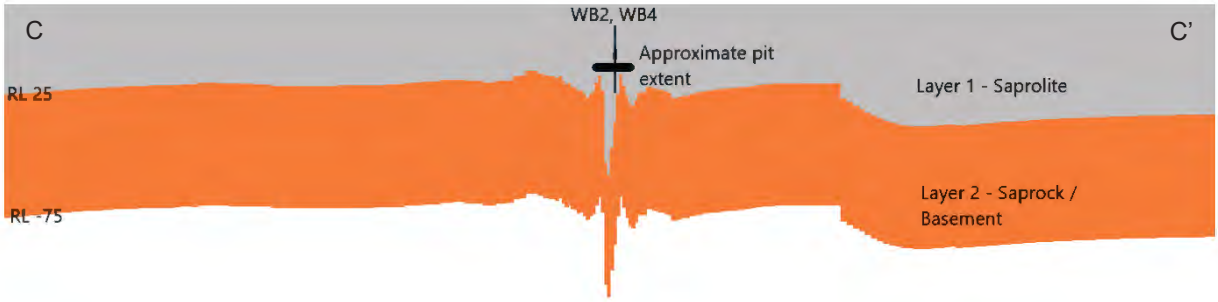


Figure 10-3 Model Layer Cross Section C-C' (refer to Figure 10-2 for location)

The following geological zones have been identified by the geological exploration and hydrogeological investigations at the site. The zones were first identified by Kalkaroo Copper through interpretation of over 500 exploration drillholes, with the water wells being later positioned to test the identified geological zones. The characteristics of the zones are summarised below:

- Kalkaroo west shear – assigned a hydraulic conductivity in model layer 2 of 22 m/d based on the WB2 and WB6a aquifer test results. An upper estimate for specific yield of 30% was assigned (Hazel, 2009).
- Subsidiary shear at west Kalkaroo – assigned a hydraulic conductivity in model layer 2 of 0.3 m/d and an estimate for specific yield of 5% was assigned.
- Western limb shear – no aquifer tests were located in this structure but discussions with Kalkaroo Copper indicate it is of a similar nature to the central shear zone intersected by WB9 and a hydraulic conductivity of 9 m/d in model layer 2 has been adopted based on this test. An estimate for specific yield of 20% was assigned.
- Central shear – three aquifer tests at WB9, WB10 and WB11 were carried out in this structure and the shear zone hydraulic properties in model layer 2 have been graded to reflect this, being 9 m/d, 3 m/d and 1 m/d, with estimated specific yield values of 20%, 15% and 10%, respectively.
- Mining sequence dome structure – based on the WB13 aquifer test a hydraulic conductivity value in model layer 2 of 3 m/d was adopted, and an estimated specific yield of 15% assigned. Discussions with Kalkaroo Copper indicate the fractured mining sequence can be modelled as a vertical fracture zone.

The above values of hydraulic conductivity and specific yield for the structural zones in model layer 2 (saprock/fresh basement) have been transferred to the overlying model layer 1 saprolite with a 50% reduction for the modelling base case. This estimated reduction in hydraulic parameters is qualitatively based on information from Kalkaroo Copper personnel that the structural zones within the saprolite do yield water, with the yield increasing with depth through the saprock/fresh basement. However, the increase has not been quantified. The extents of the structural zones are shown on Figure 4-7 and the model parameter zones reflecting these are shown on Figure 10-4 and Figure 10-5.

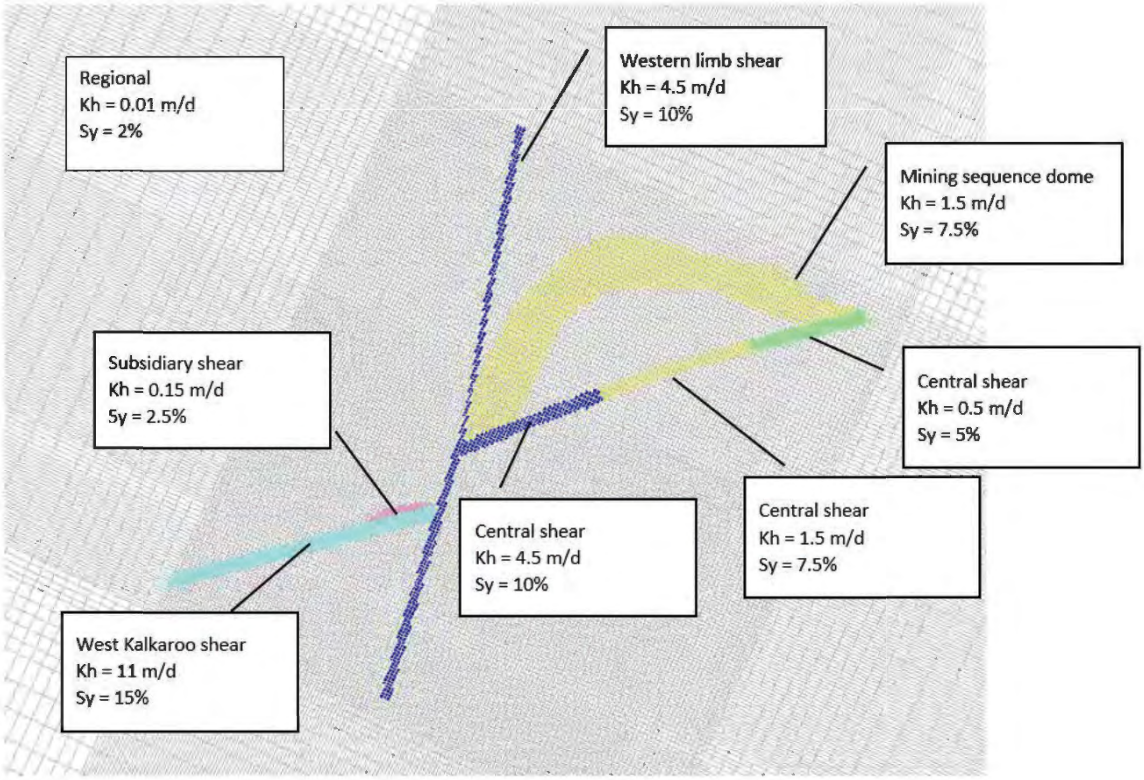


Figure 10-4 Layer 1 Parametrisation (Saprolite)

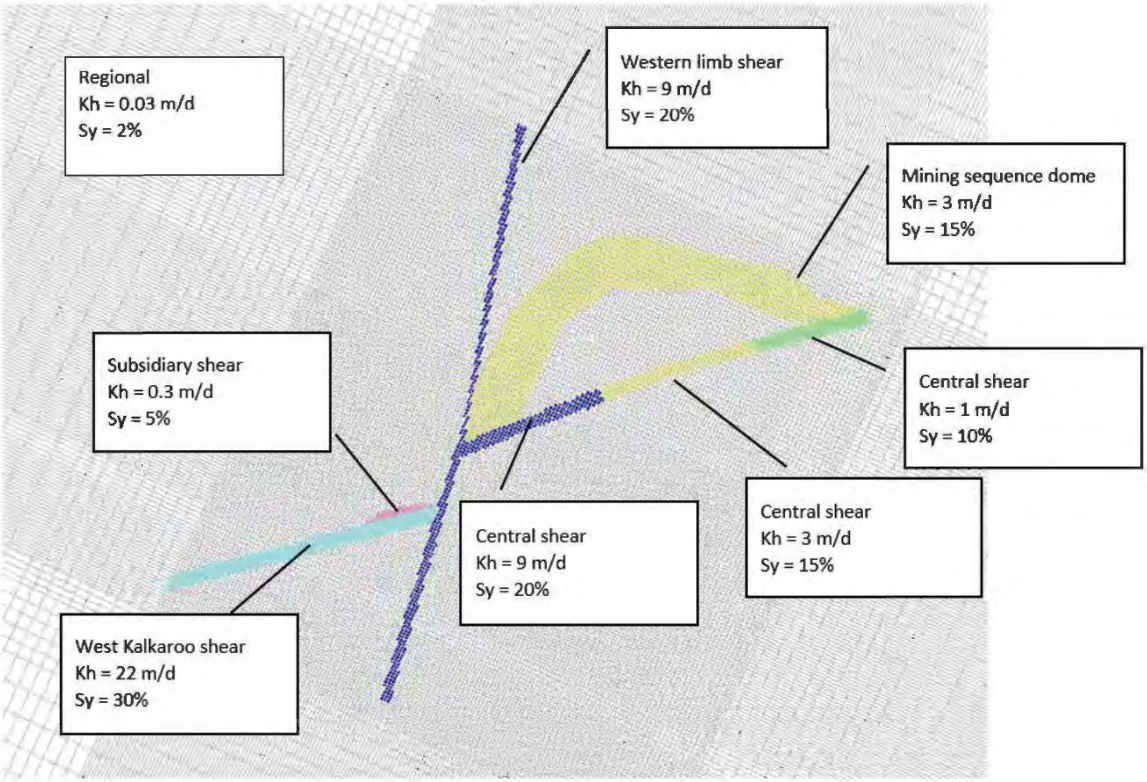


Figure 10-5 Layer 2 Parametrisation (Saprock/Fresh basement)

Table 10-2 Model Layer Parameterisation

Layer 1									Comment
Zone	Saprolite	Central shear through dome (WB9)	Central shear through dome (WB10)	Central shear east (WB11)	West Kalkaroo shear	West Kalkaroo subsidiary shear (WB8)	Western limb shear	Dome (mine sequence only)	Saprolite includes Namba Fm where NF becomes saturated at distance from the pit
Type	Unconfined								
Base	Interpolated from Kalkaroo Copper site and regional data								
Kh (m/d)	0.01	4.5	1.5	0.5	11	0.15	4.5	1.5	Saprolite average of 2 slug tests, shear zones 50% of fresh basement
Sy	2%	10%	7.5%	5%	15%	2.5%	10%	7.5%	50% of fresh basement
Storativity									

Layer 2									Comment
Zone	Saprock/ fresh basement	Central shear through dome (WB9)	Central shear (WB10)	Central shear east (WB11)	West Kalkaroo shear	West Kalkaroo subsidiary shear (WB8)	Western limb shear	Dome (WB13, mine sequence only)	
Type	Confined / unconfined								Layer 2 set as confined/unconfined to allow for dewatering due to extraction from production wells
Base	Set at 100m below Kalkaroo Copper data for base of saprolite (layer 1)								Constructed a constant thickness layer 2 otherwise very thin underneath pit
Kh	0.03	9	3	1	22	0.3	9	3	Based on re-analysis of Aldam (2009) data
Sy	2%	20%	15%	10%	30%	5%	20%	15%	
Storativity		$1x10^{-3}$	$6x10^{-6}$		$2.6x10^{-4}$	$8x10^{-3}$		$2.9x10^{-4}$	Shear zones aquifer test results
Specific storage (/m)		$1x10^{-5}$	$5x10^{-7}$		$2x10^{-5}$	$1x10^{-4}$		$4x10^{-6}$	Storativity / aquifer thickness tested, average of $3x10^{-5}$ adopted

10.2.3 Model Boundary Conditions

General Head Boundary (GHB) cells were assigned to the upgradient (south-western) and downgradient (north-eastern) edges of the model domain to establish and maintain the groundwater flow field across the model domain (Figure 10-1). GHB head values and distances were obtained from the regional groundwater contour map (Figure 5-2) and conductance values were estimated based on these and the estimated saturated layer thicknesses along the boundary edges. Parameters associated with the GHBs are summarised in Table 10-3. No boundary conditions were assigned to the north-western and south-eastern edges of the model domain as these are approximately parallel to the interpreted groundwater flow direction.

Table 10-3 Model GHB Parameters

	Layer 1		Layer 2	
GHB parameter	Upstream	Downstream	Upstream	Downstream
GHB head (m AHD)	92	60	92	60
GHB length (km)	1	1	1	1
Conductance (m^2/d)[1]	0.07	0.03	0.3	0.3

Notes: 1. C value for a 100 m wide model cell, C values for smaller cell widths are proportional relative to 100 m.

10.2.4 Model Stages and Time Discretisation

The groundwater modelling was carried out in 3 separate model stages as follows:

- A steady-state model to generate initial starting heads and test the sensitivity of model calibration to the adopted model hydraulic parameters.
- A transient model to simulate the drawdown effects of the proposed pit expansion over time and the extraction of mine groundwater requirements sourced from pit dewatering in layer 1 and production wells outside the pit in layer 2 if required.
- A transient model to simulate the recovery levels in the pit and regionally within the saprolite and saprock/basement layers post-closure and to test the potential travel paths of seepage from the TSF.

The time discretisation of the models is shown in Table 10-4.

Table 10-4 Model Time Discretisation

Model Period	Type	Stress Period	Length (days)	Time Steps	Comment
Current	Steady state	1	1	1	Used for calibration and provides initial starting heads for transient modelling
Pre-production and initial pit excavation	Transient	1	182	6	Project water supply provided from wells in shear zones in layer 2 outside pit
Phase 2 pit excavated to RL 40	Transient	2	183	6	

Model Period	Type	Stress Period	Length (days)	Time Steps	Comment
Phase 2 and 3 pits excavated to RL 40 Pit deepened to RL 10	Transient	3	365	12	Phase 2 and 3 pit excavated to RL 40, project water supply provided by pit dewatering augmented with wells in layer 2, if required
		4	365	12	Pit deepened from RL 40 to RL 10, project water supply provided as above
		5	365	12	Pit at RL 10, project water supply provided as above
		6	365	12	As above
Recovery	Transient	1	73,000 (200 years)	20	No further extraction from wells and pit, pit modelled as high K/Sy area with evaporative discharge from pit surface, recharge from TSF applied

10.3 Model Calibration

The steady-state model was used to generate current pre-mining groundwater heads and contours in layer 1 and 2 based on the interpreted hydrogeological conceptualisation described above, key elements of which included:

- No areal vertical recharge to the water table through the low permeability Quaternary and Namba Formation sediments.
- The steady-state flow field was generated using General Head Boundaries at the upstream model edge to reflect the assumed recharge to outcropping or shallow basement areas, and at the downstream model edges to provide the inferred groundwater flow direction.
- The inclusion of basement outcrop areas in layer 1 with layer 2 properties assigned.
- An assumed permeability contrast in the structural features from layer 1 to layer 2, assumed to increase by a factor of 2.
- Adopted hydraulic parameters are shown in Table 10-2.

The model calibration data set is shown in Table 10-8 and includes detailed site water level data and regional data obtained from WaterConnect records. The well locations within the model domain are shown on Figure 10-6.

Table 10-5 Calibration Groundwater Level Data Set (November 2021)

Water Well	GDA94 easting	GDA94 northing	RSWL (m AHD)
WB 2	454731	6488907	72.79
WB 3	454323	6488379	74.98
WB 4	454725	6488920	72.41
WB 5	454302	6489223	71.85
WB 6A	454291	6488777	72.64
WB 7	454833	6488600	74.06
WB 8	454709	6488956	72.55
WB 9	455112	6489244	71.90
WB 10	455764	6489492	71.81
WB 11	456347	6489657	71.64
WB 13	455362	6489871	71.76
WB 14	455368	6489862	71.71
6934-36	451193	6500380	66.95
7034-6	453980	6478580	93.60
7034-8	460541.2459	6478606.105	80.35
7034-51	455123	6479580	99.54
7034-1103	459126	6484234	75.23

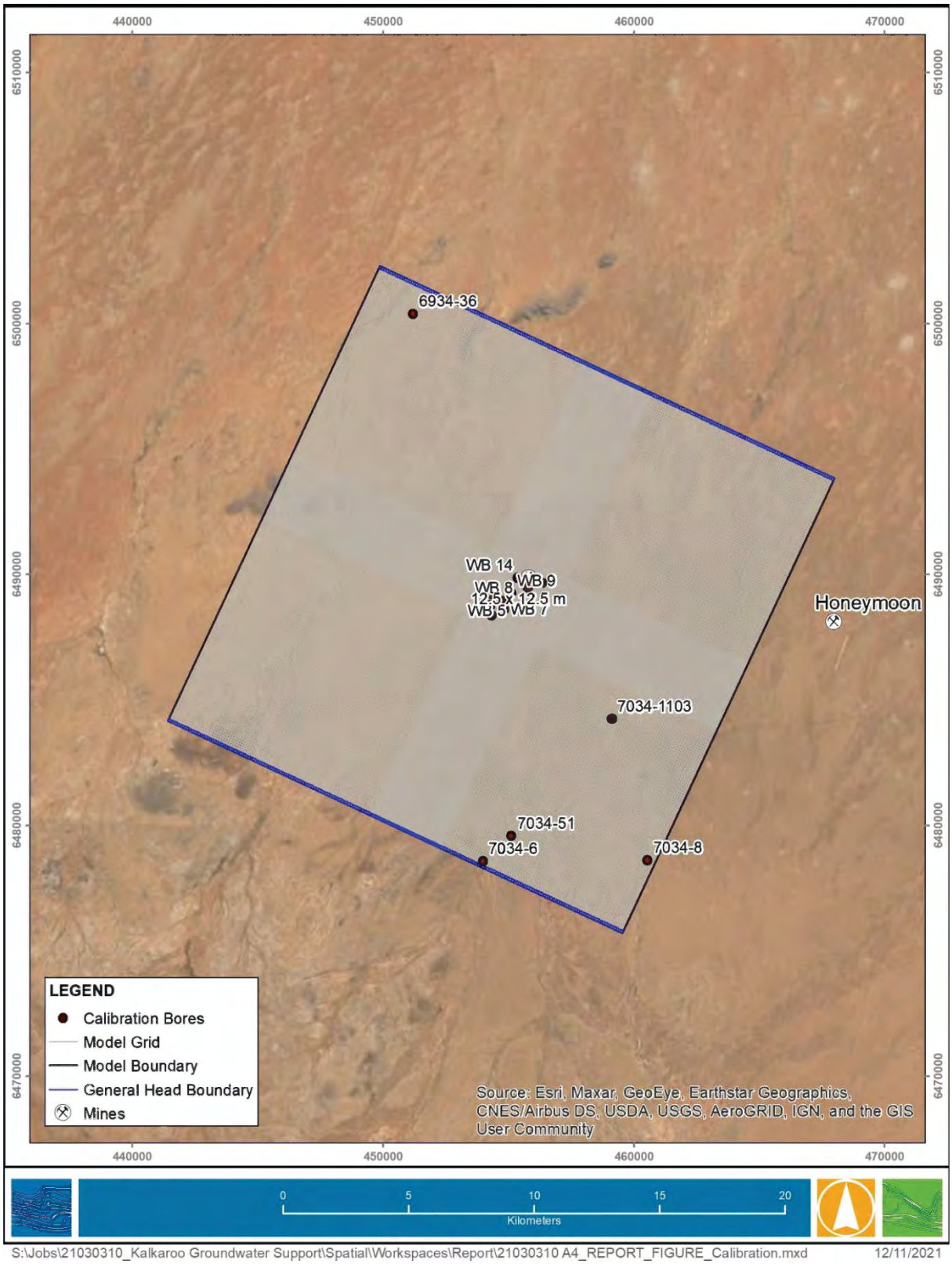


Figure 10-6 Calibration Set Well Locations

10.4 Model Sensitivity

A sensitivity analysis was undertaken for the steady-state pre-mining model results which comprised of increasing and decreasing the regional horizontal hydraulic conductivity values for layers 1 and 2 and increasing the hydraulic conductivity contrast in the structural zones between layer 1 and 2. The results of the sensitivity runs are summarised below in Table 10-6 in terms of the required criteria for the adopted PCG MODFLOW solver for the model to achieve convergence, the model mass balance discrepancy and the statistical analysis of the modelled versus observed groundwater level data.

Additional sensitivity runs were done to test the sensitivity of the calibration to the Kh/Kv ratios in both layers 1 and 2. The results are summarised in Table 10-7 below.

Table 10-6 Steady State Model Sensitivity Results

Model run	Layer 1 Kh	Layer 2 Kh	Required PCG head change criteria (m)	Required PCG mass balance residual criteria (m^3/d)	Mass balance discrepancy (%)	Variance
Base case	**0.01**	**0.03**	**0.001**	**0.01**	**-0.22**	**22.2**
High regional k case	0.1	0.3	0.001	0.01	-0.05	31.2
Low regional k case	0.001	0.003	0.001	0.01	1.35	22.2
K1 = 0.25xK2 in structural zones	0.01	0.03	0.001	0.01	-0.23	22.2

Table 10-7 Kh/Kv Sensitivity Runs

Model run	Required PCG2 head change criteria (m)	Required PCG2 mass balance residual criteria (m3/d)	Mass balance discrepancy (%)	Variance
Kh/Kv = 1	0.001	0.01	-0.23	22.0
Kh/Kv = 10	0.001	0.01	-0.21	22.1
Base case (Kh/Kv = 100)	**0.001**	**0.01**	**-0.22**	**22.2**
Kh/Kv = 1,000	0.001	0.01	-0.24	22.2

The model sensitivity results indicate that:

- All cases converged with the same head and mass balance closure criteria.
- The mass balance discrepancies for the base case were lower than for the high and low regional hydraulic conductivity cases.
- Increasing the structural zones Kh contrast achieved similar results to the base case.
- The steady state model is relatively insensitive to the choice of layer Kh/Kv with similar mass balances and head variance produced for all cases.

When considering the results of the aquifer testing undertaken at the site the results presented above support the adoption of the base case parameter values for the transient modelling. Details of the base case calibration data and statistical analysis are shown in Table 10-8 below, with a graph of modelled versus measured groundwater levels shown on Figure 10-7.

A statistical analysis was undertaken for the modelled and observed head data for the adopted base case with the results provided in Table 10-9. The groundwater contours derived from the base case steady state model runs for layers 1 and 2 are presented on Figure 10-8 and Figure 10-9, respectively.

Table 10-8 Calibration Data and Analysis

Well ID	Observed Head (November 2021)	Difference (m)	Absolute error (m)	Error^2
WB2	72.79	-3.24	3.24	10.48
WB3	74.98	-1.65	1.65	2.71
WB4	72.41	-3.62	3.62	13.12
WB5	71.85	-4.13	4.13	17.07
WB6A	72.64	-3.41	3.41	11.65
WB7	74.06	-2.05	2.05	4.19
WB8	72.55	-3.48	3.48	12.09
WB9	71.90	-3.97	3.97	15.78
WB10	71.81	-4.02	4.02	16.16
WB11	71.64	-4.09	4.09	16.70
WB13	71.76	-4.03	4.03	16.26
WB14	71.71	-4.08	4.08	16.68
6934-36	66.95	3.71	3.71	13.78
7034-6	93.60	3.44	3.44	11.84
7034-8	79.48	-7.04	7.04	49.54
7034-51	99.54	11.04	11.04	121.77
7034-1103	75.23	-4.99	4.99	24.86

Table 10-9 Statistical Analysis of Modelled and Observed Groundwater Levels

Parameter	Value	Kh/Kv = 100
Variance	Mean squared error	22.20
RMS	Root mean squared error	4.71
SRMS	Scaled root mean square error	14.5%
No. of data	Number	17
MSR	Mean sum of residuals	4.25
SMSR	Scaled mean sum of residuals	13.1%

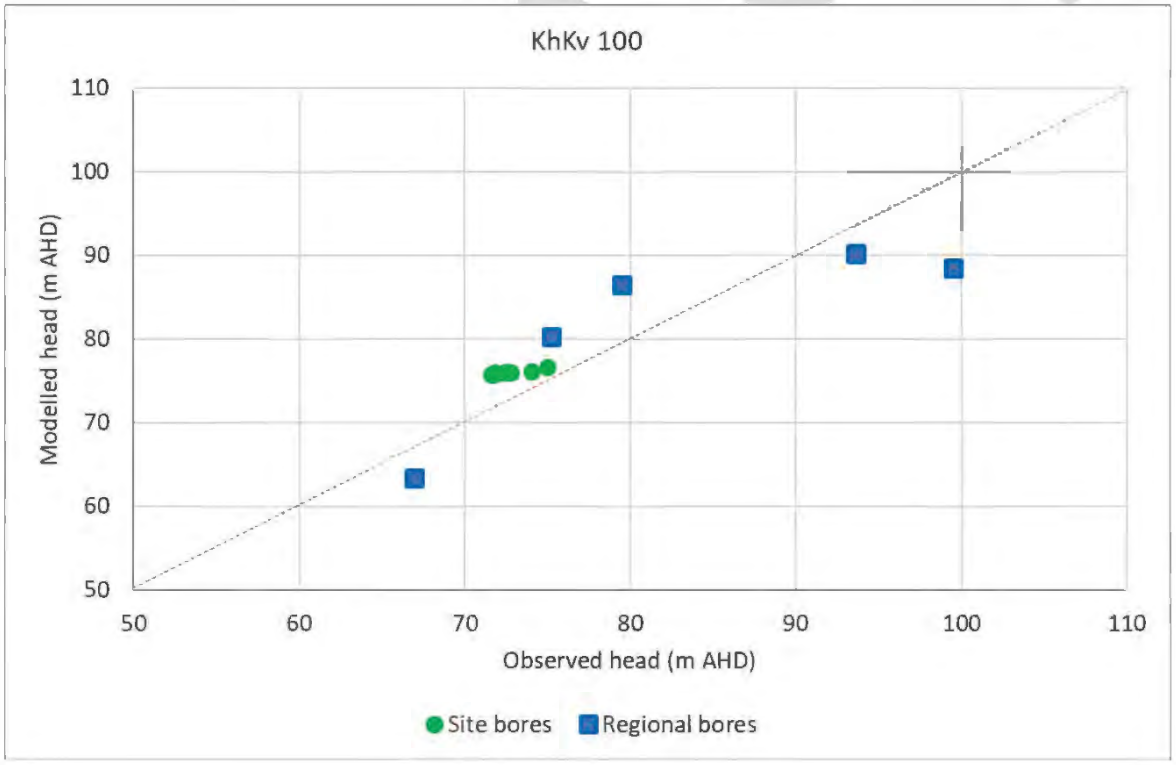


Figure 10-7 Modelled vs Measured Steady State Groundwater Levels

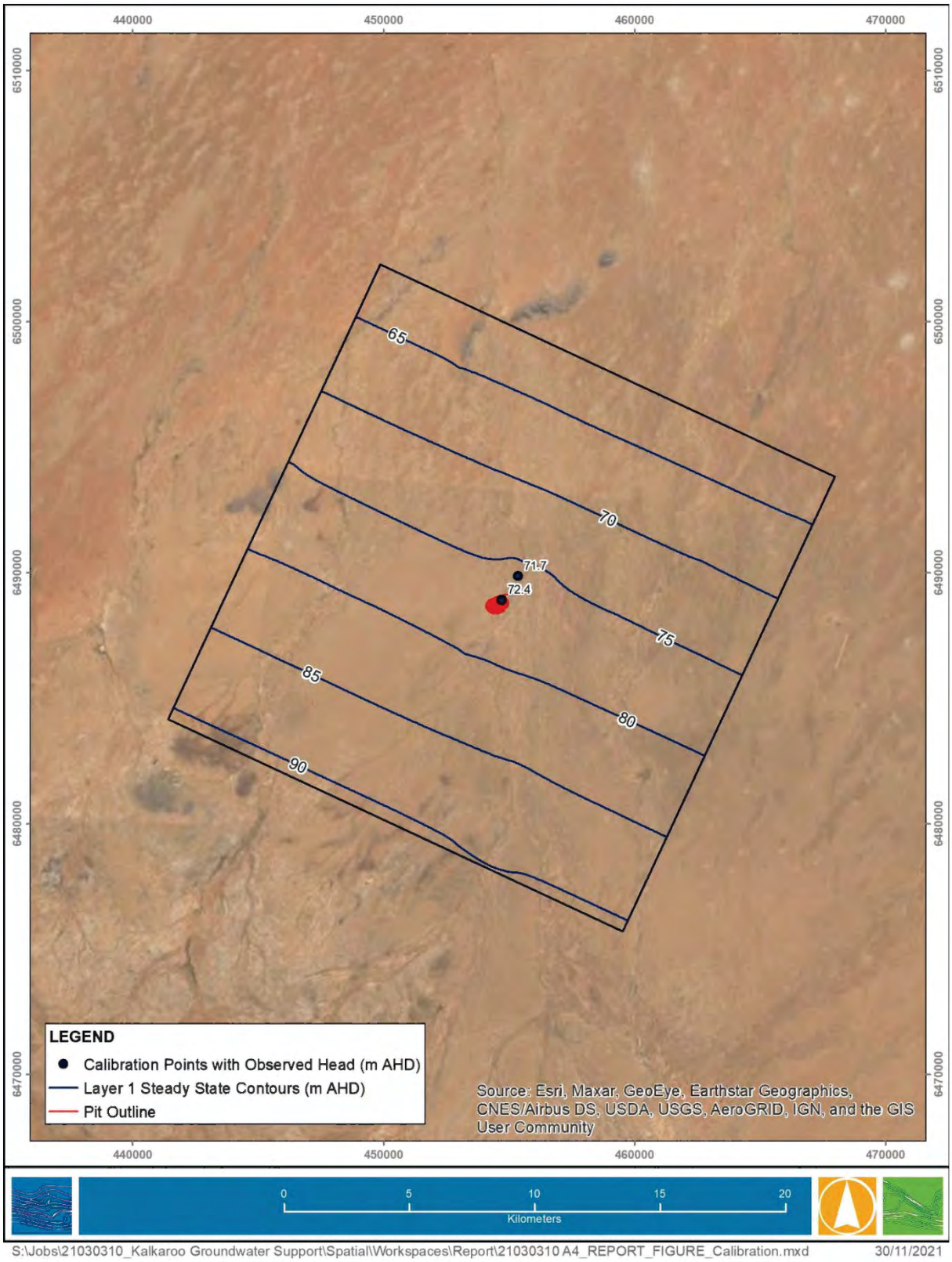


Figure 10-8 Modelled Layer 1 Steady State Groundwater Contours

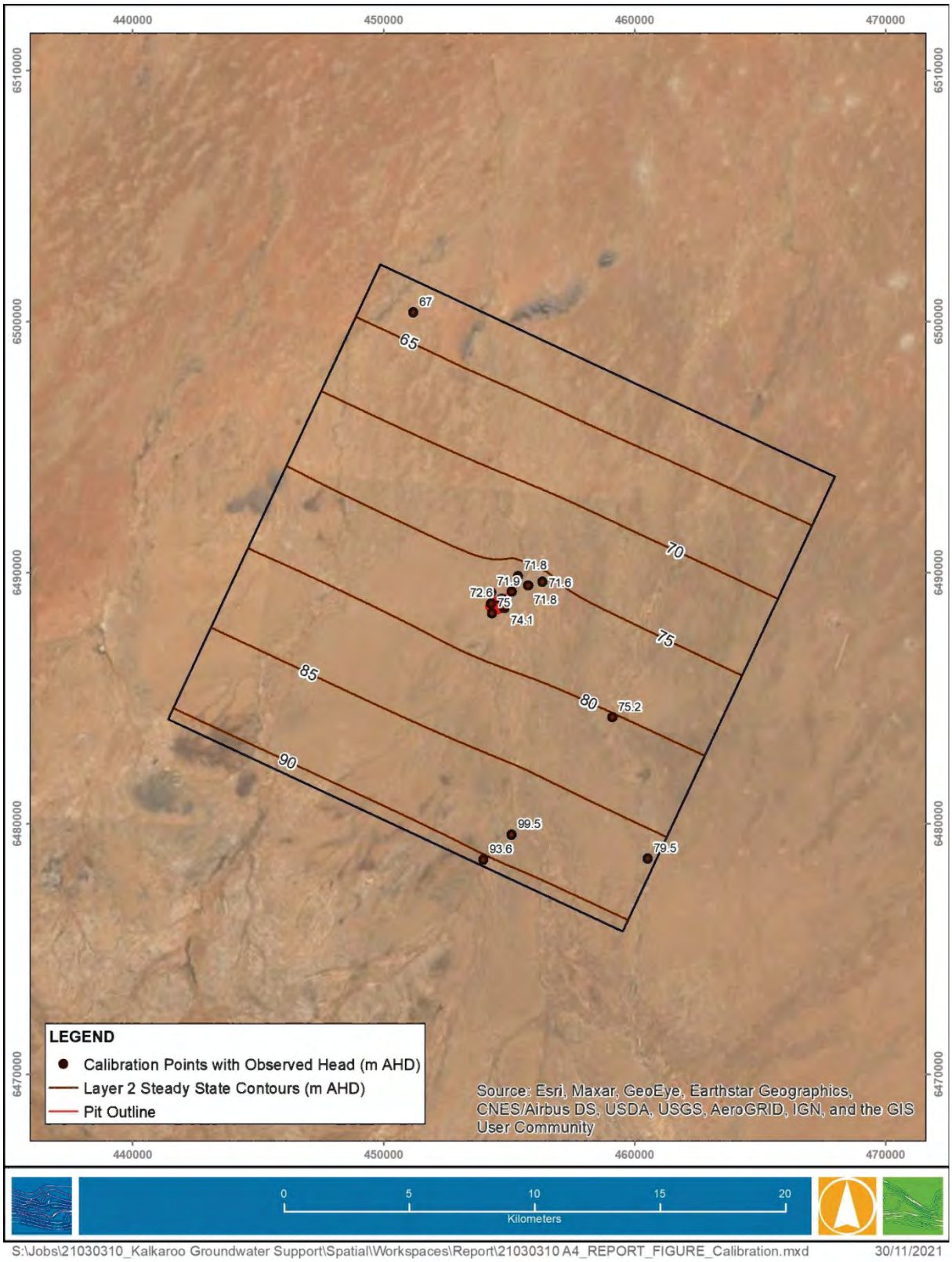


Figure 10-9 Modelled Layer 2 Steady State Groundwater Contours

10.5 Predictive Modelling

10.5.1 Pit Excavation and Ore Processing

The groundwater supply schedule shown in Table 10-10 was developed from the planned pre-production, pit excavation and ore processing timeframes. Inputs to the groundwater model assume that the project water requirements above pit dewatering estimates are sourced from wells within the shear zones outside the pit in model layer 2.

During the pre-production and initial pit excavation stage while the base of the pit is above the water table, the water demand of 1,728 m^3/d is sourced from three wells located around the pit (quarters 1 and 2). During quarters 3 to 4, the pit is excavated below the water table to 40 m AHD. The rate of advancement during this period leads to a predicted in-pit dewatering rate of 2,644 m^3/d to be managed via in-pit sump pumping. The advancement of the pit during quarters 3 to 4 results in an excess of 916 m^3/d above the required water demand. During this time, Kalkaroo Copper propose to manage excess water through evaporation within dedicated purpose-built evaporation basins. From quarters 5 through to 20 the pit advancement rate is reduced and predicted in-pit groundwater seepage is below the project water demand. During this period, make-up water is sourced from four wells located around the pit at the rates presented in Table 10-10.

Groundwater extraction from the pit and wells surrounding the pit causes drawdown in model layers 1 and 2. Groundwater elevation contours and drawdown extents after the 5-year project length (end of quarter 20) are shown in Figure 10-12 to Figure 10-14 for model layers 1 and 2.

Well hydrographs from selected wells within the planned pit extent and in the Saprolite layer to the north are shown on Figure 10-10. The hydrograph for WB4 completed within the Saprolite layer (layer 1) within the pit closely reflects the pit advancement schedule presented in Figure 9-1. Well WB2 also located within the pit, but within the underlying fresh basement (layer 2) shows a more gradual decrease due to pit dewatering and supply of make-up water from external pit wells. Well WB2, 100 m north of the pit within the Saprolite layer is predicted to drawdown by up to 30 m. Model observation wells HM1 (Saprolite) and HM2 (Basement) located near the eastern edge of the model adjacent the Honeymoon mine show no drawdown at this location. An assessment of drawdown impacts on existing groundwater receptors is provided in Section 11.3.

Water budget graphs and solver convergence criteria for the predictive modelling scenarios are provided in Appendix B.

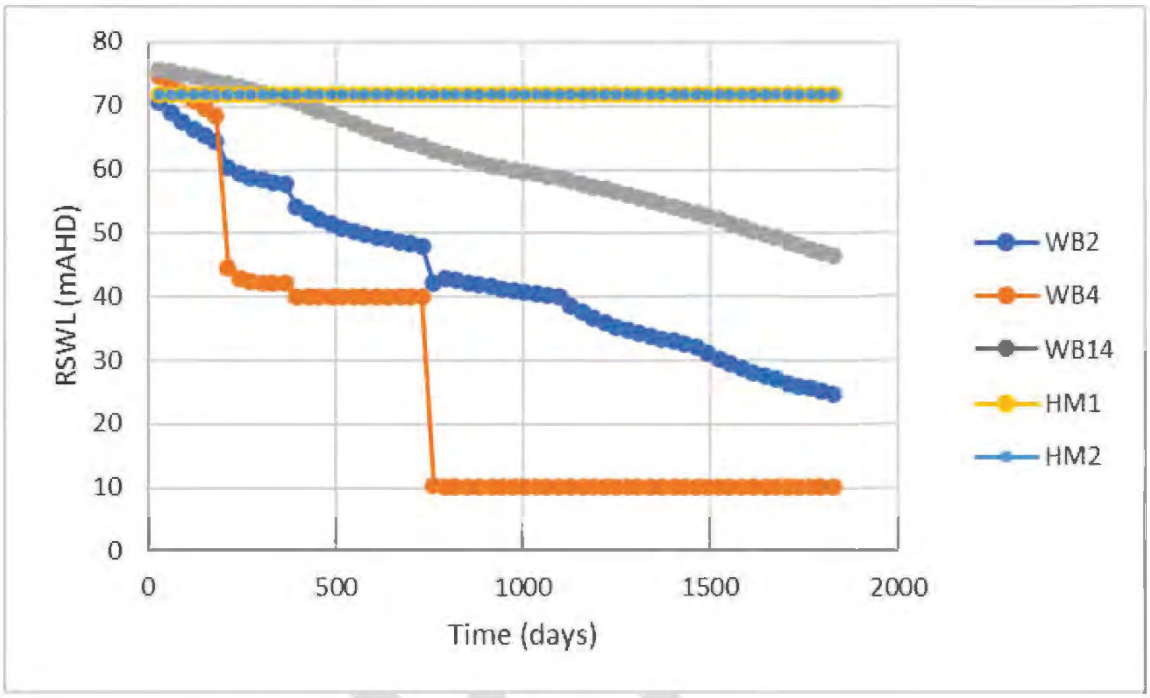


Figure 10-10 Selected Well Hydrographs

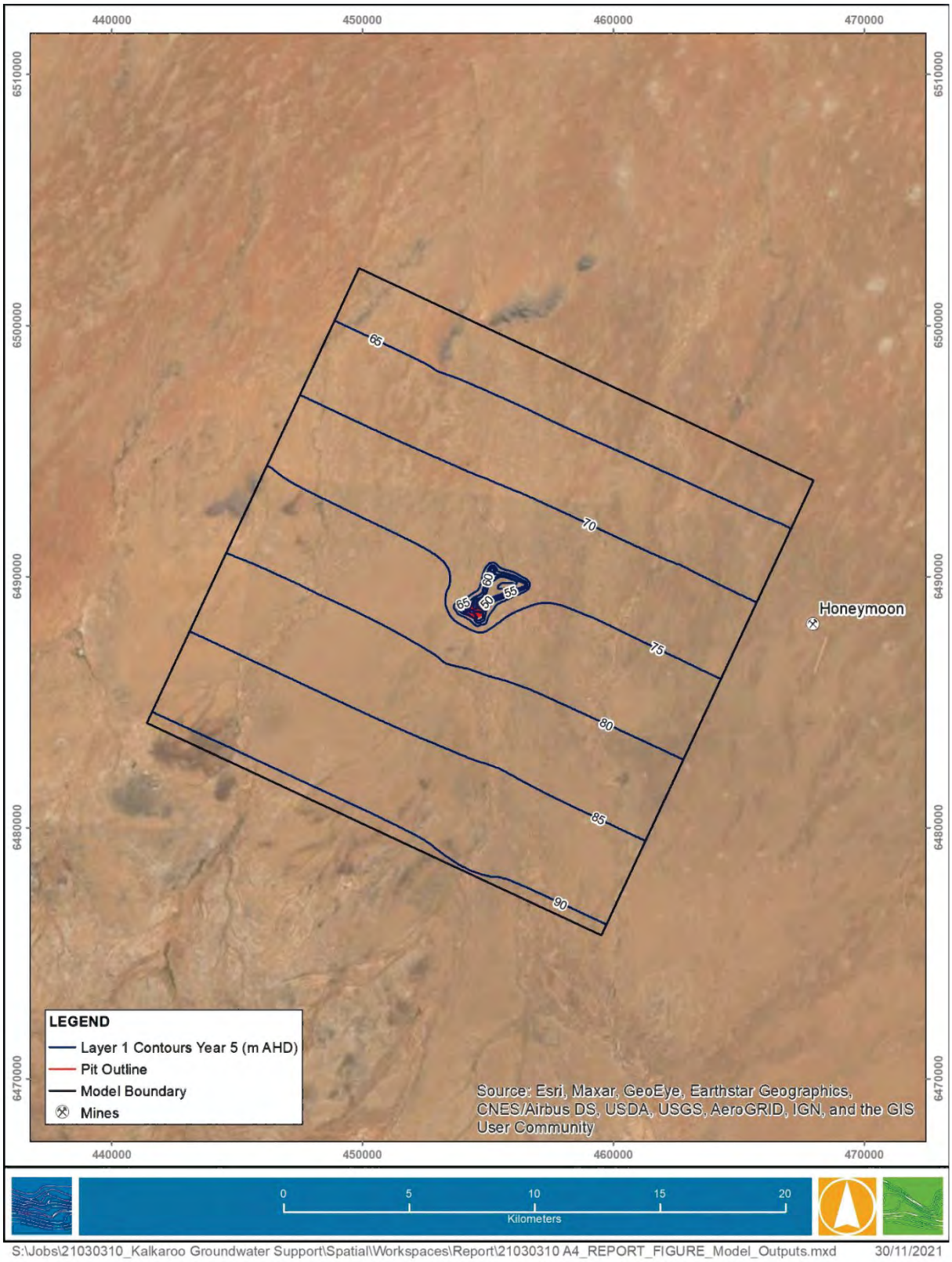


Figure 10-11 Modelled Groundwater Elevations in Layer 1 after 5 Years

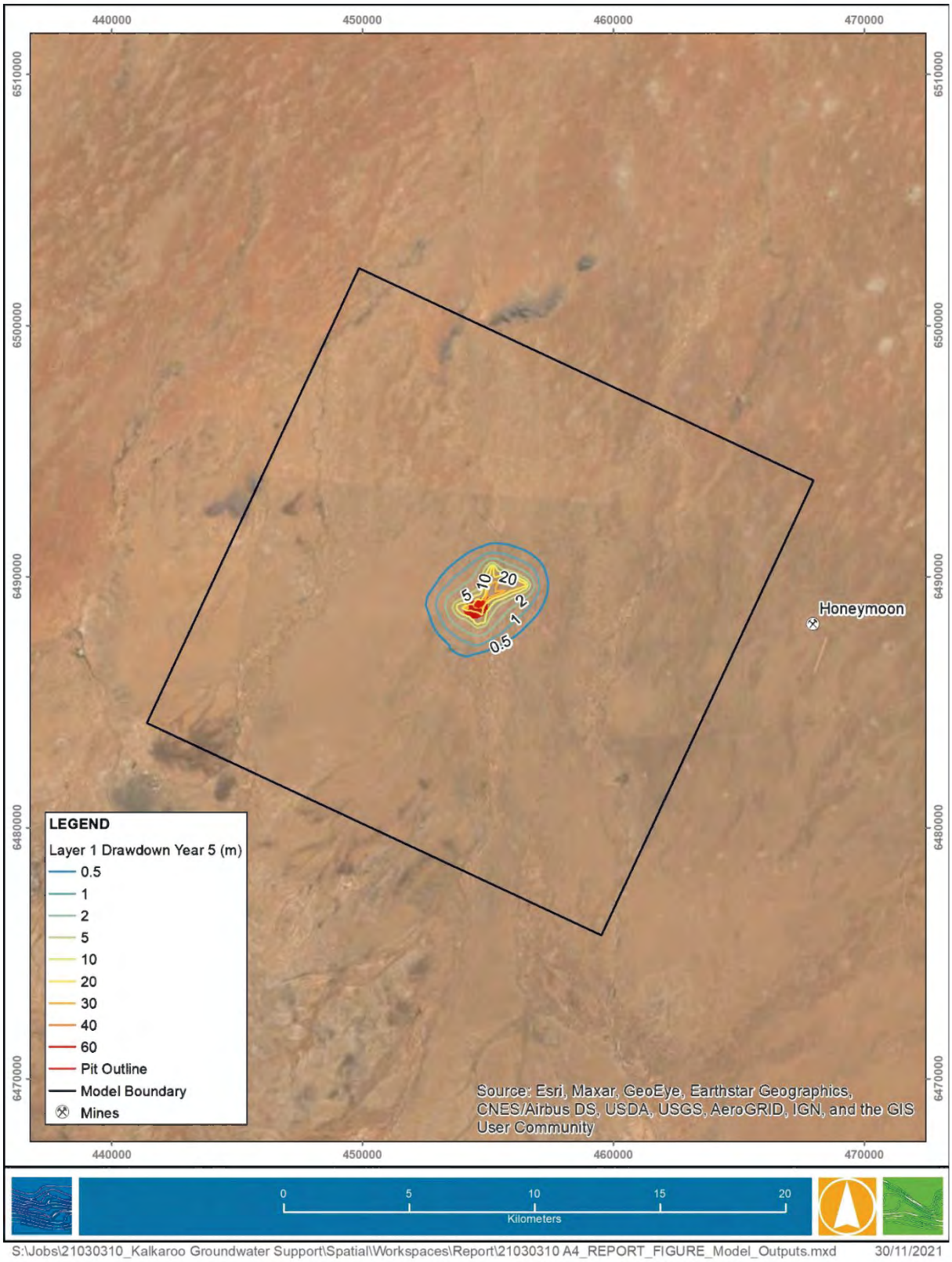


Figure 10-12 Modelled Drawdown in Layer 1 after 5 Years

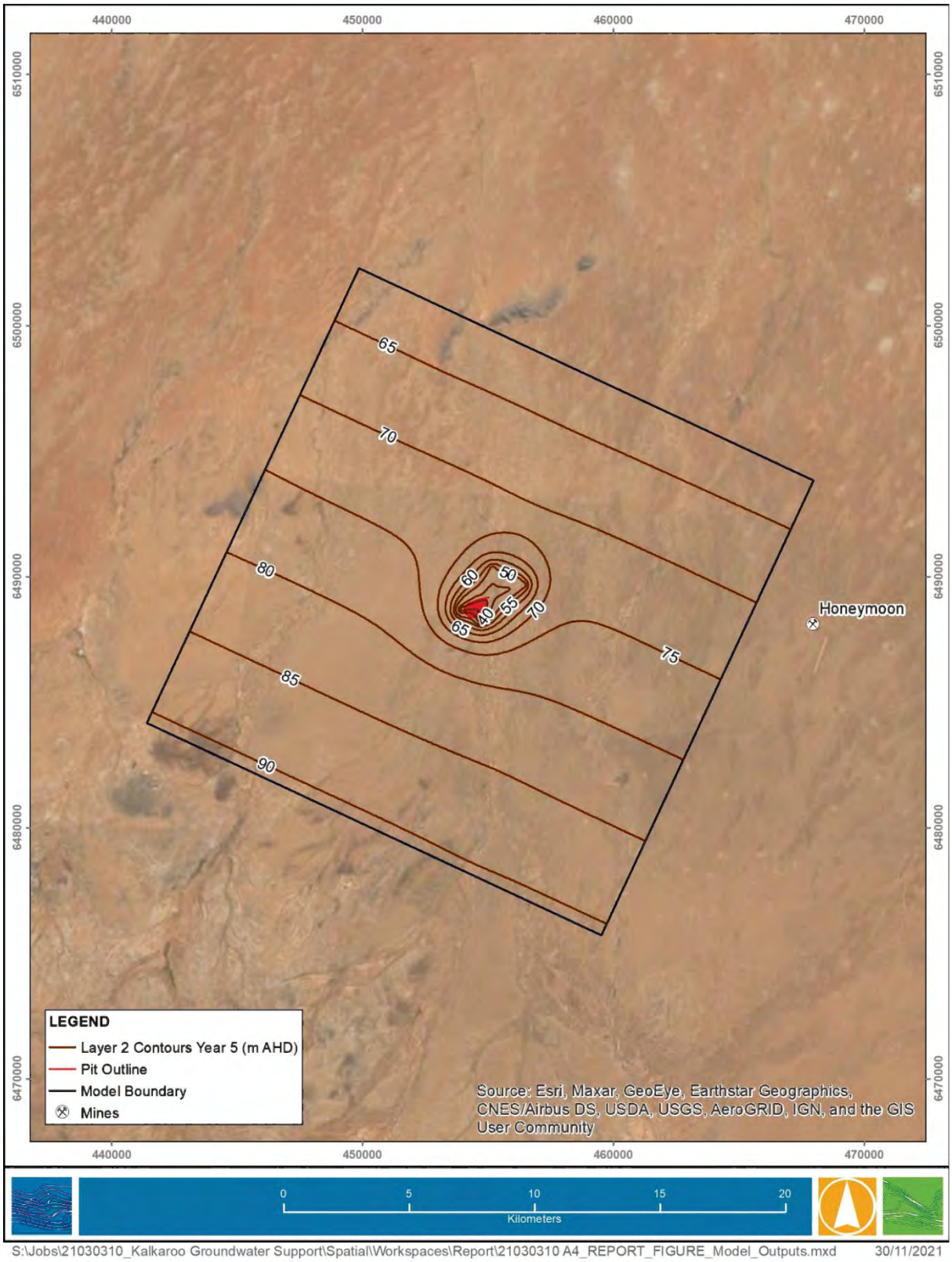


Figure 10-13 Modelled Groundwater Elevations in Layer 2 after 5 Years

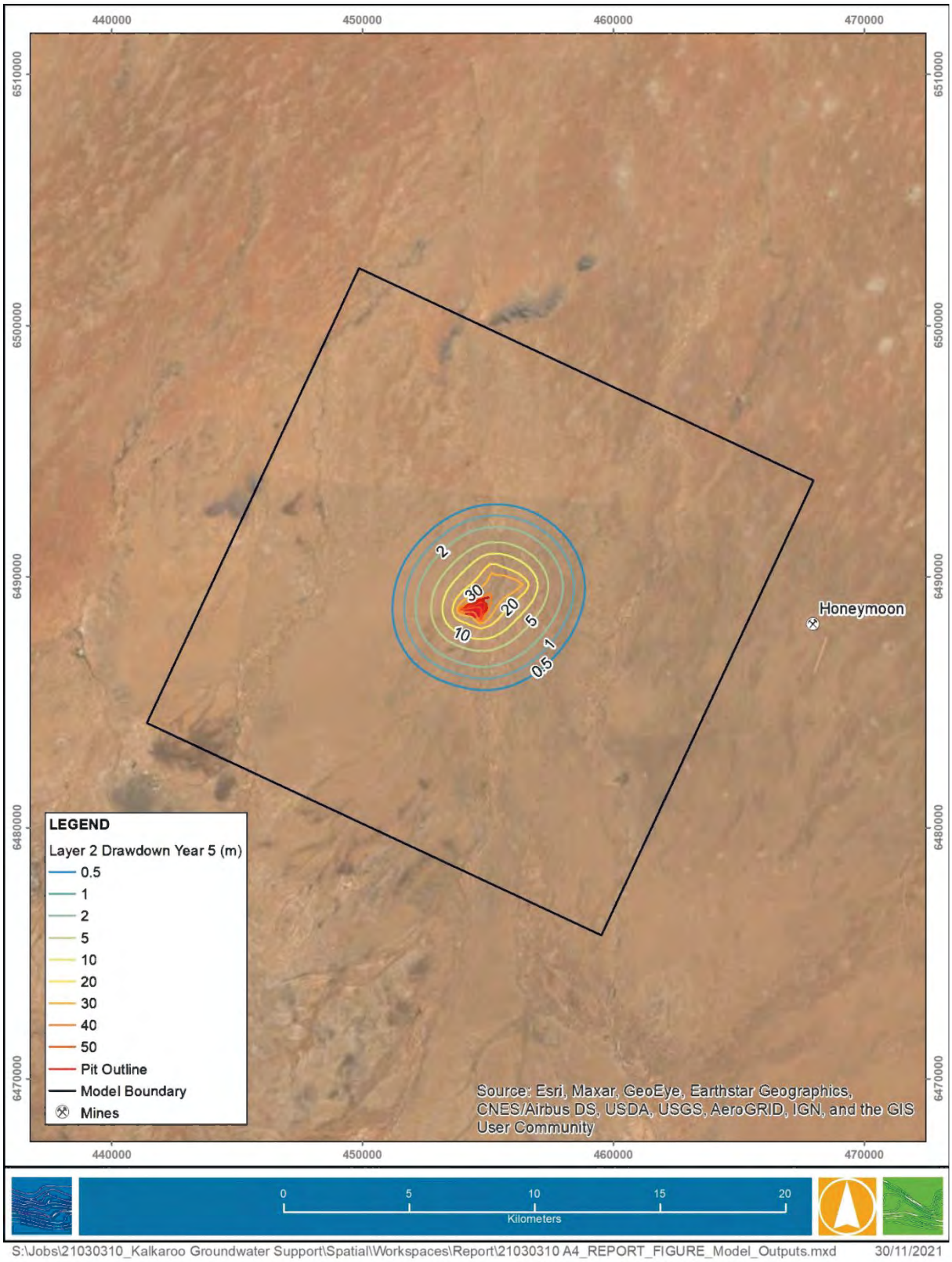


Figure 10-14 Modelled Drawdown in Layer 2 after 5 Years

Table 10-10 Mine Development and Groundwater Supply Schedule

Year	Quarter	Stage	Groundwater Requirement (m3/d)	Average Model Dewatering Rate (m3/d)	Balance from Wells Outside Pit (m3/d)	Notes
1	1	Pre-production and initial pit excavation	1,728	0	1,728	3 wells around pit
	2					
	3		1,728	2,644	-916	Excess to evaporation
	4					
2	5	Production and processing	2,274	1,634	640	3 wells around pit and additional well near WB10 at 100 m3/d to overcome near pit interactions to meet supply
	6					
	7					
	8					
3	9		2,274	2,219	55	
	10					
	11					
	12					
4	13		2,274	1,417	857	
	14					
	15					
	16					
5	17		2,665	1,333	1,332	Well near WB10 increased to 200 m3/d to meet project requirements
	18					
	19					
	20					

10.5.2 Post-closure Recovery

10.5.2.1 Pit and Regional Groundwater Levels

A 200-year post-mining recovery period was modelled with 20 time steps and a time step multiplier of 1.2, with the following inputs:

- Pit modelled as a high K / high Sy zone (1,000 m/d / 1) in layer 1.
- A nett discharge from the pit of 0.002 m/d based on an average annual evaporation of 2,717 mm/a, rainfall of 207 mm/a and a pan evaporation factor of 60%. The effective rainfall area contributing to the pit was extended to include the local catchment area created by the flood bund.
- Starting groundwater heads for layers 1 and 2 were derived from the final heads of the 5-year pit dewatering and well supply model.

The resulting model groundwater heads are shown on Figure 10-15 and Figure 10-16, and the water level recovery curve for the pit, approximated by well WB-4 and selected observation points shown in Figure 10-17. The results show that:

- Groundwater recovery levels have stabilised in layers 1 and 2 within the 50-year recovery period.
- The pit level recovers to approximately RL 57 m AHD, approximately 19 m below the pre-mining level therefore creating an evaporative groundwater sink (indicated by observation well WB4). This is also displayed by the modelled recovery hydrograph for WB14 located 850 m northeast of the pit which shows that drawdown in layer 1 initially continues to expand during the recovery period, before stabilising at approximately 17 m below the pre-mining level.
- The recovery level in observation well WB2, located within the layer 1 pit footprint, recovers to 58 m AHD compared to a pre-mining level of 73 m AHD.

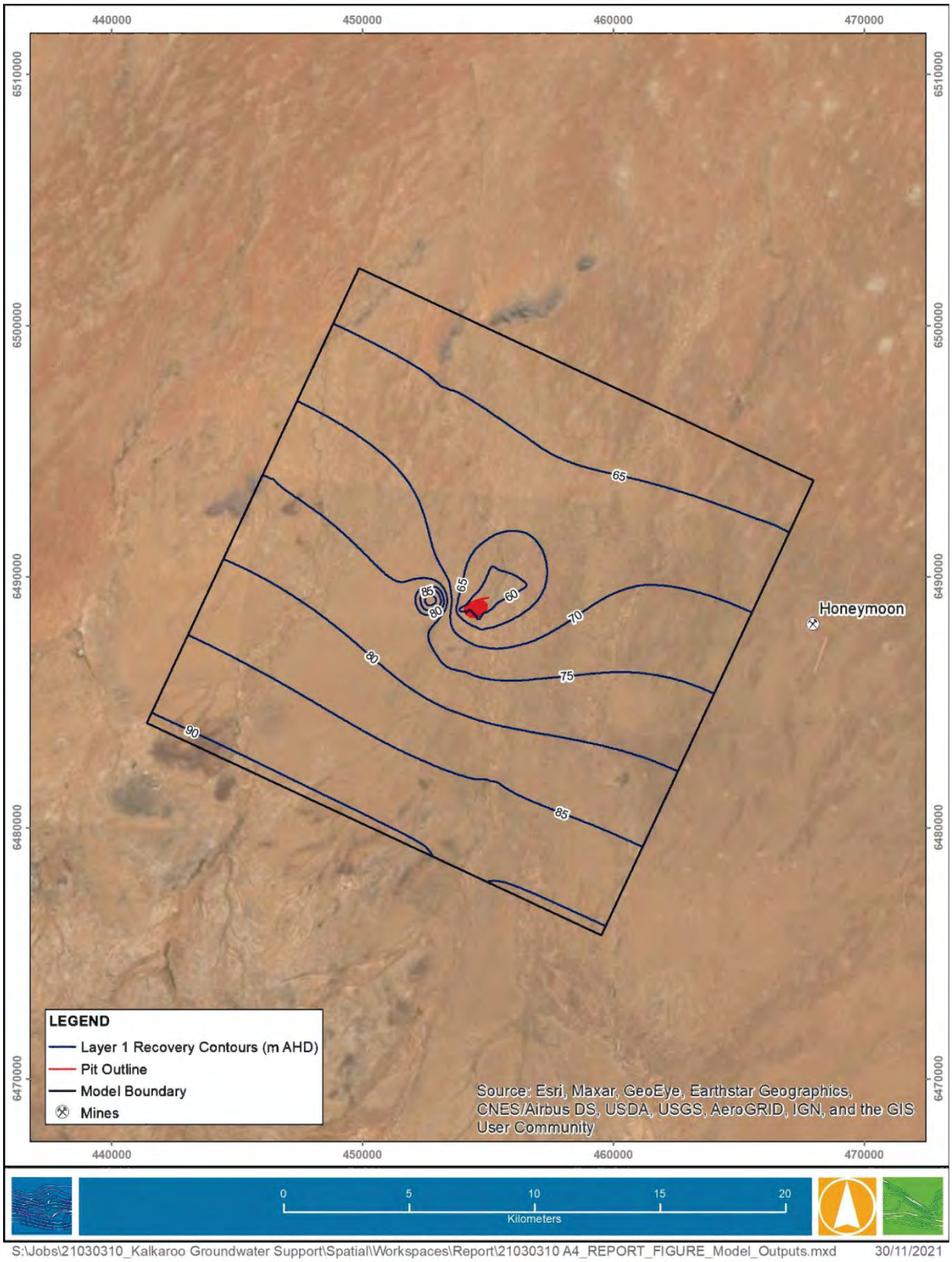


Figure 10-15 Modelled Groundwater Levels in Layer 1 after 50 Years

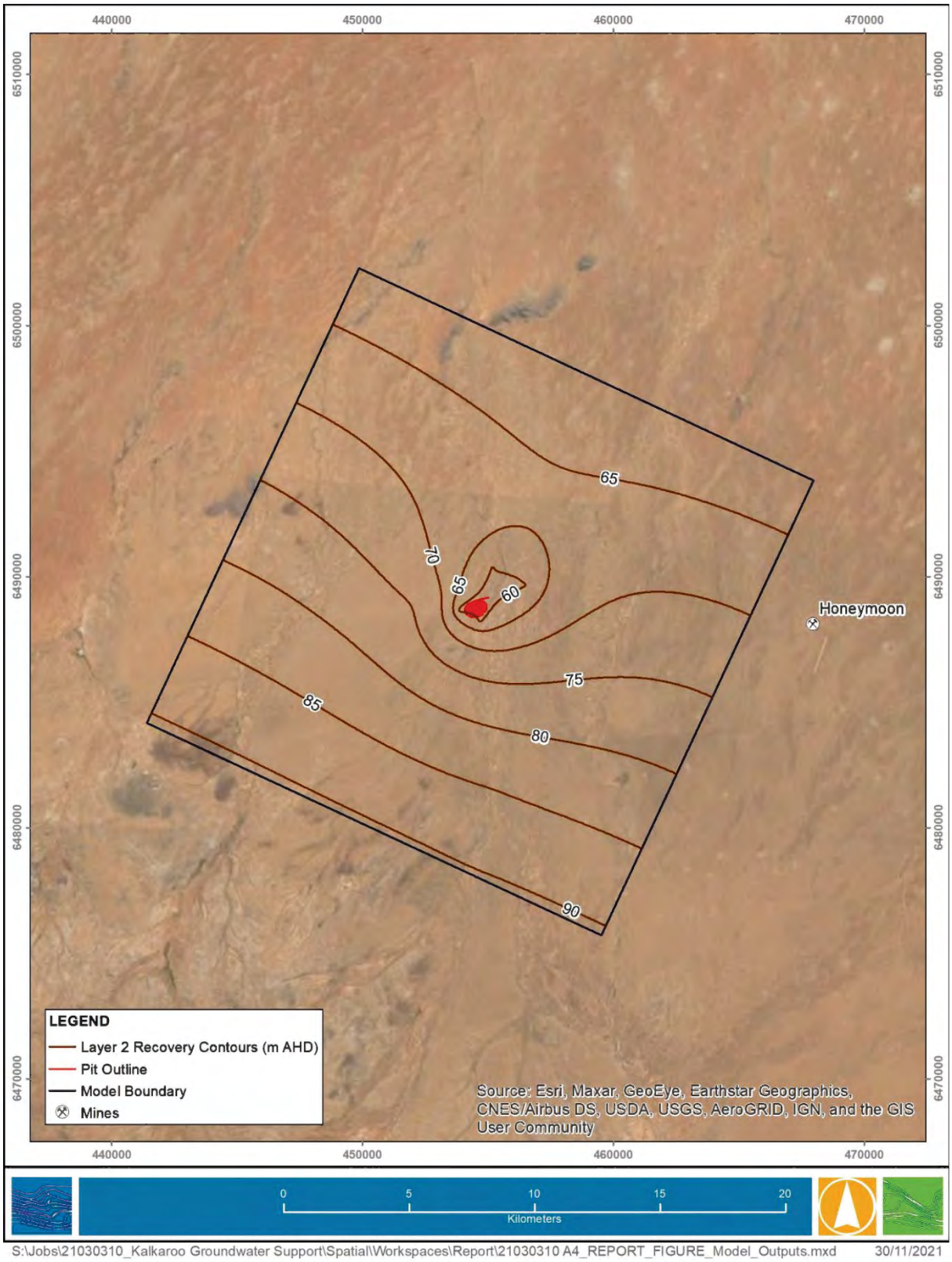


Figure 10-16 Modelled Groundwater Levels in Layer 2 after 50 Years

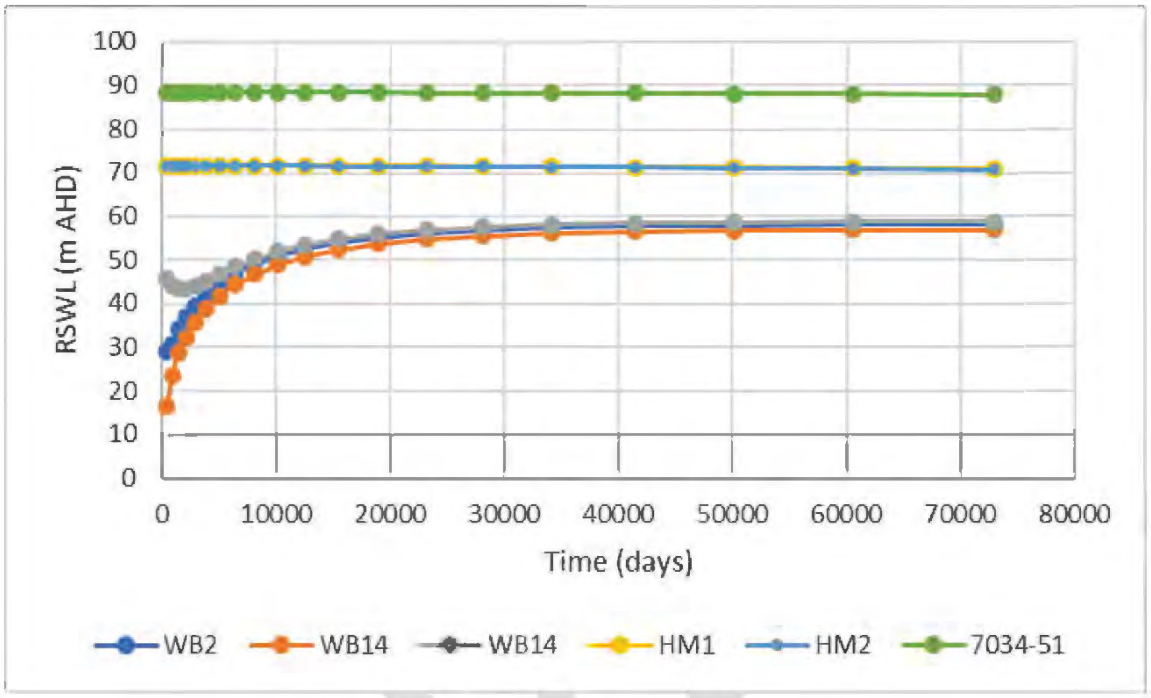


Figure 10-17 Modelled 50 Year Recovery Hydrographs

10.5.2.2 TSF Seepage

Modelling data provided by Kalkaroo Copper indicate that an estimated 56 m^3/d of seepage could occur through the floor of the TSF. This was modelled in the recovery phase by conservatively applying this recharge rate to layer 1 from the start of recovery. A recharge rate of 0.000091 m/d was applied over the TSF area to simulate the 56 m^3/d seepage supplied by Golder Associates (2021).

The advective transport model PMPATH was used to model the fate of seepage particles over a time period of 200 years. The particle tracking results are shown on Figure 10-18, which show that over the 200-year time frame:

- Seepage particles from the TSF travel radially away from the TSF due to the establishment of the recharge mound.
- For the base case travel distances over the 200 years are within 500 m from the edges of the TSF to the north and west. Particles from the east and south of the TSF are drawn towards the dewatered pit area and the high permeability Kalkaroo West shear zone and particle travel distances are modelled to be between 1 to 1.5 km. A conservative parameter case (high Kh in layer 1 of 0.02 m/d and layer 2 of 0.06 m/d, low effective porosity in layers 1 and 2 of 1%) was also run with similar patterns of response to the base case. Travel distances were increased to within 1 km from the edges of the TSF to the north and west. Particles from the east and south of the TSF confirm the influence of the dewatered pit area and the high permeability structural zones with particle travel distances modelled to be between 1.2 to 2 km.

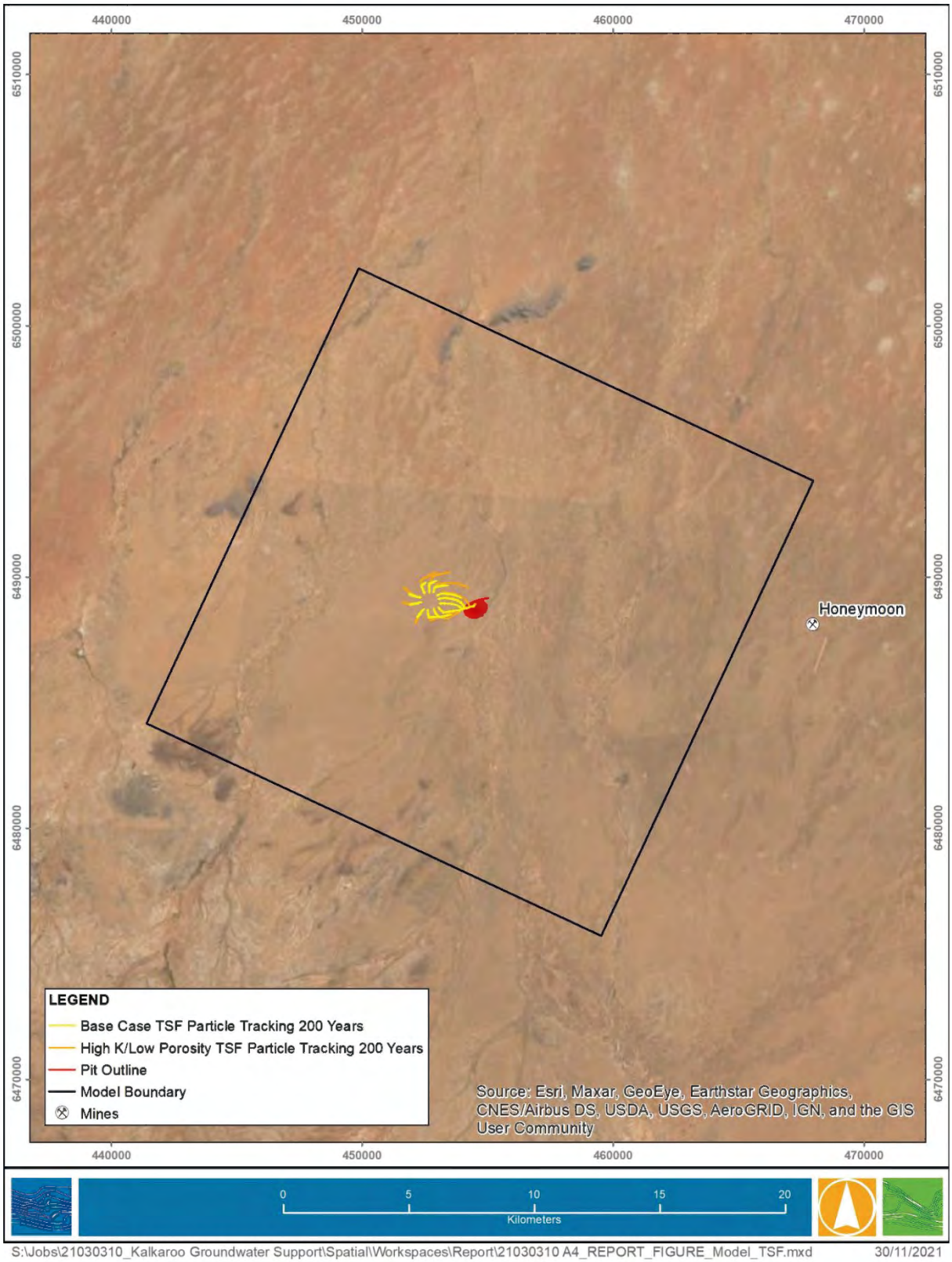


Figure 10-18 Particle Tracking Model of TSF Seepage 200 Years

10.5.3 Model Uncertainty

Key areas of model parameter uncertainty include regional values of hydraulic conductivity, estimated and adopted specific yield values and the ratios of horizontal to vertical hydraulic conductivity and hence vertical interaction between the model layers. To test the sensitivity of the model outputs to variations in these parameters the following transient runs were undertaken for the mining period:

- Case 1 – increase horizontal vertical conductivity in layers 1 and 2 by a factor of 2, reduce specific yield in layers 1 and 2 and specific storage in layer 2 by a factor of 0.5.
- Case 2 – retain base case parameters and increase Kh/Kv ratio in layers 1 and 2 from 100 to 1,000.
- Case 3 – retain base case parameters and decrease Kh/Kv ratio in layers 1 and 2 from 100 to 10.

The sensitivity runs were carried out in the transient mining period without re-calibrating the steady-state model to these parameters and adjusting the transient model starting heads, so some inconsistencies in the results can be expected. However, these parameter changes provide an indication of the possible effect on the magnitude and extents of the modelled regional drawdown patterns, with the following observations made:

- Case 1 - layer 1 and 2 hydraulic conductivity, Sy and Ss changes. The 0.5 m drawdown extent within the unconfined layer 1 is increased by approximately 1,500 m from the base case. A similar situation is observed for the reduction in potentiometric pressure in the confined layer 2 with the 0.5 m value increased by approximately 1,000 m.
- Case 2 – increased Kh/Kv ratio results in the 0.5 m drawdown contours in layers 1 and 2 being increased by approximately 200 m and 800 m, respectively.
- Case 3 – decreased Kh/Kv ratio results in the 0.5 m drawdown contours in layers 1 and 2 being decreased by approximately 500 m and 1,000 m, respectively.

A comparison of the drawdown effects of the cases in layers 1 and 2 are shown on Figure 10-19 and Figure 10-20.

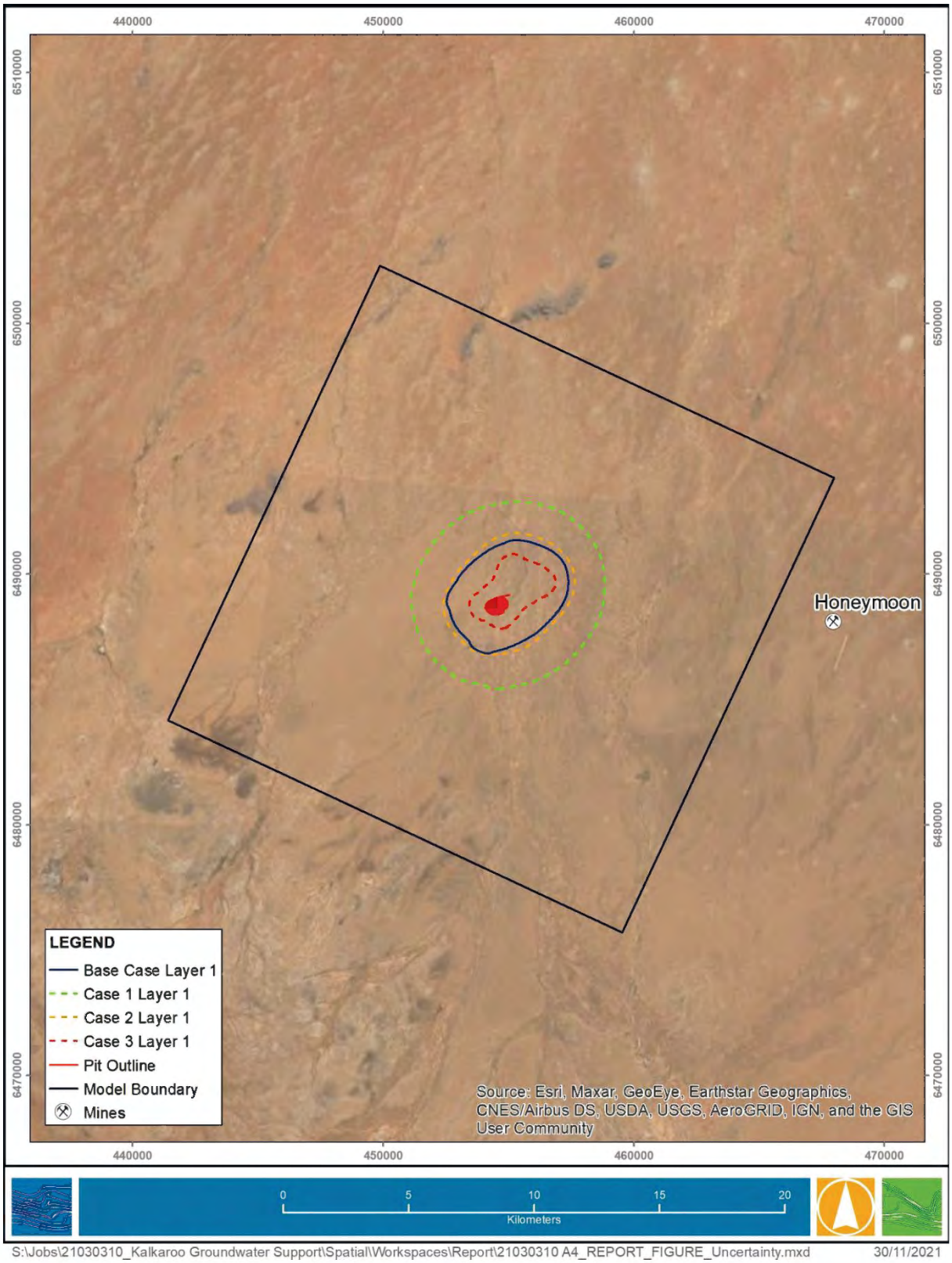


Figure 10-19 Layer 1 Uncertainty Analysis Outputs

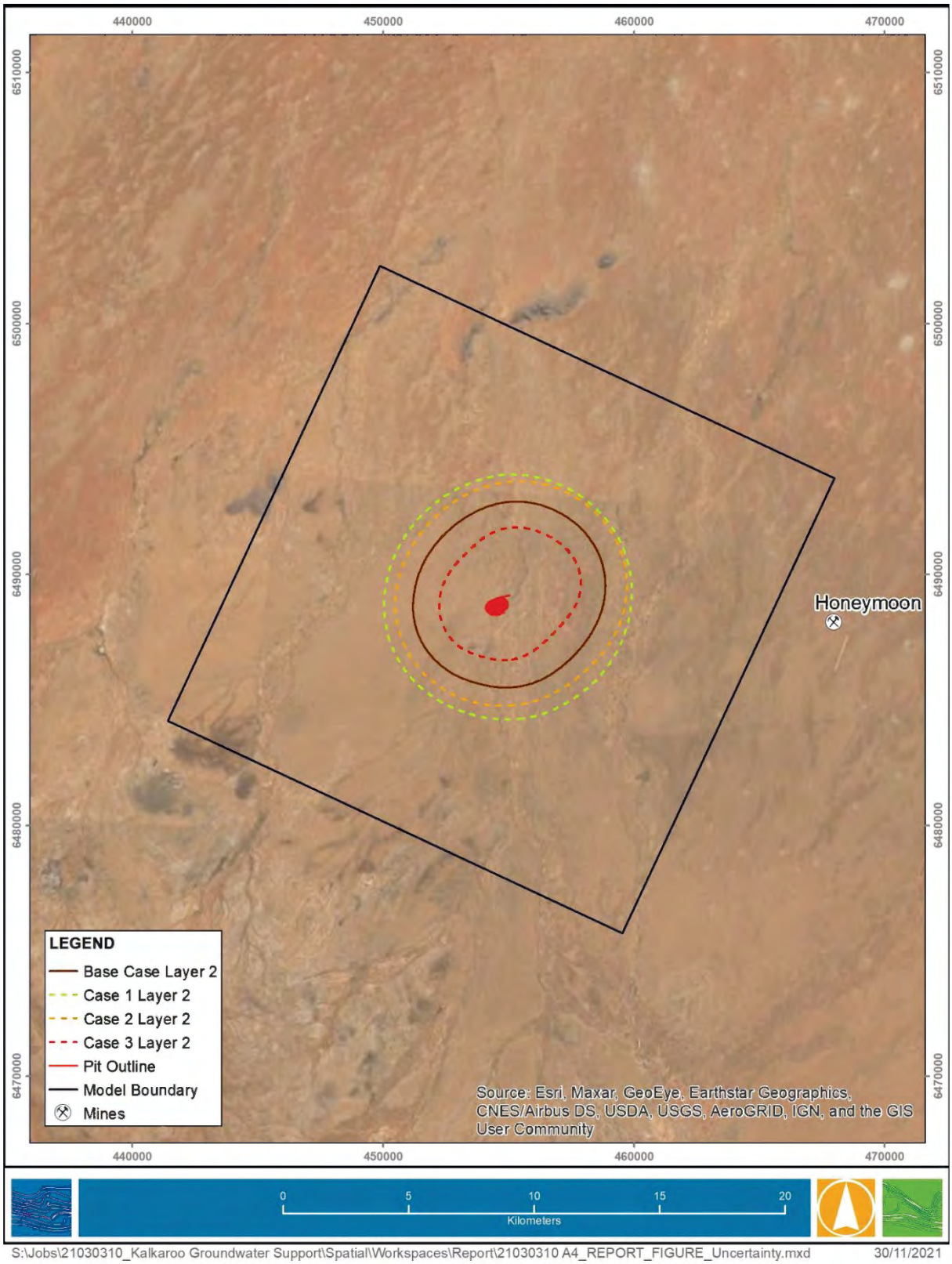


Figure 10-20 Layer 2 Uncertainty Analysis Outputs

10.6 Model Capabilities and Limitations

The modelling methodology and model code used are considered appropriate for the level of detail required to achieve the stated model objectives and are compatible with the various data inputs and hydrogeological conceptualisation, producing model outputs consistent with project requirements.

Model outcome uncertainty is described in Section 10.5.3 and based on this, the main limiting factors of the model relate to uncertainty in the vertical connectivity of the saprolite and fresh basement layers, and extending the hydraulic parameters of the layers and identified structural zones within the layers from a site scale to the semi-regional model scale. A major simplifying assumption within the model is that the layers and structural zones have been represented as homogeneous porous media but in reality are probably more typical of fractured rock units.

The model in its current state provides estimated ranges for the expected drawdowns across the model domain and it is anticipated that these will be confirmed by groundwater monitoring during the mining and recovery stages. The model also provides estimates of pit dewatering rates over the mining period but is not of sufficient detail at this stage to be used to provide detailed dewatering design parameters. The planned mine development and pit excavation schedule control the modelled project water requirements, and hence the groundwater supply to meet this can be modelled to be provided by pit dewatering augmented with wells located outside of the pit if required. This produces a groundwater supply schedule which will be sensitive to the actual pit dewatering requirements. As the project advances and data on actual water supply needs and pit dewatering become available, the model will be updated to provide improved estimates of future drawdown impacts. The model is currently not of sufficient detail to provide a basis for geotechnical applications such as pit wall seepage and pit wall instability.

11 IMPACT ASSESSMENT

11.1 Approach

The impacts described in this section have been assessed using the outputs from the mine site numerical groundwater flow model presented in Section 10. The assessment follows the National Water Commission (NWC) framework for assessing direct effects relating to groundwater quantity, groundwater quality, surface water – groundwater interaction (including groundwater dependent ecosystems) and aquifer disruption (Howe, 2011).

11.2 Environmental Value

The SA EPA Water Quality Policy (2015) describes water by its suitability for different purposes, defined as environmental values. Groundwater salinity is used as the primary guide to assess the applicable environmental values for a particular groundwater source. The salinity data collected from the on-site groundwater wells confirms that two of the nine wells sampled during 2009 had salinities between 3,000 and 13,000 mg/L which is suitable for primary industries. The remainder of the samples had groundwater salinities in excess of 13,000 mg/L. The environmental values that are applicable to this site are therefore:

- Primary industries - livestock drinking water (salinity between 3,000 and 13,000 mg/L); and
- Primary industries - aquaculture and human consumption of aquatic foods (salinity between 3,000 and 13,000 mg/L).

Of these environmental values, primary industries - livestock drinking water is considered the only environmental value that is likely to be realised at the site. The use of groundwater for aquaculture and human consumption of aquatic foods is very unlikely to occur in this arid and remote area. It is noted that lower salinity groundwater exists in the broader study area in the Olary Ranges to the south (Figure 5-3). The salinities in this region have not been used in identifying environmental values for the site as site activities are unable to impact on upgradient recharge areas to the south.

11.3 Groundwater Quantity

Groundwater levels provide a means of assessing the degree to which the quantity of groundwater within the regional groundwater system may change in response to mining activities. As a result of pit dewatering and supply of additional make-up water, groundwater levels surrounding the pit are expected to decline. At the end of mining (5 years), the 0.5 m drawdown contour is predicted to extend up to 3 km from the pit in the Saprolite aquitard and up to 5 km in the basement aquifer. The nearest groundwater well to the pit is located 10 km away and hence there are not expected to be any impacts on existing users during the mining phase (Figure 11-1 and Figure 11-2). Note well 7034-1103 could not be located during the field survey by Kalkaroo Copper in 2015, however, its presence does not change the impact assessment for the mining phase as it is located outside of the 0.5 m drawdown extent.

During the 200-year recovery model simulation, groundwater levels in the saprolite aquitard respond to seepage from the TSF and ongoing evaporative losses from the pit lake. The effects of these two processes leads to the development of a groundwater mound beneath the TSF and a cone of depression surrounding the pit lake as depicted in Figure 11-3. The peak of the mound is predicted to remain 30 m below ground level while the pit lake is predicted to stabilise at approximately 57 m AHD, 19 m below the pre-mining level. Groundwater levels within the regional basement aquifer in the pit footprint are modelled to recover to within 18 m of pre-mining levels (Figure 11-4).

There is a small amount of drawdown predicted in the Honeymoon uranium mine model observation points of around 1 m at the end of the 50-year recovery period (Figure 10-17). These simulated points are located 3 km from the actual Honeymoon uranium mine (Figure 11-1), so impacts at the mine would be expected to be less. Drawdown during the recovery period is thought to be a result of the time taken for the system to re-equilibrate following pit dewatering. Similarly, existing stock wells within the model domain also show a small amount of drawdown in the order of 0.5 m during the recovery phase (Figure 10-17), however, it is noted that these wells are currently not operational. It is recommended that the closure predictions are re-evaluated once 12 to 24 months of monitoring data becomes available to re-calibrate the model.

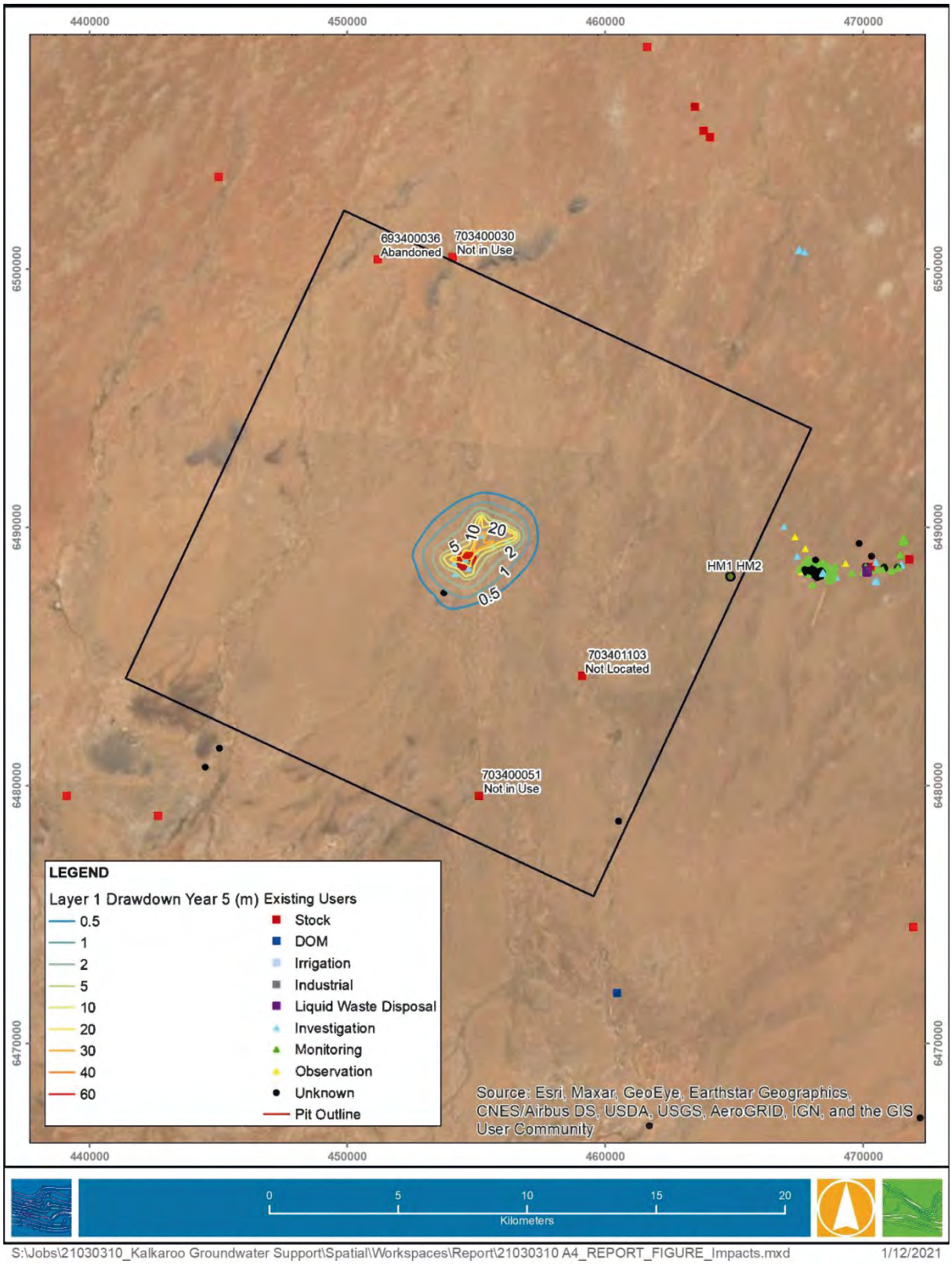


Figure 11-1 Modelled Drawdown Layer 1 End of Mining and Existing Users

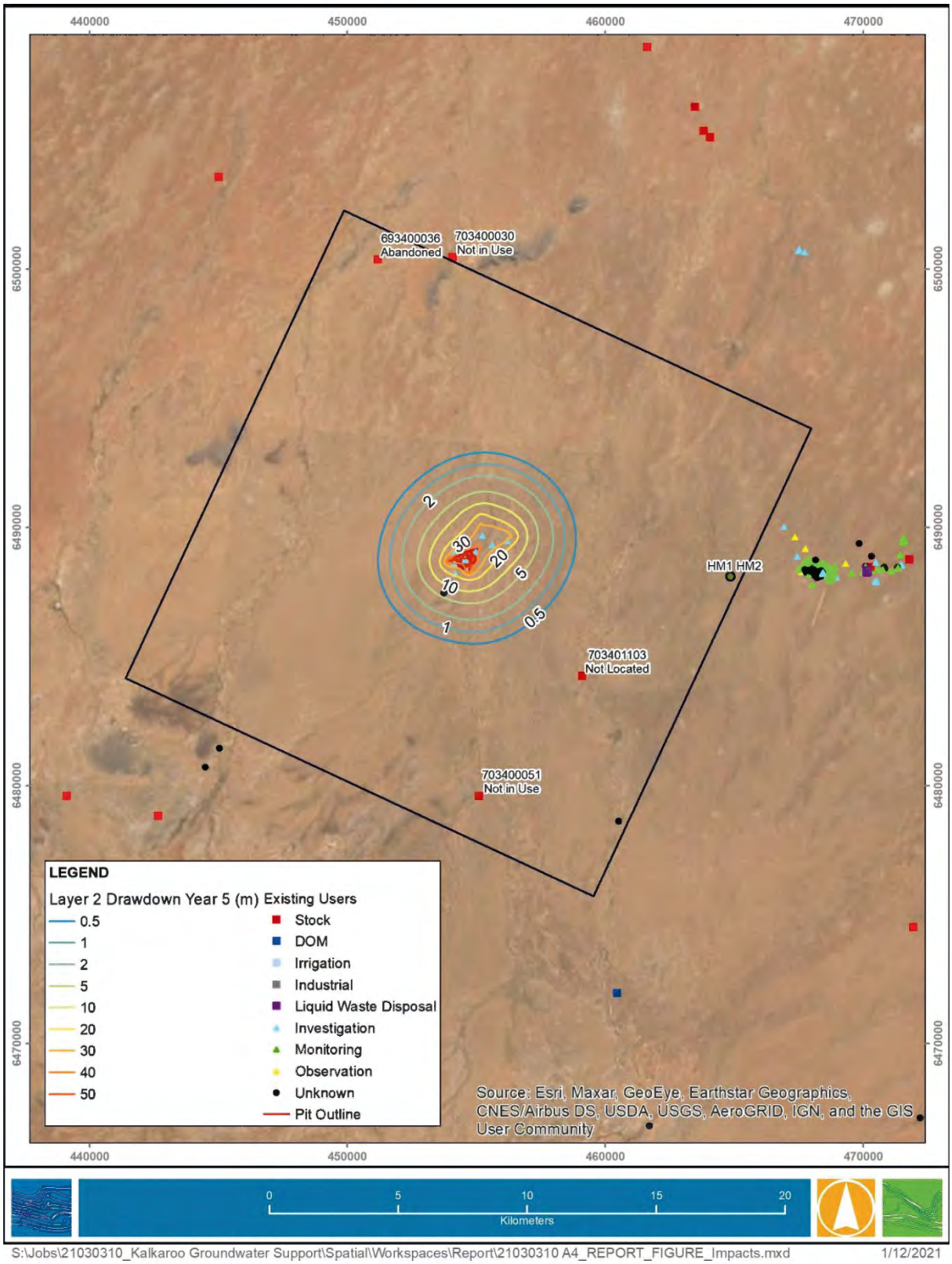


Figure 11-2 Modelled Drawdown Layer 2 End of Mining and Existing Users

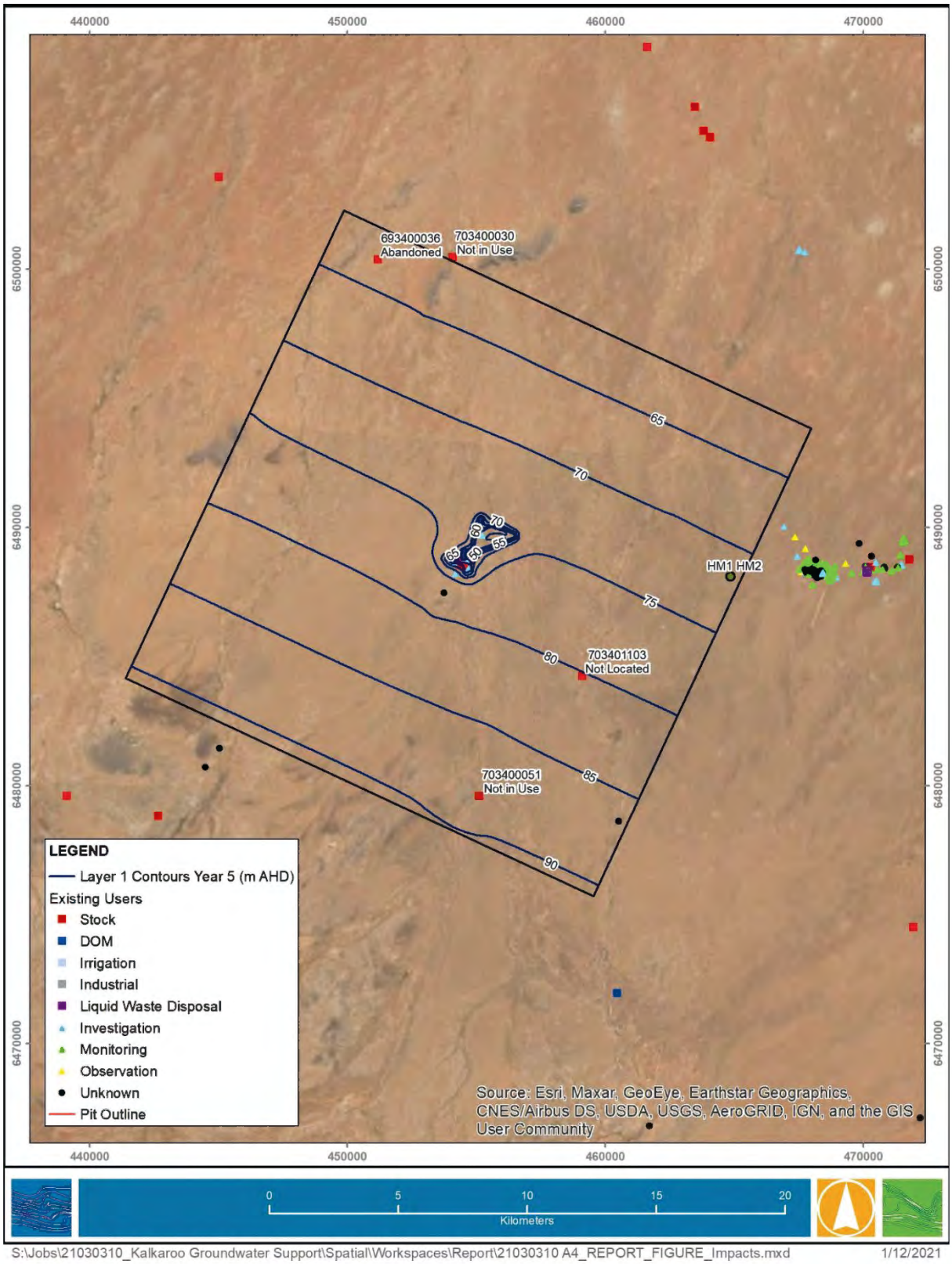


Figure 11-3 Modelled Groundwater Levels in Layer 1 after 50 Years Recovery and Existing Users

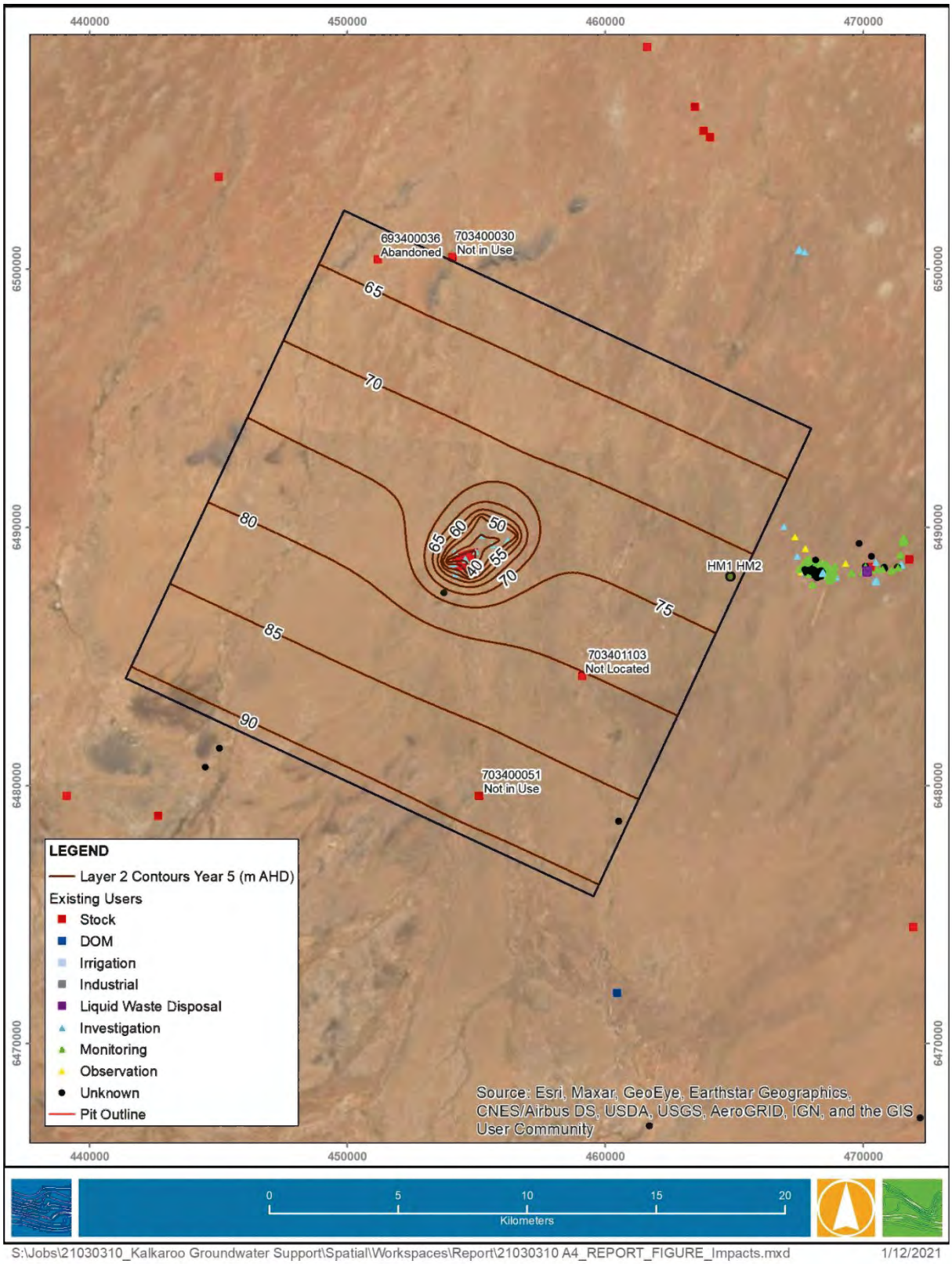


Figure 11-4 Modelled Groundwater Levels in Layer 2 after 50 Years Recovery and Existing Users

11.4 Groundwater Quality

Seepage from the TSF is the main on-site activity which has the potential to impact on groundwater quality. It is noted that primary controls are in place to reduce the impacts of this activity, such as lining of the TSF with compacted clay and groundwater interception if mounding occurs beneath the TFS. Further details regarding these primary controls can be found in the Kalkaroo Copper PEPR (Kalkaroo Copper, 2021).

In the event that these primary controls fail, the fate of potential contaminants has been assessed using particle tracking within the numerical groundwater flow model for a base case and conservative parameter set (refer to Section 10.5.2.2 for details). It is noted that this assessment does not account for other factors such as dilution, sorption or retardation which would reduce the concentration of potential contaminants.

The results of the particle tracking indicate that seepage from the TSF travels radially away from the TSF due to the establishment of the recharge mound (refer to Figure 10-18). For the base case travel distances over the 200-year simulation period are within 500 m from the edges of the TSF to the north and west. Particles from the east and south of the TSF are drawn towards the dewatered pit area and the high permeability Kalkaroo West shear zone and particle travel distances are modelled to be between 1 to 1.5 km. A conservative parameter case was also run with similar patterns of response to the base case. Travel distances were increased to within 1 km from the edges of the TSF to the north and west. Particles from the east and south of the TSF confirm the influence of the dewatered pit area and the high permeability structural zones with particle travel distances modelled to be between 1.2 to 2 km. The particles are not predicted to impact on any existing groundwater receptors throughout the 200-year simulation period.

There are not expected to be any Acid Melliferous Drainage (AMD) issues. The results from modelling and the static test work shows that there is a very low risk to AMD from the waste rock of all types. Approximately 1% of the total mass of waste to be mined has been classified as having some acid forming potential by sulphur modelling or from static testing analysis (Kalkaroo Copper, 2021).

11.5 Surface Water – Groundwater Interaction and Groundwater Dependent Ecosystems

There is no established linkage between groundwater and surface water within 10 km of the site and there are therefore not expected to be any impacts on groundwater – surface water interactions as a result of mining activities. The nearest potential aquatic GDE to the site is located around 3 km outside of the predicted drawdown extent in the saprolite layer and impacts on aquatic ecosystems are not expected.

Areas of potential Terrestrial GDEs including low level shrublands (less than 1 m) consisting of Sclerolaena divaricate, Atriplex vesicaria ssp and Maireana aphylla (mixed) exist within the predicted extent of drawdown. Although drawdown is expected beneath these potential GDEs, it is considered very unlikely that this will result in impact on these communities due to the fact that groundwater levels in this area are between 45 and 50 m below ground level. This interpretation is consistent with the assigned low probability of groundwater dependence reported in the Australian GDE atlas for these ecosystems.

11.6 Aquifer Disruption

Following the completion of mining when dewatering and water supply infrastructure are decommissioned, the pit void will remain open and a pit lake is expected to form. Once groundwater inflows equilibrate with evaporation, a new steady state flow regime will be established, the impacts of which are assessed in Sections 11.3, 11.4 and 11.5.

12 GROUNDWATER MONITORING AND MANAGEMENT

12.1 Overview

The groundwater monitoring and management plan has been developed to provide data to demonstrate compliance with the environmental outcome for the project which states that the tenement holder must during construction, operation and post-mine completion, ensure that there is no adverse impact to the quantity and quality of groundwater available to existing users as a result of mining operations. The monitoring plan also considers the general environmental duty or care which states that proponents must take all reasonable and practicable measures to prevent or minimise environmental harm resulting from undertaking an activity that pollutes or might pollute waters (EPP, 2015).

The groundwater monitoring program has been designed to:

- Collect groundwater level and pit lake water level data to be used for groundwater model calibration;
- Collect regional groundwater level data to be used to validate model predictions;
- Collect groundwater level data to assess seepage from flood events east of the pit; and
- Collect targeted groundwater quality and level data near the TSF to monitor for potential changes in groundwater quality and level as a result of mining operations.

The approach taken to develop the groundwater management and monitoring plan has been guided by the Queensland Department of Environment and Science's (DES, 2021) guideline for assessing groundwater quality and developing site-specific groundwater quality criteria.

12.2 Understanding the System

DES (2021) report that developing appropriate site-specific groundwater quality guidelines requires an understanding of the site-specific hydrogeology including aquifers and aquitards, groundwater flow and groundwater – surface water interactions. A summary of the relevant information relating to these aspects of the hydrogeological conceptualisation is provided in Table 12-1. Further details regarding the broader conceptualisation are provided in Sections 4 to 8. In summary, the groundwater system is expected to be slow moving with no groundwater – surface water interactions within at least 10 km of the site. The level of seasonal and yearly variability is expected to be low. Recommendations for establishing baseline conditions and monitoring frequency are guided by these factors.

Table 12-1 Understanding the System using the DES (2021) Framework

Theme	Summary
Aquifers and Aquitards	There are two main hydrogeological units identified at the site including a saprolite unit and fresh basement. Major ion data suggests that groundwater in the basement aquifer is of similar ionic composition suggesting that this aquifer is well connected. There is currently no major ion data available for wells screened in the saprolite unit.
Groundwater Flow	Groundwater flow is in a north-easterly direction. The groundwater flow rate in the regional fresh basement rocks is expected to be low resulting in high residence times. Seasonal variability is expected to be minimal given the very low recharge rates that are expected over the study area.
Groundwater – Surface Water Interactions	There is no established linkage between groundwater and surface water within 10 km of the site.

Theme	Summary
Environmental Values	The identified environmental values for the site include primary industries - livestock drinking water. Groundwater is not known to support any aquatic ecosystems with 10 km of the site.

12.3 Review of Existing Data and Applicable Guideline Values

Existing water chemistry data for the site is limited to one round of laboratory results from nine wells in 2009. Although the data does not span multiple time-steps, similarities in the ionic composition of the sampled wells are observed as illustrated in the Piper Diagram (Figure 6-2). This may imply that spatial variability is not expected to be significant, however, further monitoring is required to confirm this.

The water chemistry data has been compared against guideline values for livestock drinking water in Table 12-2. The full laboratory analysis results for the 2009 sampling event are provided in Appendix C with exceedances above livestock drinking water guidelines highlighted. Of note are the concentrations of copper and mercury in well WB10 and mercury in well WB7 which were marginally above the stock guideline values. TDS, calcium, magnesium and sulphate were also reported above the livestock drinking water guidelines. As there are no known historic site activities which have impacted groundwater, it would appear that these constituents are naturally elevated above the livestock drinking water guidelines values, however, further monitoring is required to confirm this.

Table 12-2 Comparison of Site Groundwater Quality against Livestock Drinking Water Guidelines (ANZEEC, 2000)

Parameter	Trigger Value (mg/L)	Min	Max	Range	No. of Samples	No. of Exceedances
TDS	13000	9520	34100	24580	9	7
Calcium	1000	754	1860	1106	9	8
Magnesium	600	337	922	585	9	4
Nitrate as N	400	0	0.09	0.09	9	0
Nitrite + Nitrate as N	30	0	1.44	1.44	9	0
Sulphate	1000	2360	3390	1030	9	9
Aluminiumn	5	-	-	-	-	-
Arsenic	0.5	0.012	0.099	0.087	9	0
Boron	5	-	-	-	-	-
Cadmium	0.01	0	0.0019	0.0019	9	0
Chromium	1	0	0.006	0.006	9	0
Cobalt	1	0.008	0.101	0.093	9	0
Copper	0.5	0.009	0.587	0.578	9	1
Fluoride	2	-	-	-	-	-
Lead	0.1	0	0.076	0.076	9	0
Mercury	0.002	0	0.004	0.004	9	2
Molybdenum	0.15	-	-	-	-	-
Nickel	1	0.006	0.06	0.054	9	0
Selenium	0.02	-	-	-	-	-
Uranium	0.2	-	-	-	-	-
Zinc	20	0.009	1.13	1.121	9	0

12.4 Establishing Baseline Conditions

The existing groundwater chemistry data suggests that there are similarities in the ionic composition of the sampled wells, however, the lack of temporal data does not allow for establishment of robust baseline conditions. To address this, it is recommended that quarterly groundwater quality sampling is undertaken for a period of one year, after which time the data is reviewed to assess the variability in the collected data. If groundwater quality parameters are stable, it is recommended that this data is used to establish baseline water quality criteria for the site. If there is unexplained variability in the data, sampling may need to continue at a quarterly frequency until the variability can be explained and baseline conditions can be established. Although the proposed number of sampling events is less than that recommended by DES (2021), site specific conditions suggest that (1) groundwater movement is expected to be very slow and (2) there is not expected to be any seasonal variability due to the low areal recharge and lack of groundwater-surface water interactions at the site.

12.5 Groundwater Quality / Chemicals of Concern

Ore will be processed using conventional gravity separation and sulphide flotation circuits. The ore material will be crushed, ground, and screened in order to generate a commercial grade saleable copper-gold concentrate product. Reagents added in the processing stream include Hydrochloric Acid, Sodium Cyanide, Lime and Sodium Hydroxide (Kalkaroo Copper, 2021). A summary of these reagents and their reaction with ore and water is provided in Table 12-3 along with the proposed laboratory analytes used to assess whether these reagents appear in groundwater.

Table 12-3 Chemicals of Concern and Proposed Monitoring Constituents

Reagent	Reaction with Ore and Water	Proposed Monitoring
Hydrochloric Acid - Commercial	Used in elution process to remove contaminants from the carbon. Reacts with water to lower the pH. Has no reaction with the ore.	pH Dissolved and total metals
Sodium Cyanide	Dissolved in water as 10% w/w solution to dissolve gold, and other minor amounts of base metals from ore.	Cyanide – free cyanide Cyanide – total cyanide Cyanide – weak acid dissociable (WAD) Dissolved and total metals
Lime	Dissolved in water inside the mill to increase slurry pH to a level where HCN gas levels are minimized. Has no reaction with the ore.	pH Dissolved and total metals
Sodium Hydroxide	Used in the elution process to remove gold from carbon. Dissolves in water. Has no reaction with the ore	pH Dissolved and total metals

12.6 Monitoring Locations and Frequency

Proposed monitoring locations, parameters and frequency are summarised in Table 12-4 and shown spatially in Figure 12-2. The following site characteristics have been taken into consideration when developing the monitoring locations and frequency:

- The low regional hydraulic conductivity resulting in long residence times; and
- The significant depth to groundwater and presence and thickness of the Namba Clay leading to significant lag times between water infiltrating at the surface and reaching the water table.

In addition to the proposal groundwater monitoring wells, a series of wells installed in the unsaturated Quaternary sediments and Namba Clay are proposed around the TSF (Golder, 2021). These wells are intended to be used to monitor for seepage from the TSF and will be used to validate the TSF seepage model predictions. Further details regarding TSF monitoring locations and frequency are provided in Golder (2021).

Table 12-4 Groundwater Monitoring Program

Purpose	Location	Parameters	Frequency
Model Calibration	WB13 (Basement)	Groundwater level	Monthly in first year Quarterly thereafter
		Groundwater quality	Quarterly
	WB14 (Saprolite)	Groundwater level	Monthly in first year Quarterly thereafter
		Groundwater quality	Quarterly
	WB3 (Basement)	Groundwater level	Monthly in first year Quarterly thereafter
		Groundwater quality	Quarterly
	WB11 (Basement)	Groundwater level	Monthly in first year Quarterly thereafter
		Groundwater quality	Quarterly
Regional Trends	7034-51	Groundwater level	Quarterly
		Groundwater quality	Twice yearly
	7034-30	Groundwater level	Quarterly
		Groundwater quality	Twice yearly
TSF Seepage	TSF 1 (Saprolite)	Groundwater level	Quarterly
		Groundwater quality	Twice yearly
	TSF 2 (Saprolite)	Groundwater level	Quarterly
		Groundwater quality	Twice yearly
Bank Infiltration	(Namba)	Groundwater level	Quarterly
		Groundwater quality	Quarterly if saturated
	(Namba)	Groundwater level	Quarterly
		Groundwater quality	Quarterly if saturated
Production	Production 1 (PB 1)	Groundwater level	Quarterly
		Groundwater quality	Twice yearly
	Production 2 (PB 2)	Groundwater level	Quarterly
		Groundwater quality	Twice yearly
	Production 3 (PB 3)	Groundwater level	Quarterly
		Groundwater quality	Twice yearly

12.7 Leading Indicator Criteria

12.7.1 Groundwater Levels

Groundwater levels in the WB series of wells should be collected monthly for the first year and quarterly thereafter. The monitoring frequency for these wells is higher in the first year as they are expected to respond to extraction from production wells surrounding the pit and pit dewatering. The frequency of all other wells is quarterly as the expected rate of change in these wells is low.

Groundwater levels should be compared against model predictions to validation and, if necessary, re-calibrate the model. It is proposed that model recalibration occurs after 24 months of operations of beforehand if:

- Drawdown is measure in the regional wells; or
- If groundwater levels in the WB series of wells deviate from model predictions by more than 10 m

The predicted responses in the regional and WB series of wells are illustrated in Figure 12-2.

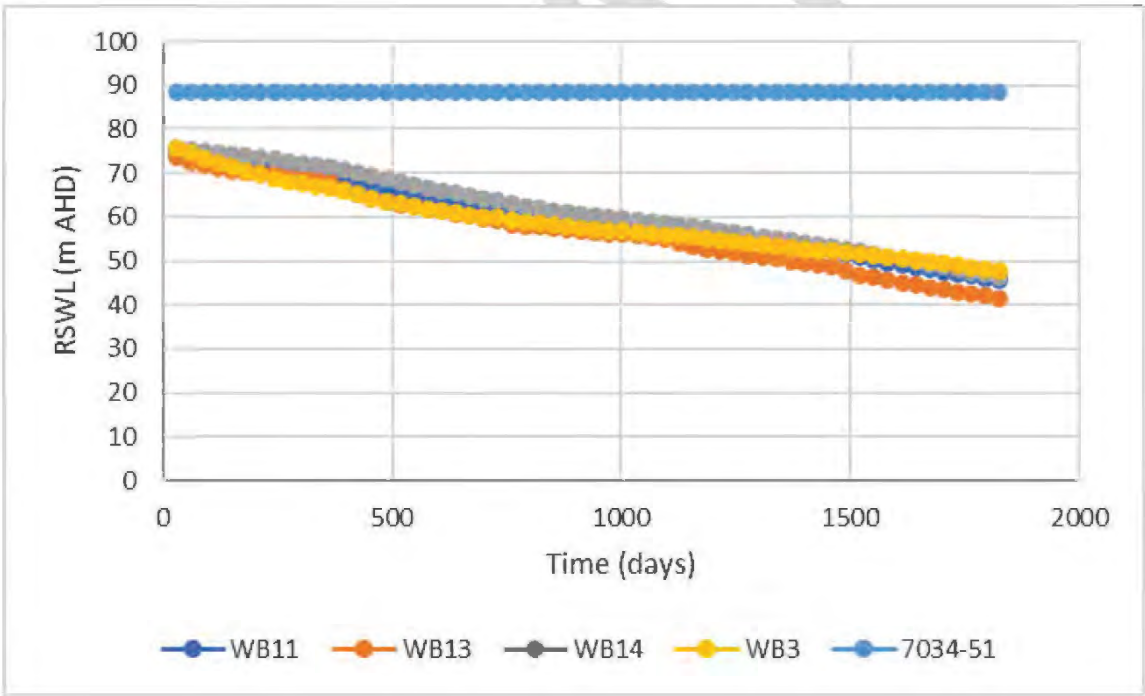


Figure 12-1 Predicted Groundwater Level Response in Monitored Wells (Operational Phase)

12.7.2 Groundwater Quality

Groundwater quality Leading Indicator Criteria (LIC) will be established once baseline condition for the site have been established. The parameters to be included in the monitoring program include pH, electrical conductivity (EC), total suspended solids (TSS), total and dissolved metals (arsenic, barium, arsenic, barium, beryllium, cadmium, cobalt, chromium, copper, cyanide, iron, manganese, nickel, lead, vanadium, zinc) and total petroleum hydrocarbons (TPH).

12.8 Site Water Balance

To track the movement of water around the site, it is recommended that all inputs and outputs are metered and recorded in the form of a site water balance. The data should be reviewed fortnightly to ensure that inputs and outputs can be accounted for.

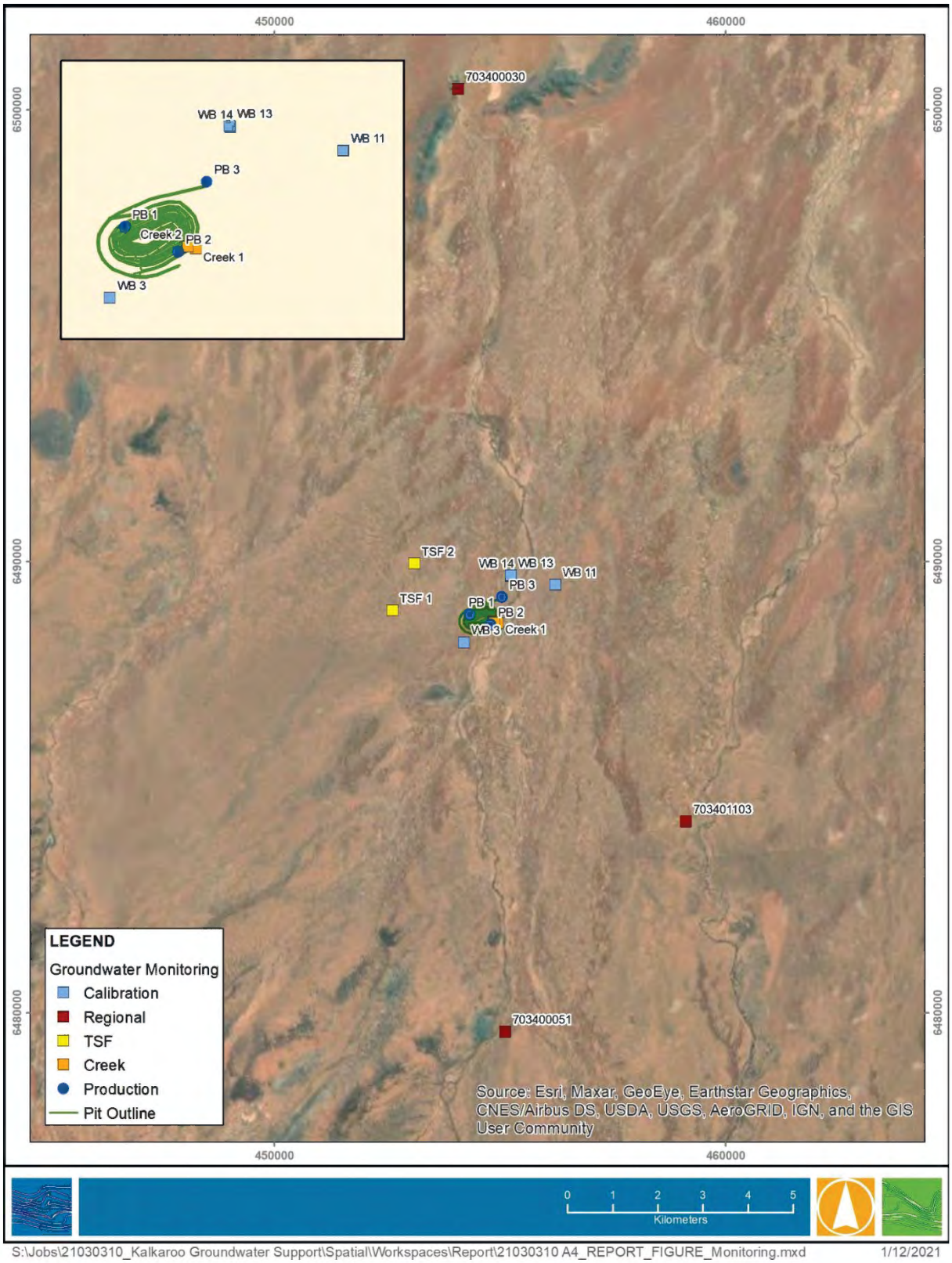


Figure 12-2 Groundwater Monitoring Locations

13 SUMMARY

The hydrogeological conceptualisation and numerical groundwater flow modelling for the Kalkaroo Copper-Gold Mine has been updated to address Government's Request for Further Information relating to Kalkaroo Copper's PEPR submission (March 2021) and review of existing hydrogeological reports and publicly available data for the site and surrounding areas. Key outcomes of this assessment are documented below:

- The numerical groundwater flow model which exists for the site (AGT, 2013) has been revised to (1) include additional supporting evidence to support aspects of the existing groundwater model set-up such as parameterisation of the shear zones and (2) better reflect the updated hydrogeological conceptualisation of the site through modification of several aspects of the model set-up including grid orientation, boundary conditions, model laying and calibration.
- In-pit dewatering rates are expected to range from 2,644 m^3/d to 2,219 m^3/d during the excavation period. Additional water to meet the site water demand will be sourced from dewatering wells targeting the basement shear zones surrounding the pit.
- During the initial pit dewatering phase when the pit is excavated below the water table to 40 m AHD, dewatering requirements are predicted to exceed the project water demand resulting in an excess of water of around 916 m^3/d for a period of 6 months. During this time disposal of excess water is predicted to be required.
- Groundwater drawdown from pit dewatering and water supply is predicted to extend up to 3 km from the pit in the Saprolite layer and 5 km in the basement aquifer by the end of the 5-year mining period.
- A pit like is expected to form following the completion of mining with the level stabilising at approximately 57 m AHD, 19 m below the pre-mining groundwater level. Residual drawdown in the saprolite layer is predicted to remain into perpetuity due to ongoing evaporative losses of water from the surface of the pit lake. Groundwater levels in the basement aquifer within the pit footprint area are predicted to recover to within 18 m of pre-mining levels.
- Seepage from the TSF has been conservatively modelled by applying water directly to the water table resulting in a groundwater mound developing beneath the TSF. Particle tracking suggests that groundwater may migrate up to 2 km away from the TSF over the 200-year closure simulation period. There are no known groundwater receptors within 10 km of the mine site.
- Groundwater from two of nine on-site wells was found to be suitable for livestock drinking water purposes based on its salinity classification. The lowest recorded salinity in the wells was 9,520 mg/L. Elevated levels of Copper and Mercury were found in two wells suggesting that these parameters may be naturally elevated.
- There are no known operational groundwater wells within 10 km of the site and impacts to existing groundwater users are not expected.
- Aquatic and terrestrial GDEs in the study area are not expected to be impacted by site operations. All potential aquatic GDEs are located outside of the predicted drawdown extent while terrestrial GDEs are not expected to be reliant on groundwater which occurs at depths of 45 to 50 m below ground level.
- A groundwater monitoring and management plan has been presented to provide the necessary data to validate the modelled predictions and impact assessment.

14 REFERENCES

Aldam Geoscience, (2009). *Kalkaroo Deposit Groundwater Investigations: Phase 1 and 2 Summary Report*. Prepared for Kalkaroo Copper Pty Ltd, June 2009.

Australian Groundwater Technologies, (2013). *Kalkaroo Mine Dewatering and Hydrogeological Impact Assessment*. Prepared for Havilah Resource, AGT Report No. 1305-13-HAD, 4 December 2013.

Callen, R.A. (1990). *CURNAMONA, South Australia. 1:250 000 Geological Series – Explanatory Notes*. Dept. of Mines and Energy.

Chiang, W. and Kinzelbach, W. (1998). *Processing Modflow. A Simulation System for Modelling Groundwater Flow and Pollution*.

Chiang W.H. and Kinzelbach W. (1994). *PMPATH. An Advective Transport Model for Processing Modflow and Modflow*. Geological Survey of Hamburg, Germany.

Dawes W.R., Gilfedder M., Stauffacher M., Coram J., Hajkowicz S., Walker G.R., Young M. (2002) *Assessing the Viability of Recharge Reduction for Dryland Salinity Control: Wanilla, Eyre Peninsula*. Australian Journal of Soil Research 40, 1407–1424.

Golder Associates (2021). *Seepage Analysis to Support PEPR Application for the Kalkaroo TSF*. Internal report 20368231-002-M-Rev0.

Hazel, C.P. (2009). *Groundwater Hydraulics*. 2nd Ed., June 2009.

Johnson, A. (1967). *Specific Yield – Compilation of Specific Yields for Various Materials.* US Geological Survey Water Supply Paper 1662-D.

Kalkaroo Copper, 2021, Program for Environment Protection and Rehabilitation

McDonald, M.G. and Harbaugh, A.W. (1988). *MODFLOW, A Modular Three-dimensional Finite Difference Ground-water Flow Model*. U. S. Geological Survey, Open-file report 83-875, Chapter A1.

Simcore Software (2012). *Processing Modflow. An Integrated Modelling Environment for the Simulation of Groundwater Flow, Transport and Reactive Processes*. July, 2012.

South Australian Government (2015). *SA Environment Protection (Water Quality) Policy 2015*.

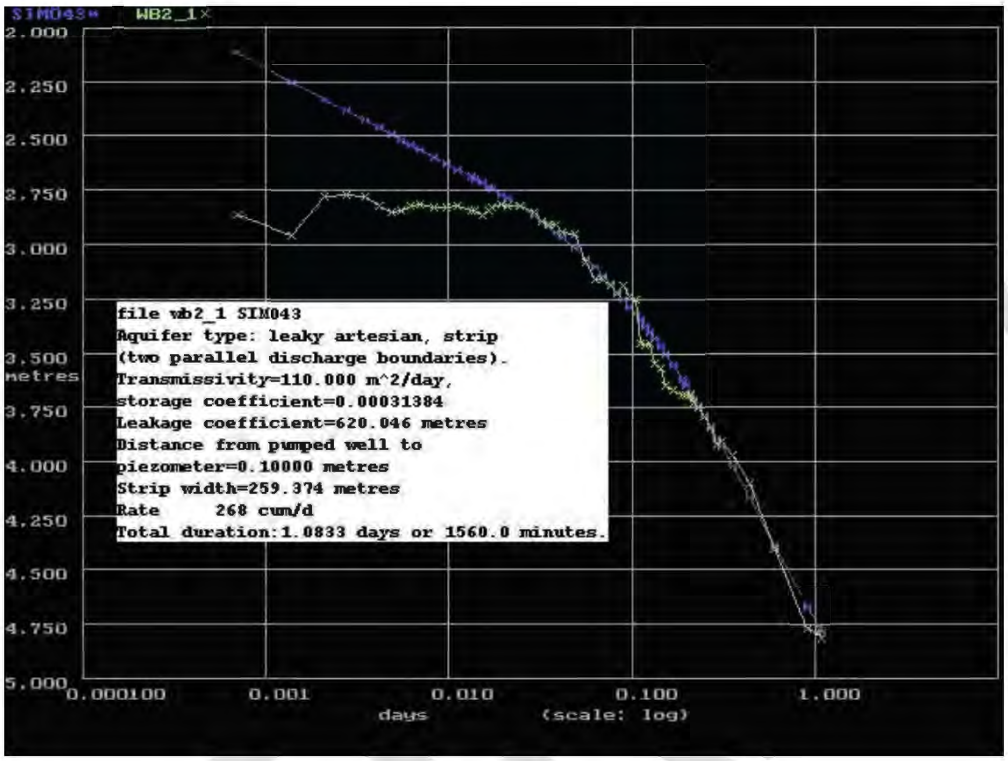
The Department for Energy and Mining, the Government of South Australia, *100K Geology – map unit symbology*, Sourced September 2021, https://map.sarig.sa.gov.au/

The Department for Energy and Mining, the Government of South Australia, *Geology – Palaeodrainage systems - Palaeogene*, Sourced September 2021, https://map.sarig.sa.gov.au/

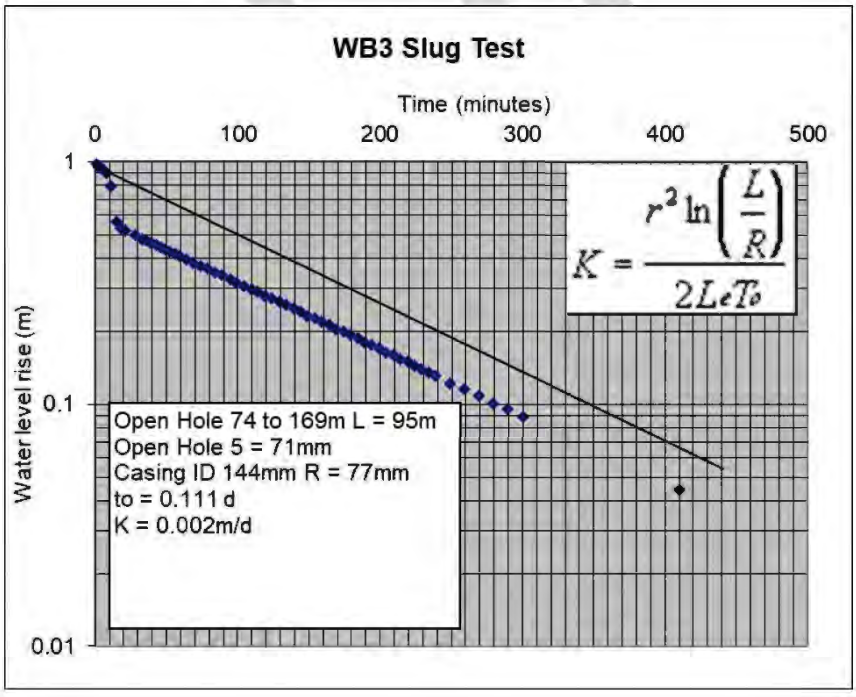
Waterhouse, J.D. and Beal, J.C., 1978. *An Assessment of the Hydrogeology of the Southern Frome Embayment*. Mining Review, Adelaide, 149:9-14.

APPENDIX A
AQUIFER TEST DATA SHEETS (AFTER ALDAM, 2009)

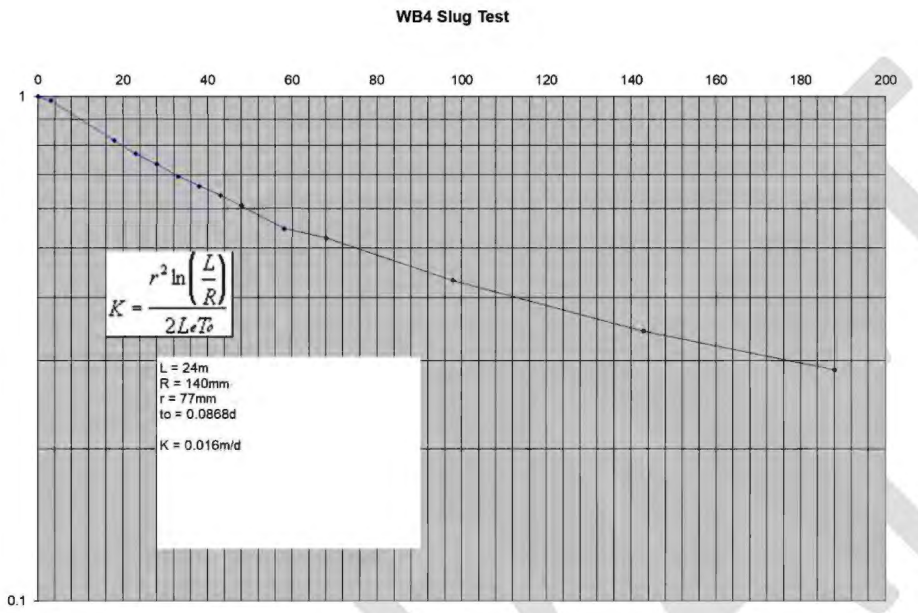
WB-2 Pump Test 1



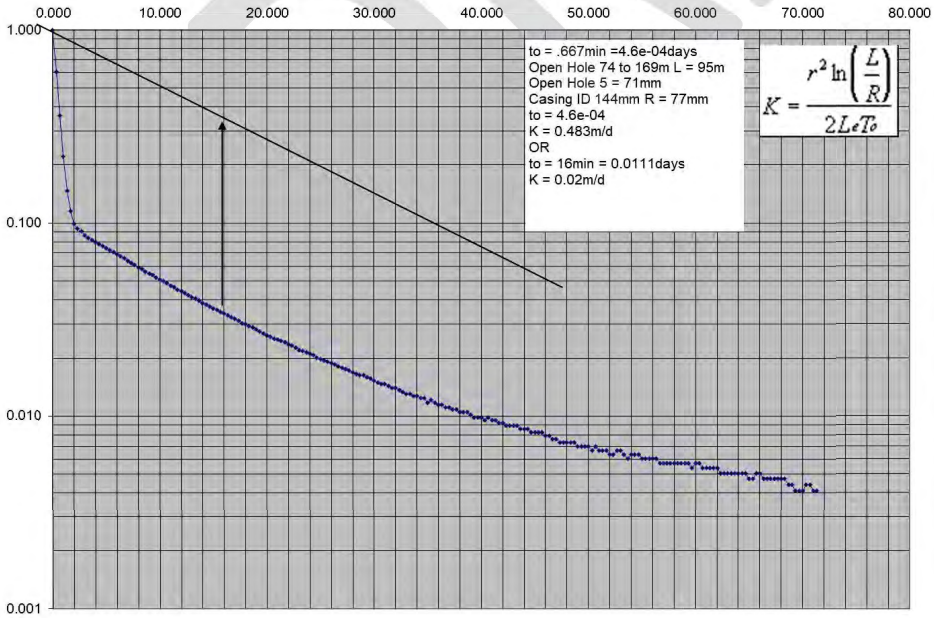
WB-3 Slug Test



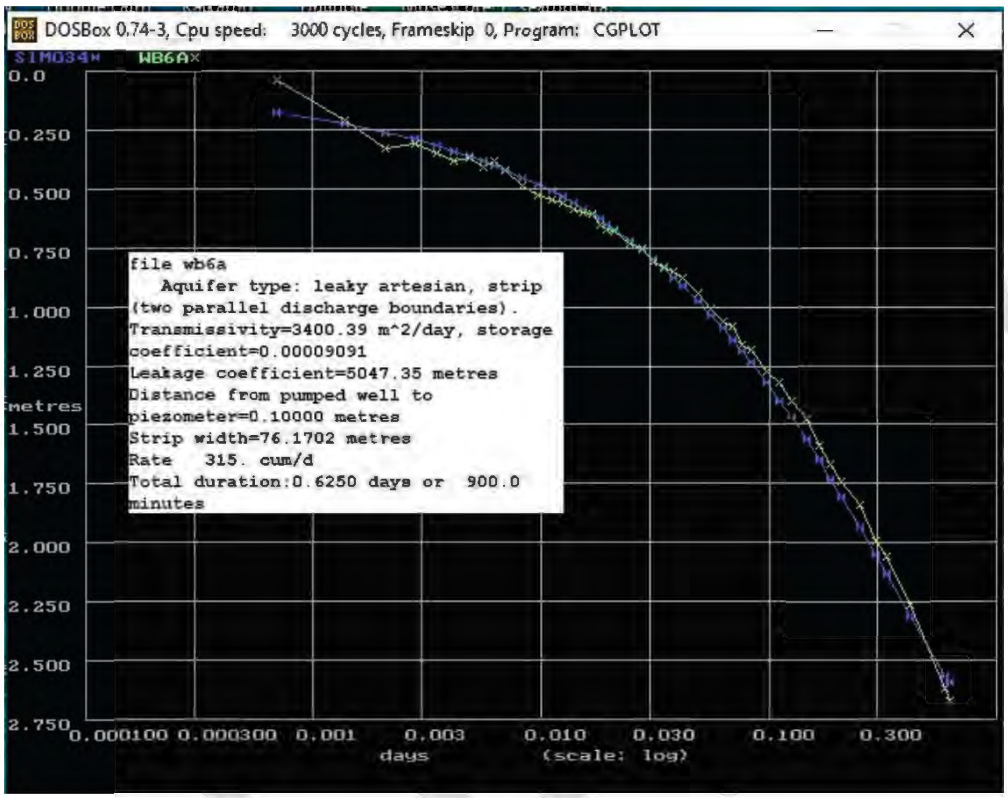
WB-4 Slug Test

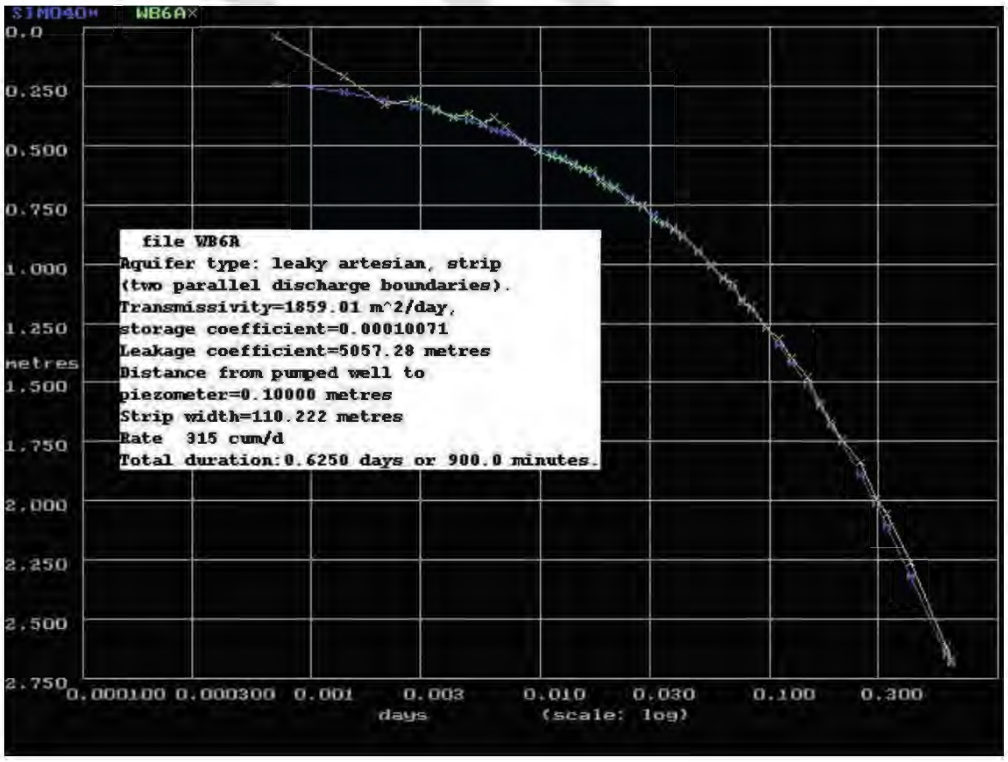


WB-5 Slug Test

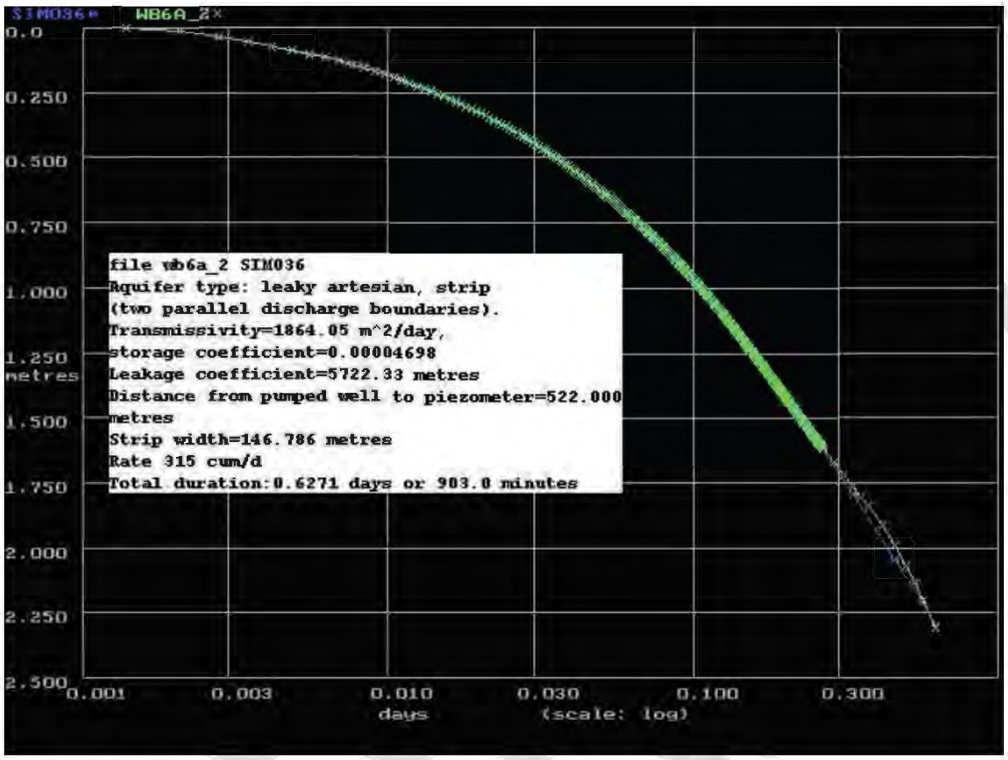


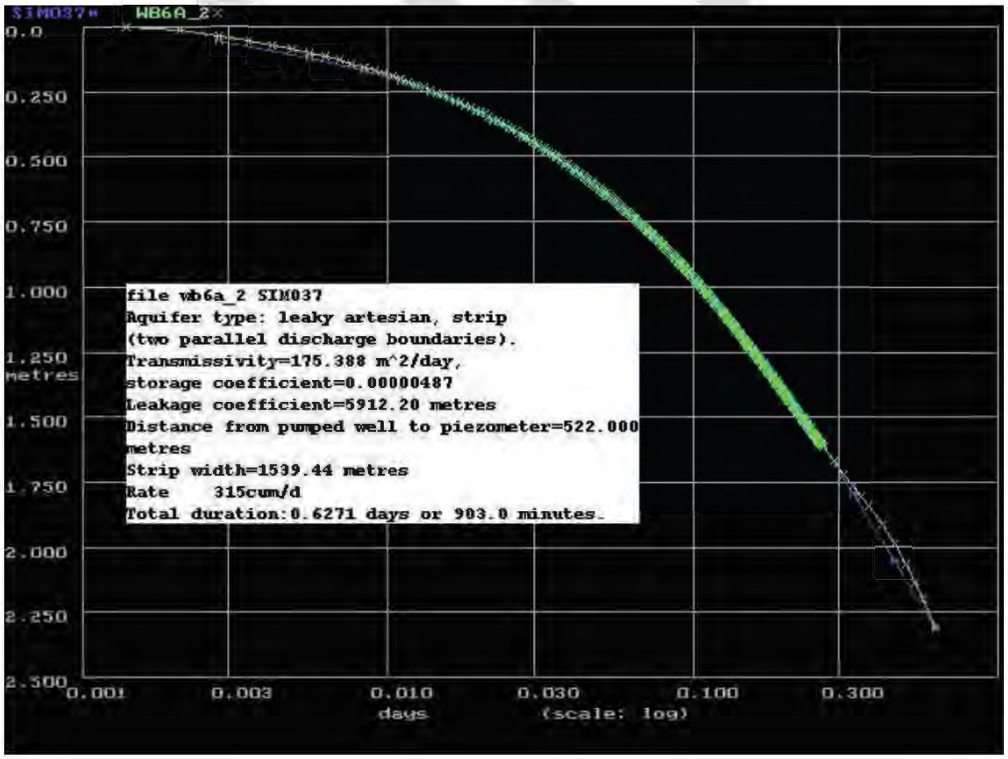
WB-6a Pump Test



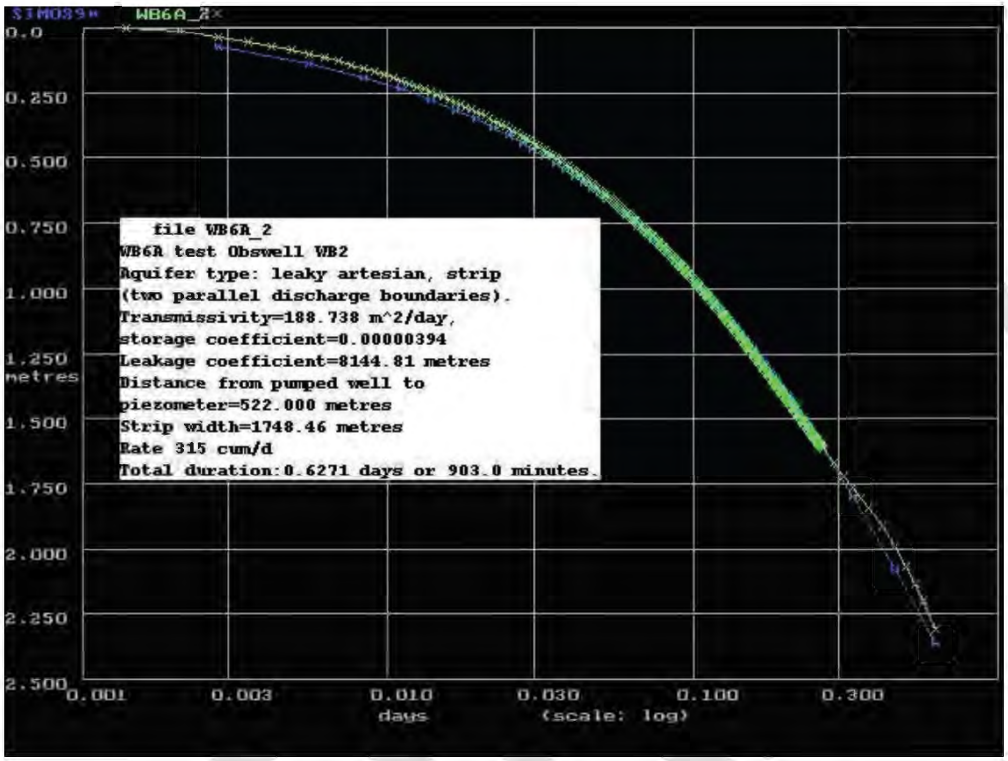


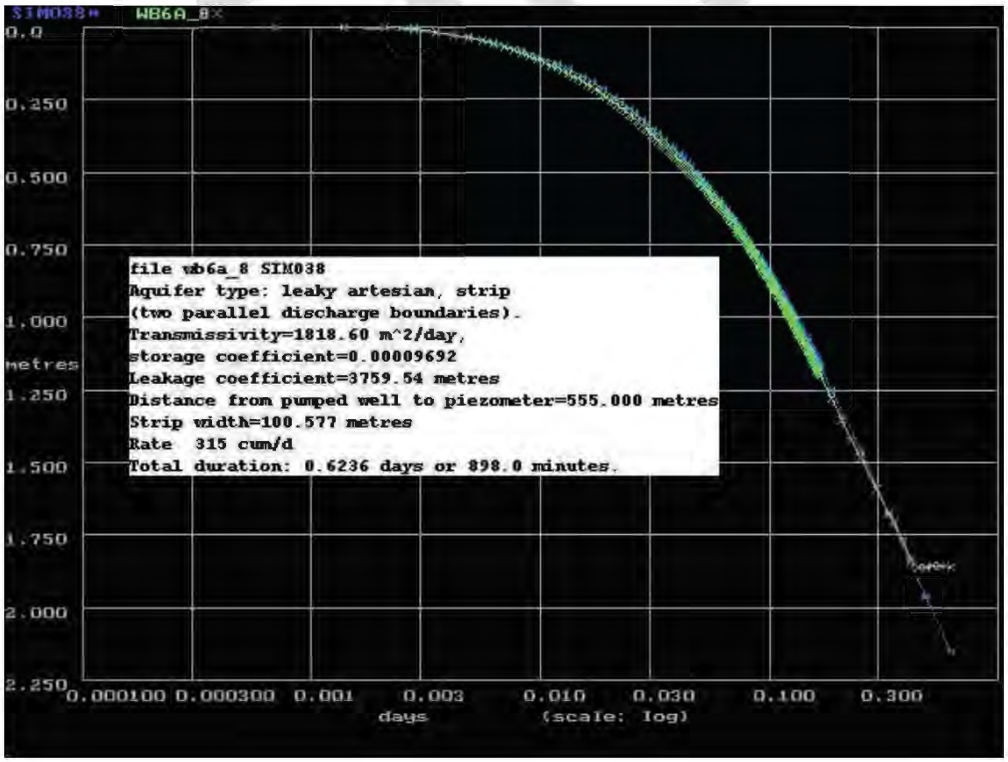
WB-6a Pump Test (continued)



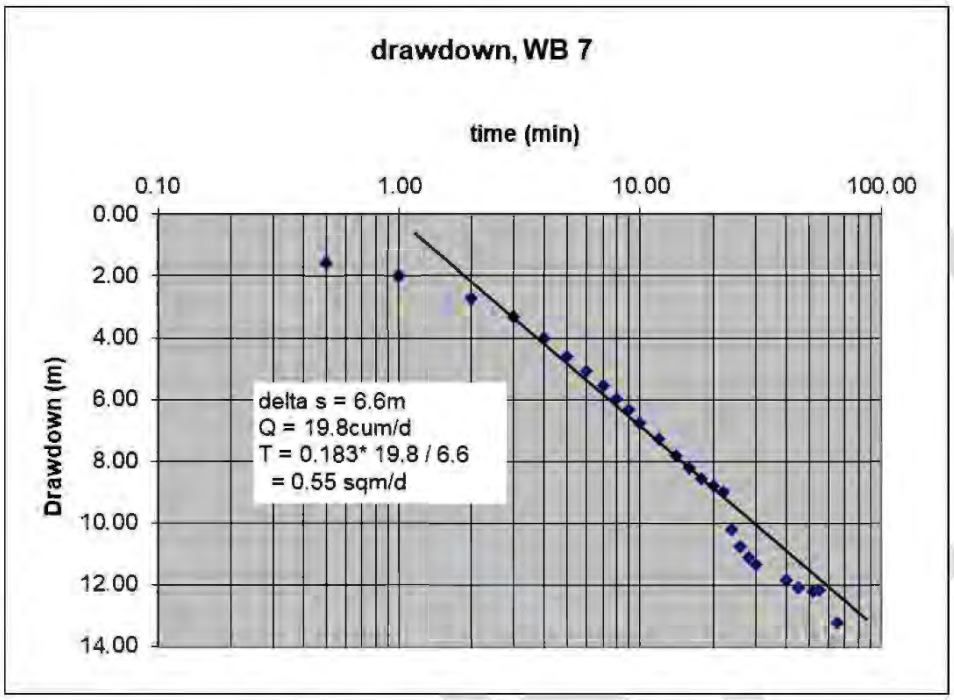


WB-6a Pump Test (continued)

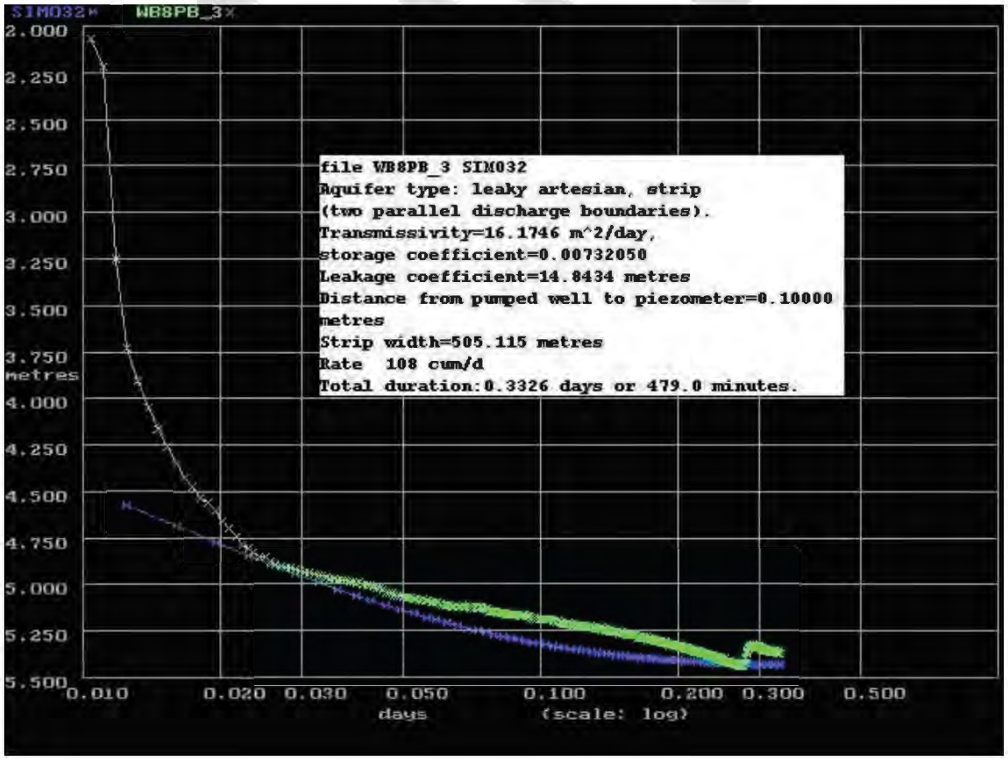




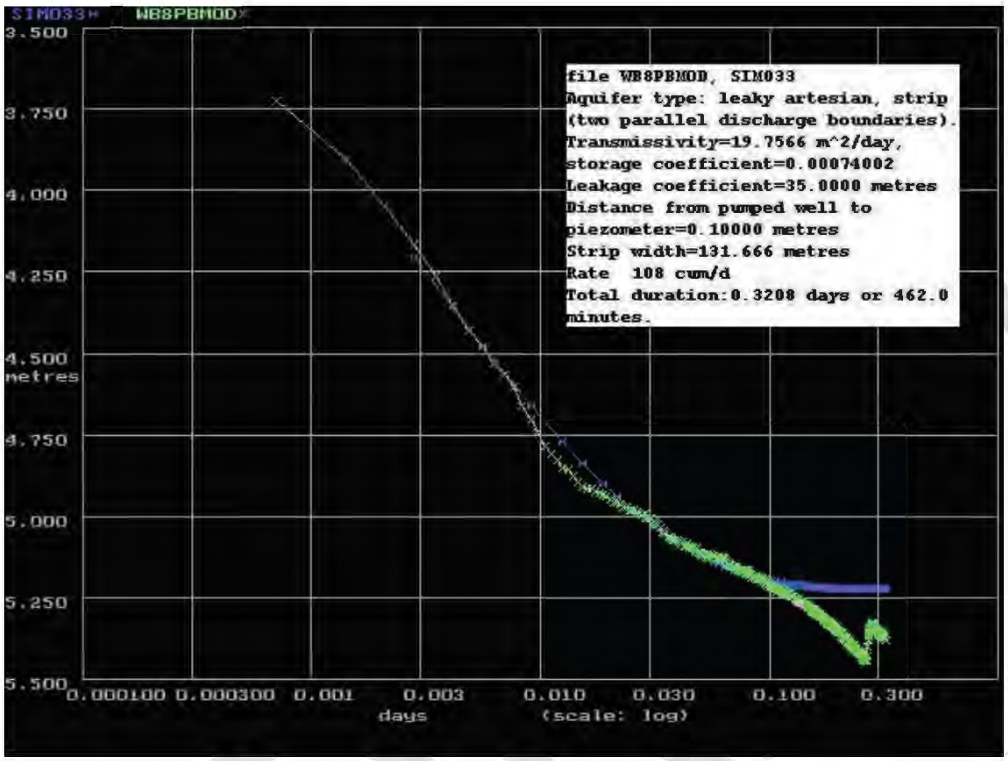
WB-7 Pump test

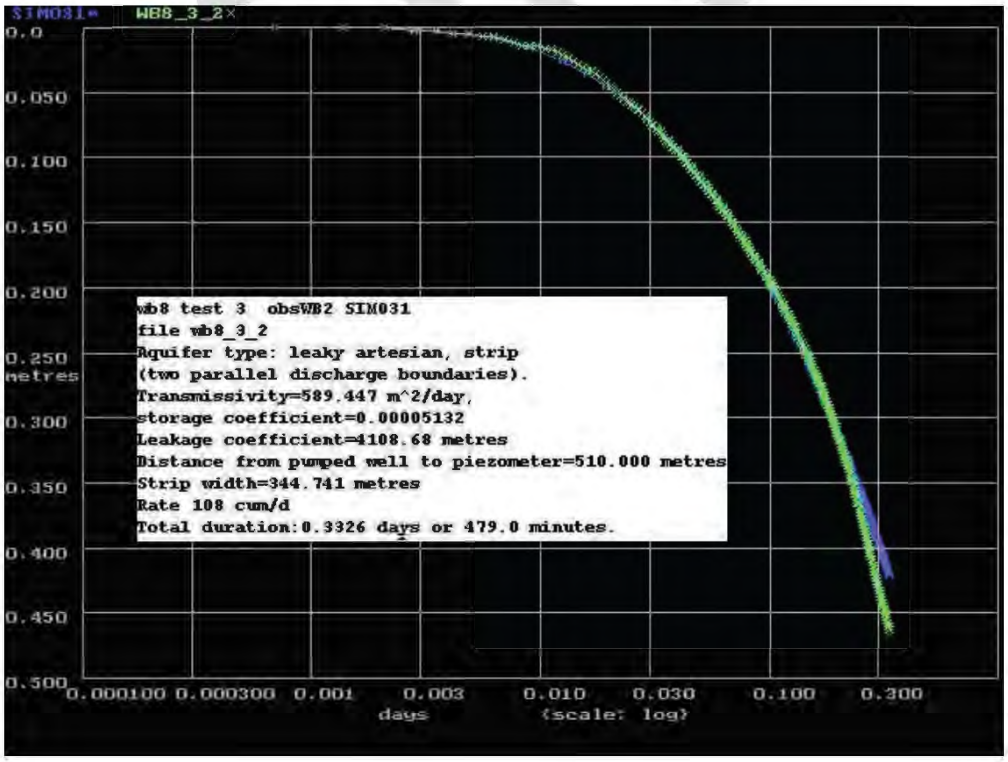


WB-8 Pump Test

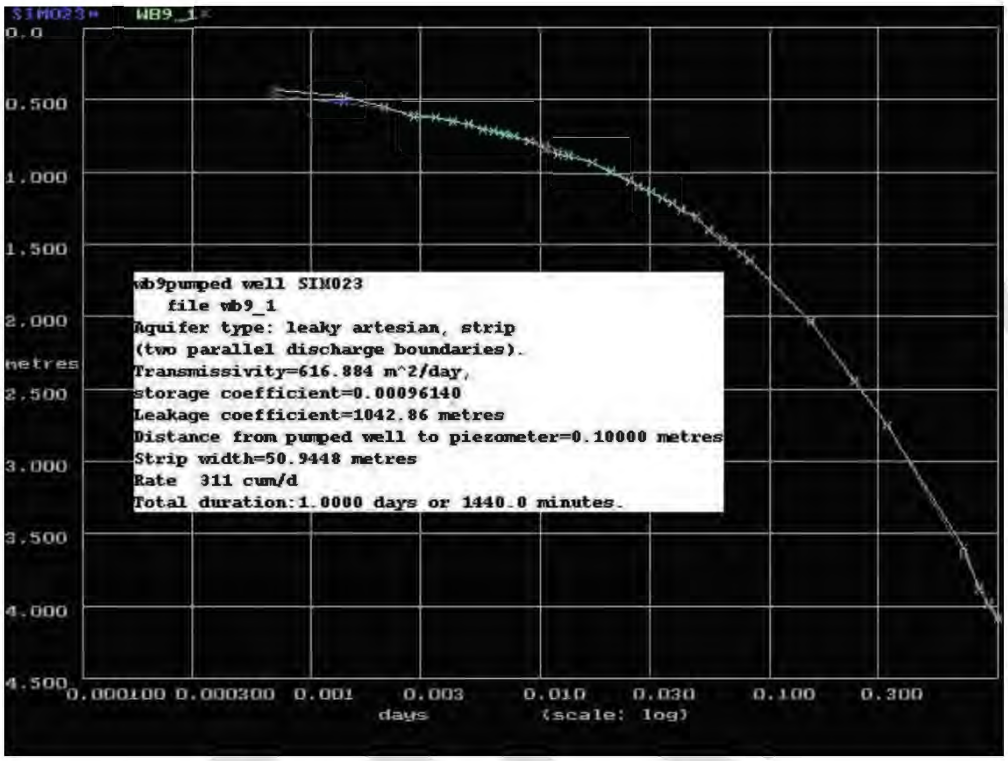


WB-8 Pump Test (continued)

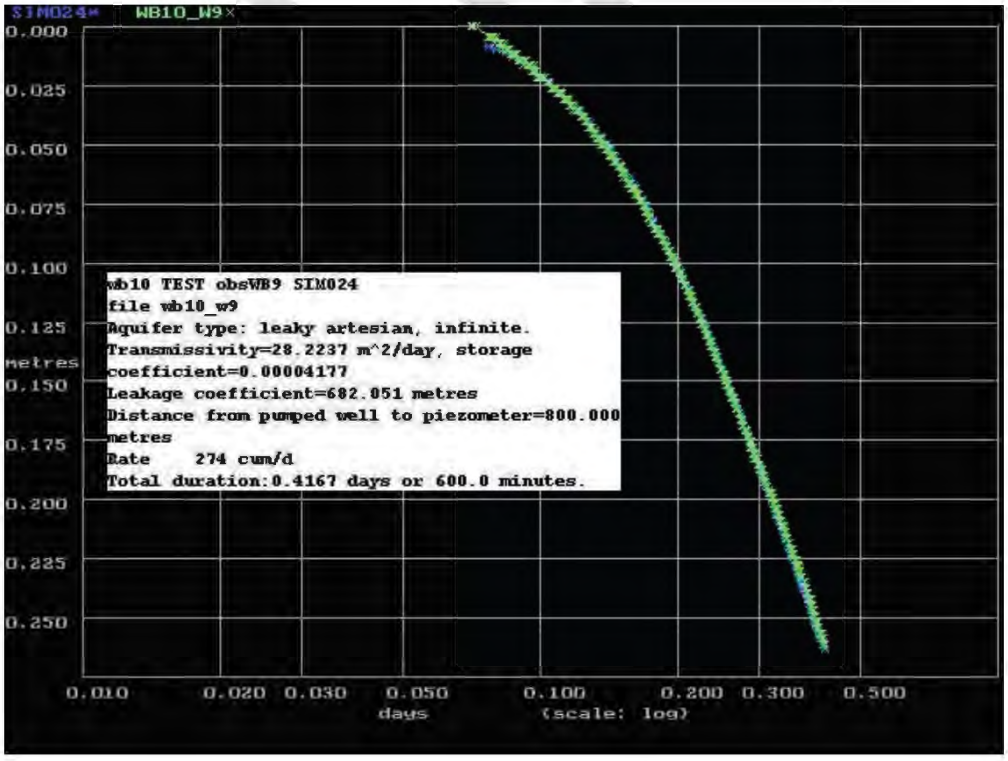




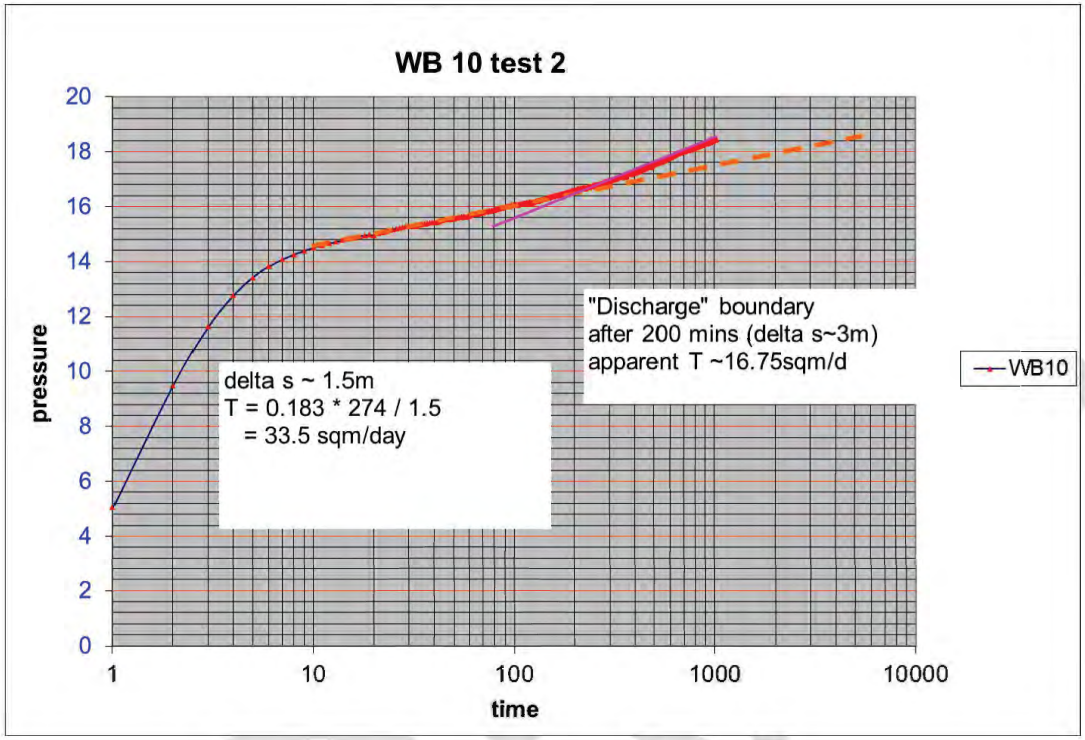
WB9 Pump Test



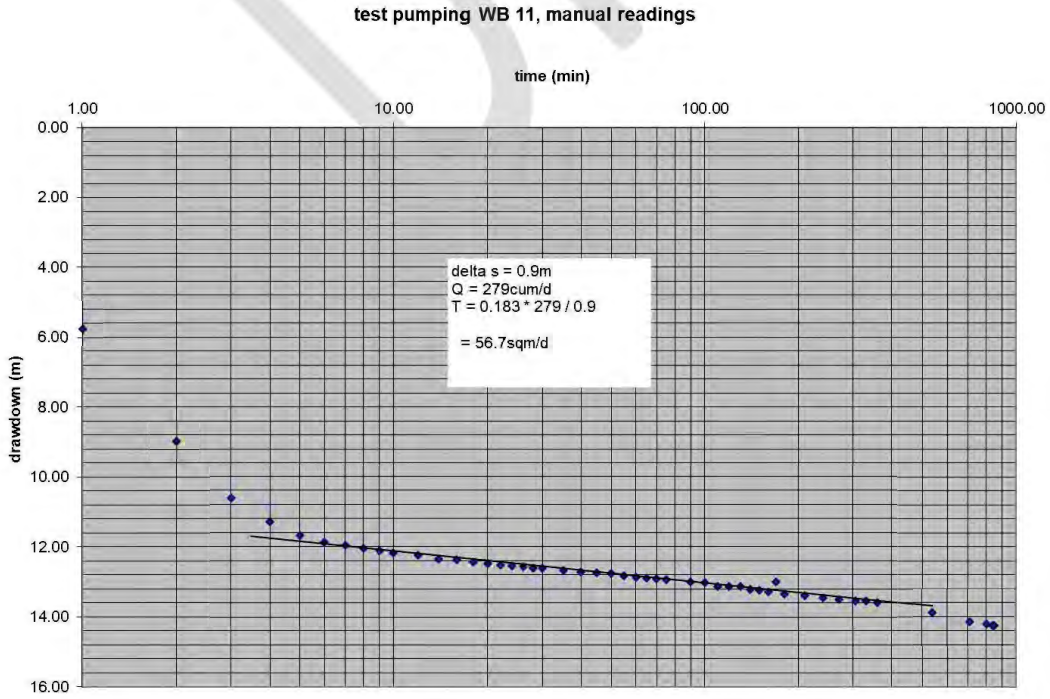
WB10 Pump Test 2



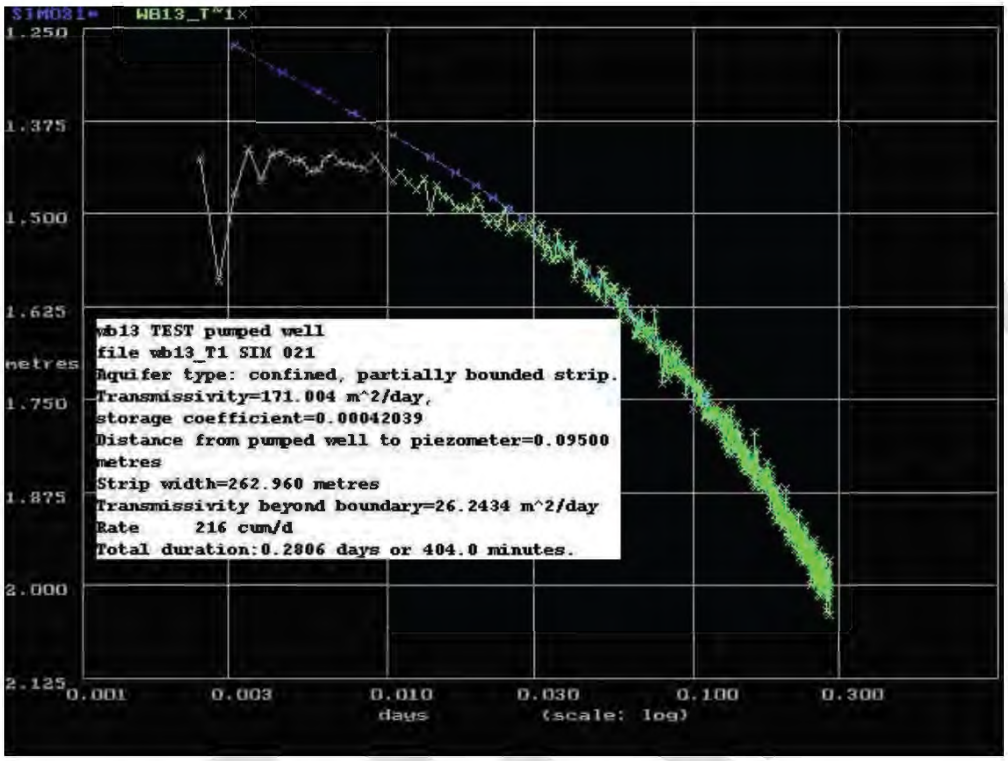
WB10 Pump Test 2 (continued)

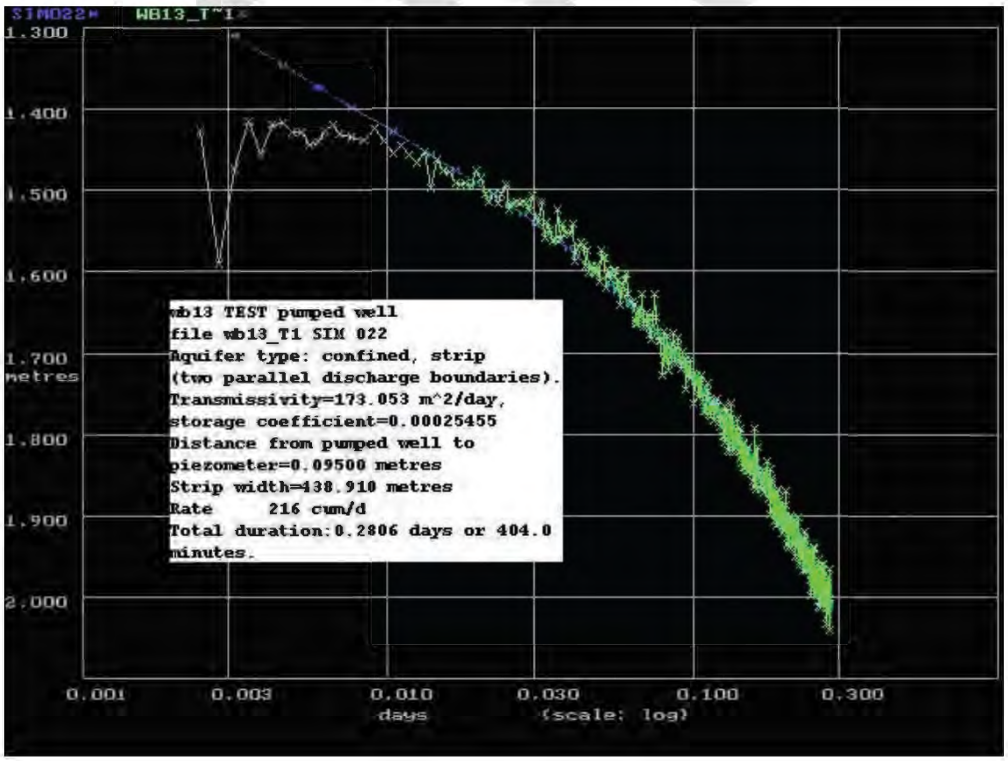


WB11 Pump Test

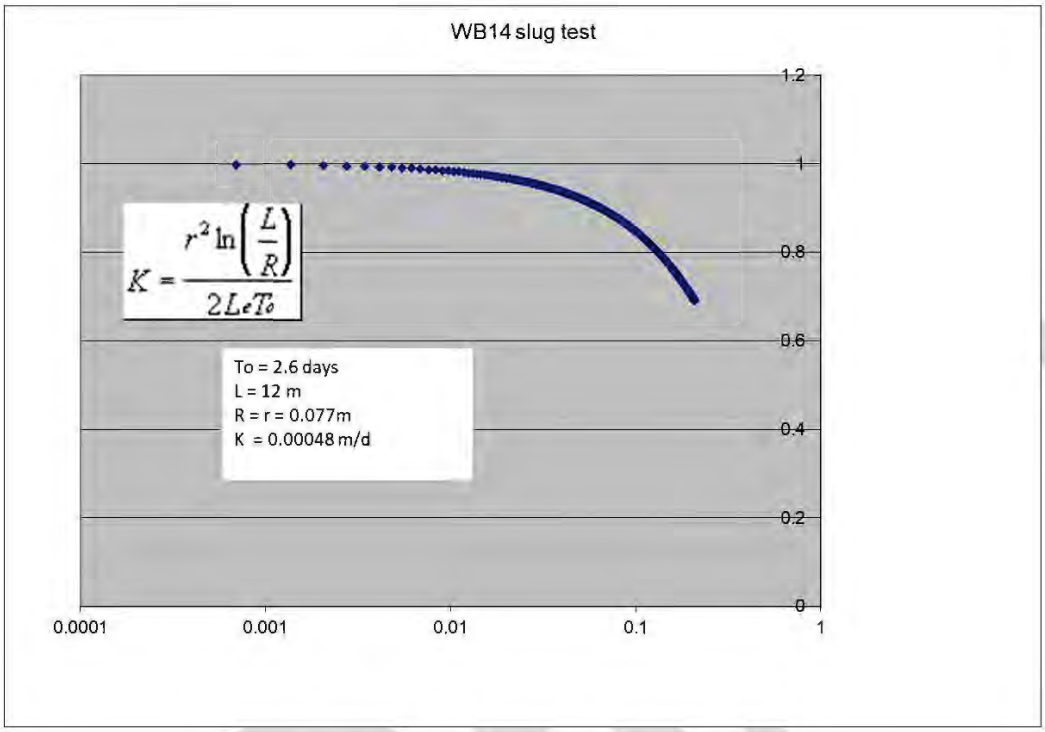


WB13 Pump Test



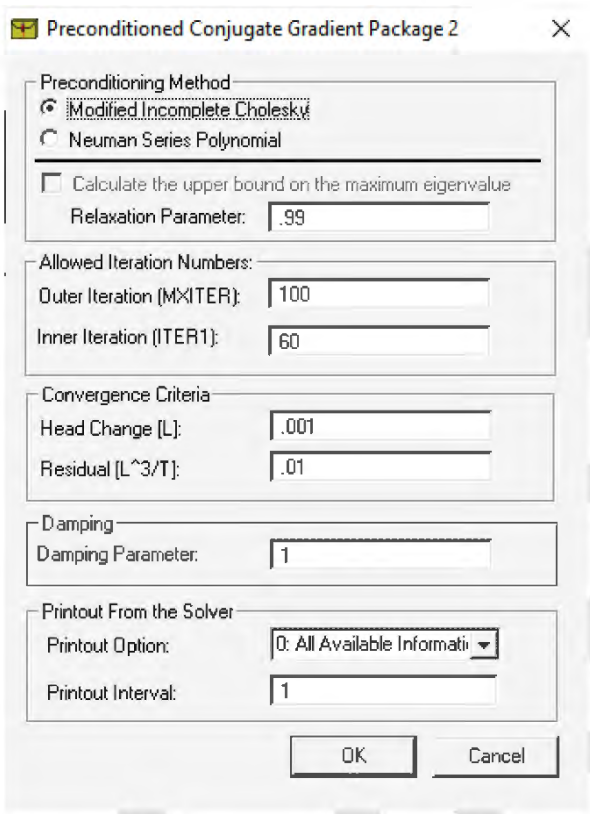


WB14 Slug Test

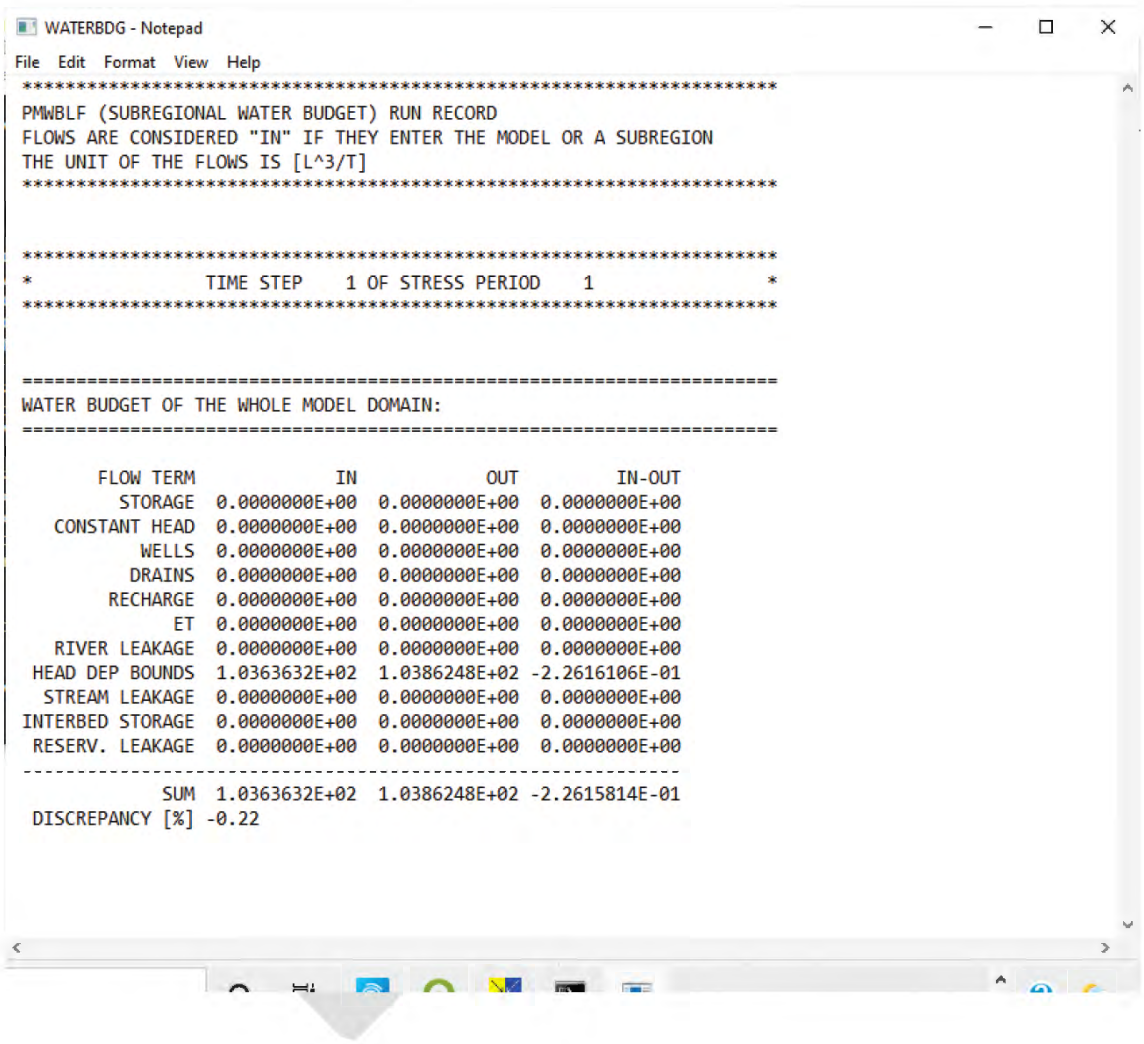


APPENDIX B
WATER BUDGET GRAPHS AND SOLVER CONVERGENCE CRITERIA

Steady state pre-mining solver settings



Steady state pre-mining water budget

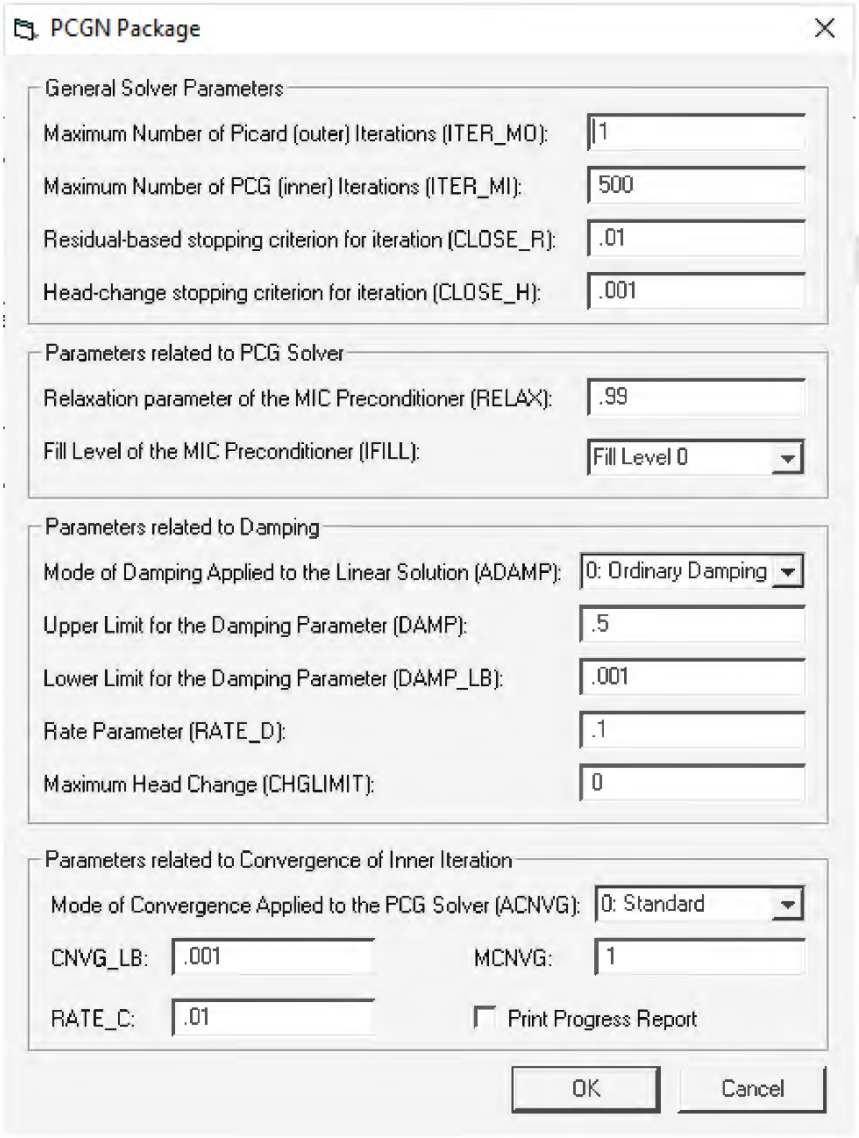


WATERBDG - Notepad

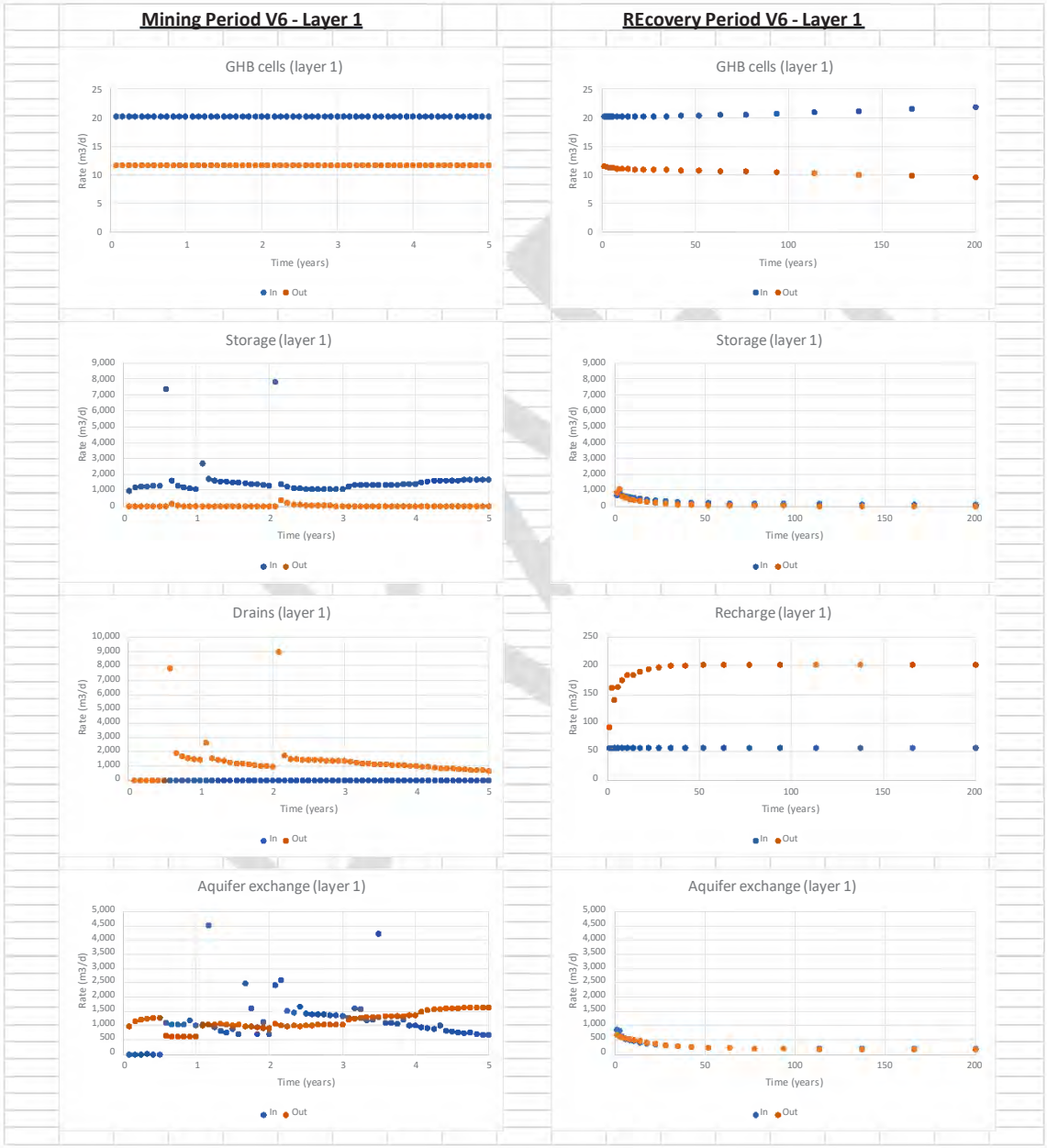
File Edit Format View Help

```
**************************************************************************
PMWBLF (SUBREGIONAL WATER BUDGET) RUN RECORD
FLOWS ARE CONSIDERED "IN" IF THEY ENTER THE MODEL OR A SUBREGION
THE UNIT OF THE FLOWS IS [L^3/T]
**************************************************************************


**************************************************************************
*                TIME STEP    1 OF STRESS PERIOD    1                    *
**************************************************************************


======================================================================
WATER BUDGET OF THE WHOLE MODEL DOMAIN:
======================================================================

       FLOW TERM             IN            OUT         IN-OUT
         STORAGE  0.0000000E+00  0.0000000E+00  0.0000000E+00
   CONSTANT HEAD  0.0000000E+00  0.0000000E+00  0.0000000E+00
           WELLS  0.0000000E+00  0.0000000E+00  0.0000000E+00
          DRAINS  0.0000000E+00  0.0000000E+00  0.0000000E+00
        RECHARGE  0.0000000E+00  0.0000000E+00  0.0000000E+00
              ET  0.0000000E+00  0.0000000E+00  0.0000000E+00
   RIVER LEAKAGE  0.0000000E+00  0.0000000E+00  0.0000000E+00
 HEAD DEP BOUNDS  1.0363632E+02  1.0386248E+02 -2.2616106E-01
  STREAM LEAKAGE  0.0000000E+00  0.0000000E+00  0.0000000E+00
INTERBED STORAGE  0.0000000E+00  0.0000000E+00  0.0000000E+00
 RESERV. LEAKAGE  0.0000000E+00  0.0000000E+00  0.0000000E+00
----------------------------------------------------------------------
             SUM  1.0363632E+02  1.0386248E+02 -2.2615814E-01
 DISCREPANCY [%] -0.22
```

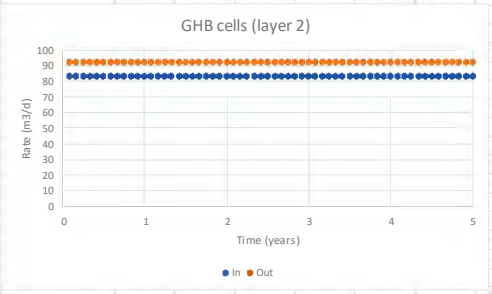
Mining and recovery period solver settings

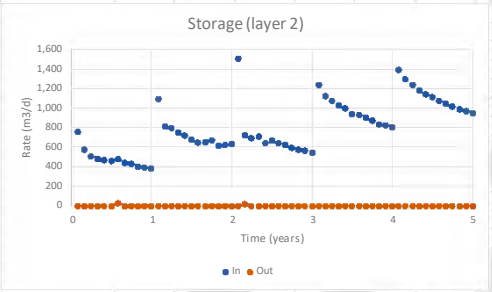


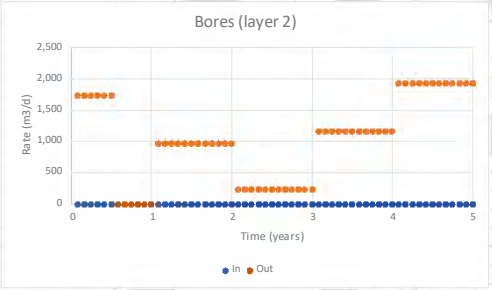
Mining and recovery period water budget graphs

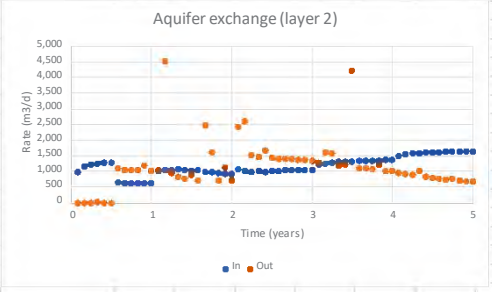


Mining Period V6 - Layer 2

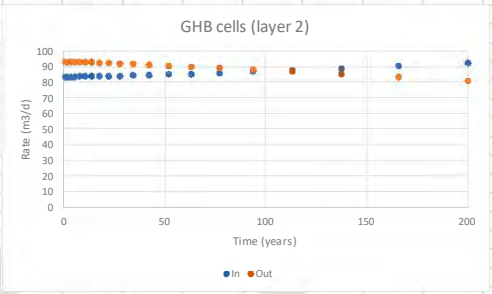


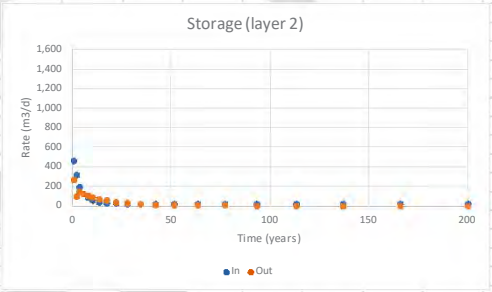


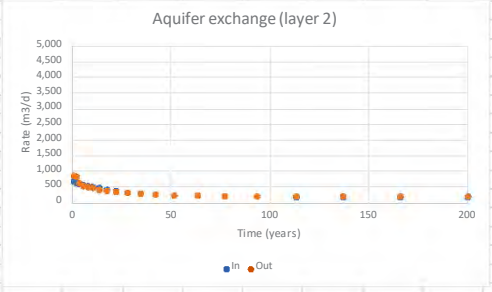




Recovery Period V6 - Layer 2







APPENDIX C
GROUNDWATER CHEMISTRY DATA

Parameter	Stock Guideline Value	Units	WB 2	WB 3	WB 7	WB 13	WB 9	WB 10	WB 11	WB 5	WB 6a
Salinity (TDS)*	<13,000	mg/L	33818	13945	20308	26601	22315	23328	25386	21352	29980
Calcium*	<1000	mg/L	1860	754	1150	1480	1050	1220	1290	1060	1490
Nitrate	<400	mg/L	0	0.09	0	0	0	0	0.01	0.05	0
Nitrite	<30	mg/L	0	0.11	0	0	0	0	0.01	1.44	0.54
Sulphate*	<1000	mg/L	2970	2360	2820	2810	3060	3320	3060	3190	3390
Aluminium	<5	mg/L									
Arsenic	<0.5	mg/L	0.062	0.099	0.083	0.034	0.029	0.028	0.036	0.012	0.082
Boron	<5	mg/L									
Cadmium	<0.01	mg/L	0	0.0002	0.0001	0.0006	0	0.0002	0.0002	0.0007	0.0019
Chromium	<1	mg/L	0	0.006	0	0	0	0	0	0	0.002
Cobalt	<1	mg/L	0.036	0.008	0.017	0.01	0.019	0.017	0.01	0.101	0.064
Copper*	<0.5	mg/L	0.009	0.057	0.015	0.021	0.204	0.587	0.026	0.218	0.057
Fluoride	<2	mg/L									
Lead	<0.1	mg/L	0.002	0.076	0.007	0.002	0	0	0	0.001	0.002
Mercury*	<0.002	mg/L	0	0	0.0031	0	0	0.004	0	0	0
Molybdenum	<0.15	mg/L									
Nickel	<1	mg/L	0.023	0.031	0.007	0.006	0.019	0.015	0.014	0.06	0.022
Selenium	<0.02	mg/L									
Uranium	<0.2	mg/L									
Zinc	<20	mg/L	0.042	1.13	0.081	0.009	0.029	0.028	0.011	0.278	0.043

Parameter	Stock Guideline Value	Units	WB 2	WB 3	WB 7	WB 13	WB 9	WB 10	WB 11	WB 5	WB 6a
Magnesium* (old guideline)	<600 (1992)	mg/L	922	337	508	736	452	543	626	548	750
Chloride	-	mg/L	18500	6500	9610	13900	11600	11900	13200	10400	15800
Sodium	-	mg/L	9390	3860	6030	7500	5990	6170	7040	5730	8420
Potassium	-	mg/L	131	76	116	81	41	67	39	300	38
Beryllium	-	mg/L	0	0	0	0	0	0.001	0.002	0	0.001
Barium	-	mg/L	0.031	0.062	0.026	0.028	0.023	0.027	0.032	0.073	0.033
Manganese	-	mg/L	3.24	1.02	2	3.16	1.77	2.09	3.92	3.02	3.5
Vanadium	-	mg/L	0	0.01	0.01	0	0	0.01	0.02	0	0
Total Anions	-	meq/L	584	234	331	454	393	408	438	363	519
Total Cations	-	meq/L	580	235	364	463	351	376	423	355	504
Ionic Balance	-	%	0.38	0.38	4.72	0.98	5.61	4.15	1.77	1.15	1.58
Total Hardness as CaCO3	-	mg/L	8430	3270	4950	6720	4490	5290	5810	4890	6820
Hydroxide Alkalinity as CaCO3	-	mg/L	0	0	0	0	0	0	0	0	0
Carbonate - Alkalinity as CaCO3	-	mg/L	0	0	10	0	0	0	0	0	0
calculated CO32- from CaCO3 alkalinity	-	mg/L	0	0	6	0	0	0	0	0	0

Parameter	Stock Guideline Value	Units	WB 2	WB 3	WB 7	WB 13	WB 9	WB 10	WB 11	WB 5	WB 6a
calculated HCO3- from CaCO3 alkalinity	-	mg/L	51.24	67.1	75.64	111.02	146.4	128.1	154.94	145.18	107.36
Bicarbonate Alkalinity as CaCO3	-	mg/L	42	55	62	91	120	105	127	119	88
Total Alkalinity as CaCO3	-	mg/L	42	55	72	91	120	105	127	119	88
pH	-	-	7.37	7.47	7.44	7.51	6.95	6.69	6.39	6.85	6.95
Electrical Conductivity @ 25°C	-	µS/cm	33700	14800	20800	27500	34600	36800	40100	33800	51400

WATER TECHNOLOGY
WATER, COASTAL & ENVIRONMENTAL CONSULTANTS

Melbourne
15 Business Park Drive
Notting Hill VIC 3168
Telephone (03) 8526 0800

Sydney
Suite 3, Level 1, 20 Wentworth Street
Parramatta NSW 2150
Telephone (02) 9354 0300

Brisbane
Level 5, 43 Peel Street
South Brisbane QLD 4101
Telephone (07) 3105 1460

Adelaide
1/198 Greenhill Road
Eastwood SA 5063
Telephone (08) 8378 8000

Perth
Ground Floor, 430 Roberts Road
Subiaco WA 6008
Telephone (08) 6555 0105

New Zealand
7/3 Empire Street
Cambridge New Zealand 3434
Telephone +64 27 777 0989

Wangaratta
First Floor, 40 Rowan Street
Wangaratta VIC 3677
Telephone (03) 5721 2650

Geelong
51 Little Fyans Street
Geelong VIC 3220
Telephone (03) 8526 0800

Wimmera
597 Joel South Road
Stawell VIC 3380
Telephone 0438 510 240

Gold Coast
Suite 37, Level 4, 194 Varsity Parade
Varsity Lakes QLD 4227
Telephone (07) 5676 7602

watertech.com.au

APPENDIX 2

Native Vegetation Management Plan

Kalkaroo Copper-Gold Mine

Native Vegetation Management Plan

Kalkaroo Copper Project

(ML6498, ML6499, ML6500, MPL158)

Exploratory Drilling Program and Temporary Camp

Clearance under the *Native Vegetation Regulations 2017*

15/04/2026

Prepared by Ecosphere Ecological Solutions

Document Information and Distribution

Document information	
Item	**Detail**
Project number	O60219
Document title	Native Vegetation Management Plan, Kalkaroo Exploratory Drilling Program
Client	Havilah Resources Ltd
Prepared by	Ecosphere Ecological Solutions
Document status	Final
Version number	4

Document distribution				
Authors	**Document status**	**Version number**	**Date of issue**	**Issued to**
Andrew Sinel	Draft	1	24/02/2026	Geoff Borg, Havilah Resources
Andrew Sinel	Draft	2	25/02/2026	Geoff Borg, Havilah Resources
Andrew Sinel	Final	3	26/02/2026	Geoff Borg, Havilah Resources
Andrew Sinel	Final	3	26/02/2026	Geoff Borg, Havilah Resources

Executive Summary

This Native Vegetation Management Plan (NVMP) has been prepared to support Mining Program for Environment Protection and Rehabilitation (MPEPR) approval of an exploratory drilling program to be undertaken within the Kalkaroo Pastoral Lease, located in the North East Pastoral Zone of South Australia, on Kalkaroo Copper Pty Ltd's mining leases ML6498, ML6499 and ML6500 and multi-purpose lease MPL158. Kalkaroo Copper is a wholly owned subsidiary of Havilah Resources Limited.

The proposed program will involve the establishment of temporary drill pads for diamond and reverse circulation drill holes to be accessed by a combination of existing station tracks and temporary access tracks, additional laydown area on ML6498, associated temporary minor infrastructure and re-establishment of a temporary camp in the same area as a previous temporary camp (2022-23). The total disturbance footprint has been designed to be minimal and temporary in nature. The site is largely within the bounds of areas previously drilled in exploratory and due diligence programs associated within relevant ML's and MPL's.

Previous disturbance has been historically rehabilitated and has demonstrated active natural recovery and regeneration of the ecosystems within the relevant leases. In the presence of suitable seasonal conditions, with management of rehabilitation practices, ongoing management and monitoring, natural regeneration has reliably occurred historically.

This NVMP demonstrates compliance with:

- *Native Vegetation Act 1991*
- *Native Vegetation Regulations 2017*
- DEM Mining PEPR requirements

The Plan applies the avoid–minimise–rehabilitate hierarchy and commits to progressive rehabilitation and ongoing post-disturbance management and monitoring to ensure vegetation recovery consistent with regional pastoral zone management principles.

Contents

List of Figures

List of Tables

1 Background

1.1 Description

This Native Vegetation Management Plan (NVMP) has been prepared to support the proposed exploratory drilling program at the Kalkaroo Project under Mining Program for Environment Protection and Rehabilitation, pursuant to the requirements of the *Mining Act 1971* and in accordance with the *Native Vegetation Act 1991* and *Native Vegetation Regulations 2017*.

The proposed program comprises:

- Construction of approximately 275 temporary drill pad sites.
- Establishment of associated access tracks where required.
- Temporary accommodation camp within same area as previous temporary camp (2022-23).
- Drillers laydown area.
- Core processing facility.

The Kalkaroo Project is located within the Kalkaroo Pastoral Lease in the North East Pastoral Zone of South Australia, approximately 90 km north-west of Broken Hill and approximately 50 km north of Mingary Siding on the transcontinental railway line at the Barrier Highway. The temporary camp infrastructure is situated within MPL 158 (248.8 ha), granted for mining-related infrastructure, while the drill pad sites and access tracks are located within ML 6498 (497.5 ha), ML 6499 (974.9ha), and ML 6500 (138ha), granted for construction materials and metallic minerals.

Historically, the Kalkaroo Pastoral Lease has been utilised for low-intensity pastoral grazing, predominantly sheep grazing, with a carrying capacity of approximately 12 sheep per square kilometre. The land was destocked in October 2009 to promote vegetative recovery, stabilise soils and reduce wind erosion following historical grazing pressure. Since destocking, vegetation communities within the lease have demonstrated measurable natural regeneration in response to seasonal rainfall patterns.

Vegetation within the project area is characterised by sparsely distributed perennial shrub species with ground cover largely comprising ephemeral grasses and forbs that fluctuate in response to rainfall. The generally open vegetation structure is typical of the arid pastoral zone and provides habitat for the nationally listed Plains-wanderer (*Pedionomus torquatus*). The vegetation communities present are disturbance-adapted and have demonstrated resilience where grazing pressure is absent and soil profiles are appropriately stabilised following disturbance.

The proposed drilling program represents temporary disturbance associated with mineral exploration activities. All drill pads, access tracks and ancillary disturbance areas will be rehabilitated progressively in accordance with the approved MPEPR and this NVMP. Rehabilitation measures will include:

- Removal of infrastructure upon completion of drilling;
- Re-levelling of disturbed surfaces;
- Light ripping of compacted soils where required to promote infiltration and seed capture;
- Retention and redistribution of available topsoil and vegetative material to encourage natural regeneration.

Previous drilling programs within the lease have demonstrated effective natural recovery of vegetation following implementation of these measures, particularly in the continued absence of stock grazing.

Given the temporary nature of the disturbance, the demonstrated regenerative capacity of the vegetation communities, and the commitment to progressive rehabilitation consistent with DEM requirements, this NVMP provides the basis for assessment of clearance in accordance with the *Native Vegetation Regulations 2017*. Havilah seeks consideration that clearance associated with temporary drill pads and access tracks be assessed in the context of exploration-related

disturbance with demonstrated rehabilitation outcomes, and that a Significant Environmental Benefit (SEB) offset not be required where clearance is temporary and rehabilitation achieves return to pre-disturbance ecological function.

This NVMP outlines the existing vegetation condition, proposed disturbance footprint, avoidance and minimisation measures, rehabilitation methodology, and monitoring framework to ensure compliance with statutory obligations and environmental protection objectives

1.2 Interim Biogeographic Regionalisation for Australia (IBRA)

The Interim Biogeographic Regionalisation for Australia (IBRA) identifies geographically distinct Bioregions based on common climate, geology, landform, native vegetation, and species information. These Bioregions are further refined into IBRA Subregions and where applicable into IBRA Environmental Associations. The Project area lies within the Flinders Lofty Block Bioregion and the Olary Spur Subregion. The Olary Spur Subregion has 97 % of its area composed of remnant native vegetation of which 1 % is formally protected. The Project area does not form part of an IBRA Environmental Association.

1.3 General Location

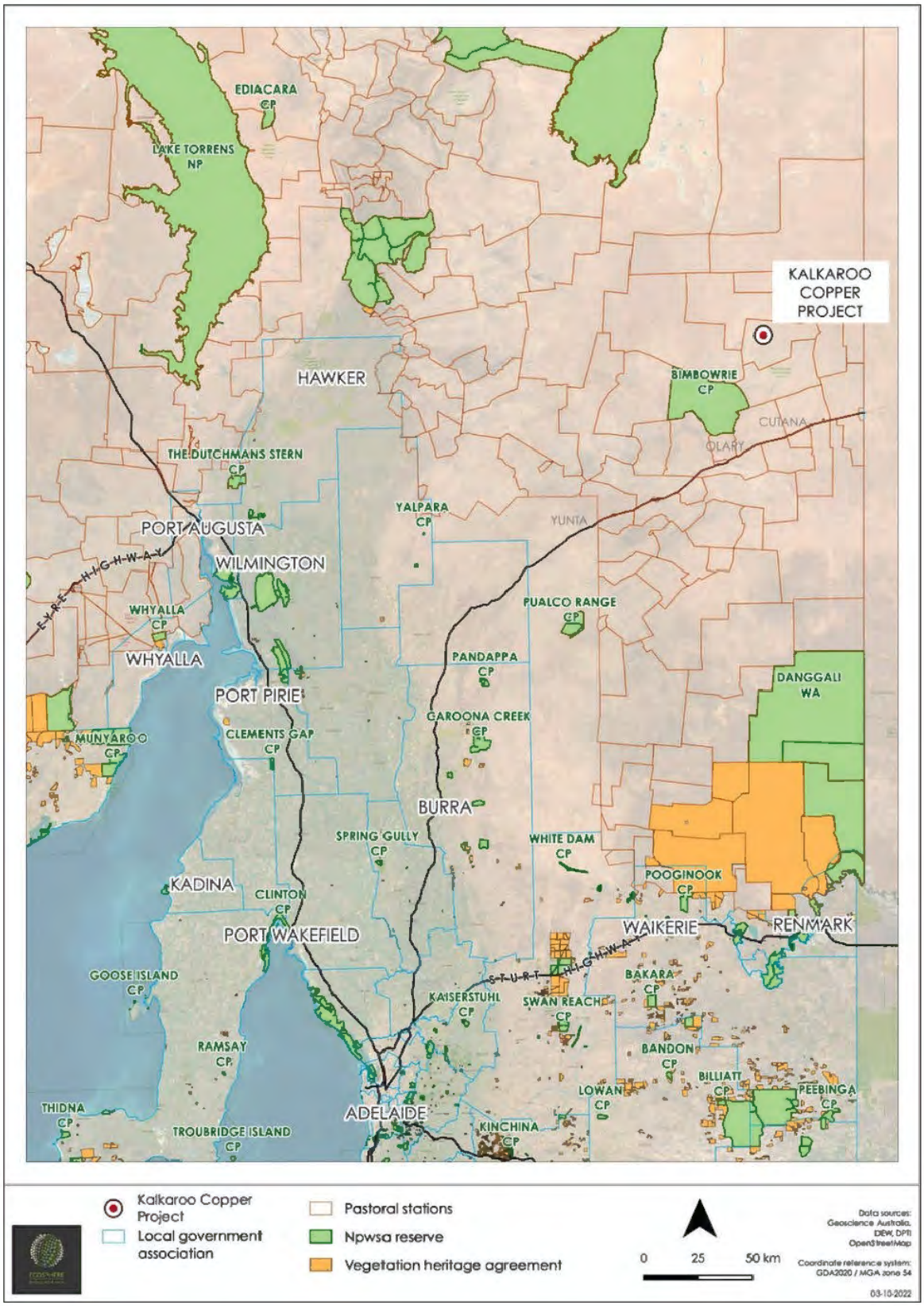


Figure 1. Location of the Project area and construction footprint.

1.4 Details of the Proposal

The exploratory drilling program will involve:

- Reverse circulation (RC) diamond drilling
- Temporary drill pads (approximately 25 m × 35 m maximum)
- Limited new access tracks (maximum 3 m width)
- Temporary water storage (tanks or bladders)
- Drill sumps (where required)
- Disturbance will be staged and progressively rehabilitated upon completion of drilling at each location.
- Laydown area on ML6498
- Temporary camp and associated infrastructure on MPL158.
- Reconfigure the existing core yard to include a core processing facility consisting of a temporary office building, sea containers, roller racks, core saws and a laydown area on MPL 158

1.4.1 Legislative and regulatory framework

In accordance with the conditions of the mining leases, it is Havilah's assessment that planned work under this MPEPR will not result in a loss of abundance or diversity of native vegetation. Using the Native Vegetation Clearance Mitigation Hierarchy this will be achieved by:

- Avoid clearance:
    - Access tracks and drill holes will be located where overland (on vegetation) access and safe working will be possible. Being predominantly grassland with occasional shrubs, no vegetation clearance will be required.
    - The exploration camp will be temporary infrastructure placed on the ground surface, i.e. no excavation and no new hardstand.
    - No trees or large shrubs will be removed during proposed works.
- Minimise clearance:
    - Where shrubs or low vegetation makes an avoidable work area unsafe, it will be removed using hand tools where possible and stockpiled for spreading during rehabilitation.
    - Temporary clearance will be limited to the excavation of sumps on drill pads. Cleared vegetation and topsoil will be stockpiled and protected ready for replacement during rehabilitation.
- Rehabilitate / Restore:
    - All disturbed areas will be progressively rehabilitated as the work program proceeds.
- Offset:
    - Not required for the proposed work as all areas will be rehabilitated to restore natural conditions and encourage regrowth of native vegetation.
    - For work areas (overland access tracks and drill pads) where native vegetation is disturbed by traffic movement or minor clearance will be rehabilitated as described in the Rehabilitation section of the MPEPR.
    - Disturbance and Rehabilitation of native vegetation will be fully documented in Environmental Compliance Reports to be submitted to DEM.

2 Methods

2.1 Baseline Survey

The baseline vegetation data and field survey was conducted in January 2021 by NVC accredited ecologist Andrew Sinel with updated vegetation assessments undertaken by Ecosphere to ground truth existing conditions in June 2024.

2.1.1 Vegetation survey

Methodology was conducted in accordance with NVC requirements, as outlined in the Rangelands Assessment Manual (NVC 2019). Background to the RAM method, and identification of landforms present within the tenements is presented below.

The NVC RAM has been developed for vegetation assessments undertaken for the NVC, including clearance or regulation application areas, potential and established SEB offset areas and Heritage Agreements. The method aligns the assessment of vegetation (and land) condition with the RAM developed by South Australian Arid Lands Landscape Management Region (SAAL) for the rapid assessment of pastoral properties in sheep and cattle country but is adapted for native vegetation assessments in arid rangelands throughout South Australia (NVC 2019).

Given the large scale of activities that occur in the rangelands, stratifying the landscape into homogeneous units is often difficult and time consuming. Vegetation compositions in the arid zone are largely driven by landform features, such as ridges, slopes or flats, which influence water redistributions in the landscape. Vegetation condition, however, is mainly driven by pastoral use (history of stock grazing). Information, such as pastoral grazing gradients, is available to assist with the division of the landscape based on these features before going into the field (NVC 2019).

2.1.2 Fauna survey

Numerous flora and fauna assessment shave been undertaken across the Kalkaroo PL for the purposes of clearance and offset assessments. The most recent was undertaken in 2021 with sites assessed across the ML and potential offset areas to determine the presence and abundance of species present. In addition, numerous historical assessments have been undertaken associated with both the Kalkaroo lease and the adjoining Honeymoon Uranium Mine which provides a significant snapshot of species likely to occur within the area. Therefore, the likelihood of specific species occurring within the project footprint buffer was made based on the presence of suitable habitat and included:

- reviewing previous field survey results and database records.
- assessing the habitat value of the vegetation during the field survey to determine the fauna species likely to occur within the Project area; and
- highlighting any areas of significant fauna value.

3 Baseline environment

3.1 Vegetation Assessment

The landscape consists of a level plain with extremely low relief across the tenements. The soils varied from heavy clay flats with minor gilgai and flood out areas occupied by ephemeral herbs and grass species through to sandy clay soils elevated less than 500mm and were occupied by larger perennial shrubs such as *Maireana*, *Atriplex* and *Gunniopsis*. These landforms were almost entirely devoid of trees due the extremely low relief. The plain is intersected by a shallow drainage channel which was differentiated from the surrounding landscape by emergent shrubs on the channel edges and flood terraces.

3.1.1 Details of the vegetation.

Vegetation associations for the camp, drill pads and access tracks were adapted from Ecosphere (2021) and were comprised of six vegetation associations (Table 1). These were dominated chenopod shrublands. Vegetation within the lease areas have been historically in excellent condition because of the destocking of the lease since 2009.

Table 1. Vegetation association within project areas.

Vegetation Association
1. Ephemeral Herb/Grassland
2. *Maireana astrotricha* (Low Bluebush) / *Atriplex vesicaria* (Bladder Saltbush) Low shrubland
3. *Maireana aphylla* (Cotton-bush) Low Shrubland
4. *Gunniopsis quadrifida* (Sturt's Pigface) Low Open Shrubland
5. *Rhagodia spinescens* (Spiny Saltbush) mixed chenopod Shrubland +/- emergent *Acacia victoriae* (Elegant Wattle) and *Eucalyptus largiflorens* (Black Box)
6. *Maireana pyramidata* (Black Bluebush) mixed chenopod shrubland

Vegetation Association 1	Ephemeral Herb/Grassland

General description	Occupying clay flats with minor gilgais hollows and slightly cracking clay. Very few perennial flora species present only as occasional				
Threatened species or community	No perennial flora community present. Not conservation significant.				
Landscape context score	1.16	Vegetation Condition Score	Ave. 26.17	Conservation significance score	1.10

Vegetation Association 2	***Maireana astrotricha* (Low Bluebush) / *Atriplex vesicaria* (Bladder Saltbush) Low shrubland**

General description	Low open shrubland on very low relief sandy clay soils elevated very slightly above the surrounding clay gibber plain. Moderately productive zone with mixed shrubland persisting on low hummocks with higher species diversity.				
Threatened species or community	Not a conservation significant community.				
Landscape context score	1.16	Vegetation Condition Score	Ave. 41.90	Conservation significance score	1.10

Vegetation Association 3	*Maireana aphylla* (Cottonbush) Low Shrubland

General description	Areas within flood terraces of the main ephemeral drainage line and other very shallow drainage depressions barely visible on surrounding plain as well as flood out zones and depressions adjacent to *Maireana astrotricha* shrublands. Highly productive zones following rainfall with high species richness and shrubs well established un-modified in most cases. Very transitional community without distinct boundaries between the surrounding shrublands.				
Threatened species or community	Not a conservation significant community.				
Landscape context score	1.16	Vegetation Condition Score	Ave. 41.00	Conservation significance score	1.10

Vegetation Association 4	*Gunniopsis quadrifida* (Sturts Pigface) Low Open Shrubland

General description	Covered the higher elevation (approximately 50-100mm above plain level) sandy hummocks primarily on the eastern side of the drainage channel. Hard pan sand with mainly ephemeral annual species associated with shrubland. This community was also associated with Casuarina pauper clumps on the highest points of these communities.				
Threatened species or community	Not a conservation significant community.				
Landscape context score	1.16	Vegetation Condition Score	39.83	Conservation significance score	1.10

Vegetation Association 5	***Rhagodia spinescens*** **(Spiny Saltbush) mixed chenopod Shrubland +/- emergent** ***Acacia victoriae*** **(Elegant Wattle) and** ***Eucalyptus largiflorens*** **(Black Box)**

General description	This community was restricted to the immediate ephemeral drainage channel alignment and the lower sections of the terrace floodplain. Was observed in particularly good condition following good spring and early summer rainfall. High density of weed species present within the channel. Some emergence of *Eucalyptus largiflorens* (Black Box) alongside creek since removal of grazing with largest trees approximately 6-8m.				
Threatened species or community	Not a conservation significant community				
Landscape context score	1.16	Vegetation Condition Score	Ave. 40.23	Conservation significance score	1.10

Vegetation Association 6	*Maireana pyramidata* (Black Bluebush) mixed chenopod shrubland

General description	Present as patches of variable density and often more a mixed community than a dominant *Maireana pyramidata* community. Present on the southern section of a low slightly raised ridgeline running roughly parallel west of the ephemeral creek line.				
Threatened species or community	Not a conservation significant community.				
Landscape context score	1.16	Vegetation Condition Score	Ave. 42.63	Conservation significance score	1.10

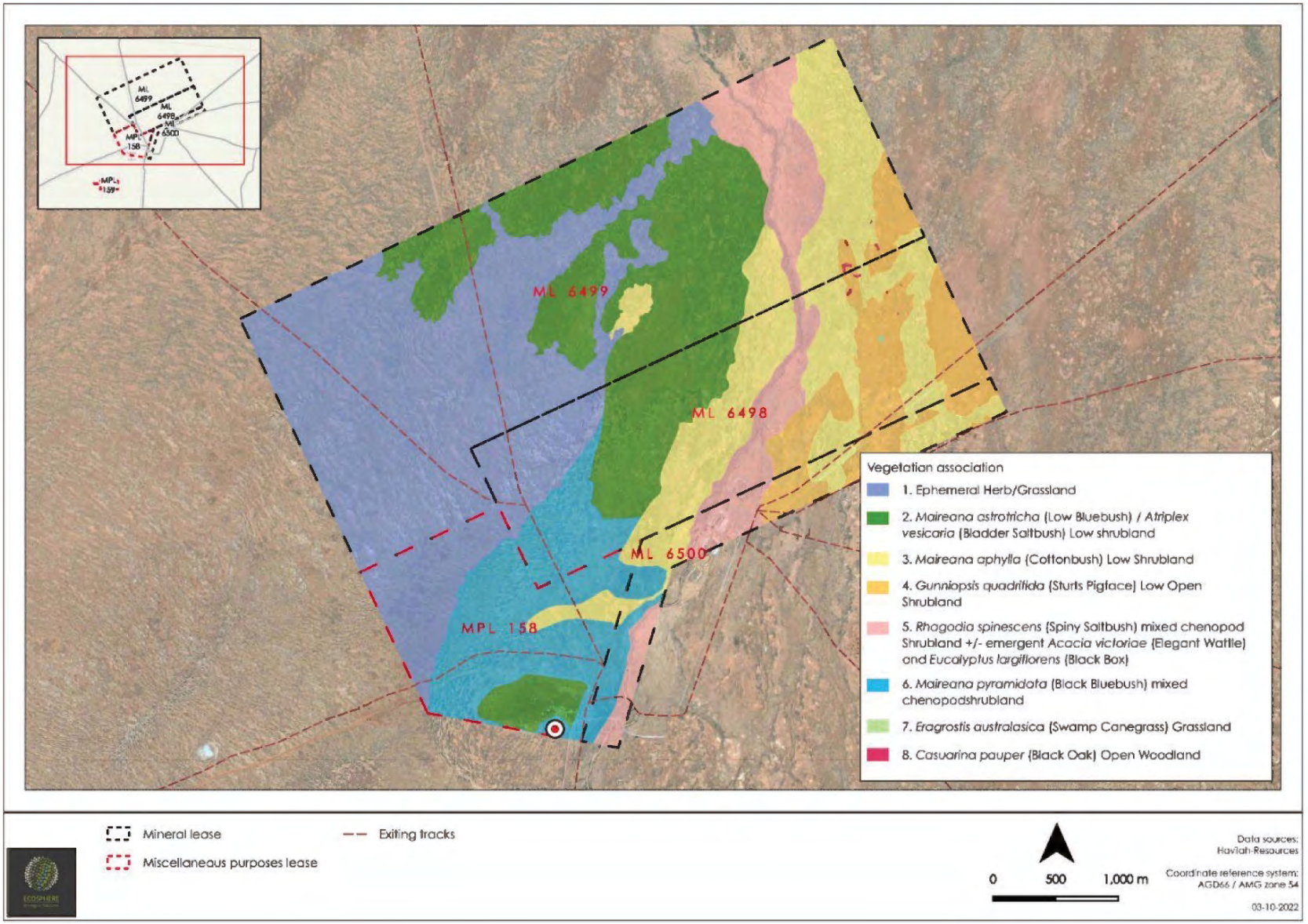


Figure 2. Vegetation associations mapped across the wider project areas.

3.2 Threatened fauna

3.2.1 Nationally threatened species

Three species of national conservation significance have historical records around the project area, *Notomys fuscus* (Dusky Hopping-mouse), *Pedionomus torquatus* (Plains-wanderer) and *Petrogale xanthopus xanthopus* (Yellow-footed Rock-wallaby).

The Dusky Hopping-mouse is considered likely to occur on the eastern extent of the tenement. The Dusky Hopping-mouse inhabits arid areas of Australia with sand dunes or sand plains with hummocks and water nearby. The species is predominantly restricted to the dune crests with only few observations of the species in the surrounding gibber or inter-dune swales and scalded areas. The Dusky Hopping-mouse does move across inter-dune clay flats within their home range (Moseby et al. 1999). After seasons of good rainfall, the species may occur in atypical habitat such as chenopod (e.g., Black Bluebush (*Maireana pyramidata*)) shrubland on gibber plains, Acacia shrubland and sandy creek lines (Waudby & How 2008). The Dusky Hopping-mouse undergoes significant population and occupation fluctuations, with density reductions or local extinction during dry periods.

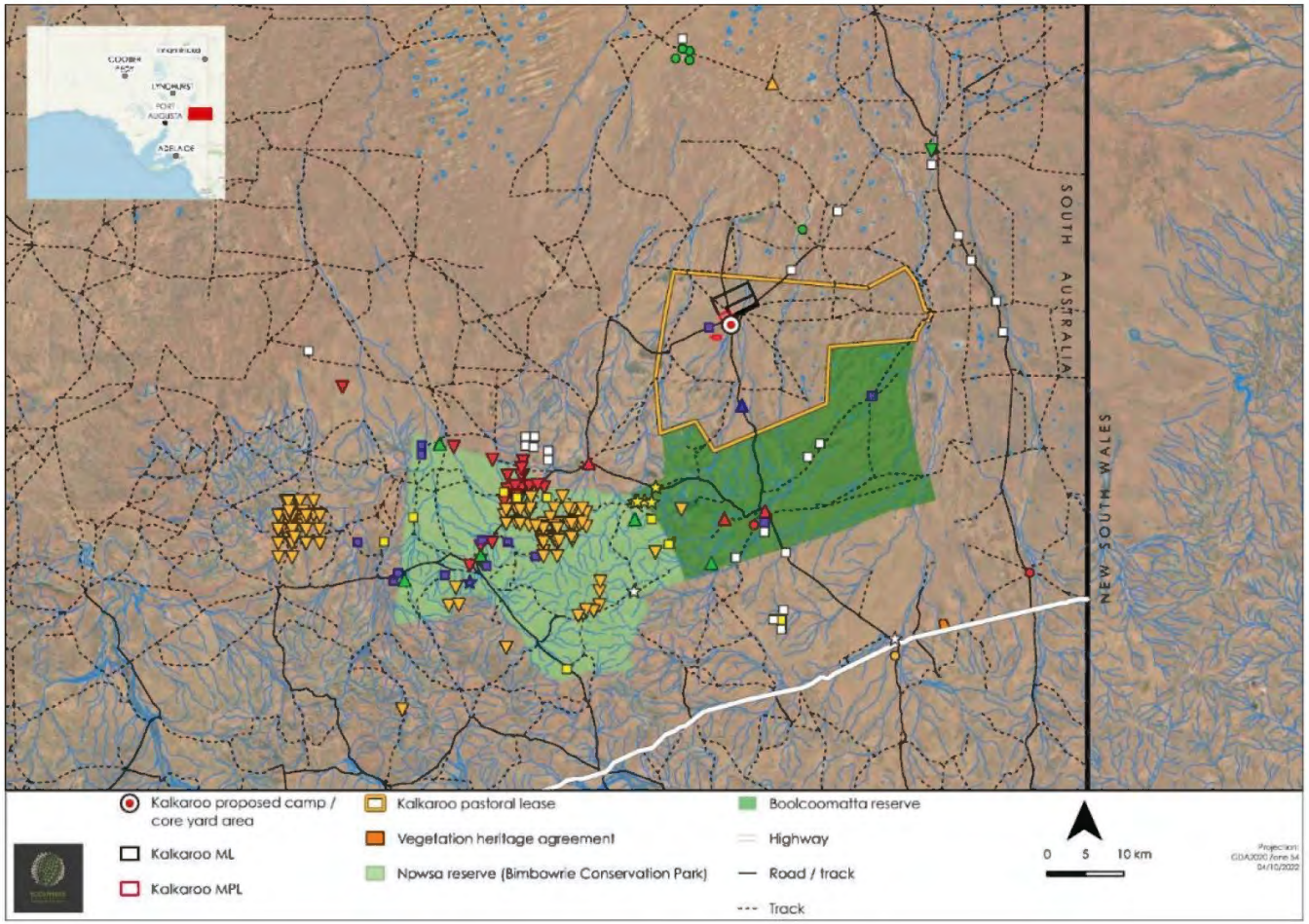
Plains Wanderer could possibly occur within the drilling areas based on BDBSA records and the availability of habitat. Boolcoomatta reserve has had numerous records since 2017 through visual sightings and acoustic recorders. This species is likely to occur on Kalkaroo at some period.

Although Yellow-footed Rock-wallaby were recorded within 50km of the project site, the species is highly unlikely to be present within the project site due to a lack of suitable habitat.

3.2.2 State threatened fauna.

Fifteen fauna species of state conservation significance have historical records within 50km of the project area. Refer to Figure 3.

Based on the information related to threatened fauna and the historical disturbance within the existing footprint which is limited to areas of lower habitat value and has a lack of significant ecological features, the potential risk of impact threatened species is deemed low within the ML area.



Threatened fauna (BDBSA records)

- Australian Bustard (*Ardeotis australis*) SA : V
- Black Falcon (*Falco subniger*) SA : R
- Blue-billed Duck (*Oxyura australis*) SA : R
- Dusky Hopping-mouse (*Notomys fuscus*) EPBC : VU, SA : V
- Elegant Parrot (*Neophema elegans elegans*) SA : R
- Hooded Robin (*Melanodryas cucullata*) SA : R
- Little Eagle (*Hieraaetus morphnoides*) SA : V
- Map Gecko (*Lucasium steindachneri*) SA : R
- Painted Finch (*Emblema pictum*) SA : R
- Plains-wanderer (*Pedionomus torquatus*) EPBC : CR, SA : E
- Restless Flycatcher (*Myiagra inquieta*) SA : R
- Scarlet Robin (*Petroica boodang boodang*) SA : R
- Slender-billed Thornbill (*Acanthiza iredalei*) SA : R
- Thick-billed Grasswren (*Amytornis modestus*) EPBC : VU
- Woma (*Aspidites ramsayi*) SA : R
- Yellow-footed Rock-wallaby (*Petrogale xanthopus xanthopus*) EPBC : VU, SA : SP

Figure 3. Threatened fauna recorded within 50km of the project site.

4 Risk assessment

4.1 Impact assessment

4.1.1 Direct impacts

Direct impacts include:

- Removal of native shrubs and groundcover
- Clearing of small areas of woodland vegetation
- Soil disturbance and compaction
- Temporary disturbance to common local fauna species

Clearance will be limited to drill pads, access tracks, and essential infrastructure only.

4.1.2 Indirect impacts

Potential indirect impacts include:

- Dust deposition on adjacent vegetation
- Altered surface water flow
- Weed introduction
- Edge effects increasing grazing pressure

Mitigation measures are described in 5.3

4.2 Potential cumulative impact

The quantum of impact to vegetation for the project is:

- Includes the rehabilitated areas associated with the previous OZ Minerals / BHP drilling program and immediate surrounds totals 275 pads with an anticipated disturbance area of 875m^2 (refer to Figure 4) is 24.06 ha
- Track length is 10.03 km @ 5\3m width is 3.01 ha
- Drillers (ML) Laydown area is 1.5 ha
- Core Processing Facility is within existing disturbance footprint
- Temporary camp area is 1.85 ha
- Existing driller laydown areas not previously rehabilitated (Fuel Farm) is 0.67 ha (refer to Figure 5).

The potential total impact to Low Open Chenopod Shrublands for the drilling project is therefore 31.09 ha

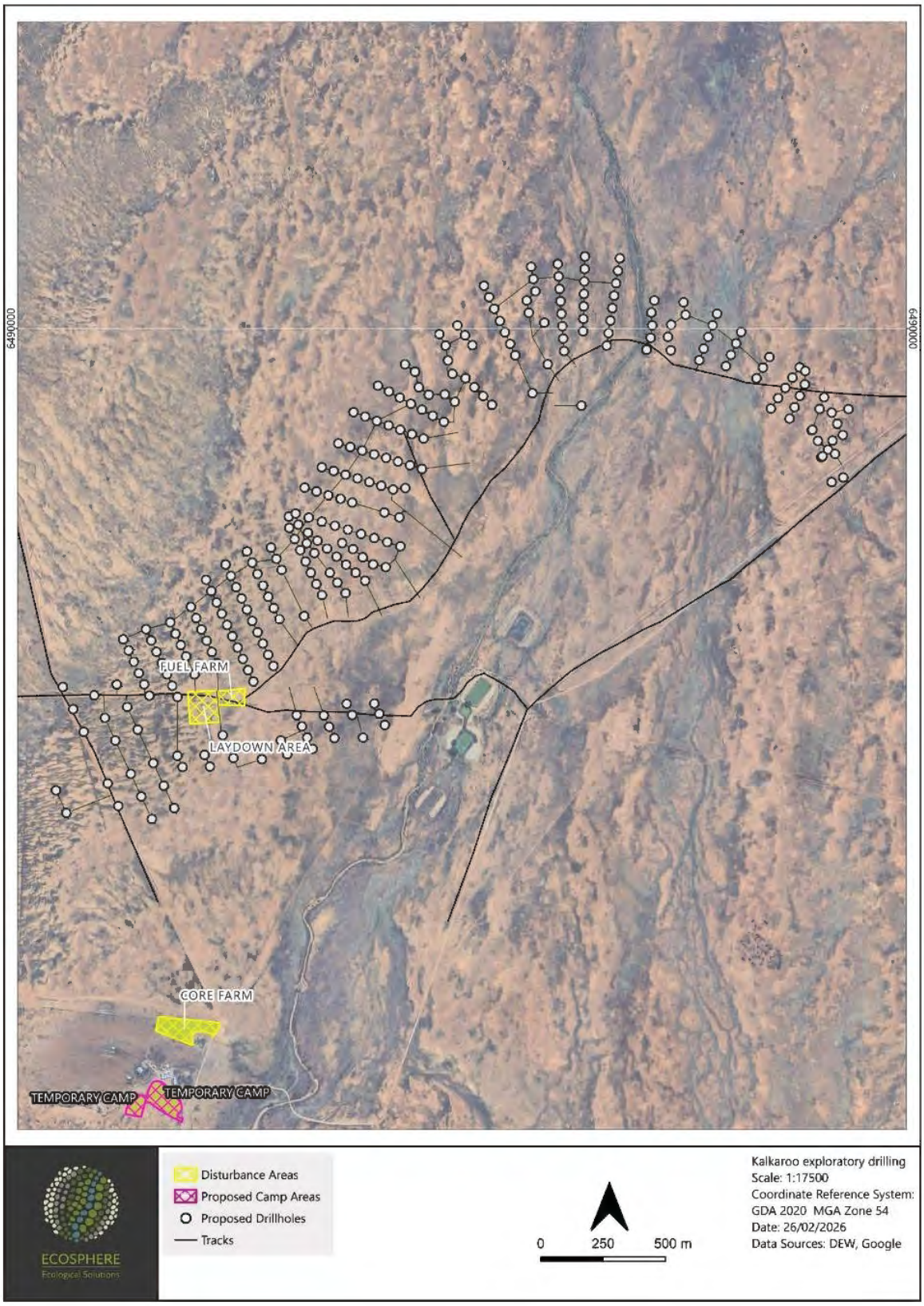


Figure 4. Planned drill holes on previously rehabilitated area.

Figure 5. Extents of temporary camp, core processing facility, drillers laydown and fuel farm disturbance footprints.

4.3 Mitigation hierarchy and rehabilitation plan

The Regulations state that all clearance activities must minimise impacts on native vegetation as much as is practically possible. In particular, proponents must apply the Mitigation Hierarchy (see below). SEB options should only be considered after all reasonable measures have been taken to avoid and minimise negative impacts (either direct or indirect) of proposed activities on biodiversity). The Mitigation Hierarchy is applied in the following order:

a) Avoid — measures should be taken to avoid clearance of native vegetation wherever possible:

The drilling will be undertaken within areas previously drilled as part of exploration activities. As a result, a number of tracks remain within the area and rehabilitation practices undertaken historically along with the removal of any grazing within the area means that some regeneration has occurred. The works will endeavour to stay within the bounds of previously disturbed areas and not physically remove any vegetation through blading of the soil surface. The nature of the vegetation being less than 500mm in height generally means that works can be undertaken without the need for actual vegetation removal. Vegetation clearance is to be limited to rolling of previously disturbed sites only.

b) Minimise — if clearance of native vegetation cannot be avoided, measures should be taken to minimise the extent, duration and intensity of impacts of the clearance on biological diversity to the fullest possible extent (whether the impact is direct, indirect or cumulative)

Drill Site Preparation

- Access to drill lines from the nearest established roads and station tracks will by driving overland (on sparse vegetation). Access tracks and drill sites will not require mechanical clearing, except for minor ground disturbance associated with sump excavation. Where necessary, low-lying vegetation (e.g. bushes) will be removed manually using hand tools to create sufficient space for safe drilling operations and for the placement of drill cuttings in small, orderly piles on the ground. Drill sites will be positioned to minimise environmental disturbance, and no trees will be removed.
- Each drill site will occupy an area of approximately 25m x 35m to accommodate drilling equipment and associated activities. Each diamond drillhole will require two sumps constructed adjacent to the drill collar, each measuring 6m x 2m x 4m, to contain drilling water. Sumps will be bunded, and an escape ramp will be installed in each sump to allow fauna egress.
- Sump excavation will be undertaken using a backhoe. Topsoil will be stripped and stockpiled separately for reuse during rehabilitation. Excavated materials will be replaced in the reverse order or removal during rehabilitation.

Camp Site Details

- The temporary accommodation camp will provide accommodation for up to 80 personnel, comprising single-occupancy rooms with ensuites, along with shared facilities including a dry mess, laundry, and gym.
- The temporary camp will be located immediately adjacent to the existing Kalkaroo workers camp and Kalkaroo Homestead, within the footprint of a previously authorised and constructed temporary camp under MPEPR 2022-160 (November 2022). The former camp has since been decommissioned and removed, with the hardstand area retained and transferred to Kalkaroo Pastoral Station (owned by Havilah Resources Limited) for use as a laydown area.
- The proposed camp location utilises the previously approved footprint for the OZ Minerals / BHP temporary camp and will not require the construction of new access tracks or result in any additional vegetation disturbance.

Driller laydown area

- Topsoil and any litter will be maintained in situ to allow maintenance of seedbank and follow up natural regeneration.

c) Rehabilitate or restore — measures should be taken to rehabilitate ecosystems that have been degraded, and to restore ecosystems that have been destroyed by impacts of clearance of native vegetation that cannot be avoided or further minimised

Rehabilitation Plan

Areas of General Site Disturbance

- Drill sites and access tracks will avoid areas of substantial vegetation (very rare in this area).
- Access to the drill sites will mainly be along existing station tracks, then by driving across country (overland) via dedicated routes.
- In some (very rare) cases, a backhoe may be required to remove vegetation, using the 'blade up' method depending on the thickness of vegetation to level ground to create a safe and level work area where required.
- Vehicles are restricted to a single access track to minimise disturbance of vegetation.
- Excavations are constructed with a shallow angle ramp to allow small animals to escape and are appropriately barricaded/bunded to prevent access.

Drill Site Rehabilitation

- All holes are capped following drilling completion.
- Unwanted drill samples and spoil from drilling are place into sumps/pits, which are backfilled, covered with topsoil (stockpiled separately during drilling) and lightly scarified to promote seed germination
- Drill pads (875 m2 each) with soil disturbance limited to 2 sumps (24 m2 each sump), drill collar and immediate work area (approx. 25 m2): total of 75 m2 of soil disturbance per drill pad. Most of the drill pad is unused except for limited vehicle or foot traffic to access the site.
- Materials excavated during sump preparation will be sequentially placed back in the order of removal during rehabilitation.

Final Rehabilitation

- Sumps backfilled, rubbish removed, topsoil respread, sump and drill collar areas scarified (disturbed area – approx. 75 m^2 as noted above) to promote seed germination and new vegetation growth.
- Drill hole decommissioned
- Progressive rehabilitation of drill pads and decommissioning of drillholes will be completed as the program progresses with a maximum of 100 drill sites awaiting rehabilitation at any one time. Final rehabilitation of camp as soon as practical after completion of the program.

Temporary Camp Rehabilitation

- Disassembling and demobilising of the transportable buildings and associated infrastructure. All transportable buildings and related infrastructure are rented from third party suppliers. All costs for disassembly and removal from site are included in the rental contracts and are the responsibility of the owners.
- All external waste material is removed from site to an approved waste facility.
- No fires are lit during the summer months, and only at other times if there is a clear area surrounding and fire danger is minimal (e.g., lack of burnable material and no fire ban period).
- Fire management procedures in places, including policy for "extreme fire danger rating" and firefighting equipment/extinguishers are always available.
- The land surface will be returned to its original profile.

Core Processing Facility

- The core processing facility includes the existing Havilah core processing facility and will extend onto disturbed land utilised by pastoral station.

Drillers (ML) Laydown Yard Rehabilitation

- Disassembling and demobilising of the transportable buildings and associated infrastructure. All transportable buildings and related infrastructure are rented from third party suppliers. All costs for disassembly and removal from site are included in the rental contracts and are the responsibility of the owners.
- All external waste material is removed from site to an approved waste facility.
- The land surface will be returned to its original profile and topsoil replaced.

d) Offset — any adverse impact on native vegetation or ecosystems that cannot be avoided or further minimised should be offset by the achievement of an SEB that outweighs that impact.

Given the planned management strategies and previous disturbance within the ML footprint, no offsetting for cleared vegetation is anticipated. A number of monitoring and performance indicators will be used to quantify any clearance that occurs, and offsets applied if necessary.

4.4 Risk management

A risk assessment combined with management strategies and resultant residual risk is shown below in Table 2.

Table 2. Residual risk assessment considering implementation of management strategies.

Management Objective	Impact and Risk	Management actions	Residual Risk		
			Likelihood	Consequence	Residual risk
Manage extent of vegetation disturbance	Disturbance outside of footprint and areas not previously disturbed during exploration activities.	• Site inductions for all contractors. • PEPR approved Project Footprint will be marked out on site. • Development of site-specific vegetation management protocols. • Utilise previously disturbed areas where possible. • Micro-siting drill pads to avoid mature perennial shrubs • Clear demarcation of disturbance boundaries • Management of storm water run-off from operational areas by construction and maintenance of perimeter storm water cut-off bunds.	Possible	Moderate	Low
Manage vegetation impacts to surrounding areas	Dust and other contaminant dispersal	• Clearance boundaries pegged and GPS verified. • Pre-clearance briefing delivered to contractors. • Dust suppression measures for operational and disturbed areas such as stockpiles utilising water trucks. • Maintenance of roads to minimise the build- up of fine particles that are susceptible to wind erosion. • Minimising the extent of exposed areas susceptible to wind erosion. • Using speed limits on roads used by mine traffic.	Possible	Low	Low
Manage fire risk	Unlikely to carry fire however sequence of several good seasons and no stocking means wildfire poses a risk to destroy vegetation and cause widespread loss of species through erosion.	• Have fire management materials such as fire extinguishers available on all plant and equipment.	Unlikely	High	Low
Rehabilitate areas after drilling complete	Areas disturbed during operations naturally rehabilitate as weed dominated areas or scalds instead of natural stratums representative of surrounding area.	• Encouragement of natural regeneration from seedbank. • Shallow harrowing of bare soil to across the contour to leave a ridge and furrow surface aimed at retaining resources in situ compared to washing or blowing away into other areas leaving hard pan surface. • Revegetation of areas using broadcast seed if monitoring shows a lack of response.	Unlikely	Moderate	Low

Management Objective	Impact and Risk	Management actions	Residual Risk		
			Likelihood	Consequence	Residual risk
Control other weeds/spread within vegetation	Loss of species richness due to weed cover and invasion	• Control of any weed species observed within project area prior to works. • Offsite vehicle hygiene measures. • Control and monitor for weed species of local concern known for the area including: o *Lycium ferocissimum (*African Boxthorn*) (declared weed SA)* o *Echium plantagineum* (Salvation Jane) o *Xanthium spinosum* (Bathurst Burr) o *Cenchrus ciliaris* (Buffel Grass)	Possible	Low	Low
Pest animals species	No increase in species such as cats, foxes and other adventitious species increase in population and having knock on effects through reduction in pollination or other functional attributes provided by indigenous fauna.	• Regular shooting • Landfill to be progressively rehabilitated to minimise exposed rubbish so as to minimise litter and attraction to feral animals. • Monitoring of pest species populations though use of camera trap grids to determine background density.	Low	Moderate	Low

5 Monitoring

5.1 Success criteria

Rehabilitation will be considered successful when:

- No active erosion is present.
- Vegetation cover reaches ≥70% of adjacent reference site cover (or alternative agreed benchmark).
- Recruitment of key native species observed.
- Weed cover remains below agreed threshold.
- Land capability consistent with pastoral use is restored.
- Monitoring will continue for a minimum of 3–5 years, rainfall dependent.

5.2 Monitoring

Monitoring will include the following elements with detailed objectives listed in Table 3 :

- Pre-disturbance baseline documentation undertaken as a series of photo points.
- Compliance inspections during clearing.
- Post rehabilitation inspections.
- Weed assessment.
- Annual report will be submitted to DEM as part of MPEPR compliance reporting.
- Adaptive management measures will be implemented where rehabilitation targets are not being met.

Table 3. Rehabilitation monitoring program

Action ID	Monitoring Component	Objective	Methodology	Timing / Frequency	Performance Criteria	Corrective Action Trigger	Corrective action	Responsible Party
KM1	Establish Monitoring Sites	Ensure representative and repeatable monitoring of rehabilitated drill pads	Establish permanent photo points and 5x2 cover abundance monitoring quadrat at one drill pad per vegetation association and an adjacent reference vegetation	Once, prior to or immediately following rehabilitation	Monitoring sites established and GPS recorded	Incomplete or poorly located sites	Re locate or add additional sites	Environmental Advisor
KM2	Photo Monitoring	Visually assess vegetation recovery and site stability over time	Fixed-point photograph from marked photo point.	Baseline, then quarterly for first three years and then assessed based on outcomes of quadrat monitoring	Visible increase in vegetation cover and reduced bare ground	Lack of continued photo point monitoring	Ensure continual stream of photoprints with report outlining failure and measures to rectify	Environmental Advisor
KM3	Vegetation Species Composition, recruitment and weeds	Assess return of native species to 70% of reference sites	5x2 quadrat surveys recording species presence, cover (%) and life form	Annually, late winter early spring.	Increasing native species richness; presence of key local species and lack of weed cover.	Dominance of non-native species or lack of native recruitment	Vegetation will re-establish naturally, however competition from weeds may need management and is dependent on professional advice.	Ecologist
		Weed cover does not significantly exceed that of background reference sites	5x2 quadrat surveys recording species presence, cover (%) and life form	Annually, late winter early spring.	Weed cover to be consistent with seasonal trends and mean cover not greater than 5% above that of reference sites	Weed species mean cover recorded as >5 % of reference sites	Weed maintenance and control	Ecologist / Environmental Advisor
KM4	Soil Stability	Confirm erosion control and soil structure recovery	Visual assessment using soil stability indicators (e.g. crusting, rilling, scalding)	Annually and after major rainfall events	No active erosion; stable soil surface comparable to reference	Evidence of erosion (rills, sediment movement)	Re contouring or shaping of surface to avoid domes or areas where run off is enhanced through landform.	Environmental Advisor

Action ID	Monitoring Component	Objective	Methodology	Timing / Frequency	Performance Criteria	Corrective Action Trigger	Corrective action	Responsible Party
KM5	Success Evaluation	Determine if rehabilitation objectives are moving towards goal state	Compare monitoring data against completion criteria and reference sites	At defined milestones (e.g. years 3 and 5)	Meets agreed completion criteria (cover, diversity, stability)	Criteria not met within expected timeframe	Regulatory compliance directive	Proponent / Ecologist
KM6	Reporting	Document outcomes and demonstrate compliance with approval conditions	Prepare monitoring reports including data analysis, photos, and recommendations	Annually or as required by approval	Reports submitted to regulator on time and to required standard	Non-compliance with reporting requirements	Regulatory compliance directive	Proponent
KM7	Adaptive Management	Ensure continuous improvement of rehabilitation outcomes	Review monitoring results and implement corrective actions where needed and based on outcomes of monitoring program, i.e. shortfalls in specific objectives.	Following each monitoring event	Identified issues addressed and improvements observed	Repeated failure to meet performance criteria.	Review of action history and identification of failures with corrective actions documented for regulator.	Proponent / Environmental Advisor

6 References

Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2026) Protected Matters Search Tool. Accessed: 27th of January 2026. Available at: http://www.environment.gov.au/epbc/protected-matters-search-tool

Department for Environment and Water (DEW) (2026) BDBSA Supertable overview. Accessed: 27th of January 2026. Available at: https://www.environment.sa.gov.au/topics/science/information-and-data/biological-databases-of-south-australia

NatureMaps (2026) EnviroData SA. Government of South Australia, Department of Environment and Water (DEW). Available at: http://spatialwebapps.environment.sa.gov.au/naturemaps/?locale=en-us&viewer=naturemaps

Native Vegetation Council (NVC) (2024) Rangelands Assessment Manual. Government of South Australia, Department for Environment and Water, Adelaide

7 Appendices

Appendix 1. Before and after drill pad rehabilitation monitoring photographs

August 2023

December 2024

Appendix 2. Before and after camp site rehabilitation

August 2023

February 2026

APPENDIX 3

Namba Formation Self-Sealing Test Report and DEW Response

Appendix A – Department for Environment and Water (DEW) comments on Self-Sealing Test

From: DEW:Mining Water Science Referrals <miningwatersciencereferrals@sa.gov.au>
Sent: Monday, 16 February 2026 8:40 AM
To: Martins, Cobus (DEM) <Cobus.Martins@sa.gov.au>
Cc: Alcoe, Darren (DEW) <Darren.Alcoe@sa.gov.au>; Bodey, Steven (DEW) <Steven.Bodey@sa.gov.au>
Subject: RE: Namba Formation Self-Sealing Test

OFFICIAL

Hi Cobus,

Review comments on the technical note are provided below. These comments have been reviewed by the DEW Drilling Inspector.

1. The test demonstrated that the Namba Formation will indeed swell when wet and therefore in theory could form a natural seal between near surface aquifers and those below the strata in question.
2. The test required the addition of water. The DEW Drilling Inspector relayed that this was undertaken to simulate the wetting that would occur if the test hole had been drilled to the general expected depth. Therefore, the test assumes that groundwater will be intersected in normal circumstances.
3. It remains unclear whether groundwater intersected below the Namba Formation is under sufficient pressure to rise up the annulus and seal the hole passively by swelling Namba Formation clays. This however can conceivably be monitored during the execution of a drilling program and conceivably modifications made to the rehabilitation protocol if groundwater pressures and volumes are found to be inadequate.
4. Where casing is left in place, the clay will be unable to swell and seal the hole. Consequently, this strategy for drillhole rehabilitation only works if the relevant casing is removed.
5. For very deep holes, it remains unclear whether the seal, if passively formed, will be sufficient to isolate the cavity below long term without additional modification to rehabilitation design.
6. Conceivably, a rehabilitation protocol could be designed to utilise the swelling nature of Namba Formation clays, however this may require plug emplacement and the addition of water to ensure a seal in a sufficiently timely manner given variables such as depth of drilling and presence or otherwise of groundwater.
7. As per M21, final strategies for drillhole rehabilitation that differ from those described in M21 should be discussed with the DEW Drilling Inspector prior to commencement of the drilling program.

Kind Regards,

Mark

Havilah Resources
Strategic Minerals in South Australia

Technical Memorandum

Date:	7 April 2026
From:	Geoff Borg MSc in Hydrogeology and Groundwater Management *Principal Environmental Advisor*
To:	Department for Energy and Mines *EPEPR 2024/015* Chris Giles *Technical Director* Amy Jacka *Tenement Manager* Traviss Just *Senior Geologist*
Subject:	**Namba Formation Strata Self-Sealing Test Report - Update**

This report documents the results of Namba Formation strata self-sealing testing conducted on EL 6659, proximal to Kalkaroo Copper's mining and multipurpose leases (ML and MPL) on Kalkaroo Pastoral Station (Figure 1).

The test procedure (Attachment 1) was included in the approved Exploration Program for Environment Protection and Rehabilitation (EPEPR2024-015) EL 5873, EL 6415, EL 6659, EL 6660 (EPEPR).

Purpose

The purpose of the test is to demonstrate the likelihood that open, unsupported, drillholes in Namba Formation will naturally close (seal) due to the reactive (swelling) nature of the smectite clay rich strata. Such natural sealing of open exploration drillholes effectively reinstates the natural hydraulic conditions between underlying groundwater bearing strata and overlying Quaternary strata, where potential ephemeral perched water tables may develop.

Method

As per the test method, time series data was collected from open vertical exploration drill holes completed into Namba Formation strata to enable semi-quantitative assessment of the self-sealing (swelling) properties of exposed sediments. Data collected included drillhole Total Depth (TD) and Standing Water Level (SWL), after a known quantity of water was introduced into a drillhole.

It was decided to vary the test method by completing two identical drillholes on the same drill pad with one hole being left dry and the other having the quantity of water introduced. This enabled measurement and comparison of open holes in Namba Formation with and without exposure to groundwater.

Typical exploration drillholes penetrating Namba Formation strata also intersect the regional water table resulting in groundwater within the open hole at the end of drilling. At Kalkaroo,

groundwater investigation wells installed as part of Groundwater Impact Assessment typically intersected the regional water table between 45 and 50 m below ground surface. This typically corresponded to being below or within the base Namba Formation strata (Attachment 2).

Observations from past drilling programs indicate Namba Formation strata in the walls of the drillhole will, depending on the relative depth of the regional water table, either produce groundwater or become saturated by groundwater pushed up the hole during drilling. If left open and unsupported (no casing) in the presence of groundwater the drillholes naturally seal due to clay rich Namba Formation strata swelling.

Drilling

The drilling method used was to replicate typical exploration drillholes, except for the holes being vertical rather that angled, to enable collection of downhole data using probes on hand operated reels of measuring tape.

Drilling parameters were determined after review of the geological cross section produced from previous exploration drilling data along the same drill line (Figure 2) and the drilling logs as the holes advanced (Figure 3).

The inferred depth to the regional water table was obtained by measuring the SWL of WB-4, an existing groundwater monitoring bore on ML6498, located approximately 1.3 km to the north-northwest of the test holes (Figure 1).

The target total depth (41 m) was determined to achieve the objectives of the test method by terminating the holes above the regional water table and within the target strata.

Two Namba Test Holes **KKNTH01** and **KKNTH02** were completed on a previously rehabilitated exploration drill pad on EL 6659 (Figure 1). These drillholes will be rehabilitated on completion of data collection as per the conditions of the EPEPR 2024-015.

Drillholes were advanced through the upper Quaternary strata from surface to a depth of 17mBGS using a “V” bit. Casing consisting of 150 mm diameter PVC was installed to 17 mBGS, isolating surficial and Quaternary strata and the top 3 to 7 m of Namba Formation strata from the drillhole.

Air core drilling was then used to advance the drillholes to the target TD of 41 mBGS.

KKNTH01 was left open and TD gauged over time to identify potential groundwater accumulation (none expected) and potential changes (closing) of the drillhole (Table 1).

KKNTH02 had approximately 200 L of groundwater introduced to the drillhole resulting in an initial SWL of 17.5 mbTOC. SWL and TD gauging data are provided in Table 2.

Groundwater was sourced from a historic exploration hole on ML6498 maintained for supply of drilling water. This water was from the same water-bearing zone that would be encountered had the test holes intersected the regional water table.

Both holes were left capped after the final gauging event on 30 October 2025. Further gauging events are planned during the next stint for Kalkaroo personnel starting 11 November 2025. Decommissioning and rehabilitation of these holes will be completed as per the conditions of approved EPEPR 2024/015.

Results

Data is summarised in Tables 1 and 2 and illustrated in Figure 4.

KKNTH01 results were within expected ranges for an open drillhole completed above the regional water table in Namba Formation. After 20 hours of the drillhole remaining open and unsupported:

- No appreciable change in TD.
- No accumulation of groundwater.

KKNTH02 results were consistent with past observations of exploration drillholes through the Namba Formation and intersecting the regional water table.

At T = 16:30 hours after the end of drilling and the introduction of approximately 200 L of groundwater into the unsupported hole:

- TD reduced from 41.48 mbTOC to 29 mbTOC indicating the bottom 12 m of the drillhole closed (self-sealed due to swelling clay) due to contact with groundwater.
- SWL remained stable around 17.6 mbTOC after introduction of groundwater indicating introduced water absorbed into swelling clay.

Measurements made from T = 14:17:10 days to 37:07:10 days:

- TD = 28.8 to 28.65 mbTOC
- SWL measurements indicated residual water at TD (i.e. probe indicated the presence of water at total depth) and, on the last measurement, no water presence was indicated.

Data indicates the section of the drillhole KKNTH02 that sealed (closed in) due to the presence of water correlates with carbonaceous strata (Figure 3) within the Namba Formation. The initial water column remaining above the closed in carbonaceous strata (measured at T = 16:30 hours) is anticipated to have absorbed into exposed overlying Namba strata (i.e. drillhole walls) and / or continued to infiltrate down the drillhole and be absorbed into the carbonaceous strata expanding into the drillhole. Based on geotechnical investigations, loss of water into the smectite clay rich Namba strata is expected. Results from this test suggest resulting changes in soil volume can vary as evidenced by that observed in the carbonaceous strata in KKNTH02.

Conclusions

This test has confirmed that open, unsupported, drillholes in Namba Formation are likely to naturally close (seal) due to the reactive (swelling) nature of the smectite clay rich strata when exposed to groundwater, e.g. groundwater rising in the drillhole during drilling or the regional water table elevation is above the base of the formation.

This natural sealing combined with backfilling drillholes effectively reinstates natural geological conditions with respect to isolating underlying groundwater bearing strata (saturated basement strata and weathering profile below the regional water table) from potential ephemeral water tables in Quaternary strata above the Namba Formation.

These conclusions of based on mineral exploration hole completions where all casing is removed from Namba Formation strata intersection.

Tables

Table 1 ***KKNTH01*** *Gauging Data*

Date	Time Elapsed (hr / days)	Total Depth (mbTOC*)
29/10/2025	10:40 0	41
	11:25 45	41
	14:25 03:45	40.35
	19:45 09:15	40.35
30/10/2025	20:50	40.35
13/11/2025	14:*22:10*	40.32
18/11/2025	19:*22:10*	40.26
23/11/2025	25:*09:10*	40.31
5/12/2025	37:*09:10*	40.5

Table 2 ***KKNTH02*** *Gauging Data*

Date	Time (24hr)	Time Elapsed (T) ** (dd:hh:mm)	Standing Water Level (mbTOC)*	Total Depth (mbTOC)*
29/10/2025	14:30			41.48
	14:50	0		
	15:05	0:15	17.5	
	15:20	0:30	18	41.4
	15:50	1:00	17.6***	
	17:40	2:50	17.6	
	19:30	4:40	17.6***	29
30/10/2025	07:20	16:30	17.6	29
13/11/2025	*09:00*	14:17:10	28.89	28.89
18/11/2025	*09:00*	19:17:10	28.84	28.84
23/11/25	20:00	25:*07:10*	28.65	28.65
5/12/2025	*09:00*	37:*07:10*		28.8

Notes:

* *"mbTOC" refers to metres below tope of casing.*

** *Approximately 200 L of groundwater introduced to hole. Groundwater was sourced from an existing exploration drillhole on the Kalkaroo Copper ML. This was selected as a source of water with comparable water chemistry to that which Namba Formation strata naturally contains where it intersects the regional water table or would be brought up though it via penetrating exploration drillholes encountering groundwater in underlying basement strata.*

*** *Measurement confirmed with second probe provided by DEW.*

Figures

Figure 1 Location of Namba Test Holes on EL6659 relative to Kalkaroo Pastoral Station Homestead / Workers Camp, Kalkaroo Copper Mining Leases (ML6499, ML6498, ML6500, MPL158), and monitoring bore WB-4.

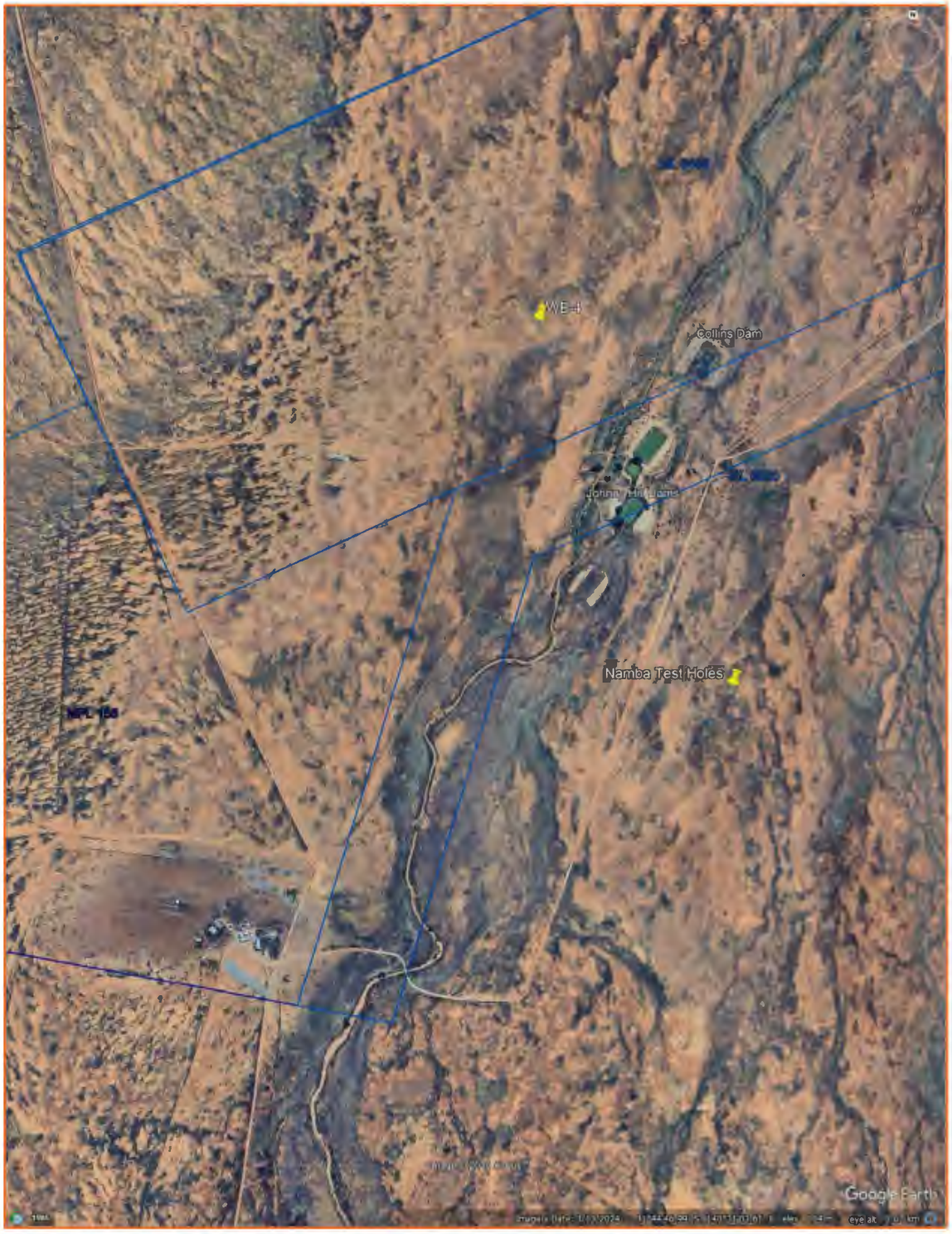


Figure 2 Geological Cross Section from 2022 exploration drilling data showing relative location of Namba Test Holes.

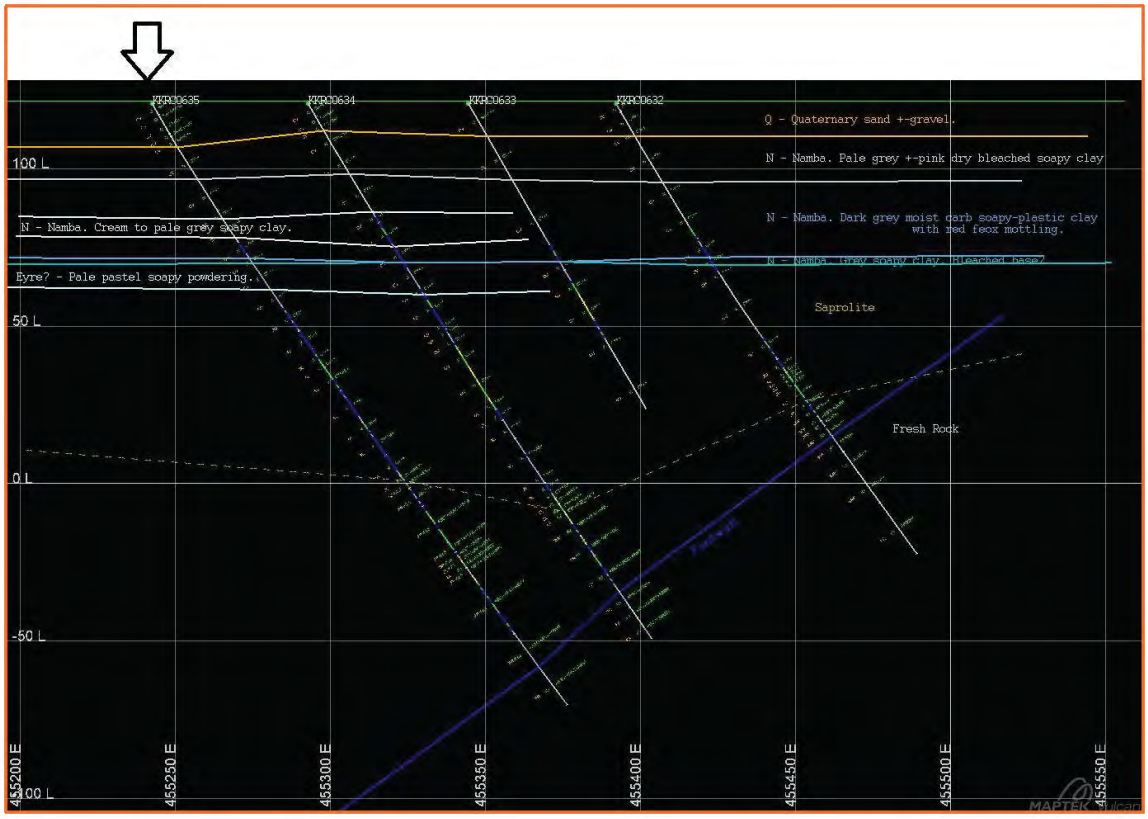


Figure 3 Geological Logs for Namba Test Holes

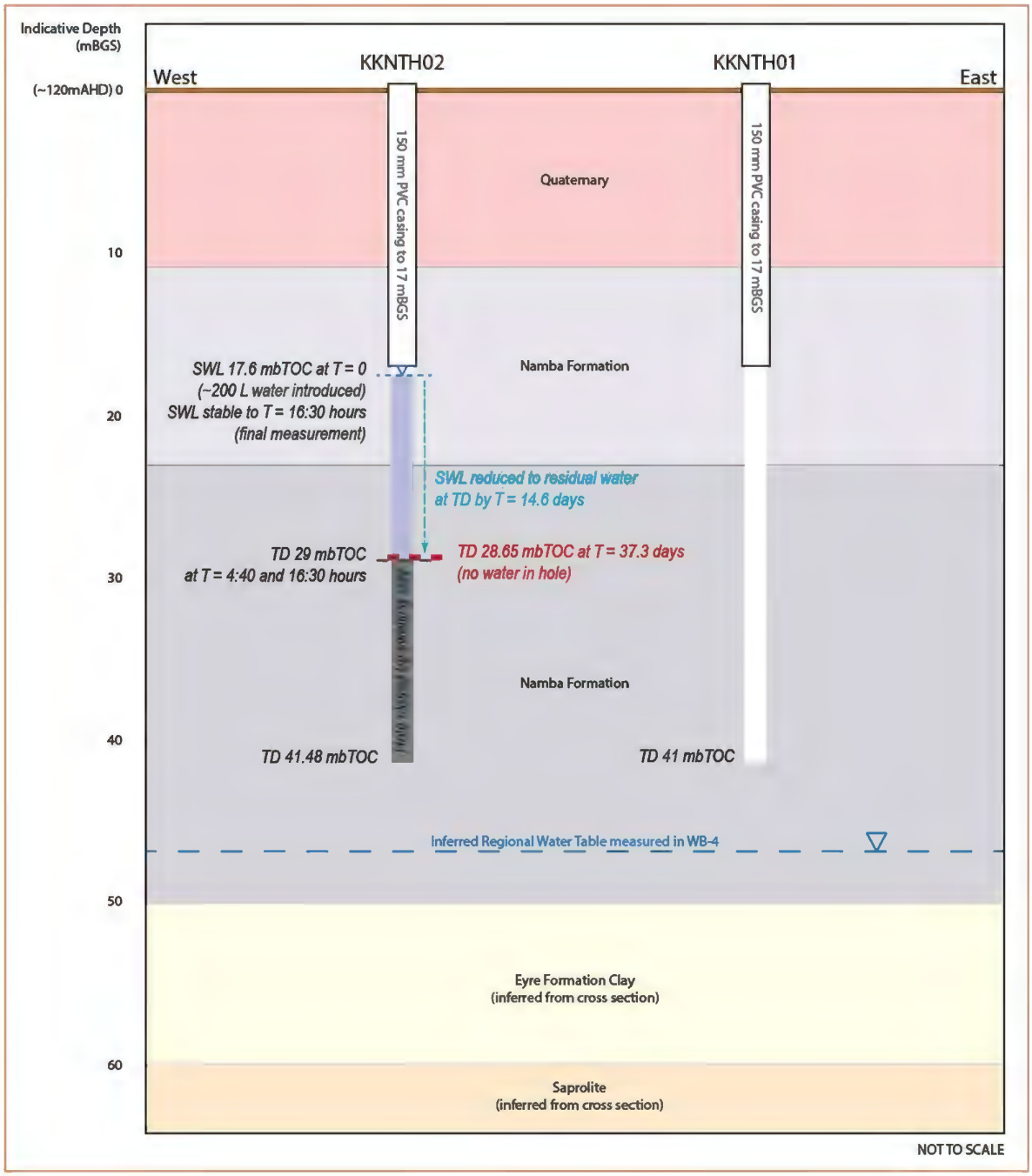
Geological Log: KKNTH01
GDA94: 455326.99 mE 6487776.56 mN
Elevation: 120.65 mAHD

Depth	Formation	Longhand Description
3	Quaternary	Red-brown fine grained ferruginous sand and clay, minor ferruginous pebbles.
6	Quaternary	Red-brown-pink fine grained ferruginous sand and clay. Common gypsum +- calcrete and ferruginous and quartz pebbles.
10	Quaternary	Red-brown-pink-pink-brown fine grained ferruginous clay and sand with common pale khaki-grey sandy soapy clay (ex Namba Formation?). Minor gypsum +- calcrete and ferruginous and quartz pebbles from above.
14	Quaternary / Namba Formation	Pale khaki-grey quite sandy soapy clay with predominantly tan goethite mottling.
18	Namba Formation	Pale grey weakly silty-sandy soapy clay with predominantly pink ferruginous mottling.
20	Namba Formation	Pale grey-grey soapy clay, with moderately pink ferruginous mottling.
25	Namba Formation	Grey soapy clay, with weak pink ferruginous mottling.
27	Namba Formation	Grey-dark grey soapy-plastic weakly carbonaceous? clay with weak red ferruginous mottling.
28	Namba Formation	Dark grey soapy-plastic carbonaceous clay with strong red ferruginous mottling.
33	Namba Formation	Dark grey soapy-plastic weakly carbonaceous clay with weak red ferruginous mottling.
38	Namba Formation	Grey-pale grey weakly silty-sandy soapy clay.
41	Namba Formation	Dark grey soapy-plastic weakly carbonaceous clay with weak red ferruginous mottling.

Geological Log: KKNTH02
GDA94: 455322.19 mE 6487776.51 mN
Elevation: 120.63 mAHD

Depth	Formation	Description
3	Quaternary	Red-brown fine grained ferruginous sand and clay, minor ferruginous pebbles.
5	Quaternary	Red-brown fine grained ferruginous sand and clay, minor fine to medium grained ferruginous pebbles. Common cream gypsum.
10	Quaternary	Red-brown fine grained ferruginous sand and clay, common moist pale khaki-grey soapy clay with angular sand grains, coated in red-brown sand and clay. Poss ex Namba Formation?
14	Namba Formation	Pale khaki-grey weakly goethite mottled soapy clay.
25	Namba Formation	Pale grey weakly goethite mottled soapy clay, with pale pink mottling. Cased 150mm diameter PVC to 17m.
29	Namba Formation	Dark grey weakly carbonaceous soapy-plastic clay with weak red ferruginous mottling. Moist balling.
34	Namba Formation	Grey-dark grey very weakly carbonaceous soapy-plastic clay with very weak red ferruginous mottling. Moist powdering.
37	Namba Formation	Pale pink-grey to grey soapy clay. Powdering.
39	Namba Formation	Grey soapy-plastic clay with very weak red ferruginous mottling. Powdering.
41	Namba Formation	Dark grey weakly carbonaceous soapy-plastic clay. Moist powdering.

Figure 4 Illustration of Namba Formation Self Sealing Test Results



Attachment 1

Namba Formation Strata Self Sealing Test Method

Purpose

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

Method

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

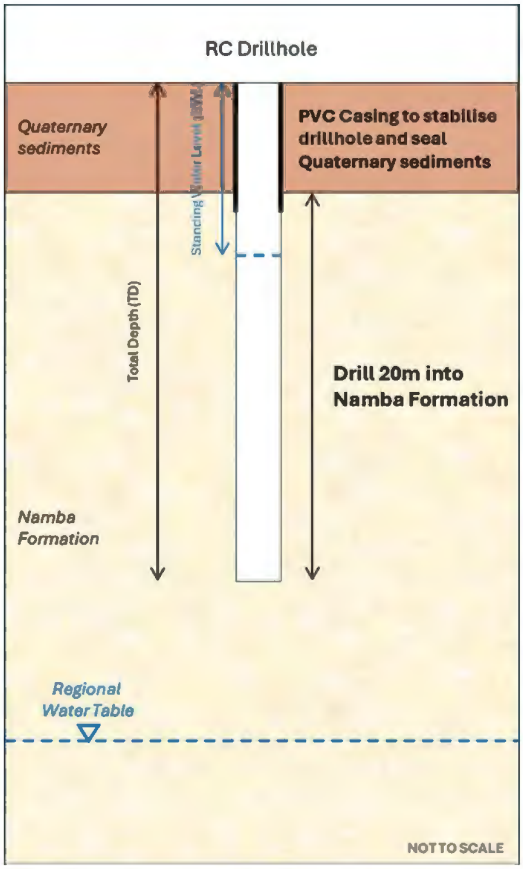


Figure 1 Drillhole details

Data Interpretation

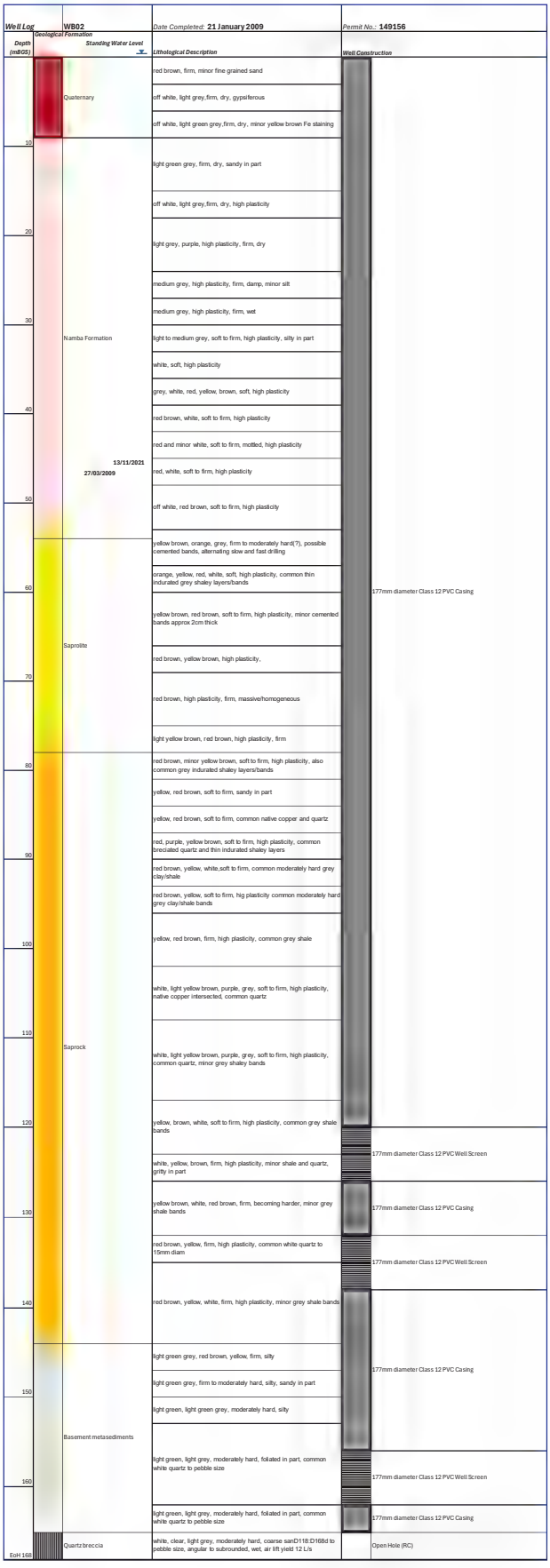
The primary data for indicating strata is self-sealing is change in TD over time. If unsaturated strata are not self-sealing, this test tests the potential for self-sealing when saturated, i.e. below the regional water table. Table 1 provides a guide to the interpretation of TD and SWL time series data.

Table 3 Data Interpretation guide.

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

Attachment 2

Graphic Logs Groundwater Investigation Wells installed on the Kalkaroo Projects Mining Leases


Well Log
WB02
Date Completed: 21 January 2009
Permit No.: 149156
Depth (mBGS)
Geological Formation
Standing Water Level
Lithological Description
Well Construction
red brown, firm, minor fine grained sand
off white, light grey,firm, dry, gypsiferous
off white, light green grey,firm, dry, minor yellow brown Fe staining
Quaternary
light green grey, firm, dry, sandy in part
off white, light grey,firm, dry, high plasticity
light grey, purple, high plasticity, firm, dry
medium grey, high plasticity, firm, damp, minor silt
medium grey, high plasticity, firm, wet
light to medium grey, soft to firm, high plasticity, silty in part
Namba Formation
white, soft, high plasticity
grey, white, red, yellow, brown, soft, high plasticity
red brown, white, soft to firm, high plasticity
red and minor white, soft to firm, mottled, high plasticity
13/11/2021
27/03/2009
red, white, soft to firm, high plasticity
off white, red brown, soft to firm, high plasticity
yellow brown, orange, grey, firm to moderately hard(?), possible cemented bands, alternating slow and fast drilling
orange, yellow, red, white, soft, high plasticity, common thin indurated grey shaley layers/bands
177mm diameter Class 12 PVC Casing
yellow brown, red brown, soft to firm, high plasticity, minor cemented bands approx 2cm thick
Saprolite
red brown, yellow brown, high plasticity,
red brown, high plasticity, firm, massive/homogeneous
light yellow brown, red brown, high plasticity, firm
red brown, minor yellow brown, soft to firm, high plasticity, also common grey indurated shaley layers/bands
yellow, red brown, soft to firm, sandy in part
yellow, red brown, soft to firm, common native copper and quartz
red, purple, yellow brown, soft to firm, high plasticity, common brecciated quartz and thin indurated shaley layers
red brown, yellow, white,soft to firm, common moderately hard grey clay/shale
red brown, yellow, soft to firm, hig plasticity common moderately hard grey clay/shale bands
yellow, red brown, firm, high plasticity, common grey shale
white, light yellow brown, purple, grey, soft to firm, high plasticity, native copper intersected, common quartz
white, light yellow brown, purple, grey, soft to firm, high plasticity, common quartz, minor grey shaley bands
Saprock
yellow, brown, white, soft to firm, high plasticity, common grey shale bands
177mm diameter Class 12 PVC Well Screen
white, yellow, brown, firm, high plasticity, minor shale and quartz, gritty in part
yellow brown, white, red brown, firm, becoming harder, minor grey shale bands
177mm diameter Class 12 PVC Casing
red brown, yellow, firm, high plasticity, common white quartz to 15mm diam
177mm diameter Class 12 PVC Well Screen
red brown, yellow, white, firm, high plasticity, minor grey shale bands
light green grey, red brown, yellow, firm, silty
177mm diameter Class 12 PVC Casing
light green grey, firm to moderately hard, silty, sandy in part
light green, light green grey, moderately hard, silty
Basement metasediments
light green, light grey, moderately hard, foliated in part, common white quartz to pebble size
177mm diameter Class 12 PVC Well Screen
light green, light grey, moderately hard, foliated in part, common white quartz to pebble size
177mm diameter Class 12 PVC Casing
Quartz breccia
white, clear, light grey, moderately hard, coarse sanD118:D168d to pebble size, angular to subrounded, wet, air lift yield 12 L/s
Open Hole (RC)
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
EoH 168

Well Log	WB03	Date Completed: 20 January 2009	Permit No.: 149161
Depth (mBGS)	Geological Formation / Standing Water Level ▼	Lithological Description	Well Construction
	Quaternary	clay, red brown, loose, dry, common quartz sand, lithic fragments	
		clay, light grey, light green grey, red brown, soft, low plasticity, common quartz, silty	
		silty clay as above, iron oxide mottling in part	
10		clay, light grey, red brown, soft to firm,low plasticity, common quartz	
		clay, light grey, yellow brown, soft to firm, high plasticity	
20		clay, light grey, red, firm, sandy	
		clay, white, soft, high plasticity	
	Namba Formation	clay, white, light grey,red, soft, high plasticity	
		clay, white, soft, high plasticity	
		clay, purple, red, grey, white, soft, high plasticity	
30		clay, as above, yellow brown, iron oxide staining	
		clay, multicoloured, firm, high plasticity	
		clay, purple, red, orange, white, soft to firm, high plasticity	
40		clay, purple, red, white, firm, high plasticity	177mm diameter Class 12 PVC Casing
		clay, purple, yellow, white, firm, high plasticity	
		clay, purple, yellow, white, high plasticity, firm to stiff	
	13/11/2021	clay, yellow brown, off white, red, purple, firm to stiff, high plasticity	
	27/03/2009	clay, white, light yellow, firm, high plasticity	
50		clay, light yellow, firm, high plasticity	
		clay, multicoloured, firm, high plasticity, some thin indurated silt layers	
	Saprolite	clay, off white, light yellow, red, purple, firm, high plasticity	
60		clay, red brown, white, firm, high plasticity	
		clay, white, red brown, firm, high plasticity, indurated silty layers becoming more common	
70		clay, light green, off white, soft to firm, high plasticity, common thin green grey indurated silt layers	
		siltstone light to medium grey, green grey, firm to moderately hard, fresh, weathered in part to clay, refusal at 75m	
	Saprock		
80		clay, green grey, soft, highly weathered	
		metasiltstone, medium to dark gey, moderately hard, slightly weathered, dry	
90			
		metasiltstone, as above, wet at 98	
100			
110			
120			Open Hole (RC)
		metasiltstone / pelilte, medium to dark grey,moderately hard to hard, pyritic in part, siliceous, quartzose, gritty in part, damp	
	Basement metasediments		
130			
140			
150			
160		metasiltstone / pelilte, dark grey to black, moderately hard, fresh, pyritic, wet	
EoH 169			

Well Log	**WB04**	*Date Completed:* **17 December 2008**	*Permit No.:* **149164**
Depth (mBGS)	***Geological Formation*** / ***Standing Water Level***	***Lithological Description***	***Well Construction***
	Quaternary	red brown, firm, minor fine grained sand	177mm diameter Class 12 PVC Casing
		off white, light grey,firm, gypsiferous clay	
		off white, light green grey,firm clay, minor yellow brown Fe staining	
10		light green grey, firm clay, sandy in part	
		off white, light grey,firm, high plasticity clay	
20		light grey, purple, high plasticity, firm clay	
		medium grey, high plasticity, firm clay, minor silt	
	Namba Formation	medium grey, high plasticity clay, firm	
30		light to medium grey, soft to firm, high plasticity clay, silty in part	
		white, soft, high plasticity clay	
		grey, white, red, yellow, brown, soft, high plasticity clay	
40		red brown, white, soft to firm, high plasticity clay	177mm diameter Class 12 PVC Screen
		red and minor white, soft to firm, mottled, high plasticity clay	
	27/03/2009 13/11/2021	red, white, soft to firm, high plasticity clay	
50		off white, red brown, soft to firm, high plasticity clay	
		yellow brown, orange, grey, firm to moderately hard(?) clay, possible cemented bands, alternating slow and fast drilling	
		orange, yellow, red, white, soft, high plasticity clay, common thin indurated grey shaley layers/bands	
60	Saprolite	yellow brown, red brown, soft to firm, high plasticity clay, minor cemented bands approx 2cm thick	177mm diameter Class 12 PVC Casing
EoH 69		red brown, yellow brown, high plasticity clay	

Well Log	**WB05**	*Date Completed:* **13 February 2009**	*Permit No.:* **149155**
Depth (mBGS)	*Geological Formation* / *Standing Water Level*	*Lithological Description*	*Well Construction*
	Quaternary	red brown, clayey, soft, minor quartz, organic matter and lithic fragments	
		red brown, light grey, white, gypsiferous silty clay, firm	
		white, light grey, soft to firm, gypsiferous clay	
		light brown, light green grey, firm, common medium to yellow quartz sand	
10		clear, white, fine to coarse grained sand, poorly sorted, subangular to subrounded, common white and light grey clay	
		white, off white, light grey, low plasticity, sandy clay	
		white, light green grey, soft to firm, high plasticity clay	
20		white, light green grey, soft to firm, high plasticity clay	
	Namba Formation	medium grey, purple, high plasticity clay	
30		light grey, soft, high plasticity clay	
40		light grey, soft, high plasticity clay	
	27/03/2009 13/11/2021	light grey, white, yellow brown and red, soft to firm, high plasticity clay	
50			177mm diameter Class 12 PVC Casing with 125mm inner casing to
60		yellow brown, red, white, soft to firm, high plasticity clay	
70		medium to dark grey, firm to moderately hard, high plasticity clay, common thin indurated bands	
80			
90	Saprolite	medium to dark grey, soft, high plasticity clay	
100		medium to dark grey, soft to firm, high plasticity, common white clay	
		medium grey, firm, high plasticity clay	
		yellow brown, soft, high plasticity clay	
110			125mm PVC casing to surface
120		white, yellow, brown, medium to dark grey, firm, high plasticity clay	
		white, yellow, brown, high plasticity clay,becoming harder	
EoH 128	Basement metasediments	albitite/siltstone	Open Hole (RC)

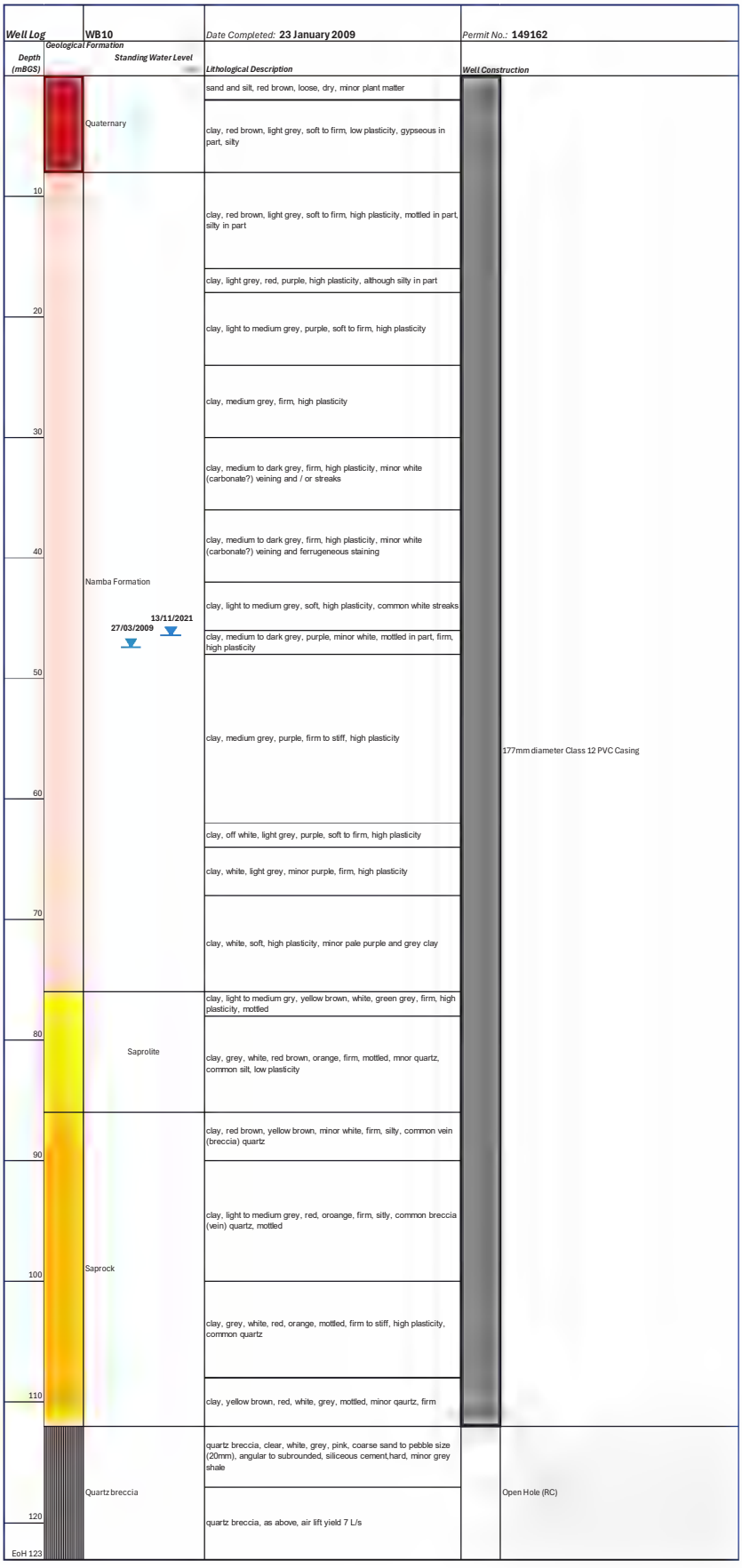
Well Log	WB06a	Date Completed: 11 February 2009	Permit No.: 149466
Depth (mBGS)	Geological Formation / Standing Water Level	Lithological Description	Well Construction
	Quaternary	clay, red brown,light grey, soft to firm,low plasticity, abundant gypsum	
10		clay, light grey, off white, soft to firm, comon lithic fragments, silty	
20		clay, medulm grey,purple, firm, high plasticity	
		clay, dark grey, purple, firm, high plasticity	
30	Namba Formation	clay, white, soft to firm, high plasticity	
		clay, white, red brown, soft, high plasticity, soft, high plasticity, common grey slatey indurated layers	177mm diameter Class 12 PVC Casing
40			
	13/11/2021		
50	11/02/2009	clay, red, purple, white, firm, high plasticity	
		clay, red, purple white, grey, high plasticity	
60		clay, red, purple, white, firm, high plasticity, common grey shaley/slatey indurated layers	
	Saprock		
70		clay, yellow brown, green brown, firm, high plasticity, common hard indurated shaley layers, refusal at 73m	
		siltstone, geen grey, fresh to slighlty weathered,moderately hard, dry	
80		siltstone, green grey, yellow brown, sandy, micaceous in part, pyritic, damp, moderately weathered in part	
90		siltstone, light to medium grey, green grey, hard, damp	
100			
		siltstone, light to medium green grey, green grey, fresh to slighlty weathered, hard, wet	
110		siltstone, off white, medium green grey,fresh, hard, pyritic, spotted, banded, air lift yield 5 L/s	
120			
	Basement metasediments	siltstone, light to medium green grey, green grey, fresh to slighlty weathered, hard, pyritic in part, quartzose, wet, yield 5 L/s	Open Hole (RC)
130		siltstone, white off white, light to medium green grey, common white, grey and clear quartz, yield 5 L/s	
140			
150		siltstone, light to dark grey, fresh, hard, pyritic, common quartz, yield 8 L/s	
160		siltstone, light to dark green grey, yellow brown, fresh to highly weathered, soft to common green (?) copper mineralisation, pyritic where fresh, common quartz, yield 8 L/s	
170		siltstone, light to medium green, green grey, off white, firm to moderately hard, weathered, common quartz, saprolitic(?), native copper at 168, yield 10 L/s	
EoH 174			

Well Log WB07 | *Date Completed:* **15 January 2009** | *Permit No.:* **149159**

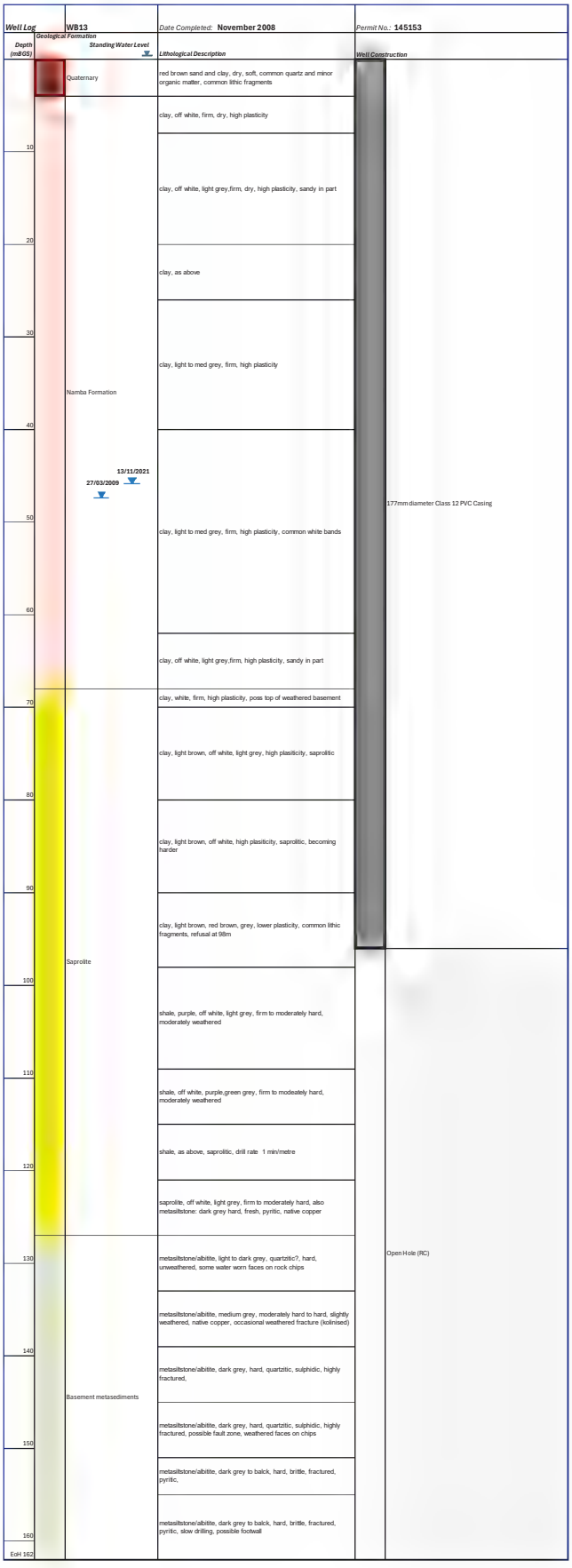
Depth (mBGS)	Geological Formation	Standing Water Level	Lithological Description	Well Construction
	Quaternary		sand, clear, orange, fine to coarse grained, poorly sorted, subangular to subrounded, common red clay	
			gravel, quartz and lithic fragments to pebble size, common fine to coarse grained sand, also poorly sorted, common clay	
			clay, off white, light grey, soft to firm, possibly gypsiferous	
			clay, off white, minor yellow brown, high plasticity, soft, minor quartz	
10			clay, white,light grey, soft, high plasticity	
20			clay, light grey, soft to firm, high plasticity	
			clay, light grey, purple, firm, high plasticity	
30			clay, medium to dark grey, purple, firm, high plasticity, minor thin white bands (possibly calcareous)	
	Namba Formation		clay, white, light grey, soft, high plasticity	
40			medium to dark grey, minor yellow brown, soft to firm, high plasticity	
		13/11/2021 27/03/2009	clay, white, light grey, yellow brown, soft to firm, high plasticity	
50			clay, white, high plasticity, soft	
60			clay, white, yellow brown, soft, high plasticity	177mm diameter Class 12 PVC Casing
70			clay, white, yellow brown, soft, high plasticity	
80			clay, yellow brown, soft to firm, high plasticity	
90	Saprolite			
100			clay, white, light brown, red brown, soft to firm, high plasticity	
110			clay, white, yellow brown, red brown, firm, low plasticity, becoming harder	
	Saprock		claystone, light grey, green grey, yellow brown, red brown, white, firm to moderately hard, slatey at 118	
120			albitite, medium to dark green grey, moderately hard to hard, common quartz layers, fresh to weathered, water cut at 125m (<1 L/s)	
130	Basement metasediments			Open Hole (RC)
EoH 138			albitite, medium to dark green grey, black, moderately hard to hard, common quartz, pyrite, gritty air lift yield 0.8 L/s	

Well Log	WB08	Date Completed: 5 February 2009	Permit No.: 149158
Depth (mBGS)	Geological Formation / Standing Water Level	Lithological Description	Well Construction
	Quaternary	sand, clear, orange, fine to coarse grained, poorly sorted, subangular to subrounded, common red clay and lithic fragments	
		clay, light grey, soft, high plasticity	
10		clay, light grey, red brown, orange, high plasticity, soft, common iron oxide staining	
20		clay, light grey, purple, orange, soft to firm, high plasticity, common iron oxide staining	
	Namba Formation	clay, grey, purple, firm to stiff, high plasticity	
30			
40		clay, white, high plasticity, soft	
		clay, white, red, high plasticity, soft	
	13/11/2021 27/03/2009	clay, red, minor white, purple, firm, high plasticity	
50			
60	Saprolite	siltstone, orange, yellow, red brown, purple, white, high plasticity, soft, common thin indurated bands (siltstone)	
		clay, orange, yellow brown,grey, firm to moderately hard, indurated	
70		shale, white, light grey, purple, orange, high plasticity, soft	177mm diameter Class 12 PVC Casing with PVC screen at 72 - 78m, 84 - 90m, 96 - 102m
		shale, green grey, white, moderately hard, moderately to slightly weathered	
80		shale, green, grey green, silty, moderately hard, abundant native copper from 74m	
		shale, yellow brown, green grey, firm to moderately hard, indurated, native copper present	
90		shale, medium to dark grey, firm to moderately hard, indurated, common native copper	
		clay and siltstone, green, grey, firm to hard, soft where weathered, some high plasticity white clays, hard and soft bands	
100		clay, off white, light yellow, light brown, soft to firm, high plasticity, interbedded green grey siltstone	
	Saprock	siltstone, dark grey to black, hard, indurated, possible ore zone, common yellow clay	
		siltstone, yellow brown, red brown, soft to hard, banded, high plasticity where soft, indurated where hard, common white quartz as grains and shards	
110		clay, red brown, purple,firm, high plasticity, common yellow and grey clay, common native copper	
		clay, white, red/purple,firm, high plasticity	
		clay, yellow brown, grey, white, purple, soft to firm, high plasticity	
120			
		clay, yellow, white, soft, high plasticity, common quartz	
130		clay, off white, light yellow, soft to firm, high plasticity, minor hard bands (?siltstone)	
		clay and siltstone, yellow, white, soft to firm, high plasticity, minor dark grey and green grey siltstone, common quartz	
		siltstone, light grey, white, light green grey, hard, splintery, becoming fresher, refusal at 135	
140		siltstone, light grey, off white, green grey, hard, banded, pyritic, dry	
		siltstone, light to medium green grey, yellow brown, fresh to moderately weathered, moderately hard, firm in part, banded, common white and clear quartz, air lift yield 0.1 L/s	
150			
	Basement metasediments	siltstone, light to medium green grey,moderately weathered, moderately hard to firm, laminated, air lift yield 0.5 L/s	Open Hole (RC)
160			
		siltstone, light to medium grey, firm to moderately hard, highly weathered, abundant white ?calcareous veining, air lift yield 3 L/s	
170		siltstone, light to dark grey, firm to moderately hard, highly weathered to fresh, pyritic where unweathered, air lift yield 8 L/s	
EoH 174			

Well Log	WB09	Date Completed: 23 January 2009	Permit No.: 149160
Depth (mBGS)	Geological Formation / Standing Water Level	Lithological Description	Well Construction
	Quaternary	sand and silt, red brown, soft to firm, loose, dry, common lithic fragments and quartz grains	
		clay, red brown, soft to firm, common lithic fragments, dry	
		clay, white, red brown, firm, dry, silty	
10		clay, off white, red brown, firm, dry, silty	
20		clay, light green grey, light purple, firm, high plasticity, damp	
30		clay, medium grey, high plasticity, firm	
40	Namba Formation		
	13/11/2021		200mm steel casing
	27/03/2009	clay, light grey, soft to firm, high plasticity	
50		clay, medium grey, purple, high plasticity, firm	
60		clay, light grey, firm, high plasticity	
		clay, medium grey, firm, high plasticity,common iron oxide staining	
		clay, white, light grey, high plasticity	
70		clay, white, light grey, high plasticity, soft to firm comon iron oxide staining,thiin harder silty bands becoming more common with depth	
80	Saprock		
90		clay, white, yellow brown, firm to moderately hard, refusal at 90m	
		clay and quartz, medium to dark grey, red, purple, high plasticity (probably cavings), abundant clear, grey, pink quartz and quartzite from sand to >20mm, angular to subrounded	
100		quartz boulders and sand, clear, yellow, grey, coarse sand to cobble size, angular to subrounded, moderately hard, probable siliceous cement, air lift yield 15 L/s	
		quartz breccia, as above, common yellow brown and grey clay, air lift yield 15 L/s	
110		quartz breccia, white, clear, orange, medium grained sand size to 20mm, angular to subrounded, hard, common cavings of shale, air lift yield 10 L/s	
		metasiltstone, medium green grey, hard, fresh	
120			
	Basement metasediments	metasiltstone, grey, green grey, purple, light brown, fresh to slightly weathered, common quartz, water worn faces on some rock chips	Open Hole (RC)
130			
140		metasiltstone, light to medium grey, green grey, white, hard, fresh, abundant white and clear quartz, minor iron oxide build up on chip faces	
150		metasiltstone, medium grey brown, hard, brittle, fresh, micaceous in part	
160			
EoH 162			


Well Log
WB10
Date Completed: 23 January 2009
Permit No.: 149162
Depth (mBGS)
Geological Formation
Standing Water Level
Lithological Description
Well Construction
sand and silt, red brown, loose, dry, minor plant matter
Quaternary
clay, red brown, light grey, soft to firm, low plasticity, gypseous in part, silty
10
clay, red brown, light grey, soft to firm, high plasticity, mottled in part, silty in part
clay, light grey, red, purple, high plasticity, although silty in part
20
clay, light to medium grey, purple, soft to firm, high plasticity
clay, medium grey, firm, high plasticity
30
clay, medium to dark grey, firm, high plasticity, minor white (carbonate?) veining and / or streaks
clay, medium to dark grey, firm, high plasticity, minor white (carbonate?) veining and ferrugeneous staining
40
Namba Formation
clay, light to medium grey, soft, high plasticity, common white streaks
13/11/2021
27/03/2009
clay, medium to dark grey, purple, minor white, mottled in part, firm, high plasticity
50
clay, medium grey, purple, firm to stiff, high plasticity
177mm diameter Class 12 PVC Casing
60
clay, off white, light grey, purple, soft to firm, high plasticity
clay, white, light grey, minor purple, firm, high plasticity
70
clay, white, soft, high plasticity, minor pale purple and grey clay
clay, light to medium gry, yellow brown, white, green grey, firm, high plasticity, mottled
80
Saprolite
clay, grey, white, red brown, orange, firm, mottled, mnor quartz, common silt, low plasticity
clay, red brown, yellow brown, minor white, firm, silty, common vein (breccia) quartz
90
clay, light to medium grey, red, oroange, firm, sitly, common breccia (vein) quartz, mottled
100
Saprock
clay, grey, white, red, orange, mottled, firm to stiff, high plasticity, common quartz
110
clay, yellow brown, red, white, grey, mottled, minor qaurtz, firm
quartz breccia, clear, white, grey, pink, coarse sand to pebble size (20mm), angular to subrounded, siliceous cement,hard, minor grey shale
Quartz breccia
Open Hole (RC)
120
quartz breccia, as above, air lift yield 7 L/s
EoH 123

Well Log	WB11	Date Completed: 4 February 2009	Permit No.: 149163
Depth (mBGS)	Geological Formation / Standing Water Level	Lithological Description	Well Construction
	Quaternary	sand and silt, red brown, soft to firm, dry, common lithic fragments, minor organic matter, common off white clay	
10	Namba Formation	clay, white, light grey, soft to firm, common lithic fragments	
		clay, white, light grey, light yellow brown, , purple, firm, high plasticity	
20		clay, light grey, purple, soft to firm, high plasticity	
		clay, medium to dark grey, firm, figh plasticity	
30		clay, medium to dark grey, white, soft to firm, figh plasticity	
		clay, white soft, high plasticity	
40			
	Saprolite 13/11/2021 27/03/2009	clay, red, white, yellow, light grey, soft, high plasticity	177mm diameter Class 12 PVC Casing
50			
60		clay, white, brown, red, soft to firm, high plasticity, minor grey indurated fragments, becoming more common with depth	
70			
80	Saprock	clay, yellow brown, firm, silty, common indurated grey siltstone/shale bands	
90		clay, white, red, purple, grey, yellow, firm to moderately hard, low plasticity, relic fractures, indurated	
		shale, red, white, grey, moderately hard, indurated	
100	Basement metasediments	shale/metasiltstone, dry, red, purple, hard, fresh, sandy	Open Hole (RC)
		shale/metasiltstone, red, grey, hard, fresh to moderately weathered, banded, slaley, dry	
110		shale, green grey, yellow, white, hard, fresh to moderately weathered, banded, dry	
		siltstone, red brown, orange, firm to moderately hard, moderately weathered, dry	
120		shale and clay, red brown, purple, yellow brown, soft to moderately hard, highly weathered in part, dry	
		shale, light grey, soft to firm, silty, dry	
130		shale/metasiltstone, green grey, firm to moderately hard, silty, dry	
		shale, light to medium green grey, yellow brown, red brown, moderately hard, silty, water cut at 141	
140			
150		shale/metasiltstone, off white, grey, yellow brown, fresh, hard, air lift yield 3 L/s (est)	
160		metasiltstone (?albitite?), dark grey to black, off white, gritty, micaceous, pyritic, moderately hard, common free quartz (breccia?)	
		albitie and quartz layers, dark grey to black, off white, minor red brown, pyritic, hard, common free quartz (breccia?), air lift yield 5 L/s (bucket)	
170			
EoH 180		albitie and quartz, medium green grey, off white, hard, fresh, common vein (breccia) quartz, pyrite, air lift yield 8 L/s	


Well Log
WB13
Date Completed: November 2008
Permit No.: 145153
Depth (mBGS)
Geological Formation
Standing Water Level
Lithological Description
Well Construction
Quaternary
red brown sand and clay, dry, soft, common quartz and minor organic matter, common lithic fragments
clay, off white, firm, dry, high plasticity
clay, off white, light grey,firm, dry, high plasticity, sandy in part
clay, as above
clay, light to med grey, firm, high plasticity
Namba Formation
13/11/2021
27/03/2009
clay, light to med grey, firm, high plasticity, common white bands
177mm diameter Class 12 PVC Casing
clay, off white, light grey,firm, high plasticity, sandy in part
clay, white, firm, high plasticity, poss top of weathered basement
clay, light brown, off white, light grey, high plasiticity, saprolitic
clay, light brown, off white, high plasiticity, saprolitic, becoming harder
clay, light brown, red brown, grey, lower plasticity, common lithic fragments, refusal at 98m
Saprolite
shale, purple, off white, light grey, firm to moderately hard, moderately weathered
shale, off white, purple,green grey, firm to modeately hard, moderately weathered
shale, as above, saprolitic, drill rate 1 min/metre
saprolite, off white, light grey, firm to moderately hard, also metasiltstone: dark grey hard, fresh, pyritic, native copper
Open Hole (RC)
metasiltstone/albitite, light to dark grey, quartzitic?, hard, unweathered, some water worn faces on rock chips
metasiltstone/albitite, medium grey, moderately hard to hard, slightly weathered, native copper, occasional weathered fracture (kolinised)
metasiltstone/albitite, dark grey, hard, quartzitic, sulphidic, highly fractured,
Basement metasediments
metasiltstone/albitite, dark grey, hard, quartzitic, sulphidic, highly fractured, possible fault zone, weathered faces on chips
metasiltstone/albitite, dark grey to balck, hard, britle, fractured, pyritic,
metasiltstone/albitite, dark grey to balck, hard, britle, fractured, pyritic, slow drilling, possible footwall
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160
EoH 162

Well Log	WB14	Date Completed: 18 November 2008	Permit No.: 145154
Depth (mBGS)	Geological Formation / Standing Water Level	Lithological Description	Well Construction
	Quaternary	sand and silt, red brown, dry, soft, common quartz and minor organic matter, common lithic fragments	
		clay, red brown, light grey, firm, dry, silty	
		clay, off white, light grey, firm, dry, silty, common fine quartz sand	
10		clay, off white, light grey, orange, , red brown, soft to firm, high plasticity	
20		clay, light grey, purple, firm, slightly indurated, shaley	
		clay, green purple, firm,high plasticity	
30		clay, grey, high plasticity, minor orange brown staining	
	Namba Formation	clay, medium to dark grey, high plasticity, firm, minor white, yellow and light brown, common cracks, fissures and inclusions	
40			
	13/11/2021 27/03/2009	clay, light grey, soft to firm, high plasticity	177mm diameter Class 12 PVC Casing with PVC screen at 72 - 84m
50			
		clay, dark grey, purple, high plasticity, minor red brown and white inclusions	
60			
		clay, medium grey, high plasticity, firm, minor iron oxide staining	
		clay, off white, light grey, soft to firm, high plasticity, common iron oxide staining	
		clay, white, yellow, high plasticity, soft	
70		clay, light green grey, high plasticity, soft	
	Saprolite	clay, light yellow brown, light green grey, high plasticity, soft,minor thin harder bands (possibly calcareous)	
		clay, white, light yellow, light green grey, red brown, soft, high plasticity	
80		clay, white, red brown, high plasticity, soft	
		clay, white, soft to firm, high plasticity	
		clay, light green grey, yellow brown, high plasticity, soft to firm	
		clay, light yellow brown, light green grey, high plasticity, soft	
EoH 90		clay, light green grey, firm, common thin hard bands	

APPENDIX 4

Mineral Lease Schedule 2 and 6

MPL 158 and ML 6498-6500

SECOND SCHEDULE
MPL 158

SECOND SCHEDULE

ADDITIONAL CONDITIONS

Explanatory Note: A condition is a clause that imposes a restriction on a Mining Tenement.

INDEX TO SECOND SCHEDULE (ADDITIONAL CONDITIONS) Condition No.

Transparency

1. The Tenement Holder agrees to the Approved PEPR and any compliance reports and reportable incident reports, submitted in accordance with the Regulations, being made available for public inspection.

Notification of Cessation of Operations

2. Within thirty (30) days of becoming aware of any event or decision which is likely to give rise to the cessation of mining related activities for a period of more than seven (7) days and prior to the cessation of mining related activities, the Tenement Holder must notify the Director of Mines (or other authorised officer) in writing of the event or decision. The notice must specify the date upon which the mining related activities are expected to cease, or have ceased and an estimate of the period of cessation.

Decommissioning and Rehabilitation Plan

3. If the Tenement Holder decides to cease mining related activities or an event occurs that is likely to give rise to the permanent cessation of mining related activities, the Tenement Holder must develop a DRP and submit it to the Director of Mines (or other authorised officer) for approval within thirty (30) days of the decision or event (or such longer period as approved by the Director of Mines (or other authorised officer)).

4. The DRP must:

   4.1. Set out the activities and scheduling required for the carrying out of the rehabilitation works specified in the Approved PEPR;

   4.2. Be prepared in accordance with any guidelines provided by the Director of Mines (or other authorised officer).

5. The Tenement Holder must carry out decommissioning and rehabilitation in accordance with the approved DRP and the Approved PEPR.

6. If, in the opinion of the Director of Mines, mining operations have substantially ceased for a period of two (2) consecutive years, the Director of Mines may direct the Tenement Holder:

   6.1. To develop and submit a DRP (which must address the requirements of Second Schedule Condition 4) for approval within thirty (30) days of the direction or such longer period as the Director of Mines may allow; and/or

   6.2. To carry out decommissioning and rehabilitation in accordance with the approved DRP and the Approved PEPR.

Additional Information in the Program

7. In accordance with section 70B(2)(d) of the Act it is a condition of the grant of the Mining Tenement that a Proposed PEPR submitted in accordance with Part 10A of the Act must include reports from suitably qualified independent experts on the following matters:

   7.1. The effectiveness of the proposed strategies in the Proposed PEPR achieving the environmental outcomes identified the Proposed PEPR, including but not limited to reports from an Independent Hydrology Expert (i.e. for surface water management). All reports must include identification of any risks, assumptions and uncertainties associated with the relevant strategies.

   7.2. The capacity of the tenement holder to achieve compliance with the Act and the Proposed PEPR in light of its management systems, personnel, policies, procedures, practices and resources.

Other Legislation

8. The Tenement Holder must comply with all State and Commonwealth legislation and regulations applicable to the activities undertaken pursuant to this Licence including (but not limited to) the:

8.1. *Environment Protection and Biodiversity Conservation Act 1999;*

8.2. *Development Act 1993;*

8.3. *Planning, Development and Infrastructure Act 2016;*

8.4. *Dangerous Substances Act 1979;*

8.5. *National Parks and Wildlife Act 1972;*

8.6. *Natural Resources Management Act 2004;*

8.7. *Public and Environmental Health Act 1987;*

8.8. *Aboriginal Heritage Act 1988;*

8.9. *Heritage Places Act 1993;*

8.10. *Work Health and Safety Act 2012;*

8.11. *Environment Protection Act 1993;*

8.12. *Native Vegetation Act 1991;*

8.13. *Mines and Works Inspection Act 1920; and*

8.14. *Road Traffic Act 1961.*

SECOND SCHEDULE
ML 6498, ML 6499, ML 6500

SECOND SCHEDULE

ADDITIONAL CONDITIONS

Explanatory note: A condition is a clause that imposes a restriction on a Mining Tenement.

INDEX TO SECOND SCHEDULE (ADDITIONAL CONDITIONS) **Condition No.**

Tailings Storage Facility (TSF)

1. Provide verification reports compiled by a suitably qualified independent expert, against the design and plans that have been adopted for the TSF construction, operation and closure:

   1.1. For all stages of TSF construction;

   1.2. At an appropriate frequency for operations; and

   1.3. For closure of the TSF including the cover system.

   All verification reports will be made publically available and must be provided to the Director of Mines (or other authorised officer) prior to the initial placement of tailings in the TSF. Subsequent reports must be provided to the Director of Mines (or other Authorised Officer) within one (1) month of completion.

Surface Water

2. The Tenement Holder must ensure that any watercourse diversions are designed to (at a minimum):

   2.1. Incorporate natural features (including geomorphic and vegetation) present in the landscape and local watercourses;

   2.2. Maintain the existing hydrology and hydraulic characteristics of surface water systems;

2.3. Maintain sediment transport and water quality regimes that allow the watercourse diversion to be self-sustaining.

Transparency

3. The Tenement Holder agrees to the Approved PEPR and any compliance reports and reportable incident reports, submitted in accordance with the Regulations, being made available for public inspection.

Notification of Cessation of Operations

4. Within thirty (30) days of becoming aware of any event or decision which is likely to give rise to the cessation of mining operations for a period of more than seven (7) days and prior to the cessation of mining operations, the Tenement Holder must notify the Director of Mines (or other authorised officer) in writing of the event or decision. The notice must specify the date upon which the mining operations are expected to cease, or have ceased and an estimate of the period of cessation.

Decommissioning and Rehabilitation Plan (DRP)

5. If the Tenement Holder decides to cease mining operations or an event occurs that is likely to give rise to the permanent cessation of mining operations, the Tenement Holder must develop a DRP and submit it to the Director of Mines (or other authorised officer) for approval within thirty (30) days of the decision or event (or such longer period as approved by the Director of Mines (or other authorised officer)).

6. The DRP must:

6.1. Set out the activities and scheduling required for the carrying out of the rehabilitation works specified in the Approved PEPR;

6.2. Be prepared in accordance with any guidelines provided by the Director of Mines (or other authorised officer).

7. The Tenement Holder must carry out decommissioning and rehabilitation in accordance with the approved DRP and the Approved PEPR.

8. If, in the opinion of the Director of Mines, mining operations have substantially ceased for a period of two (2) consecutive years, the Director of Mines may direct the Tenement Holder:

8.1. To develop and submit a DRP (which must address the requirements of Second Schedule Condition 4) for approval within thirty (30) days of the direction or such longer period as the Director of Mines may allow; and/or

8.2. To carry out decommissioning and rehabilitation in accordance with the approved DRP and the Approved PEPR.

Additional Information in the Program

9. In accordance with section 70B(2)(d) of the Act it is a condition of the grant of the Mining Tenement that a Proposed PEPR submitted in accordance with Part 10A of the Act must include reports from suitably qualified independent experts on the following matters:

9.1. The effectiveness of the proposed strategies in the Proposed PEPR achieving the environmental outcomes identified in the Proposed PEPR, including but not limited to reports from:

9.1.1. An Independent tailings storage facility expert (i.e.: for TSF design, construction methodology and operation);

9.1.2. An Independent Hydrology Expert (i.e.: for Surface water management);

9.1.3. All reports must include identification of any risks, assumptions and uncertainties associated with the relevant strategies.

9.2. The capacity of the tenement holder to achieve compliance with the Act and the Proposed PEPR in light of its management systems, personnel, policies, procedures, practices and resources.

Other Legislation

10. The Tenement Holder must comply with all State and Commonwealth legislation and regulations applicable to the activities undertaken pursuant to this Mining Tenement including (but not limited to) the:

10.1. *Environment Protection and Biodiversity Conservation Act 1999*;

10.2. *Development Act 1993*;

10.3. *Planning, Development and Infrastructure Act 2016*;

10.4. *Dangerous Substances Act 1979*;

10.5. *National Parks and Wildlife Act 1972*;

10.6. *Natural Resources Management Act 2004*;

10.7. *Public and Environmental Health Act 1987*;

10.8. *Aboriginal Heritage Act 1988*;

10.9. *Heritage Places Act 1993*;

10.10. *Work Health and Safety Act 2012*;

10.11. *Environment Protection Act 1993*;

10.12. *Native Vegetation Act 1991*;

10.13. *Mines and Works Inspection Act 1920*; and

10.14. *Road Traffic Act 1961*.

SIXTH SCHEDULE
MPL 158

SIXTH SCHEDULE

ENVIRONMENTAL OUTCOMES

AND ASSOCIATED CRITERIA AND STRATEGIES PURSUANT TO
REGULATION 65 OF THE MINING REGULATIONS 2011

Explanatory Note: The Sixth Schedule of this Tenement Document sets out outcomes contemplated in regulation 65(2) of the Regulations, that the Tenement Holder is required to address in any program submitted in accordance with Part 10A of the Act. The Sixth Schedule may also specify requirements for strategies and criteria relevant to the outcomes set out in that Schedule.

INDEX TO SIXTH SCHEDULE Clause No.

Air Quality Outcome

1. The Tenement Holder must, during construction operation and post-completion, ensure that there are no adverse impacts to:

   1.1. public health; and/or

   1.2. public amenity;

   from air emissions and/or dust generated by mining related activities.

Air Quality Strategy

2. The Tenement Holder is required to address the following matter for the purpose of Regulation 65(2)(c) in relation to the Air Quality Outcome in Sixth Schedule Clause 1:

   2.1. Demonstrate progressive rehabilitation and stabilisation of disturbed areas undertaken throughout the life of mine to control dust emissions generated by wind erosion.

Noise Outcome

3. The Tenement Holder must, during construction and operation, ensure that there are no public nuisance impacts from noise emanating from the Land.

Waste Management Outcome

4. The Tenement Holder must, during construction, operation and post-completion ensure that no contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off the Land resulting from permanent disposal or temporary storage of mine or waste material.

Waste Management Strategies

5. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Waste Management Outcome in Sixth Schedule Clause 4:

   5.1. Provide strategies as directed by any guidelines provided by the Director of Mines (or other authorised officer).

5.2. Provide strategies for the control of seepage through the WRD base, embankment and walls.

5.3. Provide the design, construction and maintenance of mine waste cover systems including, but not limited to, a detailed cover system design, construction methodology, cover system modelling and provision of a program of works for field trials and collection of site specific data to validate/calibrate the model(s).

5.4. Ensure all mine waste materials, infrastructure and landforms are geotechnically stable.

5.5. Ensure all domains have been rehabilitated in accordance with the design and closure strategies.

5.6. Ensure land is chemically stable.

5.7. Ensure no industrial or commercial wastes are left on the Land unless approved through other legislation.

5.8. Conduct trials of alternative cover systems conducted during operation to determine the optimum thickness, material properties and slope profiles (e.g. stepped or concave) for the WRD cover system.

Surface Water Outcomes

6. The Tenement Holder must during construction, operation and post-completion, ensure that there is no adverse impact on surface water quality and water dependent ecosystems as a result of contamination and sedimentation from mining related activities.

7. The Tenement Holder must during construction, operation and post-completion, ensure that no adverse impact to the quantity of surface water available to water dependent ecosystems (including permanent pools) and existing users, on and off the Land, caused by mining related activities.

Surface Water Strategies

8. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Surface Water Outcomes in Sixth Schedule Clauses 6 and 7:

8.1. The Tenement Holder must ensure no contaminated surface water leaves the Land as a result of mining related activities; and

8.2. The Tenement Holder must ensure that, apart from water contained in the pit void:

8.2.1. No contaminated surface water remains within the Land post-completion; and

8.2.2. No contamination of surface water occurs post-completion as a result of mining operations within the Land.

Groundwater Outcome

9. The Tenement Holder must during construction, operation and post-completion, ensure that there is no adverse impact to the quantity and quality of groundwater available to existing users as a result of mining related activities.

Groundwater Strategies

10. The Tenement Holder is required to address the following matters for the purposes of Regulation 65(2)(c) of the Regulations in relation to the Groundwater Outcome in Sixth Schedule Clause 9:

10.1 The Tenement Holder must provide a calibrated groundwater model.

10.1.1. The model must include modelling of mound development;

10.1.2. References must be provided for the sensitivity analyses undertaken on the groundwater model.

10.2. The Tenement Holder must establish a program for the establishment and ongoing calibration of the transient ground water model using data obtained from groundwater monitoring within the Proposed PEPR.

10.3. The Tenement Holder must establish a program for the ongoing calibration of the pit lake geochemistry and hydrogeological models using data obtained from operational monitoring to address any assumptions and uncertainty within the model.

10.4. The Tenement Holder must provide further explanation and evidence to support the conclusion that the sapprolite and sapprock material will behave as a porous media. If evidence cannot be provided the model must be updated to include a layer representing the sapprolite as an aquitard.

Groundwater Criteria

11. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(d) in relation to the Groundwater Outcome in Sixth Schedule Clause 9:

    11.1. Establish compliance groundwater monitoring bores either on the Land or at sensitive receptors that are of sufficient density and depth to detect movement of groundwater off the Land.

    11.2. Establish representative baseline water quality and quantity for groundwater within the Land and at sensitive receptors, with consideration of existing groundwater users.

Native Vegetation Outcome

12. The Tenement Holder must, during construction, operation and post-completion, ensure no loss of abundance or diversity of native vegetation on or off the Land through;

    12.1. clearance;
    12.2. dust;
    12.3. fire; or
    12.4. other damage;

    unless a significant environmental benefit has been approved in accordance with the relevant legislation.

Native Vegetation Criteria

13. Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(d) in relation to the Native Vegetation Outcome in Sixth Schedule Clause 12:

    13.1. Collect representative baseline data for native vegetation prior to commencement of mining related activities. The baseline data must include (but not limited to):

        13.1.1. The condition, abundance and diversity of native vegetation within the Land.

Weeds, Plants and Plant Pathogens Outcome

14. The Tenement Holder must, during construction, operation and post-completion, ensure no introduction of new species of weeds, pests (including feral animals) or plant pathogens, nor sustained increase in abundance of existing weeds or pests in the Land.

Weeds, Pests and Plant Pathogens Criteria

15. The Tenement Holder is required to address the following matter for the purpose of Regulation 65(2)(d) in relation to the Weeds, Plants and Plant Pathogens Outcome in Sixth Schedule Clause 14:

    15.1. Collect representative baseline data on the presence and abundance of weeds, pests and plant pathogens within the Land prior to commencement of mining related activities.

Fauna Outcome

16. The Tenement Holder must ensure during construction, operation and post-completion, that there are no native fauna injuries or deaths due to mining related activities that could have been reasonably prevented.

Soil Outcome

17. The Tenement Holder must, during construction, operation and post-completion ensure that the existing (pre-mining) soil quantity and quality is maintained.

Soil Strategies

18. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Soil Outcome in Sixth Schedule Clause 17:

    18.1. Strategies to achieve recovery of topsoil and subsoil from areas to be disturbed by mining related activities.

    18.2. Strategies for maintaining the quantity of stockpiled soil until such time that it is used for rehabilitation purposes.

18.3. Strategies that take into consideration the optimal soil stockpile heights.

18.4. Strategies for reinstatement of these soils so as to ensure achievement of the outcome.

18.5. An auditable record of soil movement including recovery, stockpiling and reinstatement.

18.6. Progressive rehabilitation would be implemented for all domains as soon as practicable.

Visual Amenity Outcome

19. The Tenement Holder must, during operation and post-completion ensure that the form, contrasting aspects and reflective aspects of mining operations are visually softened.

Visual Amenity Strategies

20. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Visual Amenity Outcome in Sixth Schedule Clause 19:

20.1. The Tenement Holder must ensure that all infrastructure is decommissioned and removed from the Land at completion unless the Director of Mines (or other authorised officer) has approved, in writing, for the infrastructure to remain;

20.2. Develop and implement strategies in consultation with affected parties for the management of visual amenity which should include (but not limited to):

20.2.1. Shape permanent mine landforms to soften the visual impact.

20.2.2. Prompt rehabilitation of disturbed areas once no longer required for mining related activities, utilising every available opportunity provided by the mine plan.

Traffic Outcome

21. The Tenement Holder must, during construction and operation, ensure that there are no traffic accidents involving the public at mine access points that could have been reasonably prevented by the Tenement Holder.

Traffic Strategy

22. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Traffic Outcome in Sixth Schedule Clause 21:

    22.1. Develop and implement strategies in consultation with affected parties to divert the proposed Kalkaroo Access Road away from Boolcoomatta Homestead.

Public Safety and Land Use Outcomes

23. The Tenement Holder must, during construction and operation, ensure that unauthorised entry to the site does not result in public injuries and or deaths that could have been reasonably prevented.

24. The Tenement Holder must demonstrate that post-completion, the risks to the health and safety of the public so far as it may be affected by mining related activities are as low as reasonably practicable.

25. The Tenement Holder must ensure that the Land is progressively and finally rehabilitated to support the future land use.

26. Before completion, the Tenement Holder must satisfy the Director of Mines (or other authorised officer) that where practicable, the pre-mining land use can be recommenced post- completion.

Heritage Outcome

27. The Tenement Holder must, in construction and operation, ensure that there is no disturbance to Aboriginal or European heritage sites, objects or remains unless it is authorised under the relevant legislation.

SIXTH SCHEDULE
ML 6498, ML 6499, ML 6500

SIXTH SCHEDULE

ENVIRONMENTAL OUTCOMES

AND ASSOCIATED CRITERIA AND STRATEGIES PURSUANT TO
REGULATION 65 OF THE MINING REGULATIONS 2011

Explanatory note: The Sixth Schedule of this Tenement Document sets out outcomes contemplated in regulation 65(2) of the Regulations, that the Tenement Holder is required to address in any program submitted in accordance with Part 10A of the Act. The Sixth Schedule may also specify requirements for strategies and criteria relevant to the outcomes set out in that Schedule.

INDEX TO SIXTH SCHEDULE **Clause No.**

Air Quality Outcome

1. The Tenement Holder must, during construction, operation and post-mine completion, ensure that there are no adverse impacts to:

   1.1. public health; and/or

   1.2. public amenity;

   from air emissions and/or dust generated by mining operations.

Air Quality Strategy

2. The Tenement Holder is required to address the following matter for the purpose of Regulation 65(2)(c) in relation to the Air Quality Outcome in Sixth Schedule Clause 1:

   2.1. Demonstrate that progressive rehabilitation and stabilisation of disturbed areas will be undertaken throughout the life of mine to control dust emissions generated by wind erosion.

Noise Outcome

3. The Tenement Holder must, during construction and operation, ensure that there are no public nuisance impacts from noise emanating from the Land.

Waste Management Outcome

4. The Tenement Holder must, during construction, operation and post-mine completion ensure that no contamination of natural water drainage systems, streams and rivers, groundwater, land and soils occurs either on or off the Land resulting from permanent disposal or temporary storage of mine or waste material.

Waste Management Strategies

5. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Waste Management Outcome in Sixth Schedule Clause 4:

5.1. Determine a sulphur cut-off grade for PAF material through further testing for each waste rock unit.

5.2. Provide block modelling of the sulphur distribution of all waste and ore to be mined for the purpose of determining the distribution and estimating the volume of NAF and PAF using the sulphur cut-off grade.

5.3. Integrate the sulphur model with the geological model to provide confidence in the definition of PAF boundaries, potential zones of high neutralising capacity and potential geological controls on mineralisation.

5.4. Provide procedures for regularly updating the models with new geological and sulphur assay data collected in the course of mine operations.

5.5. Provide procedures for ensuring PAF and NAF boundaries derived from the sulphur cut-off and the sulphur block model are included in open pit mine plans.

5.6. Provide procedures for assaying the sulphur content of waste and ore, produced during the course of mining, for verifying PAF and NAF information included in the open pit mine plans to provide a final check that all PAF and NAF materials have been correctly identified.

5.7. Provide procedures and recording systems for selective mining of the identified PAF and NAF materials and their separate placement.

5.8. Provide strategies as directed by any guidelines provided by the Director of Mines (or other authorised officer).

5.9. Provide control and management strategies to mitigate impacts to receptors from the TSF.

5.10. Ensure the design, construction, operation and closure of the TSF is prepared in accordance with, but not limited to, the most recent ANCOLD Tailings Dam Guidelines.

5.11. Provide quality control arrangements for all stages of construction of the TSF including supervision by appropriately qualified and experienced persons, documented procedures, quality control testing and record keeping.

5.12. Provide a strategy to ensure deposition of tailings to the TSF ceases if the specified limits for freeboard height or supernatant pond dimensions are exceeded. If exceeded report this to the Director of Mines (or other Authorised Officer) within twenty-four (24) hours.

5.13. Provide strategies for the control of seepage through the TSF base, embankment and walls.

5.14. Provide strategies for achieving and maintaining design tailings discharge densities and tailings consolidation rates to ensure timely construction of the cover system post cessation of tailings deposition.

5.15. Provide tailings discharge density trigger limits and remedial actions to ensure design densities are achieved.

5.16. Provide a seepage detection program for monitoring seepage through the embankment and the base of the TSF.

5.17. Provide the design, construction and maintenance of the TSF and mine waste cover systems including, but not limited to, a detailed cover system design, construction methodology, cover system modelling and provision of a program of works for field trials and collection of site specific data to validate/calibrate the model(s).

5.18. Ensure that the WRD and TSF final landforms will be chemically and physically stable post-mine completion.

5.19. Ensure all mine waste materials, infrastructure and landforms are geotechnically stable.

5.20. Ensure all domains have been rehabilitated in accordance with the design and closure strategies.

5.21. Ensure land is chemically stable.

5.22. Ensure no industrial or commercial wastes are left on the Land unless approved through other legislation.

5.23. Conduct trials of alternative cover systems during operation to determine the optimum thickness, material properties and slope profiles (e.g. stepped or concave) for the WRD and TSF cover systems.

Surface Water Outcomes

6. The Tenement Holder must during construction, operation and post-mine completion, ensure that there is no adverse impact on surface water quality and water dependent ecosystems as a result of contamination and sedimentation from mining operations.

7. The Tenement Holder must during construction, operation and post-mine completion, ensure that no adverse impact to the quantity of surface water available to water dependent ecosystems (including permanent pools) and existing users, on and off the Land, caused by mining operations.

Surface Water Strategies

8. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Surface Water Outcomes in Sixth Schedule Clauses 6 and 7:

    8.1. The Tenement Holder must ensure no contaminated surface water leaves the Land as a result of mining operations; and

    8.2. The Tenement Holder must ensure that, apart from water contained in the pit void:

        8.2.1. No contaminated surface water remains within the Land post-mine completion; and

        8.2.2. No contamination of surface water occurs post-mine completion as a result of mining operations within the Land.

    8.3. The Tenement Holder must ensure that any watercourse diversion is designed to ensure that it will be effective in achieving any surface water outcomes, including, but not limited to:

        8.3.1. Incorporate natural features (including geomorphic and vegetation) present in the landscape and local watercourses;

        8.3.2. Maintain the existing hydrology and hydraulic characteristics of surface water systems;

        8.3.3. Maintain sediment transport and water quality regimes that allow the watercourse diversion to be self-sustaining.

Groundwater Outcome

9. The Tenement Holder must during construction, operation and post-mine completion, ensure that there is no adverse impact to the quantity and quality of groundwater available to existing users as a result of mining operations.

Groundwater Strategies

10. The Tenement Holder is required to address the following matters for the purposes of Regulation 65(2)(c) of the Regulations in relation to the Groundwater Outcome in Sixth Schedule Clause 9:

    10.1. The Tenement Holder must provide a calibrated groundwater model.

        10.1.1. The model must include modelling of groundwater mounding caused by the TSF operations;

        10.1.2. Adequacy of the current closure modelling approach is to be verified by:

            10.1.2.1. Providing volumes of groundwater extracted by the ‘drain’ cells representing the pit lake;

            10.1.2.2. Providing a comparison of the pit lake levels to the regional potentiometric surface immediately adjacent to the pit.

        10.1.3. References must be provided for the sensitivity analyses undertaken on the groundwater model.

    10.2. The Tenement Holder must establish a program for the establishment and ongoing calibration of the transient ground water model using data obtained from groundwater monitoring within the proposed PEPR.

    10.3. The Tenement Holder must establish a program for the ongoing calibration of the pit lake geochemistry and hydrogeological models using data obtained from operational monitoring to address any assumptions and uncertainty within the model.

    10.4. The Tenement Holder must provide further explanation and evidence to support the conclusion that the sapprolite and sapprock material will behave as a porous media. If evidence cannot be provided the model must be updated to include a layer representing the sapprolite as an aquitard.

Groundwater Criteria

11. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(d) in relation to the Groundwater Outcome in Sixth Schedule Clause 9:

    11.1. Establish compliance groundwater monitoring bores either on the Land or at sensitive receptors that are of sufficient density and depth to detect movement of groundwater off the Land.

    11.2. Establish representative baseline water quality and quantity for groundwater within the Land and at sensitive receptors, with consideration of existing groundwater users.

Native Vegetation Outcome

12. The Tenement Holder must, during construction, operation and post-mine completion, ensure no loss of abundance or diversity of native vegetation on or off the Land through;

    12.1. clearance;

    12.2. dust;

    12.3. fire; or

    12.4. other Damage;

    unless a significant environmental benefit has been approved in accordance with the relevant legislation.

Native Vegetation Criteria

13. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(d) in relation to the Native Vegetation Outcome in Sixth Schedule Clause 12:

    13.1. Collect representative baseline data for native vegetation prior to commencement of mine operations. The baseline data must include (but not limited to):

        13.1.1. The condition, abundance and diversity of native vegetation within the Land.

Weeds, Pests and Plant Pathogens Outcome

14. The Tenement Holder must, during construction, operation and post-mine completion, ensure no introduction of new species of weeds, pests (including feral animals) or plant pathogens, nor sustained increase in abundance of existing weeds or pests in the Land.

Weeds, Pests and Plant Pathogens Criteria

15. The Tenement Holder is required to address the following matter for the purpose of Regulation 65(2)(d) in relation to the Weeds, Pests and Plant Pathogens Outcome in Sixth Schedule Clause 14:

    15.1. Collect representative baseline data on the presence and abundance of weeds, pests and plant pathogens within the Land prior to commencement of mine operations.

Fauna Outcome

16. The Tenement Holder must ensure during construction, operation and post-mine completion, that there are no native fauna injuries or deaths due to mining operations that could have been reasonably prevented.

Soil Outcome

17. The Tenement Holder must, during construction, operation and post-mine completion ensure that the existing (pre-mining) soil quantity and quality is maintained.

Soil Strategies

18. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Soil Outcome in Sixth Schedule Clause 17:

    18.1. Strategies to achieve recovery of topsoil and subsoil from areas to be disturbed by mining operations.

    18.2. Strategies for maintaining the quantity of stockpiled soil until such time that it is used for rehabilitation purposes.

    18.3. Strategies that take into consideration the optimal soil stockpile heights.

    18.4. Strategies for reinstatement of these soils so as to ensure achievement of the outcome.

18.5. An auditable record of soil movement including recovery, stockpiling and reinstatement.

18.6. Progressive rehabilitation would be implemented for all domains as soon as practicable.

Visual Amenity Outcome

19. The Tenement Holder must, during operation and post-mine completion ensure that the form, contrasting aspects and reflective aspects of mining operations are visually softened.

Visual Amenity Strategies

20. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Visual Amenity Outcome in Sixth Schedule Clause 19:

20.1. The Tenement Holder must ensure that all infrastructure is decommissioned and removed from the Land at mine completion unless the Director of Mines (or other authorised officer) has approved, in writing, for the infrastructure to remain;

20.2. Develop and implement strategies in consultation with affected parties for the management of visual amenity which should include (but not limited to):

20.2.1. Shape permanent mine landforms to soften the visual impact.

20.2.2. Prompt rehabilitation of disturbed areas once no longer required for mining operations, utilising every available opportunity provided by the mine plan.

Traffic Outcome

21. The Tenement Holder must, during construction and operation, ensure that there are no traffic accidents involving the public at mine access points that could have been reasonably prevented by the Tenement Holder.

Traffic Strategy

22. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Traffic Outcome in Sixth Schedule Clause 21:

    22.1. Develop and implement strategies in consultation with affected parties to divert the proposed Kalkaroo Access Road away from Boolcoomatta Homestead.

Public Safety and Land Use Outcomes

23. The Tenement Holder must, during construction and operation, ensure that unauthorised entry to the site does not result in public injuries and or deaths that could have been reasonably prevented.

24. The Tenement Holder must demonstrate that post-mine completion, the risks to the health and safety of the public so far as it may be affected by mining operations are as low as reasonably practicable.

25. The Tenement Holder must ensure that the Land is progressively and finally rehabilitated to support the future land use.

26. Before mine completion, the Tenement Holder must satisfy the Director of Mines (or other authorised officer) that where practicable, the pre-mining land use can be recommenced post-mine completion.

Public Safety and Land Use Strategies

27. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(c) in relation to the Public Safety and Land Use Outcome in Sixth Schedule Clause 24:

    27.1. Develop strategies to ensure final landform design for the open pit void meets the outcome for protection of public safety post-mine completion and in the long term to address potential hazards including, but not limited to:

        27.1.1. The risk of falling;

        27.1.2. The risk of drowning;

        27.1.3. The risk of vehicle incident/accidents; and

        27.1.4. Ground instability.

Heritage Outcome

28. The Tenement Holder must, in construction and operation, ensure that there is no disturbance to Aboriginal or European heritage sites, objects or remains unless it is authorised under the relevant legislation.

Blasting Outcome

29. The Tenement Holder must, during construction and operation, ensure that there are no adverse impacts to:

    29.1. public safety;

    29.2. human comfort;

    29.3. third party property;

    29.4. adjacent land use; or

    29.5. other receptors;

    from airblast, flyrock and vibration caused by blasting.

Blasting Strategies

30. The Tenement Holder is required to address the following matters for the purpose of Regulation 65(2)(d) in relation to the Blasting Outcome in Sixth Schedule Clause 29:

    30.1. Develop strategies for the management of impacts from blasting, including the determination of blast exclusion zones, in accordance with relevant standards.

    30.2. A blasting protocol and blasting schedule will be developed in consultation with residents of land within and adjoining the Land to reflect the needs of the neighbouring land use practices.

APPENDIX 5

Agent Authority and Agent Operator Approval

PUBLIC SUMMARY DOCUMENT

APPOINT/ REMOVE THIRD PARTY REPRESENTATIVE

Instrument:	56479
Category:	Instrument
Subcategory:	Appoint Third Party Representative/Remove Third Party Representative
Register:	Mining Register

DETAILS:

Third Party Representative	Sandfire South Australia Pty Ltd

TENEMENTS

Tenement type(s)	Mining Lease, Miscellaneous Purposes Licence and Mineral Claim
Tenement number(s)	ML 6498, ML 6499, ML 6500, MPL 158, MPL 159 and MC 3828
Tenement holder(s)	Kalkaroo Copper Pty Ltd

Registration details

Date of registration	10/04/2026
Endorsed by	Julie Batty
Signature *Right click on the X to sign*	*Julie Batty*
Legislative authority to register	*S15AA(3) of the Mining Act 1971*

PUBLIC SUMMARY DOCUMENT
OPERATOR APPOINTMENT

Instrument:	56478
Category:	Registrable Dealings
Subcategory:	Operator Appointment
Register:	Mining Register
Start date:	9/02/2026
Expiry:	n/a

TENEMENTS

Tenement type(s)	Mining Lease, Miscellaneous Purposes Licence and Mineral Claim
Tenement number(s)	ML 6498, MI 6499, ML 6500, MPL 158, MPL 159 and MC 3828
Tenement holder(s)	Kalkaroo Copper Pty Ltd
Operator appointed	Sandfire South Australia Pty Ltd
Registered address of Operator	Level 2, 10 Kings Park Road West Perth WA 6005
Registered email address of Operator	Adam.roeneveld@sandfire.com.au

Registration details

Date of registration	10/04/2026
Endorsed by	Julie Batty
Signature *Right click on the X to sign*	*Julie Batty*
Legislative authority to register	S15AA(3) of the Mining Act 1971

Office use only

This is the **Public Summary Document** and is to be made available to the public.

Transparency Policy, May 2023